قسم هندسة القوى الميكانيكية

➢ المرفقات:

- توصيف البرنامج .
- مصفوفة البرامج .
- مجالس تبني المعايير الأكاديمية:

1. مجلس قسم هندسة القوى الميكانيكية لتبني المعايير الأكاديمية NARS 2018 .
2. اعتماد توصيف البرنامج والمقررات من مجلس القسم.
3. مجلس الكلية لتبني المعايير الأكاديمية NARS 2018 لكل الأقسام العلمية .
4. مجلس الجامعة لتبني المعايير لكل الأقسام .

- توصيف المقررات .

Port Said University

وحدة ضمان الجودة والاعتماد
كلية الهندسة ببورسعيد

PORT SAID UNIVERSITY
FACULTY OF ENGINEERING

توصيف البرنامج

PROGRAM SPECIFICATION

B.Sc. of Mechanical Power Engineering Program

Bylaw 2014

Programme Specification
Port Said University
Faculty of Engineering, Port-Said

A- Basic Information

1- Programme title: B.SC. in Mechanical Power Engineering

2- Programme type: Single ☑ Double ☐ Multiple ☐

3- Department (s): Mechanical Power Engineering.

4- Coordinator: Dr. Sherihan Abdel-Ghafour.

5- External evaluator(s): Prof. Dr. Ibrahim Mohamed Hasaballah

6- Last date of programme specifications approval: 28 – 3- 2021

B- Professional Information

1. Program Aims:

The Mechanical Power Engineering program aims to provide the prospective engineers with appropriate theoretical knowledge, basic engineering science, applied engineering and design, humanities, and technical skills which allow the graduates to work efficiently in local and international markets and to display basic competency in each of the technical areas identified as essential to mechanical power engineers.

The Mechanical Power Engineering program aims to:

1. Apply a wide spectrum of engineering knowledge, science and specialized skills with analytical, critical and systematic thinking to identify and solve engineering problems in real life.
2. Behave professionally and adhere to engineering ethics and standards and contribute in the development of the profession and the community and promoting the sustainability principles.
3. Work in a heterogeneous team and display leadership qualities, responsibility for own and team performance, business administration, and entrepreneurial skills.

4. Master self and lifelong learning strategies using techniques, skills and modern engineering tools and demonstrate the capacity to engage in post-graduate and research studies.
5. Communicate effectively using different modes, tools, and languages with various audiences to deal with academic and professional challenges in a critical and creative manner.
6. Apply and integrate knowledge, understanding and skills of different subjects and available computer software to solve real problems in mechanical power engineering discipline.
7. Design, analyse and evaluate the performance of different mechanical systems, powered by both conventional and renewable energy sources, considering the operational, maintenance, economical, safety, and environmental aspects.
8. Utilize the codes of practice and standards as well as the quality guidelines.
9. Carry out preliminary designs of mechanical power systems, investigate their performance and solve their essential operational problems.

2. Matching of Program Aims and Graduate Attributes:

	Program Aims	Graduate Attributes
Attributes of the Graduate of	1) Apply a wide spectrum of engineering knowledge, science and specialized skills with analytical, critical and systematic thinking to identify and solve engineering problems in real life.	**1.** Master a wide spectrum of engineering knowledge and specialized skills and can apply acquired knowledge using theories and abstract thinking in real life situations.
		2. Apply analytic critical and systemic thinking to identify, diagnose and solve engineering problems with a wide range of complexity and variation.
	2) Behave professionally and adhere to engineering ethics and standards and contribute in the development of the profession and	**3.** Behave professionally and adhere to engineering ethics and standards.
		5. Recognize his/her role in promoting the engineering field and contribute in the

	the community and promoting the sustainability principles.	development of the profession and the community.
		6. Value the importance of the environment, both physical and natural, and work to promote sustainability principles.
	3) Work in a heterogeneous team and display leadership qualities, responsibility for own and team performance, business administration, and entrepreneurial skills.	**4.** Work in and lead a heterogeneous team of professionals from different engineering specialties and assume responsibility for own and team performance.
		10. Demonstrate leadership qualities, business administration and entrepreneurial skills.
	4) Master self and lifelong learning strategies using techniques, skills and modern engineering tools and demonstrate the capacity to engage in post- graduate and research studies.	**7.** Use techniques, skills, and modern engineering tools necessary for engineering practice.
		8. Assume full responsibility for own learning and self-development, engage in lifelong learning and demonstrate the capacity to engage in post- graduate and research studies.
	5) Communicate effectively using different modes, tools, and languages with various audiences to deal with academic and professional challenges in a critical and creative manner.	**9.** Communicate effectively using different modes, tools, and languages with various audiences; to deal with academic/professional challenges in a critical and creative manner.
Attributes of Mechanical Power	**6)** Apply and integrate knowledge, understanding and skills of different subjects and available computer software to solve real problems in mechanical power engineering discipline.	**11.** Apply and integrate knowledge, understanding and skills of different subjects and available computer software to solve real problems in industries and power stations.
	7) Design, analyse and evaluate the performance of different mechanical systems, powered by both conventional and renewable energy sources, considering the	**12.** Evaluate the sustainability and environmental issues related to mechanical power systems.
		13. Use energy efficiently and apply industrial safety.

	operational, maintenance, economical, safety, and environmental aspects.	**14.** Design, operate and maintain internal combustion and steam engines.
	8) Utilize the codes of practice and standards as well as the quality guidelines.	**15.** Utilize the codes of practice and standards and the quality guidelines.
	9) Carry out preliminary designs of mechanical power systems, investigate their performance and solve their essential operational problems.	**16.** Carry out preliminary designs of fluid transmission and power systems, investigate their performance and solve their essential operational problems.

3. The Academic Reference NARS 2018

3.1. Competencies for Engineering Graduates (A-Level)

The **Engineering** Graduate must be able to:

A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science, and mathematics

A2. Develop and conduct appropriate experimentation and/or simulation, analyse and interpret data, assess and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.

A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.

A4. Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues, and risk management principles.

A5. Practice research techniques and methods of investigation as an inherent part of learning.

A6. Plan, supervise and monitor implementation of engineering projects.

A7. Function efficiently as an individual and as a member of multi-disciplinary and multi-cultural teams.

A8. Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools.

A9. Use creative, innovative, and flexible thinking and acquire entrepreneurial and leadership skills to anticipate and respond to new situations.

A10. Acquire and apply new knowledge, and practice self, lifelong and other learning strategies.

3.2 Competencies of Basic Mechanical engineering (B-Level)

In addition to the Competencies for all Engineering Programs, the **basic Mechanical Engineering** graduate must be able to:

B1. Model, analyse and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.

B2. Plan, manage and carry out designs of mechanical systems and machine elements using appropriate materials both traditional means and computer-aided tools and software contemporary to the mechanical engineering field.

B3. Select conventional mechanical equipment according to the required performance.

B4. Adopt suitable national and international standards and codes; and integrate legal, economic and financial aspects to: design, build, operate, inspect and maintain mechanical equipment and systems.

3.3 High Specialized Competencies (C-Level)

The graduates of the **Mechanical Power Engineering** program should be able to:

C1. Recognize the design concepts, operation and characteristics of internal combustion engines, boilers, heat exchangers, turbomachines and hydraulic machines.

C2. Analyze, evaluate and enhance the performance of the HVAC systems, automatic control systems, pneumatic systems, hydraulic systems, combustion systems, thermal and nuclear power plants.

C3. Judge the optimal solution according to the constraints of operation, costs, safety, reliability and environmental impacts.

C4. Choose, apply and assess the newable and renewable energy resources in water desalination, power generation, heating, cooling and air conditioning applications.

C5. Select appropriate solutions for mechanical power engineering problems based on analytical and numerical techniques.

C6. Use and develop codes using a wide range of software packages pertaining to the discipline.

C7. Exchange knowledge and skills with engineering community and industries; prepare the presentations and technical reports.

4. Academic Standards

4.1 External References for Standards (Benchmarks)

The external references for standards considered in the development of this program were the **National Academic Reference Standards** for Engineering (NARS 2018) for **Mechanical Power Engineering** graduate.

4.2 The Academic Reference NARS 2018 and Program Aims

The following table displays how the LOs of the current program achieve the program aims:

Program Aims	Academic Reference LOS
1) Apply a wide spectrum of engineering knowledge, science and specialized skills with analytical, critical and systematic thinking to identify and solve engineering problems in real life.	**A1.** Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.
	A2. Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions**.**
2) Behave professionally and adhere to engineering ethics and standards and contribute in the development of the profession and the community and promoting the sustainability principles.	**A3.** Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.
	C3. Judge the optimal solution according to the constraints of operation, costs, safety, reliability and environmental impacts.
3) Work in a heterogeneous team and display leadership qualities, responsibility for own and team performance, business administration, and entrepreneurial skills.	**A7.** Function efficiently as an individual and as a member of multi-disciplinary and multicultural teams.
	A9. Use creative, innovative and flexible thinking and acquire entrepreneurial and leadership skills to anticipate and respond to new situations.
4) Master self and lifelong learning strategies using techniques, skills and modern engineering tools and	**A5.** Practice research techniques and methods of investigation as an inherent part of learning.

demonstrate the capacity to engage in post- graduate and research studies.	**A10.** Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.
5) Communicate effectively using different modes, tools, and languages with various audiences to deal with academic and professional challenges in a critical and creative manner.	**A8.** Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools.
	C7. Exchange knowledge and skills with engineering community and industries; prepare the presentations and technical.
6) Apply and integrate knowledge, understanding and skills of different subjects and available computer software to solve real problems in mechanical power engineering discipline.	**B3.** Select conventional mechanical equipment according to the required performance.
	C1. Recognize the design concepts, operation and characteristics of internal combustion engines, boilers, heat exchangers, turbomachines and hydraulic machines
	C5. Select appropriate solutions for mechanical power engineering problems based on analytical and numerical techniques.
	C6. Use and develop codes using a wide range of software packages pertaining to the discipline.
7) Design, analyse and evaluate the performance of different mechanical systems, powered by both conventional and renewable energy sources, considering the operational, maintenance, economical, safety, and environmental aspects.	**B1.** Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.
	C2. Analyze, evaluate and enhance the performance of the HVAC systems, automatic control systems, pneumatic

	systems, hydraulic systems, combustion systems, thermal and nuclear power plants.
	C4. Choose, apply and assess the newable and renewable energy resources in water desalination, power generation, heating, cooling and air conditioning applications.
8) Utilize the codes of practice and standards as well as the quality guidelines.	**A4.** Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues and risk management principles.
	B4. Adopt suitable national and international standards and codes; and integrate legal, economic and financial aspects to: design, build, operate, inspect and maintain mechanical equipment and systems**.**
9) Carry out preliminary designs of mechanical power systems, investigate their performance and solve their essential operational problems.	**A6.** Plan, supervise and monitor implementation of engineering projects , taking into consideration other trades requirements
	B2. Plan, manage and carry out designs of mechanical systems and machine elements using appropriate materials both traditional means and computer-aided tools and software contemporary to the mechanical engineering field.

5. Curriculum Structure and Contents

5.1 Program Duration

5 years

5.2 Program Structure

Table (a) shows the courses teaching hours according to the academic year.

Table (a)

Level	No. Hours / week						Average Hours / Week			Total / Week
	First Term (15 Weeks)			Second Term (15 weeks)						
	Lec.	Tut.	Lab.	Lec.	Tut.	Lab.	Lec.	Tut.	Lab.	
Preparatory	13	8	3	13	8	5	13	8	4	25
First	13	9	3	13	7	5	13	8	4	25
Second	12	10	3	14	7	4	13	8.5	3.5	25
Third	12	7	5	14	9	3	13	8	4	25
Fourth	10	8	7	10	9	6	10	8.5	6.5	25
Total	60	42	21	64	41	23	62	41	22	125

No. of hours per week: (Third): Compulsory 25 Elective 4 Optional ---

(Fourth): Compulsory 19 Elective 6 Optional---

Table (b) displays the classification of courses in mechanical power engineering program

Table (b)

Year	Humanities and Social Sciences		Mathematic and basic sciences		Basic Eng. sciences		Applied Eng. and Design		Computer Application and ICT		Projects and Practice		Discretionary subjects		Total
	1st term	2nd term	1st term	2nd term	1st term	2nd term	1st term	2nd term	1st term	2nd term	1st term	2nd term	1st term	2nd term	
Preparatory	4	2	16	12	4	6	-	-	-	4	-	2	-	-	50
First year	2	2	12	4	8	13	-	-	-	4	3	2	-	-	50
Second year	2	4	4	-	9	7	5	8	1	4	4	2	-	-	50
Third year	4	2	1	1	2	6	12	7	1	5	4	1	-	4	50
Fourth year	-	-	-	-	-	-	14	11	2	2	4	3	5	9	50
Total	12	10	33	17	23	32	31	26	4	19	15	10	5	13	250
%	**8.8**		**20**		**22**		**22.8**		**9.2**		**10**		**7.2**		**100**
NARS (%)	**9-12**		**20-26**		**20-23**		**20-22**		**9-11**		**8-10**		**6-8**		

6. Program Courses

6.1 Level/Year of Program

Preparatory (1st Semester):

Code No.	Course Title	No. of hours /week				Programme ILOs Covered (By No.)
		Lec.	Tut.	Lab.	Total	
SCI001	**Mathematic (1)**	2	2	-	4	A1, A2
SCI002	**Mechanics (1)**	2	2	-	4	A1, A2
SCI003	**Physics (1)**	2	1	1	4	A1, A2
SCI004	**Engineering Chemistry**	2	-	2	4	A1, A2, A8
PRD002	**Engineering drawing and Projection (1)**	1	3	-	4	A1, A3, A10
HUU001	**Technical English Language**	2	-	-	2	A7, A8
HUF002	**History of Engineering and Technology**	2	-	-	2	A7, A9, A10
Total		**13**	**8**	**3**	**24**	

Preparatory (2nd Semester):

Code No.	Course Title	No. of hours /week				Programme ILOs Covered (By No.)
		Lec.	Tut.	Lab.	Total	
SCI005	**Mathematics (2)**	2	2	-	4	A1, A2
SCI006	**Mechanics (2)**	2	2	-	4	A1, A2
SCI007	**Physics (2)**	2	1	1	4	A1, A2
PRD001	**Production Technology**	2	-	2	4	A1, A2, A4
PRD003	**Engineering drawing and Projection (2)**	1	3	-	4	A1, A3, A10
CCE 001	**Computer and Programming**	2	-	2	4	A1, A3, A10
HUU002	**Human Rights**	2	-	-	2	A8, A9, A10
Total		**13**	**8**	**5**	**26**	

First Year (1st Semester):

Code No.	Course Title	No. of hours /week				Programme ILOs Covered (By No.)
		Lec.	Tut.	Lab.	Total	
SCI109	**Mathematics (3B)**	2	2	-	4	A1, A10
SCI111	**Applied Mechanics**	2	2	-	4	A1
SCI115	**Physics 3-B**	2	-	2	4	A1, A2, B1
MPE101	**Mechanical drawing**	1	-	3	4	A3, A4, B2, B4
PRD113	**Manufacturing Engineering**	2	-	1	3	A1, A3, B2
CIV106	**Analysis and Mechanics of Structure**	2	2	-	4	A1, B1
HUU103	**Development of thinking skills**	2	-	-	2	A8, A9, A10
Total		**13**	**6**	**6**	**25**	

First Year (2nd Semester):

Code No.	Course Title	No. of hours /week				Programme ILOs Covered (By No.)
		Lec.	Tut.	Lab.	Total	
SCI119	**Mathematics (4B)**	2	2	-	4	A1, A5, A10
MPE102	**Mechanical-Drawing-using-computer**	1	-	3	4	A3, A4, B2, B4
MPE103	**Fluid Mechanics**	2	1	1	4	A1, A5, B1, C1, C5
MPE104	**Thermodynamic(1)**	2	1	1	4	A1, A3, B1, C1
PRD 114	**Thermal and Mechanical Stress Analysis**	2	1	-	3	A1, A3, A10, B1, B2
PRD 115	**Theory of Machines**	2	2	-	4	A1, B1, B2
HUF 102	**Writing Technical Reports**	2	-	-	2	A8, A10
Total		**13**	**7**	**5**	**25**	

Second Year (1st Semester):

Code No.	Course Title	No. of hours /week				Programme ILOs Covered (By No.)
		Lec.	Tut.	Lab.	Total	
SCI229	Numerical Analysis	2	2	-	4	A1
MPE210	Fluid Dynamics	2	1	1	4	A1, A2, A10, B1, C1, C2, C5
MPE211	Thermodynamics(2)	2	2	1	5	A1, B1, C1, C3
MPE212	Mechanical and Thermal Measurements	2	1	1	4	A3, A10, B1, B3, C1, C3
MPE213	Summer Training (1)	-	2	-	2	A3, A4, B2, B4, C1, C6, C7
PRD223	Design of Machine Elements	2	2	-	4	A1, A3, B1, B2, B4
HUU204	Management and marketing	2	-	-	2	A7, A9, A10
Total		12	10	3	25	

Second Year (2nd Semester):

Code No.	Course Title	No. of hours /week				Programme ILOs Covered (By No.)
		Lec.	Tut.	Lab.	Total	
MPE214	Combustion technology	2	2	1	5	A3, A4, B1, B3, C1, C2, C3, C4
MPE215	Heat transfer	2	2	1	5	A1, A3, B1, C1, C3, C5
EPM212	Computer Applications in Mechanical Power Engineering	2	-	1	3	A1, A1, B1, B2, C5, C6
PRD224	Design of Machine	2	2	-	4	A1, A3, B1, B2, B4
EPM212	Electrical and Electronics Engineering	2	1	1	4	A1, A2, B1
HUF203	Engineering Applications in Marine Environment	2	-	-	2	A3, A7, A10
HUF204	Environment sciences and Occupational safety	2	-	-	2	A4, A6, A10
Total		14	7	4	25	

Third Year (1^{st} Semester):

Code No.	Course Title	No. of hours /week				Programme ILOs Covered (By No.)
		Lec.	Tut.	Lab.	Total	
MPE322	**Internal Combustion Engines**	2	2	1	5	A3, A4, B1, B3, B4, C1, C2, C4
MPE 323	**Heat and Mass Transfer**	2	2	1	5	A1, A3, B1, C1, C3, C5
MPE324	**Mechanical Vibrations**	2	2	-	4	A1, B1, C5
MEP301	**Steam Technology**	2	1	1	4	A3, B1, B3, C1, C2, C3, C4
MPE326	**Summer Training (2)**	-	-	2	2	A5, A6, A7, A8, A9, A10, B4, C1, C7
HUD303	**Security & Safety of Mechanical Equipment**	2	-	-	2	A4, B4
HUU305	**Leadership Skills**	2	-	-	2	A6, A7, A8, A9
Total		**12**	**7**	**5**	**24**	

Third Year (2^{nd} Semester):

a. Compulsory

Code No.	Course Title	No. of hours /week				Programme ILOs Covered (By No.)
		Lec.	Tut.	Lab.	Total	
MPE327	**Automatic Control**	2	2	-	4	A1, B1, B4, C2
MPE 328	**Use of Commercial Packages in Mechanical Power Engineering**	2	1	1	4	A1, A2, A5, A10, B1, B2, C5, C6
MPE329	**Gas Dynamics**	2	1	1	4	A1, B1, B3, C1
MPE330	**Basics of Refrigeration and Freezing**	2	2	1	5	B1, C1, C2, C3, C4
MEP3XX	**Elective course (1)**	2	2	-	4	A3, B4, C3, C4
EPM322	**Electrical Machines and Power networks**	2	1	-	3	A1, B1, C1
HUF305	**Presentation Skills**	2	-	-	2	A7, A8, A9, A10
Total		**14**	**9**	**3**	**26**	

b. Elective Course (1) – Number Required: (One)

Group	Code No.	Course Title	No. of hours /week				Programme ILOs Covered (By No.)
			Lect.	Tut.	Lab.	Total	
A	MEP331	Energy Sources	2	2	-	4	A3, B4, C3, C4
B	MEP 332	Newable and Renewable Thermal Energy	2	2	-	4	A3, B4, C3, C4
C	MPE333	Newable and Renewable hydrodynamics Energy	2	2	-	4	A3, B4, C3, C4

Fourth Year (1st Semester):

a. Compulsory

Code No.	Course Title	No. of hours /week				Programme ILOs Covered (By No.)
		Lec.	Tut.	Lab.	Total	
MPE436	Turbomachines	2	2	1	5	A3, A10, B1, B2, B3, C1, C2
MPE437	Hydraulic Machines	2	2	1	5	A1, A2, B1, B3, B4, C1, C2, C4, C7
MPE438	Ventilation and Air Conditioning	2	2	1	5	B1, B2, B4, C2, C3, C4, C6
MPE4XX	Elective Course (2)	2	2	-	4	A3, A10, B1, B3, B4, C1, C2, C3, C7
HUD404	Energy Economics	2	-	-	2	A3, A4, B4, C3, C4
MPE439	Projects	-	-	4	4	A1, A2, A3, A4, A5, A6, A7, A8, A9, A10, B1, B2, B3, C2, C3, C5, C7
Total		10	8	7	25	

b. Elective Course (2) – Number Required: (One)

Group	Code No.	Course Title	No. of hours /week				Programme ILOs Covered (By No.)
			Lec.	Tut.	Lab.	Total	
A	MPE442	Combustion Systems	2	2	-	4	A3, A10, B1, B3, B4, C1, C2, C3, C7
B	MPE443	Systems and Equipments of Refrigeration	2	2	-	4	A3, A10, B1, B3, B4, C1, C2, C3, C7
C	MPE444	Design of Fire-Fighting Systems	2	2	-	4	A3, A10, B1, B3, B4, C1, C2, C3, C7

Fourth Year (2nd Semester)

a. Compulsory

Code No.	Course Title	No. of hours /week				Programme ILOs Covered (By No.)
		Lec.	Tut.	Lab.	Total	
MPE440	Thermal and Nuclear Power Stations	2	2	1	5	A3, B1, B3, C1, C2, C3, C4
MPE441	Pneumatic and Hydraulic Systems	2	1	1	4	A1, A2, A3, A4, B1, B3, B4, C1, C2, C3
MEP4xx	Elective Course (3)	2	2	-	4	A3, A5, B1, B2, B3, C2, C3, C5, C6
MEP4xx	Elective Course (4)	2	2	-	4	A4, A5, A10, B4, C1, C2, C3, C7
PRD456	Industrial and legislation regulating	2	2	-	4	A3, B4, C3
MPE439	Projects	-	-	4	4	A1, A2, A3, A4, A5, A6, A7, A8, A9, A10, B1, B2, B3, C2, C3, C5, C7
Total		10	9	6	25	

b. **Elective Course (3) – Number Required: (One)**

Group	Code No.	Course Title	No. of hours /week				Programme ILOs Covered (By No.)
			Lec.	Tut.	Lab.	Total	
A	**MPE445**	**Internal Combustion Engines Design**	2	2	-	4	A3, A5, B1, B2, B3, C2, C3, C5, C6
B	**MPE446**	**Air Conditioning Systems & Equipment**	2	2	-	4	A3, A5, B1, B2, B3, C2, C3, C5, C6
C	**MEP447**	**Computational Fluid Dynamics**	2	2	-	4	A3, A5, B1, B2, B3, C2, C3, C5, C6

c. **Elective Course (4) – Number Required: (One)**

Group	Code No.	Course Title	No. of hours /week			Programme ILOs Covered (By No.)
			Lec.	Lab.	Total	
A	**MPE448**	**Maintenance of the Engines**	2	2	4	A4, A5, A10, B4, C1, C2, C3, C7
B	**MPE449**	**Water Desalination and Treatment**	2	2	4	A4, A5, A10, B4, C1, C2, C3, C7
C	**MEP450**	**Compressors**	2	2	4	A4, A5, A10, B4, C1, C2, C3, C7

7. Program Admission Requirements

- **Admission to the preparatory year:**

  Having Egyptian secondary education or equivalent certificate with major in Mathematics with the minimum grades determined by the National Admission Office.

- **Admission to the Mechanical power Department:**

  At the end of the preparatory year, students should fill an application form to choose the program he/she wishes to join (in a priority sequence). The students are selected according to the total no. of grades attained by each student at the end of the preparatory year. The number of students is determined according to the availability of educational resources.

8. Regulations for Progression and Program Completion

- **All Years (except the last year)**

  The student is considered successful if he passes the examinations in all courses of his class.

  - The student must get a minimum of 50% to pass each course.
  - To pass a level (Year) the student should not fail in more than two courses of his class or from lower classes.

- **Last Year**
  - To be graduated, the student must pass all the courses.
  - If he fails in one or two courses, not including the project, he/she has the opportunity to be retested in September, and he must pass these courses to be graduated.
  - If the student fails in the project; he must repeat it during the next academic year.

- **The Grades of Success:**

  The student achieves one of the following grades in the examinations results and in the general grade according to the marks achieved:

  - Excellent: from 85% of the total mark and upwards.
  - Very Good: from 75% to less than 85%of the total mark.
  - Good: from 65% to less than 75%of the total mark.
  - Pass: from 50% to less than 65% of the total mark.

  The grades of a failing student in a course are estimated in one of' the following grades:

  - Weak: from 30% of the total mark to less than 50%
  - Very Weak: Less than 30%of the total mark.

Also, the student is failing in exam if he doesn't have at least 30% of final exam maximum grade.

9. Teaching and Learning Methods

No.	Method
1.	Lecture (Online/ In class)
2.	Interactive lectures
3.	Flipped Classroom
4.	Presentation
5.	Discussion
6.	Problem-solving
7.	Brain storming
8.	Projects
9.	Site visits
10.	Self-learning
11.	Cooperative
12.	Drawing Studio
13.	Computer Simulation
14.	Practical Experiments

10. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials
2	Online lectures and assignments

11. Evaluation Methods of Students:

No.	Method
1	Mid Term Examination (written/ online)
2	Oral Examination
3	Practical
4	Formative (quizzes- online quizzes- presentation - …….)
5	Final Term Examination (written)
6	Graduation Project

12. Evaluation of Program Learning Outcomes (Los):

Evaluator	Tool
1- Senior Students	Meeting + questionnaire
2- Alumni	questionnaire
3- Stakeholders (Employers)	Site visits
4-External Evaluator(s) (External Examiner (s)	Evaluation report **(Attached)**

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

Date of Approval: 28 / 3 / 2021

مصفوفة البرنامج

	Course Code	Course title	Competencies of Engineering Graduate (A- Level)										Competencies of Mechanical Engineering Graduate				Competencies of Mechanical Power Engineering Program Graduate (C- Level)						
			1	2	3	4	5	6	7	8	9	10	1	2	3	4	1	2	3	4	5	6	7
Prepyear-Term 1	SCI001	Mathematics (1)	x	x																			
	SCI002	Mechanics (1)	x	x																			
	SCI003	Physics (1)	x	x																			
	SCI004	Engineering Chemistry	x	x						x													
	PRD002	Engineering Drawing and Projection (1)	x		x							x											
	HUU 001	Technical English Language							x	x													
	HUF002	Engineering &Technology History							x		x	x											
Prepyear-Term 2	SCI005	Mathematics (2)	x	x																			
	SCI006	Mechanics (2)	x	x																			
	SCI007	Physics (2)	x	x																			
	PRD001	Production Technology	x	x		x																	
	PRD003	Engineering Drawing and Projection (2)	x		x							x											
	CCE001	Computer and Programming	x		x							x											
	HUU 002	Human Rights								x	x	x											
Year 1- Term 1	SCI109	Mathematics (3B)	x									x											
	SCI111	Applied Mechanics	x																				
	SCI115	Physics 3-B	x	x									x										
	MPE101	Mechanical drawing			x	x								x		x							
	PRD 113	Manufacturing Engineering	x		x									x									
	CIV106	Analysis and Mechanics of Structure	x										x										
	HUU103	Development of thinking skills								x	x	x											
Year 1-Term 2	SCI119	Mathematics (4B)	x				x					x											
	MPE102	Mechanical Drawing using Computer			x	x								x		x							
	MPE103	Fluid Mechanics	x				x						x				x				x		
	MPE104	Thermodynamic(1)	x		x								x				x						
	PRD114	Thermal & Mechanical stress	x		x							x	x	x									
	PRD115	Theory of Machines	x										x	x									
	HUF102	Technical report Writing								x		x											x
Year 2- Term 1	SCI229	Numerical Analysis	x																				
	MPE210	Fluid Dynamics	x	x								x	x				x	x			x		
	MPP211	Thermodynamics(2)	x										x				x		x				
	MPE212	Mechanical& Thermal Measurements			x							x	x		x		x		x				
	MPE213	Summer Training (1)			x	x								x		x	x					x	x
	PRD223	Design of Machine Elements	x		x								x	x		x							
	HUU204	Management and Marketing							x		x	x											

Year 2- Term 2	MPE214	Combustion technology			x	x							x		x		x	x	x	x			
	MPE215	Heat transfer	x		x								x				x		x		x		
	MPE216	Computer Applications in Mechanical Power Engineering	x	x									x	x							x	x	
	PRD224	Machine Design	x		x								x	x		x							
	EPM212	Electrical and Electronics Engineering	x	x									x										
	HUF203	Engineering applications in marine environment			x				x			x											
	HUF204	Environment sciences and Occupational safety				x		x				x											
Year 3-Term 1	MPE322	Internal Combustion Engines			x	x							x		x	x	x	x		x			
	MPE 323	Heat and Mass Transfer	x		x								x				x		x		x		
	MPE324	Mechanical Vibrations	x										x								x		
	MEP301	Steam Technology			x								x		x		x	x	x	x			
	MPE326	Summer Training (2)					x	x	x	x	x	x				x	x						x
	HUD303	Security&safety of mechanical					x									x							
	HUU305	Leadership Skills						x	x	x	x												
Year 3- Term 2	MPE327	Automatic Control	x										x			x		x					
	MPE 328	Use of Commercial Packages in Mechanical Power Engineering	x	x			x					x	x	x							x	x	
	MPE329	Gas Dynamics	x										x		x		x						
	MPE330	Basics of Refrigeration and Freezing											x				x	x	x	x			
	MEP33x	Elective course (1)			x											x			x	x			
	EPM322	Electrical Machines and Power networks	x										x				x						
	HUF305	Presentation Skills							x	x	x	x											
Year 4- Term 1	MPE 436	Turbomachines			x							x	x	x	x		x	x					
	MPE437	Hydraulic Machines	x	x									x		x	x	x	x		x			x
	MPE438	Ventilation and Air Conditioning											x	x		x		x	x	x		x	
	MPE44x	Elective Course (2)			x							x	x		x	x	x	x	x				x
	HUD404	Energy Economics			x	x										x			x	x			
	MPE439	Projects	x	x	x	x	x	x	x	x	x	x	x	x	x			x	x		x		x
Year 4- Term 2	MPE440	Thermal and Nuclear Power Plants			x								x		x		x	x	x	x			
	MPE441	Pneumatic and Hydraulic Systems	x	x	x	x							x		x	x	x	x	x				
	MEP 44x	Elective Course (3)			x		x						x	x	x			x	x		x	x	
	MPE44x	Elective Course (4)				x	x					x				x	x	x	x				x
	PRD456	Industrial and legislation regulating			x											x			x				
	MPE439	Projects	x	x	x	x	x	x	x	x	x	x	x	x	x			x	x		x		x

مجالس تبني المعايير الأكاديمية

- أ.د / أحمد شرف عبدالحميد - أ.م.د / حماده جاد محمد
- د / ياسر نبيل الحناوى - د / شيريهان عبده عبدالغفور
- د / مصطفى محمد عطية عقيلى - د / محمد محمد متولى السقا

الموضوع الخامس عرض الطلب المقدم من السيد أ.م.د / محمد الغندور الغندور – الأستاذ المساعد بالقسم بشأن انتداب سيادته انتداب جزئى الى المعهد العالى للهندسة والتكنولوجيا بالمنزلة للفصل الدراسى الثانى للعام الجامعى 2021/2020 بواقع يوما أسبوعيا (يوم السبت).

القـــــرار: أوصى المجلس بالموافقة على انتداب سيادته .

الموضوع السادس عرض الطلب المقدم من السيد الدكتور / ياسين السيد ياسين – المدرس بالقسم بشأن انتداب سيادته انتداب جزئى الى المعهد العالى للهندسة والتكنولوجيا بالمنزلة للفصل الدراسى الثانى للعام الجامعى 2021/2020 بواقع يوما أسبوعيا (يوم الاثنين).

القـــــرار: أوصى المجلس بالموافقة على انتداب سيادته .

الموضوع السابع عرض الطلب المقدم من السيد الدكتور / ياسر نبيل الحناوى – المدرس بالقسم بشأن تجديد رخصة مزاولة المهنة خارج الجامعة فى غير أوقات العمل الرسمية للعام الثانى .

القـــــرار: أوصى المجلس بالموافقة تجديد رخصة مزاولة المهنة لسيادته .

الموضوع الثامن: عرض الطلب المقدم من المهندس / ياسر السيد السيد – المعيد بالقسم بشأن تعيينه بوظيفة مدرس مساعد بذات القسم بناءا على القرار رقم (186) بتاريخ 2021/3/1 بمنحة درجة الماجيستير فى العلوم الهندسية فى هندسة القوى الميكانيكية

القـــــرار: أوصى المجلس بالموافقة على تعيينه بوظيفة مدرس مساعد بذات القسم .

الموضوع التاسع: عرض مقترح الجدارات "C" الخاصه بتخصص هندسة القوى الميكانيكية فى عام NARS 2018.

القـــــرار: أوصى المجلس بالموافقة على المقترح .

الموضوع العاشر: عرض موضوع تبنى برنامج قسم هندسةالقوى الميكانيكية NARS 2018 فى توصيف البرنامج وتوصيف المقررات الدراسية لمقررات اللائحة الدراسية2014 لطلاب البكالوريوس.

القـــــرار: وافق المجلس على تبنى برنامج قسم هندسةالقوى الميكانيكية NARS 2018 فى توصيف البرنامج وتوصيف المقررات.

الموضوع الحادى عشر: عرض التسجيل لدرجة الماجستير للدارس / محمود حسن محمد خليل – المعيد بالقسم

وعنوان الرسالة باللغة العربية

" تأثير الجنيحات على معامل القدرة لنموذج تربين رياح أفقى المحور "

وعنوان الرسالة باللغة الانجليزية :

" Effect of flaps on power coefficient of a Horizontal axis"

ولجنة الاشراف كالآتى :-

* أ.د / عبدالهادى عبدالمطلب العبادى	أستاذ بقسم هندسة القوى الميكانيكية – كلية الهندسة- جامعة بورسعيد.
* أ.م.د / محمد الغندور الغندور	أستاذ مساعد بقسم هندسة القوى الميكانيكية – كلية الهندسة- جامعة بورسعيد .
* د / محمد محمد متولى السقا	مدرس بقسم هندسة القوى الميكانيكية – كلية الهندسة- جامعة بورسعيد

القـــــرار: أوصى المجلس بالموافقة على التسجيل للدارس .

الموضوع الثانى عشر: عرض موضوع تحديد الجدارات الخاصه ببرنامج هندسة القوى الميكانيكية .

القـــــرار: وافق المجلس بالموافقة على الجدارات التالية :- .

الموضوع السادس : عرض الطلب المقدم من السيد الدكتور / ياسين السيد ياسين – المدرس بالقسم بشأن تدريب الرسم للفرقة الثانية قسم هندسة القوى الميكانيكية بالكلية

القــــــرار: أوصى المجلس بالموافقة على الطلب المقدم من سيادته .

الموضوع السابع: عرض توصيات السيد أ.د / أحمد شرف عبدالحميد – الأستاذ المتفرغ بالقسم لتعديل اللائحة.

القــــــرار: أوصى المجلس بالموافقة على وضع مادة آمن وسلامة مهنية بدلا من مصادر واقتصاديات الطاقة على أن تحتوى على فصل عن أنظمة مكافحة الحرائق مع ابقاء مادة أنظمة مكافحة الحرائق كمادة اختيارية وأيضا الموافقة على الترتيب الجديد لمجموعات المقررات الاختيارية .

الموضوع الثامن : عرض التسجيل لدرجة الماجستير للدارس / مصطفى محمد مصطفى محمود الجبرونى – المعيد بالقسم

<u>وعنوان الرسالة باللغة العربية</u>

" دراسة أداء النظام الشمسي الكهروضوئي-المولدات الكهروحرارية الهجين"

<u>وعنوان الرسالة باللغة الانجليزية :</u>

"performance Study of Hybird Solar Photovoltaic-Thermoelectric Generators System"

<u>ولجنة الاشراف كالآتي :-</u>

* أ.د / أيمن ابراهيم محمد رئيس الجامعه وأستاذ بقسم هندسة القوى الميكانيكية – كلية الهندسة - جامعة بورسعيد.
*.د / أماني محمود عرفات سيف المدرس بقسم هندسة القوى الميكانيكية – كلية الهندسة - جامعة بورسعيد
* د / شيريهان عبده عبدالغفور المدرس بقسم هندسة القوى الميكانيكية – كلية الهندسة - جامعة بورسعيد

القــــــرار: أوصى المجلس بالموافقة على الطلب المقدم التسجيل

الموضوع التاسع: عرض تقرير المراجع الخارجي والرد على الملاحظات الوارده فى التقرير على توصيف البرنامج والمقررات

القــــــرار: وافق المجلس على الملاحظات الموجوده بالتقرير

الموضوع العاشر: عرض توصيف البرنامج والمقررات بعد اجراء التعديلات المطلوبه وفقا لملاحظات المراجع الخارجى .

القــــــرار: وافق المجلس

الموضوع الحادي عشر: <u>ما استجد من الاحاطات بالنشرات والندوات التى وردت للقسم حتى حينه:-</u>

- احاطة المجلس بما ورد الينا من المعهد العالى للهندسة والتكنولوجيا بالعريش بشأن انتداب السيد الدكتور / جمال عباس زغلول – المدرس المتفرغ بالقسم انتداب كلى (اعاره كامله) وذلك بداية من 2021/4/1 للعام الجامعى 2021/2020 .
- احاطة المجلس بما ورد الينا من مكتب السيد أ.د / وكيل الكلية لشئون التعليم والطلاب بشأن تعديل الخطة الزمنية للفصل الدراسى الثانى بناء على قرار المجلس الأعلى للجامعات للعام الدراسى الجارى لمدة (3 أسابيع) مبدئيا.
- احاطة مجلس القسم بما ورد الينا من وزارة التعليم العالي – وكيل أول الوزارة – رئيس قطاع الشئون والبعثات بشأن الاعلان عن منحه كامله لأعضاء هيئة التدريسبالجامعات للحصول على درجة الدكتوراه من جامعة سول الوطنية فى كافة المجالات مع أولوية مجالات الطب والهندسة والزراعة والدراسات التنموية والدراسات الكورية .
- احاطة المجلس بما ورد الينا من مكتب السيد أ.د / وكيل الكلية لشئون التعليم والطلاب بشأن التدريب الصيفى (1) والتدريب الميدانى للعام الماضى والتى تم تأجيله بسبب جائحة كورونا .
- احاطة المجلس بما ورد الينا من وزارة التعليم العالى – مكتب الوزير بشأن توجيهات السيد رئيس الجمهورية بالموافقة على التقديرات والتوصيات المرفقة فى ضوء الاجراءات المتخذه من قبل الجهات المعنيه حيال جائحة كورونا مع اعتبار الموضوع هام جدا .
- احاطة المجلس بما ورد الينا من مكتب السيد أ.د / نائب رئيس الجامعه لشئون التعليم والطلاب بشأن التوجيه للساده أعضاء هيئة التدريس بأن المحاضرات الأون لاين لجميع الفرق الدراسية تفاعلية بين الطلاب وأستاذ الماده وليس بادراج ملف (PDF) أو تسجيل المحاضرات فقط.
- احاطة المجلس بما ورد الينا من جامعة عين شمس بشأن تشكيل لجنة لوضع مقترح بتعديل نصوص مواد قانون تنظيم الجامعات رقم (49) لسنة 1972 ولائحته التنفيذية وفقا لمقتضيات العصر.
- احاطة المجلس بما ورد الينا من مكتب السيد أ.د / وكيل الكلية لشئون التعليم والطلاب بضرورة متابعة العملية التدريسية بالقسم (المحاضرات - التمارين – العملى) مع الالتزام الكامل بالمواعيد حسب الجدول المعلن .

وقد أنهى المجلس أعماله فى تمام الساعه الواحده ظهرا الأحد الموافق 28 / 3 / 20201. فى تمام الساعه الثانية ظهرا

أمين سر المجلس
د / مصطفى محمد عطيه عقيلى

رئيس مجلس القسم
أ.د / كمال كمال أمين مراد

تمهيد:

- في بداية الجلسة رحب السيد أ.د/**حسن محمد حسن**- عميد الكلية بالسادة أعضاء مجلس الكلية
- وتقدم بخالص الشكر لكلا من السادة الاتى اسماؤهم وذلك لعمل فيديو يوضح اهم المواد المتاحة للكلية طبقا لطلب هيئة ضمان الجودة والاعتماد لرفعه ضمن الوثائق المطلوب.
  - **السيدة الدكتوره/هبه عبد العاطى**- مدير وحدة الجودة لاخراج وكتابه التعليق الصوتي.
  - **المهندس/عبد الرحمن احمد صالح** - المعيد بقسم الهندسة المدنية لكتابه التعليق الصوتي.
  - **الطالب/مؤمن الهوارى**- طالب بالفرقة الثانية قسم الهندسة المدنية لكتابه التعليق الصوتي.
  - **الطالب/شادى عيسي**- طالب بالفرقة الثانية قسم الهندسة المدنية لقيامه بالتصوير والمونتاج.

اولا:المصادقة:-

- التصديق علي مجلس الكلية الجلسة(٦) **والذى عقد بتاريخ ١٤ /٢/ ٢٠٢١م**

القرار: صادق المجلس

ثانيا: إحاطة المجلس علما بشأن موضوعات اللجان المنبثقة عن مجلس الكلية

الموضوع الاول:

بشأن احاطة مجلس الكلية علماً **بموضوعات لجنة المختبرات والمعامل المنعقدة بتاريخ ٧ /٣/ ٢٠٢١م**

القرار: احيط المجلس علماً

الموضوع الثانى:

بشان اقتراح لجنة المختبرات والمعامل المنعقدة بتاريخ ٧ /٣/ ٢٠٢١م **بالموافقة** على شراء اجهزة ومعدات لمعمل الطاقة الشمسية بقيمة تقديرية فى حدود مبلغ ٣٠٠,٠٠٠ (ثلاثمائة الف جنيها لا غير) وذلك لاهميتها العملية والعلمية لطلاب القسم والعملية التعليمية.

القرار: وافق المجلس

الموضوع الثالث:

بشأن احاطة مجلس الكلية علماً **بموضوعات لجنة المكتبات بتاريخ ٧ /٣/ ٢٠٢١م**

القرار: احيط المجلس علماً

ثالثا: وحدة توكيد الجودة والاعتماد:

الموضوع الاول :

بشأن عرض معايير NARS 2018 المتبناه للائحة ٢٠١٤ للاقسام الاتيه:-

١. قسم الهندسة البحرية وعمارة السفن
٢. قسم الهندسة الكهربية(شعبة قوى كهربيه)
٣. قسم الهندسة الكهربية(شعبة اتصالات)
٤. قسم الهندسة الكهربية(شعبة حاسبات)
٥. قسم الهندسة المعمارية والتخطيط العمراني
٦. قسم هندسة الانتاج والتصميم الميكانيكي
٧. قسم الهندسة المدنية
٨ . برنامج الغاز
٩. قسم القوى الميكانيكية
١٠. قسم الهندسة الكيميائية
١١. برنامج التشيد

القرار: وافق المجلس

الموضوع الثانى :

بشأن **الموافقة** على قائمة المراجعين الخارجيين للبرامج الاكاديمية (مرحلة البكالوريوس)٢٠٢٠/٢٠٢١ المرشحين من الاقسام العلمية على النحو التالى:-

القسم	الاسم	الكليه/الجامعة
الهندسة المدنية	أ.د/ابراهيم هاشم	كليه الهندسة–جامعة المنوفيه
الهندسة الكهربية(شعبه قوى كهربيه)	أ.د/ابراهيم بدران	كليه الهندسة–جامعة المنصوره
الهندسة الكهربية(شعبه اتصالات)	أ.د/سيد ربيعي	كليه الهندسة–جامعة المنوفية
الهندسة الكهربية (شعبه حاسبات)	أ.د/ابراهيم بدران	كليه الهندسة– جامعة المنصوره
هندسة الانتاج التصميم الميكانيكي	أ.د/مصطفى شعبان	كليه الهندسة– جامعةعين شمس
الهندسة المعمارية والتخطيط العمراني	أ.د/محمد هشام السعودى	كليه الفنون الجميلة– جامعة الاسكندرية
الهندسة البحرية وعمارة السفن	أ.د/احمد الحيوي	كليه الهندسة–جامعة الاسكندرية
الهندسة الكيميائية	أ.د/فاطمة عاشور	كليه الهندسة–جامعة القاهرة
برنامج الغاز	أ.د/عطية محمد عطية	الجامعة البريطانية
برنامج التشيد	أ.د/ابراهيم هاشم	كليه الهندسة–جامعة منوف
الفيزيقا والرياضيات الهندسية	أ.د/ميرفت ابو الخير	كليه الهندسة – جامعة المنصوره

القرار: وافق المجلس

الموضوع الثالث :

بشأن **الموافقة** على قائمة المراجعين الداخلين للبرامج الاكاديمية (مرحلة البكالوريوس)٢٠٢٠/٢٠٢١ المرشحين من الاقسام العلمية على النحو التالى:-

القسم	الاسم
الهندسة المدنية	أ.د/محمد محمد الغندور
الهندسة الكهربية(شعبه قوى كهربيه)	أ.د/صبحي سرى
الهندسة الكهربية(شعبه اتصالات)	أ.د/راوية يحي رزق
الهندسة الكهربية (شعبه حاسبات)	أ.د/راوية يحى رزق
هندسة الانتاج التصميم الميكانيكي	أ.د/شعبان عبده ابراهيم
الهندسة المعمارية والتخطيط العمراني	أ.د/نجلاء على مجاهد
الهندسة البحرية وعمارة السفن	أ.د/عادل عبد الله توفيق
الهندسة الكيميائية	أ.د/طه ابراهيم فراج
برنامج الغاز	أ.د/ممدوح جاد الله
برنامج التشيد	أ.د/محمد محمد الغندور
الفيزيقا والرياضيات الهندسية	أ.د/يوسف هاشم زهران

القرار: وافق المجلس

رابعا: شئون أعضاء هيئة التدريس

الموضوع الاول:

بشأن اقتراح مجلس قسم هندسة الانتاج والتصميم الميكانيكي بجلسته المنعقدة في ٢٠٢١/٢/٢٨م **بالموافقة** على تعيين **المهندسة / الشيماء جمال عبد الناصر ابراهيم علي عثمان** ــ المدرس المساعد بذات القسم ــ بوظيفة مدرس بالقسم , حيث أنها حصلت على درجة دكتوراه الفلسفة في هندسة الانتاج والتصميم الميكانيكي طبقا لقرار أ .د/ رئيس الجامعة في ٢٠٢١/٢/٢٥م, علما بأنها على رأس العمل وملتزمة في عملها ومسلكها منذ تعيينها بالقسم .

القرار: وافق المجلس

جامعة بورسعيد
كلية الهندسة
Port Said University
Faculty of Engineering
مكتب عميد الكلية — Dean Office

السيد الأستاذ الدكتور / ايمن محمد ابراهيم

رئيس جامعة بورسعيد

تحية طيبة وبعد ،،،،

نحيط سيادتكم علما بموافقة مجلس الكليه بتاريخ ٢٠٢١/٣/١٣ على تبني معايير NARS 2018 للائحة ٢٠١٤ للاقسام الاتيه:-

١. قسم الهندسة البحرية وعمارة السفن
٢. قسم الهندسة الكهربية(شعبة قوى كهربيه)
٣. قسم الهندسة الكهربية(شعبة اتصالات)
٤. قسم الهندسة الكهربية(شعبة حاسبات)
٥. قسم الهندسة المعمارية والتخطيط العمراني
٦. قسم هندسة الانتاج والتصميم الميكانيكي
٧. قسم الهندسة المدنية
٨. برنامج الغاز
٩. قسم القوى الميكانيكية
١٠. قسم الهندسة الكيميائية
١١. برنامج التشييد

لذا برجاء التكرم بالموافقه على عرض الموضوع على مجلس الجامعة

وتفضلوا بقبول فائق الاحترام ،،

عميد الكلية

٢٩/٣/٢٠٢١

أ.د / حسن محمد حسن

توصيف المقررات

1. Basic Information:

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Physics and Mathematical Engineering		
Course Code	**SCI001**		
Year/ Level	Preparatory- 1st semester		
Teaching Hours	Lectures	Tutorial	Practical/Lab.
	2	2	---

2. Course aims:

No.	Aim
1	Identify the essential knowledge about Calculus and some of its applications (Functions, Limits and continuity, Differentiation, Applications of Differentiation, and Partial Differentiation) and to have knowledge about Analytic Geometry and its applications (straight line, Ellipse, parabola, hyperbola, and circle equations).

3. Learning Outcomes (LOs):

A1.1	Recognize the functions (graphs and their properties), the differentiation and its applications, the partial differentiation and its applications and the geometric graphs and their equations.
A1.2	State acquaints with the continuity and different limits.
A1.3	Solve a variety of differentiation problems and the equations of straight line, Ellipse, parabola, hyperbola, and circle.
A1.4	Specify the problems to find its solutions.
A1.5	Use the suitable methods for solving the different types of differentiation and the suitable equations for different types of graphs.
A1.6	Distinguish the kinds of different types of differentiation and different types of geometric Graphs such as straight line, Ellipse, parabola, hyperbola, and circle equations.
A2.1	Acquire the experience to design differentiation problems and geometric problems and solve them.

4. Course Contents:

No.	Topics	Week
1	**Lectures:** • Functions. • Limits and Continuity. • Differentiation. **Tutorials:** • Recognize many functions with their graphs and properties. • Evaluate the limits and the continuity of many functions • Solve a variety of differentiation problems.	1-4
2	**Lectures:** • Applications of Differentiation. • Partial Differentiation. **Tutorials:** • Use the textbooks to solve some application of differentiation. • Review solving problem of partial differentiation.	5-8
3	Midterm	9
4	**Lectures:** • Equations of Straight lines. • Circles and their applications. **Tutorials:** • Review examples of Circles and their applications	10-11
5	**Lectures:** • Equations of Ellipse. • Equations of parabola. **Tutorials:** • Solve problem Related to Equations of Ellipse and parabola.	12-14
6	Final Submission	15

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method													
		Lecture (online/ in class)	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A1.1**	X					x								
	A1.2	X	x				x								
	A1.3	X		X			x	x							
	A1.4	X		X	x		x								
	A1.5	X	x				x								
	A1.6	X	x				x								
	A2.1	X	x			x	x	x							

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	Los
1	Mid Term Examination (written/ online)	A1.1, A1.2, A1,3, A1.4, A1.6, A2.1
2	Formative (quizzes- online quizzes)	A1.1, A1.2, A1.3, A1.4, A1.6, A2.1
3	Final Term Examination (written)	A1.1, A1.2, A1.3, A1.4, A1.4, A1.5, A1.6, A2.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written/ online)	9
2	Formative (quizzes- online quizzes)	Every week
3	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights
1	Mid Term Examination (written/ online)	20
2	Formative (quizzes- online quizzes)	10
3	Final Term Examination (written)	70
Total		100%

8. List of References:

No.	Reference List
1	Advanced Engineering Mathematics, Erwin Kreyszig, Wiley, 10th edition ,2011
2	William E. Boyce, Richard: "Elementary Differential Equations and Boundary Value Problems", John Wiley & Sons, Inc edition,2014

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture / Online Classroom
2	White Board
3	Data Show System
4	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aim	LOs
1	**Lectures:** • Functions. • Limits and Continuity. • Differentiation. **Tutorial:** • Recognize many functions with their graphs and properties. • Evaluate the limits and the continuity of many functions • Solve a variety of differentiation problems.	1	A1.1, A1.2, A1.4
2	**Lectures:** • Applications of Differentiation. • Partial Differentiation. **Tutorial:** • Use the textbooks to solve some application of differentiation. • Review solving problem of partial differentiation.	1	A1.3, A1.4, A2.1
3	Midterm		A1.1, A1.2, A1.3, A1.4, A1.4, A2.1
4	**Lectures:** • Equations of Straight lines. • Circles and their applications. **Tutorial:** • Review examples of Circles and their applications	1	A1.3, A1.6, A2.1
5	**Lectures:** • Equations of Ellipse. • Equations of parabola. **Tutorial:** • Solve problem Related to Equations of Ellipse and parabola.	1	A1.3, A1.5, A1.6
6	Final Submission	1	A1.1, A1.2, A1.3, A1.4, A1.5, A1.6, A2.1

Course: Mathematics (1)	
Program Competencies	**Course LOs**
A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science, and mathematics	**A1.1** Recognize the functions (graphs and their properties), the differentiation and its applications, the partial differentiation and its applications and the geometric graphs and their equations. **A1.2** State acquaint with the continuity and different limits. **A1.3** Solve a variety of differentiation problems and the equations of straight line, Ellipse, parabola, hyperbola and circle. **A1.4** Specify the problems to find its solutions. **A1.5** Use the suitable methods for solving the different types of differentiation and the suitable equations for different types of graphs. **A1.6** Distinguish the kinds of different types of differentiation and different types of geometric Graphs such as straight line, Ellipse, parabola, hyperbola, and circle equations.
A2. Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess, and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.	**A2.1** Acquire the experience to design differentiation problems and geometric problems and solve them.

Course Coordinator: Dr. Mohamed Yousef Farghaly

Dr. Mohamed Khalil EL Gayyar

Dr. Youssef Mohamed Baghdadi

Dr. Moanis Abdel Tawab Moaz

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information:

<table>
<tr><td>Program Title</td><td colspan="3">B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)</td></tr>
<tr><td>Department offering the Program</td><td colspan="3">Mechanical Power Engineering</td></tr>
<tr><td>Department Responsible for the Course</td><td colspan="3">Physics and Mathematical Engineering</td></tr>
<tr><td>Course Code</td><td colspan="3">SCI002</td></tr>
<tr><td>Year/ Level</td><td colspan="3">Preparatory Year – First Semester</td></tr>
<tr><td rowspan="2">Teaching Hours</td><td>Lectures</td><td>Tutorial</td><td>Practical/Lab.</td></tr>
<tr><td>2</td><td>2</td><td>-</td></tr>
</table>

2. Course aims:

No.	Aim
1	Recognize the principles of the mechanics and statics of particles, moments, Equilibrium's equations and solve any problem in a simple and logical manner

3. Learning Outcomes (LOs):

A1.1	Identify the mechanics and statics of particles.
A1.2	Recognize the laws of additions and multiplication of vectors.
A1.3	Define different methods to determine the resultant and moments of forces system
A1.4	Identify rectangular component of a force.
A2.1	Discuss the Reduction of a system of forces to one force and one couple.
A2.2	Evaluate Moment of force about a given Axis to the students
A2.3	Resolve the given force into a force at any point and a couple**.**
A2.4	Solve Equilibrium's equations of Rigid Bodies in two and three dimensions.
A2.5	Apply Distributed Forces: Centroids and Centers of Gravity.
A2.6	Solve some problems and collect some data.

4. Course Contents:

No.	Topics	Week
1	**Lectures: Chapter 1** -Introduction -The meaning of mechanics, static's and Static's of particles. -Vectors, addition of vectors. -Resultant of several concurrent forces. -Rectangular component of a force. -Addition of forces by summing x& y components. -Force defined by its magnitude and two points on its line of action -Rigid Bodies & Equivalent Systems of Forces. **Tutorials:** • Solve the problems.	1-4
2	**Lectures: Chapter 2** External and Internal Forces -Vector product of two vectors and Applications. -Moment of force about a point. -Scalar product of two vectors and applications. -Mixed Triple product of Three vectors and Applications. -Moment of force about a given Axis. -Moment of a Couple and Addition of couple -Resolution of a given force into a force at any point and a couple -Reduction of a system of forces to one force and one couple. **Tutorials:** • Solve the problems.	5-8
3	**Midterm**	9
4	**Lectures: Chapter 3** Equilibrium of Rigid bodies -Reactions at Supports and Connections for a two Dim. Structure. -Equilibrium of Rigid Bodies in two Dimensions. -Equilibrium of a Two –Force and a Three –Force Body. **Tutorials:** • Solve the problems.	10-12
5	**Lectures: Chapter 4** Distributed Forces: Centroids and Centers of Gravity -Centers of Gravity Two-Dimensional body. -Centroids of Areas and Lines & Determination of centroids by Integration. -Distributed Forces: Centroids and Centers of Gravity. -Centroids of Areas and Lines & Determination of centroids by Integration **Tutorials:** • Solve the problems.	13-14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method													
		Lecture(online / in class)	Interactive lectures	Flipped Classroom	Presentation	Discussion	Problem-solving	Brain storming	Projects	Site visits	Self-learning	Cooperative	Drawing Studio	Computer Simulation	Practical Experiments
A-Level	A1.1	x	x				x								
	A1.2	x	x	x		x									
	A1.3	x	x	x		x	x								
	A1.4	x	x												
	A2.1	x	x			x		x							
	A2.2	x	x												
	A2.3	x	x				x								
	A2.4	x	x				x								
	A2.5	x	x				x								
	A2.6	x	x				x								

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written/ online)	A1.1, A1.2, A1.3, A1.4, A2.1, A2.2, A2.3
2	Formative (quizzes- online quizzes)	A2.4, A2.5,
3	Final Term Examination (written)	A1.1, A1.2, A1.3, A1.4, A2.1, A2.2, A2.3, A2.4, A2.5, A2.6.

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written/ online)	9
2	Formative (quizzes- online quizzes)	Every week
3	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights
1	Mid Term Examination (written/ online)	15
2	Formative (quizzes- online quizzes)	15
3	Final Term Examination (written)	70
Total		100%

8. List of References

No.	Reference List
1	Erwin Kreyszig, "Advanced Engineering Mathematics" John Wiley & Sons Inc., 10th Edition, 2011
2	Ferdinand P. Beer and E. Russell Johnston, Jr."Vector Mechanics for Engineers" – Statics Metric Edition adapted by G. Wayne Brown, Sir Sandford Fleming College, New York, 2010.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture / Online Classroom
2	White Board
3	Data Show System
4	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	aim	LO's
1	**Chapter 1** -Introduction -The meaning of mechanics, static's and Static's of particles. -Vectors, addition of vectors. -Resultant of several concurrent forces. -Rectangular component of a force. -Addition of forces by summing x& y components. -Force defined by its magnitude and two points on its line of action -Rigid Bodies & Equivalent Systems of Forces.	1	A1.1, A1.2, A1.3, A1.4
2	**Chapter 2** - External and Internal Forces -Vector product of two vectors and Applications. -Moment of force about a point. -Scalar product of two vectors and applications. -Mixed Triple product of Three vectors and Applications. -Moment of force about a given Axis. -Moment of a Couple and Addition of couple -Resolution of a given force into a force at any point and a couple -Reduction of a system of forces to one force and one couple.	1	A2.1, A2.2, A2.3
3	Midterm	1	A1.1, A1.2, A1.3, A1.4, A2.1, A2.2, A2.3

4	**Chapter 3** Equilibrium of Rigid bodies -Reactions at Supports and Connections for a two Dim. Structure. -Equilibrium of Rigid Bodies in two Dimensions. -Equilibrium of a Two –Force and a Three –Force Body.	1	A2.4
5	**Chapter 4** Distributed Forces: Centroids and Centers of Gravity -Centers of Gravity Two-Dimensional body. -Centroids of Areas and Lines & Determination of centroids by Integration. -Distributed Forces: Centroids and Centers of Gravity. -Centroids of Areas and Lines & Determination of centroids by Integration	1	A2.5, A2.6.

Course: Mechanics (1)	
Program Competencies	**Course LOs**
A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.	**A1.1** Identify the mechanics and statics of particles. **A1.2** Recognize the laws of additions and multiplication of vectors. **A1.3** Define different methods to determine the resultant and moments of a System of forces system. **A1.4** Identify rectangular component of a force.
A2. Develop and conduct appropriate experimentation and /or simulation, analyze and interpret data, assess and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.	**A2.1** Discuss the Reduction of a system of forces to one force and one couple. **A2.2** Evaluate Moment of force about a given Axis to the students. **A2.3** Resolve the given force into a force at any point and a couple. **A2.4** Solve Equilibrium's equations of Rigid Bodies in two and three dimensions. **A2.5** Apply Distributed Forces: Centroids and Centers of Gravity. **A2.6** Solve some problems and collect some data.

Course Coordinator: Prof. Dr. Abdalla Wassf Isaac.

Program coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information:

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Physics and Mathematical Engineering		
Course Code	**SCI003**		
Year/ Level	Preparatory year -First semester		
Teaching Hours	Lectures	Tutorial	Practical/Lab.
	2	1	1

2. Course aims:

No.	Aim
1	Describe phenomena and theories of waves and heat, type of modulus of elasticity, Newton's law of cooling and thermodynamics laws.

3. Learning Outcomes (LOs):

A1.1	Distinguish between the fine measurements.
A1.2	Describe the waves, its properties, the interference of waves and the parameters which effect on it.
A1.3	Identify the temperature scales, the different kinds of Thermometers, thermal heat conductivity for different materials and the Triple point.
A1.4	Recognize the Kinetic Theory of gases, the Heat engine, Otto Cycle, Heat pump Cooling cycle by vapor pressure and the Meaning of Entropy.
A1.5	Show the types of substances according to Elasticity materials problems and different laws of thermodynamic.
A2.1	Evaluate the results given from experiments.
A2.2	Analyze data given from experiments.

4. Course Contents:

No.	Topics	Week
1	**Lectures:** • Material Properties. • Temperature measurement and Specific Heat. **Labs/Tutorials:** • Practicing on measuring instruments (micrometer, spherometer, and vernier). • Evaluate the acceleration due to gravity experimentally using simple pendulum.	1-3
2	**Lectures:** • Elasticity • Heat transfer **Labs/Tutorials:** • Evaluate the thermal conductivity coefficient of rubber material. • Observe the latent heat of condensation the water. • Assess the relation between stress and strain of a string.	4-5
3	**Lectures:** • Fluids • Properties of gases and Vapors **Labs/Tutorials:** • Identify the specific weight of liquid.	6-7
4	**Lectures:** • Surface tension. • Thermodynamics **Labs/Tutorials:** • Evaluate the surface tension of a liquid by experiment. • Determinate the linear expansion coefficient for a metallic road. • Assess the relation between stress and strain of a string.	8
5	Midterm	9
6	**Lectures:** • Viscosity • Heat Engines **Labs/Tutorials:** • Analyze the rigidity coefficient of a wire experimentally.	10-12
7	**Lectures:** • Acoustic waves • Entropy **Labs/Tutorials:** • Final practical examination	13-14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method													
		Lecture (online/in class)	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A1.1**	x	x				x								
	A1.2	x	x		x	x									
	A1.3	x	x	x		x	x								
	A1.4		x	x	x						x				
	A1.5			x											
	A2.1		x			x		x				x			x
	A2.2		x		x	x						x			x

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written/ online)	A1.2, A1.3
2	Practical	A2.1, A2.2
3	Oral Examination	A1.1, A1.2, A1.3
4	Formative (quizzes- online quizzes- reports)	A1.1, A1.2, A1.4
5	Final Term Examination (written)	A1.2, A1.3, A1.4, A1.5

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written/ online)	9
2	Practical/ Oral Examination	15
3	Formative (quizzes- online quizzes- reports)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights
1	Mid Term Examination (written/ online)	10
2	Practical/ Oral Examination	20
3	Formative (quizzes- online quizzes- presentation)	10
4	Final Term Examination (written)	60
Total		100%

8. List of References:

No.	Reference List
1	Serway R. A., Jewett J. W. “Physics” ,5th Edition,2013
2	Mckie D., Mckie C.,” Essentials of crystallography” ,1st Edition,2011.
3	Kittle C.: Introduction to solid state physics 9th Edition, 2013.
4	أساسيات الفيزياء – تأليف بوش – الطبعة الخامسة 2011 - ترجمة د. سعيد الجز يرى & د. محمد أمين سليمان.
5	أساسيات الفيزياء الكلاسيكية والمعاصرة – تأليف أ. د. رأفت كامل واصف – الطبعة الأولي 2011.
6	فيزياء الجوامد – تأليف أ. د. محمد أمين سليمان و أ. د. أحمد فؤاد باشا و أ. د. شريف خيري 2013

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture /Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aim	LOs
1	**Lectures:** • Material Properties. • Temperature measurement and Specific Heat. **Labs:** • Practicing on measuring instruments (micrometer, spherometer, and vernier). • Evaluate the acceleration due to gravity experimentally using simple pendulum.	1	A1.1, A1.3, A2.1, A2.2
2	**Lectures:** • Elasticity • Heat transfer **Labs:** • Evaluate the thermal conductivity coefficient of rubber material. • Observe the latent heat of condensation the water. • Assess the relation between stress and strain of a string.	1	A1.5, A2.1, A2.2
3	**Lectures:** • Fluids • Properties of gases and Vapors **Labs:** • Identify the specific weight of liquid.	1	A1.4, A2.1, A2.2
4	**Lectures:** • Surface tension. • Thermodynamics **Labs:** • Evaluate the surface tension of a liquid by experiment. • Determinate the linear expansion coefficient for a metallic road. • Assess the relation between stress and strain of a string.	1	A2.1, A2.2

5	Midterm	1	A1.2, A1.3
6	**Lectures:** - Viscosity - Heat Engines **Labs:** - Analyze the rigidity coefficient of a wire experimentally.	1	A2.2
7	**Lectures:** - Acoustic waves - Entropy **Labs:** - Final practical examination	1	A1.2, A1.3, A1.4, A1.5, A2.1

Course: Physics (1)	
Program Competencies	**Course LOs**
A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.	**A1.1** Distinguish between the fine measurements. **A1.2** Describe the waves, its properties, the interference of waves and the parameters which effect on it. **A1.3** Identify the temperature scales, the different kinds of Thermometers, thermal heat conductivity for different materials and the Triple point. **A1.4** Recognize the Kinetic Theory of gases, the Heat engine, Otto Cycle, Heat pump Cooling cycle by vapor pressure and the Meaning of Entropy. **A1.5** Show the types of substances according to Elasticity materials problems and different laws of thermodynamic.
A2. Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.	**A2.1** Evaluate the results given from experiments. **A2.2** Analyze data given from experiments.

Course Coordinator: Ass. Prof. Dr. Abdel Naser Ahmed Mansour

Dr. Fatma Fathy El - Sanabary

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information:

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Physics and Mathematical Engineering		
Course Code	**SCI004**		
Year/ Level	Preparatory Year		
Teaching Hours	Lectures	Tutorial	Practical/Lab.
	2	-	2

2. Course aims:

No.	**Aim**
1	Identify essential knowledge of basic principles, laws and theories of physical Chemistry, applied chemistry, which are necessary for engineering students. Quantitative and theoretical study of the properties and structure of matter and their relation to the interaction of matter with energy will be discussed.

3. Learning Outcomes (LOs):

A1.1	Recognize the ability to solve quantitative problems in matter changes
A1.2	Outline the comprehension the physical effects on the chemical compounds and recognize its chemical structure
A1.3	Recognize the equations of physical chemistry
A1.4	Define different topics and theories of physical chemistry
A1.5	State the difference between organic and inorganic samples
A2.1	Show the difference between the different types of polymers
A2.2	Investigate the behavior of gases
A2.3	Estimate the difference between the physical and chemical properties of different matters
A2.4	Discuss how to apply mathematics in chemistry in such a way that the equations paint a clear picture of the physical phenomena being studied
A2.5	Identify the Physical behavior of solid, liquid gas and mixed phase
A8.1	Communicate verbally with the colleagues in the lab

4. Course Contents:

No.	Topics	Week
1	**Chapter 1: physical chemistry** -Introduction to physical Chemistry -Major consideration in physical chemistry: Matter – quantifying matter (SI & cgs units) and derived SI units -Properties of gases -The perfect gas - gas laws -Problems -The real gas -Molecular interactions – Van der Waals equation. -Kinetics theory of gases- Problems **Chapter 2: Organic Chemistry** -Introduction to organic chemistry: -Lewis symbols, chemical bonding - electronic distributions Nomenclature of organic compounds – hybridization of orbital -Physical properties of organic compounds, aliphatic compounds and their derivatives effect of structure on the chemical properties **Chemistry lab**: -Introduction to the quantitative & qualitative analysis -Standardization of sodium Carbonate solution -Standardization of Hydrochloric acid solution using sodium Hydroxide Solution	1-3
2	**Chapter 3: chemical thermodynamics and thermochemistry** -First and second law of thermodynamics – heats of reactions – laws of heat reactions - standard states – spontaneous of chemical reaction – entropy and free energy **Chapter 4: Electrochemistry:** -Electrolysis -Application of electrochemistry on the corrosion of metals **Chemistry lab**: -Titration of strong acid against strong base -Analysis of alkaline mixture	4-6
3	**Chapter 5: Chemical equilibrium**: -Law of mass action and reversible reactions -Ionic theory – ionization of water - titration process and titration curves – indicators – hydrolysis of salts. Solubility product & common ion effect **Chemistry lab**: -Analysis of acidic mixture	7-8
4	**Midterm**	9
5	**Chapter 6: Natural gas & Petroleum oil:** -Composition of natural gas – process of separation **Petroleum oil:** -Composition – Classification – Separations **Chemistry lab**: -Identification of metal cations	10-11
6	**Chapter 7: Polymer chemistry:** -Introduction – classification of polymers - Mechanism of	12-14

	polymerization – free radical mechanism competitive reactions -Anionic and cationic Mechanism of polymerization – copolymers -Mechanical properties of polymers - relation between mechanical properties & Temperature **Chemistry lab**: -Identification of metals cations	

5. Teaching and Learning Methods:

LOs		**Teaching and Learning Method**													
		Lecture (online/ in class)	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A1.1**	x	x			x									
	A1.2	x	x												
	A1.3	x	x			x									
	A1.4	x	x			x									
	A2.5	x	x												
	A2.1	x	x					x							x
	A2.2	x	x												x
	A2.3	x	x												x
	A2.4	x	x					x							
	A2.5	x	x				x								
	A8.1						x								x

6. Teaching and Learning Methods low capacity and outstanding Student:

No.	**Teaching Method**
1	Additional Tutorials
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	Los
1	Mid Term Examination (written/ online)	A1-1, A1-2, A1-3, A1-4, A1-5, A2-4, A2-5
2	Practical	A2-1, A2-2, A2-3, A8-1
3	Oral Examination	A1-1, A1-2, A1-3, A1-4, A1-5
4	Formative (quizzes- online quizzes- reports)	A1-1, A1-2, A1-3, A1-4, A1-5, A2-1,
5	Final Term Examination (written)	A1-1, A1-2, A1-3, A1-4, A1-5, A2-1, A2-2, A2-3, A2-4, A2-5, A8-1,

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written/ online)	8
2	Practical/ Oral Examination	15
3	Formative (quizzes- online quizzes- reports)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights
1	Mid Term Examination (written/ online)	10
2	Practical/ Oral Examination	20
3	Formative (quizzes- online quizzes- presentation -reports)	10
4	Final Term Examination (written)	60
Total		100%

8. List of References:

No.	Reference List
1	Atkins. Peter, Julio de Paula, James Keeler, "Physical chemistry ", 11th ed, Oxford University Press, 2019.
2	I.N. Levine, " Physical chemistry”, 6th ed, The McGraw-Hill Companies, 2009.
3	J. Brady and G. Humistom "General chemistry, Principles and structure", 5th ed. John Wiley and Sons Inc., 1990.
4	Francis A Carey, Robert M Giuliano, 11th ed, Mc Graw Hill Education, 2017.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture / Online Classroom
2	laboratory Usage:
3	Library Usage
4	White Board
5	Data Show System
6	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aim	LO's
1	**Chapter 1: physical chemistry** -Introduction to physical Chemistry -Major consideration in physical chemistry: Matter – quantifying matter (SI & cgs units) and derived SI units -Properties of gases -The perfect gas - gas laws -Problems -The real gas -Molecular interactions – Van der Waals equation. Kinetics theory of gases- Problems **Chapter 2: Organic Chemistry** -Introduction to organic chemistry: -Lewis symbols, chemical bonding - electronic distributions Nomenclature of organic compounds – hybridization of orbital -Physical properties of organic compounds, aliphatic compounds, and their derivatives effect of structure on the chemical properties **Chemistry lab**: -Introduction to the quantitative & qualitative analysis -Standardization of sodium Carbonate solution -Standardization of Hydrochloric acid solution using sodium Hydroxide solution	1	A1-1 A1-2 A1-3 A1-4 A1-5 A2-1 A2-2 A2-3 A8-2
2	**Chapter 3: chemical thermodynamics and thermochemistry** -First and second law of thermodynamics – heats of reactions – laws of heat reactions - standard states – spontaneous of chemical reaction – entropy and free energy **Chapter 4: Electrochemistry:** -Electrolysis -Application of electrochemistry on the corrosion of metals **Chemistry lab**: -Titration of strong acid against strong base Analysis of alkaline mixture	1	A1-1 A1-2 A1-3 A1-4 A8-2
3	**Chapter 5: Chemical equilibrium**: -Law of mass action and reversible reactions Ionic theory – ionization of water - titration process and	1	A2-1 A2-2 A2-3

	titration curves – indicators – hydrolysis of salts. Solubility product & common ion effect **Chemistry lab**: -Analysis of acidic mixture		A2-4 A8-1
4	**Midterm**	1	A1-1, A1-2, A1-3, A1-4, A1-5, A2-1, A2-2, A2-3, A2-4, A2-5,
5	**Chapter 6: Natural gas & Petroleum oil:** -Composition of natural gas – process of separation **Petroleum oil:** -Composition – Classification – Separations **Chemistry lab**: -Identification of metal cations	1	A1-1 A1-4 A2-3 A2-4 A8-1
6	**Chapter 7: Polymer chemistry:** -Introduction – classification of polymers - Mechanism of polymerization – free radical mechanism competitive reactions -Anionic and cationic Mechanism of polymerization – copolymers -Mechanical properties of polymers - relation between mechanical properties & Temperature **Chemistry lab**: -Identification of metals cations	1	A1-4 A3-4 A2-5 A8-1

Course :Engineering Chemistry	
Program Competencies	**Course LOs**
A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.	**A1.1** Recognize the ability to solve quantitative problems in matter changes. **A1.2** Outline the comprehension the physical effects on the chemical compounds and recognize its chemical structure. **A1.3** Recognize the equations of physical chemistry. **A1.4** Define different topics and theories of physical chemistry. **A1.5** State the difference between organic and inorganic samples.
A2. Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.	**A2.1** Show the difference between the different types of polymers. **A2.2** Investigate the behavior of gases. **A2.3** Estimate the difference between the physical and chemical properties of different matters. **A2.4** Discuss how to apply mathematics in chemistry in such a way that the equations paint a clear picture of the physical phenomena being studied. **A2.5** Identify the Physical behavior of solid, liquid gas and mixed phase
A8. Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools.	**A8.1** Communicate verbally with the colleagues in the lab

Course Coordinator: Prof. Dr. Walid Fathallah
Dr. Sameh Mekawy

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information:

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Production Engineering & Mechanical Design		
Course Code	**PRD002**		
Year/ Level	Preparing year – First semester		
Teaching Hours	Lectures	Tutorial	Practical/Lab.
	1	3	-

2. Course aims:

No.	Aim
1	Provide the basic knowledge and skills of the concepts and principles of engineering drawing and fundamental of drawing projections. The basic principles of drawing with several applications are also studied.

3. Learning Outcomes (LOs):

A1.1	Identify the materials related to the parts of machines.
A1.2	Analyze the engineering problems that are used in engineering drawing.
A3.1	Apply the computer software (AutoCAD) for different drawing exercises.
A3.2	Employ the image and samples of machines drawing applications.
A10.1	Solve the different types of drawing exercises.
A10.2	Recognize the characteristics and processes related to the different machines and symbol drawing.
A10.3	Use engineering drawing and mechanics drawing handbook.

4. Course Contents:

No.	Topics	Week
1	**Lectures:** • Introduction of principles of engineering lines used in drawing. **Tutorials:** • Drawing of some exercise for different line weights.	1
2	**Lectures:** • Geometric construction theories of view derivation. **Tutorials:** • Drawing of some exercise on geometric construction.	2
3	**Lectures:** • Orthographic projection of engineering bodies. **Tutorials:** • Drawing of some exercise for projection.	3-4
4	**Lectures:** • Projection of point, lines, surfaces, and bodies. **Labs/Tutorials:** • Drawing of some exercise for projection of a very simple shapes.	5
5	**Lectures:** • How to divide of engineering drawing board and general engineering drawing. **Tutorials:** • Drawing of some exercise on how to divide an engineering drawing board.	6
6	**Lectures:** • Drawing engineering operations and some application on it. **Tutorials:** • Drawing of some exercise on engineering operations.	7-8
7	**Midterm Exam.**	9
8	**Lectures:** • Drawing of simple isometrics and its projections. **Tutorials:** • Drawing of some exercise for simple isometrics.	10-11
9	**Lectures:** • Drawing of complicated isometrics with inclined surfaces. **Tutorials:** • Drawing of some exercise for complicated isometrics.	12-13
10	**Lectures:** • Drawing of the third projection with the knowledge of the other projectors. **Tutorials:** • Some exercise on the drawing of the third projection with the knowledge of the other projectors.	14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method													
		Lecture (online / in class)	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A1.1**	x	x		x	x									
	A1.2	x	x		x		x			x					
	A3.1	x	x		x	x	x	x							
	A3.2	x	x		x										
	A8.1	x	x		x					x	x	x			
	A8.2	x	x		x	x	x	x							
	A8.3										x	x			

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written/ online)	A1.1, A1.2, A3.2, A8.1, A8.2
2	Formative (quizzes- online quizzes)	A1.1, A1.2, A3.1, A3.2, A8.1, A8.2, A8.3
3	Final Term Examination (written)	A1.1, A1.2, A3.1, A3.2, A8.1, A8.2

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written/ online)	9
2	Formative (quizzes- online quizzes)	Every 3 weeks
3	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights
1	Mid Term Examination (written/ online)	15
2	Formative (quizzes- online quizzes)	15
3	Final Term Examination (written)	70
Total		100%

8. List of References:

No.	Reference List
1	K. L. Narayana, P. Kannaiah, and K. Venkata Reddy ' Machine Drawing' New Age International (P) Ltd., 2006.
2	Fatehy El-shrif, ' Mechanical Drawing' Helwan Univ., 1975.
3	C. Simmons, D. Maguive, and N. Phelps, 'Manual of Engineering Drawing', Elsevier Ltd., 2009.
4	K. R. Hart 'Engineering Drawing with Problems and Solutions' ELBS, 1984.
5	Book," Engineering Drawing", prepared by staff of production engineering and Machine design department

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture /Online Classroom
2	White Board
3	Data Show System
4	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aim	LOs
1	**Lectures:** • Introduction of principles of engineering lines used in drawing. **Labs/Tutorials:** • Drawing of some exercise for different line weights.	1	A1.1
2	**Lectures:** • Geometric construction theories of view derivation. **Labs/Tutorials:** • Drawing of some exercise on geometric construction.	1	A1.2
3	**Lectures:** • Orthographic projection of engineering bodies. **Labs/Tutorials:** • Drawing of some exercise for projection.	1	A1.2, A3.2, A10.1
4	**Lectures:** • Projection of point, lines, surfaces, and bodies. **Labs/Tutorials:** • Drawing of some exercise for projection of a very simple shapes.	1	A1.2, A3.2, A10.1, A10.2
5	**Lectures:** • How to divide of engineering drawing board and general engineering drawing. **Labs/Tutorials:** • Drawing of some exercise on how to divide an engineering drawing board.	1	A1.2, A3.2, A10.1, A10.2
6	**Lectures:** • Drawing engineering operations and some application on it. **Labs/Tutorials:** • Drawing of some exercise on engineering operations.	1	A1.2, A3.2, A10.1, A10.2, A10.3
7	Midterm	1	A1.1, A1.2, A3.2,

			A10.1, A10.2
8	**Lectures:** - Drawing of simple isometrics and its projections. **Labs/Tutorials:** - Drawing of some exercise for simple isometrics.	1	A1.2, A3.1, A3.2, A10.1, A10.2
9	**Lectures:** - Drawing of complicated isometrics with inclined surfaces. **Labs/Tutorials:** - Drawing of some exercise for complicated isometrics.	1	A1.2, A3.1, A3.2, A10.1, A10.2, A10.3
10	**Lectures:** - Drawing of the third projection with the knowledge of the other projectors. **Labs/Tutorials:** - Some exercise on the drawing of the third projection with the knowledge of the other projectors.	1	A1.2, A3.1, A3.2, A10.1, A10.2, A10.3

Course: Engineering Drawing and Geometric Projection (1)	
Program Competencies	**Course LOs**
A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.	**A1.1** Identify the materials related to the parts of machines. **A1.2** Analyze the engineering problems that are used in engineering drawing.
A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical, and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.	**A3.1** Apply the computer software (AutoCAD) for different drawing exercises. **A3.2** Employ the image and samples of machines drawing applications.
A10. Acquire and apply new knowledge, and practice self, lifelong and other learning strategies.	**A10.1** Solve the different types of drawing exercises. **A10.2** Recognize the characteristics and processes related to the different machines and symbol drawing. **A10.3** Use engineering drawing and mechanics drawing handbook.

Course Coordinator: Prof. Dr. Gamal Abdel Nasser

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information:

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Electrical Engineering		
Course Code	**HUU001**		
Year/ Level	Preparatory year- First semester		
Teaching Hours	Lectures	Tutorial	Practical
	2	---	---

2. Course Aims:

No.	Aim
5	Use techniques, skills, and some English grammar and rules necessary for effectively writing numbers, equations, symbols, and some different types of technical documents such as reports, proposals, letters, and presentations.

3. Learning Outcomes (LOs):

A7-1	Work independently and within a team to prepare different types of technical reports and presentations.
A7-2	Choose the most adequate dictionaries to follow in writing the technical documents.
A8-1	Communicate effectively with colleges to identify the characteristics of a good technical report.
A8-2	Practice the rules and principles of technical writing.
A8-3	Acquire the skills to differentiate between the different types of technical documents reports, proposals, manuals, and presentations.

4. Course Contents:

Week No.	**Topic**	**Total Hours**	**Contact hrs**		
			Lec.	**Tut.**	**Lab.**
Week 1-2	Review of English Grammar and Mechanics of Language (Capitalization –Punctuation)	4	4	--	--
Week-3	Some characteristics of Technical Language (Abbreviation)	2	2	--	--
Week 4-5	How to write numbers, units, equations, symbols, and units of measure	4	4	--	--
Week 6-8	Technical words problems: such as jargons, Big words, Wordy phrases, Redundancies, Clichés, Nouns as adjectives, and Misused and troublesome words and phrases	6	6	--	--
Week 9	**Midterm Exam**	2	2	--	--
Week 10-11	Rules and Principals of technical writing	4	4	--	--
Weeks 12-13	Good technical writing	4	4		
Week 14	Applications of technical writing • Letters • reports • manuals • proposals • presentations	4	4	--	--

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method													
		Lecture (online-In class)	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A7-1**	X	X			X		X				X			
	A7-2	X	X			X		X			X	X			
	A8-1	X	X			X									
	A8-2	X				X	X								
	A8-3	X		X	X	X									

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials.
2	Online lectures and documentation.

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written)	A7-1, A7-2, A8-1, A8-2, A8-3
2	Formative (quizzes - online quizzes - reports)	A7-1, A7-2, A8-1, A8-2, A8-3
3	Final Term Examination (written)	A7-1, A7-2, A8-1, A8-2, A8-3

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (online written)	Week 9
2	Formative (quizzes - online quizzes - reports)	Throughout the semester
3	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights
1	Mid Term Examination (written)	10
2	Formative (quizzes - online quizzes - reports)	10
3	Final Term Examination (written)	80
Total		100%

8. List of References:

No.	Reference List
1	D. J. Weatherford, “Technical Writing in Engineering Professions“, 2016.
2	Phillip A. Laplante, “Technical Writing: A Practical Guide for Engineers and Scientists”, CRC Press, 2nd edition, July 2018.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture / Online Classroom
2	White Board
3	Data Show System
4	Sound System Facility
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aim	LOs
1	Review of English Grammar and Mechanics of Language (Capitalization –Punctuation)	5	A7-1, A8-1, A8-2
2	Some characteristics of Technical Language (Abbreviation)	5	A7-1, A8-1, A8-2
3	How to write numbers, units, equations, symbols, and units of measure	5	A7-1, A8-2, A8-3
4	Technical words problems: such as jargons, Big words, Wordy phrases, Redundancies, Clichés, Nouns as adjectives, and Misused and troublesome words and phrases	5	A7-2, A8-2
5	Midterm Exam	5	A7-1, A7-2, A8-1, A8-2, A8-3
6	Rules and Principals of technical writing	5	A7-2, A8-2, A8-3
7	Good technical writing	5	A7-2, A8-2, A8-3
8	Applications of technical writing • letters • reports • manuals • proposals • presentations	5	A7-1, A8-2, A8-3,
9	Final written exam	5	A7-1, A7-2, A8-1, A8-2, A8-3,

Course: Technical English Language	
Program Competencies	**Course LOs**
A7. Function efficiently as an individual and as a member of multi-disciplinary and multi-cultural teams.	**A7.1** Work independently and within a team to prepare different types of technical reports and presentations. **A7.2** Choose the most adequate dictionaries to follow in writing the technical documents.
A8. Communicate effectively graphically, verbally and in writing – with a range of audiences using contemporary tools.	**A8.1** Communicate effectively with colleges to identify the characteristics of a good technical report. **A8.2** Practice the rules and principles of technical writing. **A8.3** Acquire the skills to differentiate between the different types of technical documents reports, proposals, manuals, and presentations.

Course Coordinator: Dr. Hosam Elashkar

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1 Basic Information:

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Mechanical Power Engineering		
Course Code	**HUF001**		
Year/ Level	Preparatory year- First semester		
Teaching Hours	Lectures	Tutorial	Practical/Lab.
	2	**--**	**--**

2 Course aims:

No.	**Aim**
1	Apply a wide spectrum of knowledge for society driving engineering developments and engineering developments changing society with the main emphasis placed on developments and changes over the past three hundred years.

3 Learning Outcomes (LOs):

A7.1	Recognize the importance and the evolution of engineering education.
A9.1	Identify the responsibilities and job description of engineers in different positions.
A10.1	Demonstrate the skill of making good communication using internet or brief presentation.
A10.2	Use the internet to communicate and present summaries or opinions.

4 Course Contents:

No.	**Topics**	**Week**
1	**Lectures:** • Definitions: art, science, technology and engineering.	**1-2**
2	**Lectures:** • Relationship between civilizations and natural and social sciences.	**3-4**
3	**Lectures:** • Development of different engineering fields.	**5-6**
4	**Lectures:** • Historical relationship between sciences and technology.	**7-8**
5	**MID-TERM EXAM**	**9**
6	**Lectures:** • The impact of the engineering evolution on societal and economic development.	**10-12**

7	**Lectures:** • Various examples on the aspects of engineering activities.	**13-14**

5 Teaching and Learning Methods:

LOs		**Teaching and Learning Method**													
		Lecture (Online/in class)	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A7.1**	x			x	x						x			
	A9.1	x		x	x	x	x	x				x			
	A10.1	x		x	x	x	x	x				x			
	A10.2	x			x	x			x						

6 Teaching and Learning Methods of Disable Students:

No.	**Teaching Method**
1	Online lectures and assignments

7 Student assessment:

7.1 Student Assessment Methods:

No.	**Assessment Method**	**LOs**
1	Mid Term Examination (written/ online)	A7.1, A9.1, A10.1
2	Exercises & Reports	A7.1, A9.1, A10.1, A10.2
3	Formative (quizzes- online quizzes- presentation)	A7.1, A9.1, A10.1, A10.2
4	Final Term Examination (written)	A7.1, A9.1, A10.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written/ online)	9
2	Exercises & Reports	Weekly
3	Formative (quizzes- online quizzes- presentation)	6th -11th
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights
1	Mid Term Examination (written/ online)	10
2	Exercises & Reports	5
3	Formative (quizzes- online quizzes- presentation)	5
4	Final Term Examination (written)	80
Total		100%

8 List of References:

No.	Reference List
1	Course notes
2	Essential books (text books) ● مُلاحظات المنهج ● الكُتُب الضرورية (كتب دراسية) ● كتاب تأريخ الهندسة والتكنولوجيا + اسطوانة مدمجة، اعداد أ.د عاطف علم الدين ● تأريخ العلوم و التكنولوجيا الهندسية ● د. أحمد على العريان – عالم الكتب 1996. ● تاريخ العلوم و التكنولوجيا في العصور القديمة و الوسطى ● د. مصطفى محمود سليمان – الهيئة المصرية العامة للكتاب 1995. ● التنمية التكنولوجية مفهومها و متطلباتها ● د. يعقوب فهد العبيد – الدار الدولية للنشر و التوزيع 1989. ● الطاقة لعالم الغد (الحقائق ، و الخيارات الواقعية ، و برنامج للإنجاز) ● لجنة مجلس الطاقة العالمي – الطبعة العربية 1993. • Brain, M. The Engineering Book: From the Catapult to the Curiosity Rover, 250 Milestones in the History of Engineering (Sterling Milestones), 2015

9 Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture / Online Classroom
2	Reports
3	White Board
4	Data Show System
5	Presenter

10 Matrix of Knowledge and Skills of the Course:

No.	Topic	Aim	LOs
1	**Lectures:** Definitions: art, science, technology and engineering.	**1**	A7.1, A9.1, A10.1
2	**Lectures:** Relationship between civilizations and natural and social sciences.	**1**	A9.1, A10.2
3	**Lectures:** Development of different engineering fields.	**1**	A9.1, A10.1, A10.2
4	**Lectures:** Historical relationship between sciences and technology.	**1**	A9.1, A10.1, A10.2
5	**MID-TERM EXAM**	**1**	A7.1, A9.1, A10.1
6	**Lectures:** The impact of the engineering evolution on societal and economic development.	**1**	A9.1, A10.1, A10.2
7	**Lectures:** Various examples on the aspects of engineering activities.	**1**	A9.1, A10.1, A10.2

Course: Engineering and Technology History	
Program Competencies	**Course LOs**
A7. Function efficiently as an individual and as a member of multi-disciplinary and multi-cultural teams.	**A7.1** Recognize the importance and the evolution of engineering education.
A9. Use creative, innovative and flexible thinking and acquire entrepreneurial and leadership skills to anticipate and respond to new situations.	**A9.1** Identify the responsibilities and job description of engineers in different positions.
A10. Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.	**A10.1** Demonstrate the skill of making good communication using internet or brief presentation. **A10.2** Use the internet to communicate and present summaries or opinions.

Course Coordinator: Prof. Dr. Attef Alam Eldeen

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information:

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Physics and Mathematical Engineering		
Course Code	**SCI005**		
Year/ Level	Preparatory year- Second semester		
Teaching Hours	Lectures	Tutorial	Practical/Lab.
	2	2	-

2. Course aims:

No.	Aim
1	Identify all techniques of integration, Numerical integration, and Fundamental Theorem of Calculus. As well as partial fraction-Mathematical, Complex Numbers-Determinates-Matrices-Theory of reminder and Synthetic Division-Theory of equations-set theory.

3. Learning Outcomes (LOs):

A1.1	Recognize integration by using: Substitution-Integration by parts- Numerical methods.
A1.2	Define the Complex Numbers-Determinates-Matrices.
A1.3	Recognize integration of exponential and logarithmic functions using Trigonometric substitutions.
A1.4	Solve the matrices problems.
A1.5	Estimate integral with finite sum and Integrating by using: Trapezoidal rule-Simpson's rule.
A1.6	Use the method of Gauss elimination.
A1.7	Analyze the fraction to its partial fractions.
A2.1	Solve a variety of Theory of reminder and Synthetic division problems.
A2.2	Apply the Theory of equations-set theory to solve different problems.
A2.3	Estimate to read and understand, write, and construct mathematical proofs.
A2.4	Use the quadratic formula to find the roots of a second-degree polynomial and solve quadratic equations.
A2.5	Evaluate the area between two curves.
A2.6	Relate derivatives and integrals (Fundamental Theorem of calculus).
A2.7	Apply integration methods to find areas**.**

4. Course Contents:

No.	Topics	Week
1	**Lectures:** • Indefinite integrals. • Integration methods. • Partial fractions. • Mathematical induction. • Complex numbers. **Tutorials:** • Solve multiple Indefinite integrals.	1-4
2	**Lectures:** • Definite integral - improper integral. • Determinates - Matrices -Theory of reminder and Synthetic division. • Theory of equations. **Tutorials:** • Evaluate definite integral and improper integral.	5-8
3	Midterm	9
4	**Lectures:** • Applications (areas, arc length, volume) • Sequences and infinite series. **Tutorials:** • Solve the problems of sequences and infinite series.	10-11
5	**Lectures:** • Numerical integration (trapezoidal rule, Simpson's rule) • Set theory. **Tutorials:** • Solve the problems of numerical integration and Set theory.	12-14
6	Final submission	15

5. Teaching and Learning Methods:

LO's		Teaching and Learning Method													
		Lecture (online/ in class)	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A1.1**	X	x				x								
	A1.3	X	x				x								
	A1.4	X	x				x								
	A1.5	X	x				x								
	A1.6	X	x				x								
	A1.7	X	x				x								
	A2.1	X					x								
	A2.2	X		X			x								
	A2.3	X		X			x								
	A2.4	X		X			x								
	A2.5	X		X			x								
	A2.6	X					x								
	A2.7	X				X	x	x				x			

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written/ online)	A1.1, A1.2, A1.3, A1.4, A1.5, A1.7, A2.1, A2.3, A2.6
2	Formative (quizzes- online quizzes)	A1.1, A2.3, A1.3, A1.5, A1.7, A2.6
3	Final Term Examination (written)	A1.1, A1.2 A1.3, A1.3, A1.4, A1.5, A1.6, A1.7, A2.1, A2.2, A2.3, A2.4, A2.5, A2.6, A2.7

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written/ online)	9
2	Formative (quizzes- online quizzes)	Every week
3	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights
1	Mid Term Examination (written/ online)	20
2	Formative (quizzes- online quizzes)	10
3	Final Term Examination (written)	70
Total		100%

8. List of References:

No.	Reference List
1	Calculus 5e, James Stewart, McMaster university, Thomson, Australia, 2003.
2	Erwin Kreyszig :"Advanced Engineering Mathematics" John Wiley & Sons, N.Y 10th edition, 2011)
3	- William E. Boyce, Richard: "Elementary Differential Equations and Boundary Value Problems", John Wiley & Sons, Inc,4th edition,2014

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture / Online Classroom
2	White Board
3	Data Show System
4	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aim	LO's
1	**Lectures:** • Integration methods. • Partial fractions. • Mathematical induction. • Complex numbers. **Tutorials:** • Solve multiple Indefinite integrals	1	A1.1, A1.2, A1.3, A1.7, A2.3, A2.6
2	**Lectures:** • Definite integral - improper integral. • Determinates - Matrices -Theory of reminder and Synthetic division. • Theory of equations. **Tutorials:** • Evaluate definite integral and improper integral.	1	A1.4, A1.5, A2.1
3	Midterm	1	
4	**Lectures:** • Applications (areas, arc length, volume) • Sequences and infinite series. **Tutorials** • Solve the problems of sequences and infinite series.	1	A1.4, A1.5, A1.6, A2.4, A2.5, A2.7
5	**Lectures:** • Numerical integration (trapezoidal rule, Simpson's rule). • Set theory. **Tutorials** • Solve the problems of numerical integration and Set theory**.**	1	A1.4, A2.2
6	Final submission of the project.	1	A1.1, A1.2, A1.3, A1.4, A1.5, A1.6, A1.7, A2.1, A2.2, A2.3, A2.4, A2.5, A2.6, A2.7

Course: Mathematics (2)	
Program Competencies	**Course LOs**
A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science, and mathematics	**A1.1** Recognize integration by using: Substitution-Integration by parts-Numerical methods. **A1.2** Define the Complex Numbers-Determinates-Matrices. **A1.3** Recognize integration of exponential and logarithmic functions using Trigonometric substitutions. A1.4 Solve the matrices problems. **A1.5** Estimate integral with finite sum and Integrating by using: Trapezoidal rule-Simpson's rule. **A1.6** Use the method of Gauss elimination. **A1.7** Analyze the fraction to its partial fractions.
A2. Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess, and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.	**A2.1** Solve a variety of Theory of reminder and Synthetic division problems. **A2.2** Apply the Theory of equations-set theory to solve different problems. **A2.3** Estimate to read and understand, write, and construct mathematical proofs. **A2.4** Use the quadratic formula to find the roots of a second-degree polynomial and solve quadratic equations. **A2.5** Evaluate the area between two curves. **A2.6** Relate derivatives and integrals (Fundamental Theorem of calculus). **A2.7** Apply integration methods to find areas**.**

Course Coordinator: Dr. Mohamed Yousef Farghaly

Dr. Mohamed Khalil EL Gayyar

Dr. Youssef Mohamed Baghdadi

Dr. Moanis Abd Eltawab

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information:

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Physics and Mathematical Engineering		
Course Code	**SCI006**		
Year/ Level	Preparatory Year -Second semester		
Teaching Hours	Lectures	Tutorial	Practical/Lab.
	2	2	-

2. Course aims:

No.	**Aim**
1	Identify the principles of dynamics, Rectilinear and Curvilinear motion, the Linear momentum, Angular momentum of particles, and solve any problem in a simple and logical manner

3. Learning Outcomes (LOs):

A1.1	Identify the Rectilinear motion of particles (Position, Velocity, and acceleration).
A1.2	Recognize the Curvilinear motion of particles (Position vector, Velocity and Acceleration).
A1.3	Define the Linear Momentum of particles, rate of change of Linear Momentum.
A1.4	Identify the equations of motion.
A2.1	Discuss the Angular momentum of particles.
A2.2	Evaluate the Trajectory of particles under a central force.
A2.3	Resolve the equations of motion in different coordinates**.**
A2.4	Solve the Projectiles problems.
A2.5	Apply to the Central Impact of two Spheres.
A2.6	Solve the Loss of Kinetic Energy during the Impact of two Spheres.

4. Course Contents:

No.	Topics	Week
1	**Lectures: Chapter 1** - Kinematics of particles. - Rectilinear motion of particles (Position, Velocity and acceleration). - Curvilinear motion of a particles (Position vector, Velocity and Acceleration). **Tutorials:** • Solve the Position, Velocity and acceleration problems. • Review examples of the Curvilinear motion of a particle	1-4
2	**Lectures: Chapter 2** - Kinetics of particles. - Newton’s Second law of motion. - Equations of motion in different coordinates. - Angular momentum of a particles. - Kepler’s Laws of Planetary motion. - Trajectory of a particles under a central force. **Tutorials:** -Solve the problems.	5-8
3	**Midterm**	9
4	**Lectures: Chapter 3** - Projectiles **Tutorials:** - Solve the Projectiles problems.	10-11
5	**Lectures: Chapter 4** - Impact. - Equations of Impact of a Sphere on a Fixed Body. - Central Impact of two Spheres. - Oblique Central Impact of two Spheres. - Loss of Kinetic Energy. **Tutorials:** Solve the problems.	12-14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method													
		Lecture(online/ in class)	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A1.1**	x	x				x								
	A1.2	x	x			x									
	A1.3	x	x			x	x								
	A1.4	x	x												
	A2.1	x	x			x		x							
	A2.2	x	x												
	A2.3	x	x				x								
	A2.4	x	x				x								
	A2.5	x	x				x								
	A2.6	x	x				x								

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written/ online)	A1.1, A1.2, A1.3, A1.4, A2.1, A2.2, A2.3
2	Formative (quizzes- online quizzes)	A2.4, A2.5,
3	Final Term Examination (written)	A1.1, A1.2, A1.3, A1.4, A2.1, A2.2, A2.3, A2.4, A2.5, A2.6.

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written/ online)	9
2	Formative (quizzes- online quizzes)	Every week
3	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights
1	Mid Term Examination (written/ online)	15
2	Formative (quizzes- online quizzes)	15
3	Final Term Examination (written)	70
Total		100%

8. List of References:

No.	Reference List
1	Erwin Kreyszig, "Advanced Engineering Mathematics" John Wiley & Sons Inc., 10th Edition, 2010.
2	Ferdinand P. Beer and E. Russell Johnston, Jr."Vector Mechanics for Engineers" Dynamics Metric Edition adapted by G. Wayne Brown, Sir Sandford Fleming College, New York 2014.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture /Online Classroom
2	White Board
3	Data Show System
4	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aim	LOs
1	**Chapter 1** - Kinematics of particles. - Rectilinear motion of particles (Position, Velocity and acceleration). - Curvilinear motion of a particles (Position vector, Velocity and Acceleration).	1	A1.1, A1.2, A1.3, A1.4
2	**Chapter 2** - Kinetics of particles. - Newton's Second law of motion. - Equations of motion in different coordinates. - Angular momentum of a particles. - Kepler's Laws of Planetary motion. - Trajectory of a particles under a central force.	1	A2.1, A2.2, A2.3
3	Midterm	1	A1.1, A1.2, A1.3, A1.4, A2.1, A2.2, A2.3
4	**Chapter 3** - Projectiles	1	A2.4
5	**Chapter 4** - Impact. - Equations of Impact of a Sphere on a Fixed Body. - Central Impact of two Spheres. - Oblique Central Impact of two Spheres. - Loss of Kinetic Energy.	1	A2.5, A2.6.

Course :Mechanics(2)	
Program Competencies	**Course LOs**
A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.	**A1.1** Identify the Rectilinear motion of particles (Position, Velocity, and acceleration). **A1.2** Recognize the Curvilinear motion of particles (Position vector, Velocity and Acceleration). **A1.3** Define the Linear Momentum of particles, rate of change of Linear Momentum. **A1.4** Identify the equations of motion**.**
A2. Develop and conduct appropriate experimentation and /or simulation, analyze and interpret data, assess, and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.	**A2.1** Discuss the Angular momentum of particles. **A2.2** Evaluate the Trajectory of particles under a central force. **A2.3** Resolve the equations of motion in different coordinates**.** **A2.4** Solve the Projectiles problems. **A2.5** Apply to the Central Impact of two Spheres. **A2.6** Solve the Loss of Kinetic Energy during the Impact of two Spheres.

Course Coordinator: Dr. Amr Hassan Abdalla

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information:

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Physics and Mathematical Engineering		
Course Code	**SCI007**		
Year/ Level	Preparatory year – Second semester		
Teaching Hours	Lectures	Tutorial	Practical/Lab.
	2	1	1

2. Course aims:

No.	Aim
1	Describe the electricity and magnetism laws, properties of light as a wave and its laws, the applications of laser and types of optical lens.

3. Learning Outcomes (LOs):

A1.1	Identify the basics of electric field and its laws, the relation between the magnetic potential and the magnetic field intensity, the nature of light waves.
A1.2	Distinguish between the electric conductors and insulators, between different properties of light and between images formed by various lenses.
A1.3	Recognize the electric field by using Gauss's Law, the Capacitors, effect of an insulator inside a capacitor.
A1.4	Recognize the Magnetic fields, Magnetic forces, and the optical instruments and lenses.
A2.1	Investigate Snell's law of light refraction, ohm’s law experiment and Stefan Boltzmann's radiation law.
A2.2	Evaluate different parameters of optical lenses and the prism, the electrochemical equivalent of copper, magnetic dipole constant of magnetic by magnetometer.
A2.3	Show the different parameters through the lens maker's equation and the angular magnification for optical instruments.

4. Course Contents:

No.	Topics	Week
1	**Lectures:** **Chapter 1: The Electric field** • The Electric field due to a continuous distribution of charge (charged wire-charged ring-charged plate). • The effect of the electric field on a charged point. • The effect of the electric field on the Electric Dipole examples. **Chapter 1: Nature of light** • Light as a corpuscle and as a wave. • Measurements of the speed of light (Fizeau method) -Wave front -Huygens's principle. • Reflection of Light: The Laws of reflection- rotation of reflected planes - Spherical Mirror and its type -The relation between focal Length and the radius of curvature. • The general law of spherical mirrors. • Concave mirror and its cases of formed images. • Convex Mirror and its cases of formed images. **Labs/Tutorials:** • Determination the power of convex lens.	1-3
2	**Lectures:** **Chapter2: Electric Flux** • Electric flux and Gauss's law • Applications of Gauss's law **Chapter2: Refraction of Light** • Refraction of light -The index of refraction -The laws of refraction -Deriving the Snell’s law of refraction using Huygens’s principle -Refraction by plane-parallel plate. Total internal reflection -The critical angle and its application. • Fiber optics -Types of fiber optics (single-mode, multi-mode). • The physical basic for transport of light through the fiber optics -The components of the fiber optics -The advantage of fiber optics -Practical application on using of the fiber optics. Images formed by refraction at spherical surfaces. **Labs/Tutorials:** • Determination of refractive index of water by liquid lens method.	4-5
3	**Lectures:** **Chapter 3: Electric Potential** • Electric Potential - Potential difference (in a uniform field-not a uniform field- a continuous distribution of charge). • The potential for (a charged wire- a charged sphere) –The electric potential energy –The relation between the electric field and the	6-8

	electric potential. **Chapter 3: Thin Lenses and Optical Instruments** • Thin lenses and optical instruments - Thin lens equation and lens-Makers' Equation -The lateral magnification-fundamental principles of light by lenses (converging lens- diverging lens) - Graphical method of forming images by converging lens and diverging lens - The Power of lens -Combination of thin lenses -Thin Lenses in Contac -The simple magnifier –The compound Microscope –The Astronomical Telescope. **Labs/Tutorials:** • Determination of apex angel and refractive index of prism by using spectrometer.	
4	**Midterm exam**	9
5	**Lectures:** **Chapter 4: Capacitors** • Capacitors – The parallel plate capacitor – Cylindrical capacitor – Spherical capacitor. • Electric volume energy density – Effect of a conductor inside a capacitor -Effect of an insulator inside a capacitor. **Chapter4: Interference Diffraction and Polarization of Light** • Diffraction and polarization of light - Interference of light waves and conditions for Interference -Young's Double Slit experiment Lloyd's mirror - Interference in thin films, find of constructive and destructive -Application on Interference in thin films - Newton's Rings -The Michelson interferometer. **Labs/Tutorials:** • Determination of the electrochemical equivalent of copper. • Determination of radius of curvature of convex lens by using Newton's rings.	10-11
6	**Lectures:** **Chapter 5: Electric current** • Electric current and Ohm's Law Solving electrical circuit by using Kirchhoff's Law. **Chapter 5: Diffraction** • Fraunhofer Diffraction -Fresnel Diffraction – Single slit diffraction -The diffraction grating - Resolving power of the diffraction grating -Polarization of light waves -Polarization by selective absorption polarization by reflection. • Polarization by Double Refraction. • Polarization by Scattering. **Labs/Tutorials:** • Investigate ohm's low experiment.	12-13

7	**Lectures:** **Chapter 6: Magnetic field** • Magnetic fields and Magnetic forces (magnetic field intensity - magnetic induction-magnetic flux - magnetic moment - magnetic voltage) - The relation between the magnetic potential and the magnetic field intensity. Magnetic effect for the electric current (Biot - Savart Law- Magnetic induction of a circular conductor - Magnetic induction of a straight conductor). **Chapter 6: Laser Emission** • Laser emission - Types of laser emission - Population inversion by optical pumping - Gaseous laser (Helium-Neon) -The holography (Pictures in three dimensions)-Fluorescence and phosphorescence-Laser application (Industrial, Medical, Military, and daily application). **Labs/Tutorials:** • Determination of magnetic dipole constant of magnetic by magnetometer**.**	14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method													
		Lecture (online / in class)	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A1.1**	x					x								
	A1.2	x	x		x		x								
	A1.3	x	x				x								
	A1.4	x	x				x								
	A2.1	x					x								x
	A2.2	x					x								x
	A2.3	x					x								x

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written/ online)	A1.1, A1.2, A1.3
2	Practical	A2.1, A2.2, A2.3
3	Oral Examination	A1.1, A1.2, A1.3, A1.4
4	Formative (quizzes- online quizzes- Reports.)	A1.1, A1.2, A1.3, A1.4
5	Final Term Examination (written)	A1.1, A1.2, A1.3, A1.4

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written/ online)	9
2	Practical/ Oral Examination	15
3	Formative (quizzes- online quizzes- reports)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights
1	Mid Term Examination (written/ online)	10
2	Practical/ Oral Examination	20
3	Formative (quizzes- online quizzes- presentation reports)	10
4	Final Term Examination (written)	60
Total		100%

8. List of References:

No.	Reference List
1	.أساسيات الفيزياء – تأليف بوش – الطبعة الخامسة 2011 - ترجمة د. سعيد الجزيرى & د. محمد أمين سليمان
2	أساسيات الفيزياء الكلاسيكية و المعاصره تأليف د/رأفت كامل واصف – الطبعة الاولى (2011)
3	فيزياء الجوامد – تأليف أ. د. محمد أمين سليمان و أ. د. أحمد فؤاد باشا و أ. د. شريف خيري (2013)
4	Wahab. “Essentials of crystallography” second Edition, Narosa Publishing House, 2014
5	Kittel C.” Introduction to Solid State Physics” Wiley; 8th edition, 2018

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture / Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aim	LOs
1	**Lectures:** • The Electric field due to a continuous distribution of charge (charged wire-charged ring-charged plate). • The effect of the electric field on a charged point. • The effect of the electric field on the Electric Dipole examples. • Light as a corpuscle and as a wave. • Measurements of the speed of light (Fizeau method) -Wave front - Huygens's principle. • Reflection of Light: The Laws of reflection-rotation of reflected planes - Spherical Mirror and its type -The relation between focal Length and the radius of curvature. • The general law of spherical mirrors. • Concave mirror and its cases of formed images. • Convex Mirror and its cases of formed images. **Labs/Tutorials:** • Determination of refractive index of water by liquid lens method.	1	A1.1, A2.2
2	**Lectures:** • Electric flux and Gauss's law • Applications of Gauss's law • Refraction of light -The index of refraction -The laws of refraction -Deriving the Snell's law of refraction using Huygens's principle -Refraction by plane-parallel plate. Total internal reflection -The critical angle and its application. • Fiber optics -Types of fiber optics (single-mode, multi-mode). • The physical basic for transport of light through the fiber optics -The components of the fiber optics -The advantage of fiber optics -Practical application on using of the fiber optics. Images formed by refraction at spherical surfaces. **Labs/Tutorials:** • Determination of refractive index of water by liquid lens method.	1	A1.1, A1.2 , A1.3, A2.2
3	**Lectures:**	1	A2.2, A2.3, A1.1,

	 - Electric Potential - Potential difference (in a uniform field-not a uniform field- a continuous distribution of charge). - The potential for (a charged wire- a charged sphere) –The electric potential energy –The relation between the electric field and the electric potential. - Thin lenses and optical instruments - Thin lens equation and lens-Makers' Equation -The lateral magnification-fundamental principles of light by lenses (converging lens- diverging lens) - Graphical method of forming images by converging lens and diverging lens -The Power of lens -Combination of thin lenses -Thin Lenses in Contac -The simple magnifier –The compound Microscope –The Astronomical Telescope. **Labs/Tutorials:** - Determination of apex angel and refractive index of prism by using spectrometer..		A1.2
4	Midterm	1	A1.1, A1.2, A1.3
5	**Lectures:** - Capacitors – The parallel plate capacitor – Cylindrical capacitor – Spherical capacitor. - Electric volume energy density – Effect of a conductor inside a capacitor -Effect of an insulator inside a capacitor. - Diffraction and polarization of light - Interference of light waves and conditions for Interference - Young's Double Slit experiment Lloyd's mirror - Interference in thin films, find of constructive and destructive -Application on Interference in thin films - Newton's Rings -The Michelson interferometer. **Labs/Tutorials:** - Determination of the electrochemical equivalent of copper. - Determination of radius of curvature of convex lens by using Newton's rings.	1	A1.1, A1.2, A1.3, A2.2
6	**Lectures:** - Electric current and Ohm's Law Solving electrical circuit by using Kirchhoff's Law. - Fraunhofer Diffraction -Fresnel Diffraction – Single slit diffraction -The diffraction grating - Resolving power of the diffraction grating - Polarization of light waves -Polarization by	1	A1.1, A1.2, A1.3, A2.2, A2.3

7	selective absorption polarization by reflection. - Polarization by Double Refraction. - Polarization by Scattering. **Labs/Tutorials:** - Investigate ohm's low experiment.		
7	**Lectures:** - Services within neighborhoods Magnetic fields and Magnetic forces (magnetic field intensity - magnetic induction-magnetic flux - magnetic moment - magnetic voltage) - The relation between the magnetic potential and the magnetic field intensity. Magnetic effect for the electric current (Biot - Savart Law- Magnetic induction of a circular conductor - Magnetic induction of a straight conductor). - Laser emission - Types of laser emission - Population inversion by optical pumping - Gaseous laser (Helium-Neon) -The holography (Pictures in three dimensions)-Fluorescence and phosphorescence-Laser application (Industrial, Medical, Military, and daily application). **Labs/Tutorials:** - Determination of magnetic dipole constant of magnetic by magnetometer**.**	1	A1.1, A1.2, A1.3, A1.4, A2.1, A2.2, A2.3
8	Final Term Examination	1	A1.1, A1.2, A1.3, A1.4

Course: Physics (2)	
Program Competencies	**Course LOs**
A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science, and mathematics.	**A1.1** Identify the basics of electric field and its laws, the relation between the magnetic potential and the magnetic field intensity, the nature of light waves. **A1.2** Distinguish between the electric conductors and insulators, between different properties of light and between images formed by various lenses. **A1.3** Recognize the electric field by using Gauss's Law, the Capacitors, effect of an insulator inside a capacitor. **A1.4** Recognize the Magnetic fields, Magnetic forces, and the optical instruments and lenses.
A2. Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess, and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.	**A2.1** Investigate Snell's law of light refraction, ohm’s law experiment and Stefan Boltzmann's radiation law. **A2.2** Evaluate different parameters of optical lenses and the prism, the electrochemical equivalent of copper, magnetic dipole constant of magnetic by magnetometer. **A2.3** Show the different parameters through the lens maker's equation and the angular magnification for optical instruments.

Course Coordinator: Ass. Prof. Dr. Abdel Naser Ahmed Mansour
Dr. Fatma Fathy El-Sanabary

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information:

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Production Engineering & Mechanical Design		
Course Code	**PRD001**		
Year/ Level	Preparatory year		
Teaching Hours	Lectures	Tutorial	Practical/Lab.
	2	0	2

2. Course aims:

No.	Aim
1	Identify the basic knowledge for both manufacturing and industrial engineering beside the information about engineering materials, workshop safety and bench work. Acquire knowledge and skills in the use of hand tools, layout tools, measuring tools and machine tools

3. Learning Outcomes (LOs):

A1.1	Identify the classification of engineering materials according to their crystal structures and their main properties.
A1.2	Recognize the tools and the methods that are used in designing and manufacturing of casting processes.
A1.3	Demonstrate the essential knowledge to understand and conduct forming and cutting processes.
A2.1	Develop a creative and innovative way to select appropriate method to conduct forming, cutting, welding, and casting processes, considering design requirements.
A2.2	Select a proper material and a suitable process considering design requirements to obtain a certain product.
A2.3	Use measuring instruments and workshops to conduct the practical part of the course.
A4.1	Utilize the essential knowledge to apply quality assurance requirements, codes of practice and standards, health and industrial safety requirements and environmental issues during conducting the workshops.
A4.2	Apply safe systems at work to observe the appropriate steps to manage risk during conducting the workshops.

4. Course Contents:

No.	Topics	Week
1	**Lectures:** • Introduction to engineering materials. **Labs/Tutorials:** • Carpentry workshop.	1
2	**Lectures:** • Crystal structures of metals and alloys. **Labs/Tutorials:** • Models Workshop.	2-3
3	**Lectures:** • Metal alloys – Powder metallurgy. **Labs/Tutorials:** • Casting Processes Workshop.	4
4	**Lectures:** • Casting processes. **Labs/Tutorials:** • Welding Workshop.	5-6
5	**Lectures:** • Forming processes (forging, rolling, extrusion and drawing). **Labs/Tutorials:** • Workbench Processes Workshop.	7-8
6	Midterm	9
7	**Lectures:** • Cutting processes (turning, planning, milling, drilling and grinding). **Labs/Tutorials:** • Lathing Workshop.	10-11
8	**Lectures:** • Welding processes **Labs/Tutorials:** • Machine workshop.	12
9	**Lectures:** • Bench Work (Filling, Taping, Drilling and Sawing). **Labs/Tutorials:** • Electricity Workshop.	13
10	**Lectures:** • Measuring tools, quality and safely. **Labs/Tutorials:** • Laboratory measurements and measuring instrumentations.	14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method													
		Lecture (online / in class)	Interactive lectures	Flipped Classroom	Presentation	Discussion	Problem-solving	Brain storming	Projects	Site visits	Self-learning	Cooperative	Drawing Studio	Computer Simulation	Practical Experiments
A-Level	A1.1	x	x			x	x								
	A1.2	x	x			x	x								
	A1.3	x	x			x	x								
	A2.1	x				x				x					x
	A2.2	x				x	x								x
	A2.3	x		x		x				x					x
	A4.1	x		x		x	x								
	A4.2	x		x		x				x					

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written/ online)	A1.1, A1.2, A1.3, A2.1, A2.2, A4.1
2	Practical	A2.1, A2.2, A2.3,
3	Formative (quizzes- online quizzes- presentation)	A1.1, A1.2, A1.3, A2.1, A2.2, A2.3, A4.1, A4.2
4	Final Term Examination (written)	A1.1, A1.2, A1.3, A2.1, A2.2, A4.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written/ online)	9
2	Practical	15
3	Formative (quizzes- online quizzes- presentation)	Every 3 weeks
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights
1	Mid Term Examination (written/ online)	10
2	Practical	10
3	Formative (quizzes- online quizzes- presentation)	20
4	Final Term Examination (written)	60
Total		100%

8. List of References:

No.	Reference List
1	Mittemeijer, E. J. Fundamentals of Materials Science: The Microstructure–Property Relationship Using Metals as Model Systems, 2010.
2	Fundamentals of Manufacturing for Engineers, Published by University College London (UCL), 1996.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture / Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aim	LOs
1	**Lectures:** • Introduction to engineering materials. **Labs/Tutorials:** • Carpentry workshop.	1	A1.1, A1.2, A4.2
2	**Lectures:** • Crystal structures of metals and alloys. **Labs/Tutorials:** • Models Workshop.	1	A1.1, A1.2
3	**Lectures:** • Metal alloys – Powder metallurgy. **Labs/Tutorials:** • Casting Processes Workshop.	1	A1.1, A1.3, A2.2, A2.3, A4.1
4	**Lectures:** • Casting processes. **Labs/Tutorials:** • Welding Workshop.	1	A1.1, A1.2, A2.3, A4.2
5	**Lectures:** • Forming processes (forging, rolling, extrusion and drawing). **Labs/Tutorials:** • Workbench Processes Workshop.	1	A1.3, A2.2, A2.3, A4.1
6	Midterm	1	A.1, A1.2, A1.3, A2.1, A2.2, A4.1
7	**Lectures:** • Cutting processes (turning, planning, milling, drilling, and grinding). **Labs/Tutorials:** • Lathing Workshop.	1	A1.3, A2.2, A2.3, A4.1

8	**Lectures:** • Welding processes **Labs/Tutorials:** • Machine workshop.	1	A2.1, A2.2, A2.3, A4.1, A4.2
9	**Lectures:** • Bench Work (Filling, Taping, Drilling and Sawing). **Labs/Tutorials:** • Electricity Workshop.	1	A1.3, A2.2, A4.2
10	**Lectures:** • Measuring tools, quality and safely. **Labs/Tutorials:** • Laboratory measurements and measuring instrumentations.	1	A2.2, A2.3

Course: Production Technology	
Program Competencies	**Course LOs**
A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science, and mathematics.	**A1.1** Identify the classification of engineering materials according to their crystal structures and their main properties. **A1.2** Recognize the tools and the methods that are used in designing and manufacturing of casting processes. **A1.3** Demonstrate the essential knowledge to understand and conduct forming and cutting processes.
A2. Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.	**A2.1** Develop a creative and innovative way to select appropriate method to conduct forming, cutting, welding, and casting processes, considering design requirements. **A2.2** Select a proper material and a suitable process considering design requirements to obtain a certain product. **A2.3** Use measuring instruments and workshops to conduct the practical part of the course.
A4. Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues and risk management principles.	**A4.1** Utilize the essential knowledge to apply quality assurance requirements, codes of practice and standards, health and Industrial safety requirements and environmental issues during conducting the workshops. **A4.2** Apply safe systems at work to observe the appropriate steps to manage risk during conducting the workshops.

Course Coordinator: Prof. Dr. Ahmed Nassef

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information:

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Production Engineering & Mechanical Design		
Course Code	**PRD003**		
Year/ Level	Preparing year – Second semester		
Teaching Hours	Lectures	Tutorial	Practical/Lab.
	1	3	-

2. Course aims:

No.	Aim
1	Provide the Student, the basic knowledge and skills of the concepts and principles of engineering drawing and fundamental of drawing projections. The basic principles of drawing with several applications are also studied.

3. Learning Outcomes (LOs):

A1.1	Identify the materials related to the parts of machines.
A1.2	Analyze the engineering problems that are used in engineering drawing.
A3.1	Apply the computer software (AutoCAD) for different drawing exercises.
A3.2	Use the image and samples of machines drawing applications.
A10.1	Identify the different type of drawing exercise.
A10.2	Study the characteristics and processes related to the different machines and symbol drawing.
A10.3	Use engineering drawing and mechanics drawing handbook.

4. Course Contents:

No.	Topics	Week
1	**Lectures:** • Review on the drawing of the third projector with the knowledge of the other projections. **Tutorials:** • Drawing of some exercise for third projector.	1
2	**Lectures:** • How to make a section in the engineering drawing. **Tutorials:** • Drawing of some exercise on simple section geometrics.	2
3	**Lectures:** • Definition of the different Types in section bodies. **Tutorials:** • Drawing of some exercise for section bodies.	3-4
4	**Lectures:** • Intersections of bodies and surfaces and development of surfaces. **Tutorials:** • Exercise on the intersections of bodies.	5
5	**Lectures:** • How to draw the screw and nut in screwed joints. **Tutorials:** • Drawing of some exercise on screws and nuts.	6
6	**Lectures:** • Drawing of the sections for different types of screwed joints. **Tutorials:** • Drawing some exercise on the sections for different types of screwed joints.	7-8
7	Midterm	9
8	**Lectures:** • Identification for different of steel sections. **Tutorials:** • Steel construction, Symbols of electrical circuits, fasteners.	10-11
9	**Lectures:** • Drawing of the sections for different types of steel joints. **Tutorials:** • Some exercise on the sections for different types of steel joints.	12-13
10	**Lectures:** • Assembly of some mechanical components. **Labs:** • Computer aided drafting using solid work program.	14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method													
		Lecture (online / in class)	Interactive lectures	Flipped Classroom	Presentation	Discussion	Problem-solving	Brain storming	Projects	Site visits	Self-learning	Cooperative	Drawing Studio	Computer Simulation	Practical Experiments
A-Level	A1.1	x	x		x	x									
	A1.2	x	x		x		x								
	A3.1	x	x		x	x	x	x							
	A3.2	x	x		x										
	A8.1	x	x		x						x	x			
	A8.2	x	x	x	x	x	x	x							
	A8.3			x							x	x			

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written/ online)	A1.1, A1.2, A3.2, A8.1, A8.2
2	Formative (quizzes- online quizzes)	A1.1, A1.2, A3.1, A3.2, A8.1, A8.2, A8.3
3	Final Term Examination (written)	A1.1, A1.2, A3.1, A3.2, A8.1, A8.2

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written/ online)	9
2	Formative (quizzes- online quizzes)	Every 3 weeks
3	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights
1	Mid Term Examination (written/ online)	15
2	Formative (quizzes- online quizzes)	15
3	Final Term Examination (written)	70
Total		100%

8. List of References:

No.	Reference List
1	K. L. Narayana, P. Kannaiah, and K. Venkata Reddy ' Machine Drawing' New Age International (P) Ltd., 2006.
2	Fatehy El-shrif, ' Mechanical Drawing' Helwan Univ., 1975.
3	C. Simmons, D. Maguive, and N. Phelps, 'Manual of Engineering Drawing', Elsevier Ltd., 2012.
4	K. R. Hart 'Engineering Drawing with Problems and Solutions' ELBS, 1984.
5	Book,” Engineering Drawing”, prepared by staff of production engineering and Machine design department

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture /Online Classroom
2	White Board
3	Data Show System
4	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aim	LOs
1	**Lectures:** • Review on the drawing of the third projector with the knowledge of the other projections. **Labs/Tutorials:** • Drawing of some exercise for third projector.	1	A1.1
2	**Lectures:** • How to make a section in the engineering drawing. **Labs/Tutorials:** • Drawing of some exercise on simple section geometrics.	1	A1.2
3	**Lectures:** • Definition of the different Types in section bodies. **Labs/Tutorials:** • Drawing of some exercise for section bodies.	1	A1.2, A3.2, A8.1
4	**Lectures:** • Intersections of bodies and surfaces and development of surfaces. **Labs/Tutorials:** • Exercise on the intersections of bodies.	1	A1.2, A3.2, A8.1, A8.2
5	**Lectures:** • How to draw the screw and nut in screwed joints. **Labs/Tutorials:** • Drawing of some exercise on screws and nuts.	1	A1.2, A3.2, A8.1, A8.2
6	**Lectures:** • Drawing of the sections for different types of screwed joints. **Labs/Tutorials:** • Drawing some exercise on the sections for different types of screwed joints.	1	A1.2, A3.2, A8.1, A8.2, A8.3

7	Midterm	1	A1.1, A1.2, A3.2, A8.1, A8.2
8	**Lectures:** • Identification for different of steel sections. **Labs/Tutorials:** • Steel construction, Symbols of electrical circuits, fasteners.	1	A1.2, A3.1, A3.2, A8.1, A8.2
9	**Lectures:** • Drawing of the sections for different types of steel joints. **Labs/Tutorials:** • Some exercise on the sections for different types of steel joints.	1	A1.2, A3.1, A3.2, A8.1, A8.2, A8.3
10	**Lectures:** • Assembly of some mechanical components. **Labs/Tutorials:** • Computer aided drafting using solid work program.	1	A1.2, A3.1, A3.2, A8.1, A8.2, A8.3

Course: Engineering Drawing and Geometric Projection (2)	
Program Competencies	**Course LOs**
A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.	**A1.1** Identify the materials related to the parts of machines. **A1.2** Analyze the engineering problems that are used in engineering drawing.
A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.	**A3.1** Apply the computer software (AutoCAD) for different drawing exercises. **A3.2** Use the image and samples of machines drawing applications.
A10. Acquire and apply new knowledge, and practice self, lifelong and other learning strategies.	**A10.1** Apply the different type of drawing exercise. **A10.2** Study the characteristics and processes related to the different machines and symbol drawing. **A10.3** Use engineering drawing and mechanics drawing handbook.

Course Coordinator: Prof. Dr. Gamal Abdel Nasser

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information:

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Electrical Engineering		
Course Code	**CCE001**		
Year/ Level	Preparatory year – 2nd Semester		
Teaching Hours	Lectures	Tutorial	Practical/Lab.
	2	0	2

2. Course aims:

No.	Aim
1	Describe an introduction to personal computer, operating systems, filling systems, and introduction to word processing, spread sheet theory, introduction to data base, multi-media and presentations, introduction to computer networks.

3. Learning Outcomes (LOs):

A1.1	Define the concept of personal computers.
A1.2	Describe and review of basic computer languages.
A3.1	Describe the different word processing tools.
A3.2	Develop spreadsheets exercises.
A3.3	Create different types and designs of presentations.
A10.1	Prepare different database panes.
A10.2	Apply different techniques to relate surfing the network.

4. Course Contents:

No.	Topics	Week
1	**Lectures:** - Introduction to PC **Labs/Tutorials:** - Operating Systems (DOS – WINDOWS)	1-2
2	**Lectures:** - Filling Systems **Labs/Tutorials:** - Word Processing.	3-4
3	**Lectures:** - Introduction to Computer Network **Labs/Tutorials:** - Application of Network Surfing.	5-6
4	**Lectures:** - Introduction to Data Base. **Labs/Tutorials:** - Access Database.	7-8
5	Midterm	9
6	**Lectures:** - Multimedia & Presentation. **Labs/Tutorials:** - Spreadsheet Theory.	10-12
7	**Lectures:** - General Revision **Labs/Tutorials:** - General Revision	13-14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method													
		Lecture (online/in class)	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A1.1**	x	x	x	x		x								
	A1.2	x	x		x	x		x	x				x		
	A3.1	x	x		x	x	x		x						
	A3.2	x	x		x			x							
	A3.3	x	x		x		x								x
	A10.1		x		x			x							x
	A10.2		x		x		x								x

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written/ online)	A1.1, A1.2, A3.1, A3.2
2	Practical	A10.1
3	Formative (quizzes- online quizzes)	A1.1, A1.2, A3.1, A3.2,
4	Final Term Examination (written)	A1.1, A1.2, A3.1, A3.2, A10.1, A10.2

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written/ online)	9
2	Practical	15
3	Formative (quizzes- online quizzes)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights
1	Mid Term Examination (written/ online)	10
2	Practical	20
3	Formative (quizzes- online quizzes)	20
4	Final Term Examination (written)	50
Total		100%

8. List of References

No.	Reference List
1	"Computers - Timeline of Computer History - Computer History Museum". Retrieved 9 January 2017.
2	Ackerman, Dan (22 August 2013). "Don't buy a new PC or Mac before you read this". CNET. CBS Interactive. Retrieved 5 October 2014.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture / Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aim	LOs
1	**Lectures:** - Introduction to PC **Labs/Tutorials:** - Operating Systems (DOS – WINDOWS)	1	A1.1
2	**Lectures:** - Filling Systems **Labs/Tutorials:** - Word Processing.	1	A3.1
3	**Lectures:** - Introduction to Computer Network **Labs/Tutorials:** - Application of Network Surfing.	1	A1.1, A1.2, A10.2
4	**Lectures:** - Introduction to Data Base. **Labs/Tutorials:** - Access Database.	1	A1.1, A1.2, A3.3, A10.2
5	Midterm	1	A1.1, A1.2, A3.3, A10.2
6	**Lectures:** - Multimedia & Presentation. **Labs/Tutorials:** - Spreadsheet Theory.	1	A3.2
7	**Lectures:** - General Revision **Labs/Tutorials:** - General Revision	1	A1.1, A1.2, A3.1, A10.2

Course: Computer and programming	
Program Competencies	**Course LOs**
A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.	**A1.1** Define the concept of personal computers. **A1.2** Describe and review of basic computer languages.
A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.	**A3.1** Describe the different word processing tools. **A3.2** Develop spreadsheets exercises. **A3.3** Create different types and designs of presentations.
A10. Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.	**A10.1** Prepare different database panes. **A10.2** Apply different techniques to relate surfing the network.

Course Coordinator: Dr. Walaa Elsayed Saber

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information:

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Electrical Engineering		
Course Code	**HUU002**		
Year/ Level	Preparatory year- Second semester		
Teaching Hours	Lectures	Tutorial	Practical
	2	---	---

2. Course Aims:

No.	**Aim**
3	Identify the basic knowledge and skills of political significance of human rights, the idea of "universal" human rights, its global politics for condemning these and other crimes against humanity.

3. Learning Outcomes (LOs):

A8-1	Communicate effectively with colleges to prepare and present HUMAN RIGHTS case studies as a technical report and presentation.
A8-2	Work independently and within a team for class project and assignments.
A9-1	Use Moral Elements in The HUMAN RIGHTS to Lead and motivate individuals.
A9-2	Use FOUNDATIONS OF RIGHTS to anticipate and respond to new situations related to Human Rights
A10-1	Organize and manage time and resources effectively; for short-term and longer-term commitments.
A10-2	Demonstrate an understanding of the effect of Symptoms Scientific Thought in Society.
A10-3	Identify the difference between INTERNATIONAL CRIMINAL LAW, and HUMAN RIGHTS COURTS

4. Course Contents:

Week No.	*Topic*	*Total Hours*	*Contact hrs*		
			Lec.	**Tut.**	**Lab.**
Week 1-2	What are human rights? (Or the problem of definitions).	4	4	--	--
Week-3	Foundations of rights: enlightenment history and theory.	2	2	--	--
Week 4	The united nations: structure and function.	2	2	--	--
Week 5	Genocide, international criminal law, and human rights courts.	2	2	--	--
Week 6	The interrelatedness of rights.	2	2	--	--
Week 7	Types of rights 1: civil and political rights.	2	2	--	--
Weeks 8	Types of rights: economic, social, and cultural rights.	2	2		
Week 9	Midterm Exam	2	2		
Week 10	Human rights in Egypt.	2	2		
Week 11	Social movements, social media, and representations of rights.	2	2	--	--
Week 12	Human rights narratives.	2	2		
Week 13	“Special rights”: women’s rights.	2	2		
Week 14-15	Group project discussion and presentation	4	4		

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method													
		Lecture (online-In class)	Interactive lectures	Flipped Classroom	Presentation	Discussion	Problem-solving	Brain storming	Projects	Site visits	Self-learning	Cooperative	Drawing Studio	Computer Simulation	Practical Experiments
A-Level	A8-1	X		X	X	X		X	X			X			
	A8-2	X			X			X	X		X				
	A9-1	X				X		X							
	A9-2	X		X		X		X							
	A10-1	X			X				X			X			
	A10-2	X				X		X							
	A10-3	X				X		X							

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials
2	Online lectures and documentation.

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written/ online)	A8-1, A8-2, A9-1, A9-2, A10-2, A10-3
2	Formative (quizzes- online quizzes- presentation - reports)	A8-1, A8-2, A9-1, A9-2, A10-1, A10-2, A10-3
3	Final Term Examination (written)	A8-1, A8-2, A9-1, A9-2, A10-1, A10-2, A10-3

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written/ online)	Week 9
2	Formative (quizzes- online quizzes- presentation - reports)	Throughout the semester
3	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights
1	Mid Term Examination (written/ online)	10
2	Formative (quizzes- online quizzes- presentation - reports)	10
3	Final Term Examination (written)	80
Total		100%

8. List of References:

No.	Reference List
1	Surya P. Subedi, OBE, QC, The Effectiveness of the UN Human Rights System: Reform and the Judicialisation of Human Rights, 2019
2	Daniel Moeckli, Sangeeta Shah, Sandesh Sivakumaran, David Harris, International Human Rights Law 1st Edition, Oxford University Press; 2010.
3	Reis Monteiro, A., Ethics of Human Rights.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture /Online Classroom
2	White Board
3	Data Show System
4	Sound System Facility
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aim	LO's
1	What are human rights? (Or the problem of definitions).	3	A8-1, A8-2, A9-1
2	Foundations of rights: enlightenment history and theory.	3	A8-1, A8-2, A9-1, A9-2
3	The united nations: structure and function.	3	A8-1, A8-2, A9-1, A9-2
4	Genocide, international criminal law, and human rights courts.	3	A8-1, A8-2, A10-3
5	The interrelatedness of rights.	3	A8-1, A8-2, A10-2
6	Types of rights 1: civil and political rights.	3	A8-1, A8-2, A10-2
7	Types of rights: economic, social, and cultural rights.	3	A8-1, A8-2, A10-2
8	Midterm Exam	3	A8-1, A8-2, A9-1, A9-2, A10-2, A10-3
9	Human rights in Egypt.	3	A9-1, A9-2, A10-2
10	Social movements, social media, and representations of rights.	3	A9-1, A10-2
11	Human rights narratives.	3	A9-1, A10-2
12	“Special rights”: women’s rights.	3	A9-1, A10-2
13	Group project discussion and presentation	3	A8-1, A8-2, A9-1, A9-2, A10-1, A10-2, A10-3

Course: Human Rights	
Program Competencies	**Course Los**
A8. Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools.	**A8.1** Communicate effectively with colleges to prepare and present HUMAN RIGHTS case studies as a technical report and presentation.
	A8.2 Work independently and within a team for class project and assignments.
A9. Use creative, innovative, and flexible thinking and acquire entrepreneurial and leadership skills to anticipate and respond to new situations.	**A9.1** Use Moral Elements in The HUMAN RIGHTS to Lead and motivate individuals.
	A9.2 Use FOUNDATIONS OF RIGHTS to anticipate and respond to new situations related to Human Rights.
A10. Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.	**A10.1** Organize and manage time and resources effectively; for short-term and longer-term commitments.
	A10.2 Demonstrate an understanding of the effect of Symptoms Scientific Thought in Society.
	A10.3 Identify the difference between INTERNATIONAL CRIMINAL LAW, and HUMAN RIGHTS COURTS

Course Coordinator: Dr. Mona Hamouda

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

FIRST YEAR

1. Basic Information:

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)	
Department offering the Program	Mechanical Power Engineering	
Department Responsible for the Course	Physics and Mathematical Engineering	
Course Code	**SCI109**	
Year/ Level	First year- 1st semester	
Specialization	Minor	
Teaching Hours	Lectures	Tutorial
	2	2

2. Course aims:

No.	Aim
1	Acquire the essential knowledge to understand some basics of calculus: Multiple Integrals, Normal and tangent plane, Surface Integration, Differential equations of the first order (basic definitions, separable, homogeneous, exact equations) , Partial derivatives applications, Maxima of Multivariate functions, Higher order differential equations: (homogeneous and non-homogeneous), Simultaneous, Curvature and Special curves.

3. Learning Outcomes (LOs):

A1.1	Define the different classification of equations.
A1.2	Recognize the difference between the different types of differential equations.
A1.3	Categorize the Non- homogeneous equations; Method of Undetermined coefficients and Variation of parameters.
A1.4	Identify the different between the double Integral and the triple Integral.
A1.5	Recognize the difference between the Maximum and minimum of function of two Variables.
A1.6	Recognize the concepts and theories of Fourier series.
A10.1	Use text- books and scientific web sites to solve some problems and collect data.

4. Course Contents:

No.	Topics	Week
1	**Lectures:** Chapter 1: First Order Differential Equations: - Introduction about Classification of the Differential Equations - Separation of Variables, - Homogeneous Equations - Exact Equations - Integrating Factors - Linear Equations - Bernoulli’s Equation **Tutorials:** - Apply the classification of differential equations. - Practice of solving differential equations	1-4
2	**Lectures:** Chapter 2: Higher Order Linear Differential Equation. - Homogeneous equations with constant coefficients. - Non homogeneous equations; Method of Undetermined coefficients – Variation of parameters. **Tutorials:** - Apply the different methods to solve the second order differential equations and determine the particular solutions.	5-7
3	**Lectures:** Chapter 3: Multiple Integrals - Double integral - Triple integral - Surface integration **Tutorials:** - Evaluate the double Integral, the triple Integral and the area between two curves. - Solve multiple integrals in any other area.	8
4	**Midterm Exam**	9
5	**Lectures:** Chapter 4: Functions of Several Variables - Partial derivatives - Euler's Theorem for homogeneous Functions - Exact differentials - Taylor series of a function of two variables - Maximum and minimum of a function of two variables **Tutorials:** - Apply the limits, discuss continuity, and solve differentiability, of functions of several variable. - Use of text- books to solve some problems and collect some data.	10-12

6	**Lectures:** Chapter 5: Fourier series (Periodic functions - triangular series - Fourier series of functions of the **2-pi** cycle - Fourier series of even and odd functions - Fourier series of functions with different cycles). **Tutorials:** Use of text- books to solve some problems.	13-14

5. Teaching and Learning Methods:

LOs		**Teaching and Learning Method**														
		Lecture(online / in class)	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial(on line / in class)**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A1.1**	x	x													
	A1.2	x	x				x									
	A1.3	x	x	x			x									
	A1.4	x	x				x									
	A1.5	x	x	x			x	x								
	A1.6	x	x	x			x	x								
	A10.1					x	x	x	x							

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written/ online)	A1.1, A1.2, A1.3
2	Formative (quizzes- online quizzes- assignments)	A1.1, A1.2, A1.3, A1.4, A1.5, A1.6, A10.1
3	Final Term Examination (written)	A1.1, A1.2, A1.3, A1.4, A1.5, A1.6

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written/ online)	9
2	Formative (quizzes- online quizzes- assignments)	Every week
3	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights
1	Mid Term Examination (written/ online)	20
3	Formative (quizzes- online quizzes- assignments)	10
4	Final Term Examination (written)	70
Total		100%

8. List of References

No.	Reference List
1	Sheply L. Ross, John Wiley and Sons, “Differential equations 3rd Edition”, copy right 1984, by john Wiley & Sons, Inc., published simultaneously in Canada 2017.
2	Dennis G. Zill and Michael R. Cullen, “Differential Equations with Boundary Problem”, seven edition, PWS Publishers; published simultaneously in Canada.
3	William E. Boyce, Richard: " Elementary Differential Equations and Boundary Value Problems", 8th Edition Wiley, Publisher John Wiley & Sons, Inc., 2014.
4	K. A. Stroud and Dexter J. Booth, “Advanced Engineering Mathematics” publisher Palgrave Macmillan, 2011.
5	Erwin Kreyszig, Kreyszig Textbook: “Advanced Engineering Mathematics, 10th Edition- slader.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture / Online Classroom
2	White Board
3	Data Show System
4	Presenter

10. Matrix of Knowledge and Skills of the Course:

No	Topic	Aim	LOs
1	**Lectures:** Chapter 1: First Order Differential Equations: • Introduction about Classification of the Differential Equations • Separation of Variables, • Homogeneous Equations • Exact Equations • Integrating Factors • Linear Equations • Bernoulli's Equation **Tutorials:** • Apply the classification of differential equations. • Practice of solving differential equations	1	A1.1, A1.2
2	**Lectures:** Chapter 2: Higher Order Linear Differential Equation. • Homogeneous equations with constant coefficients. • Non homogeneous equations; Method of Undetermined coefficients – Variation of parameters. **Tutorials:** • Apply the different methods to solve the second order differential equations and determine the particular solutions.	1	A1.3
3	**Lectures:** Chapter 3: Multiple Integrals • Double integral • Triple integral • Surface integration **Tutorials:** • Evaluate the double Integral, the triple	1	A1.4

	Integral and the area between two curves. - Solve multiple integrals in any other area.		
4	**Lectures:** Chapter 4: Functions of Several Variables - Partial derivatives - Euler's Theorem for homogeneous Functions - Exact differentials - Taylor series of a function of two variables - Maximum and minimum of a function of two variables **Tutorials:** - Apply the limits, discuss continuity, and solve differentiability, of functions of several variable. - Use of text- books to solve some problems and collect some data.	1	A1.5, A10.1
5	**Lectures:** Chapter 5: Fourier series (Periodic functions - triangular series - Fourier series of functions of the **2-pi** cycle - Fourier series of even and odd functions - Fourier series of functions with different cycles). **Tutorials:** Use of text- books to solve some problems.	1	A1.6

Course: Mathematics 3-B	
Program Competencies	**Course LOs**
A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.	**A1.1** Define the different classification of equations. **A1.2** Recognize the difference between the different types of differential equations. **A1.3** Categorize the Non-homogeneous equations; Method of Undetermined coefficients and Variation of parameters. **A1.4** Identify the different between the double Integral and the triple Integral. **A1.5** Recognize the difference between the Maximum and minimum of function of two variables. **A1.6** Recognize the concepts and theories of Fourier series.
A10. Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.	**A10.1** Use text- books and scientific web sites to solve some problems and collect data.

Course Coordinator: Dr. Mohamed K. El Gayyar

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Physics and Mathematical Engineering		
Course Code	**SCI111**		
Year/ Level	First year -1st Semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical/Lab.
	2	2	-

2. Course Aims:

No.	Aim
1	Analyze the statics and dynamics problems in a simple and logical manner and to apply during its solution a few, well-understood, basic principles of the dynamics course (Applied Mechanics)

3. Learning Outcomes (LOs):

A1.1	Identify the Second moment (moment of Inertia).
A1.2	Identify the Product of Inertia.
A1.3	Define the Virtual work and its applications.
A1.4	Determine of the orbit shape.
A1.5	Identify the translation, Rotation and general plane motion.
A1.6	Analyze plane motion in terms of a parameters.
A1.7	Define the equations of motion of a rigid body.
A1.8	Evaluate the principle of work and energy for a rigid body.
A1.9	Apply the systems of rigid bodies.
A1.10	Evaluate the principle of impulse and momentum for the plane motion of a rigid body.

4. Course Contents:

No.	Topics	Week
1	**Lectures: Chapter 1 & 2** - Distributed forces Moment of Inertia. - Moment of Inertia in a plane. - Moment of Inertia of a rectangular area. - Polar, volume and mass moment of Inertia. - Radius of gyration of an area and mass. -The Virtual work and its applications. **Tutorials**: • Solve the problems on the Moment of Inertia • Review examples of the virtual work and its applications.	1-4
2	**Lectures: Chapter3:** - Motion under central forces. - Determination of the orbit. - Dependence of the orbit shape on initial conditions. - Kinematics of rigid bodies. - Equations defining the rotation of a rigid body about a fixed axis. - Absolute and relative velocity and acceleration in plane motion. - Analysis of plane motion. **Tutorials:** • Solve the problems on the motion under central force, Orbit Shape, Kinematics of Rigid Body, Analysis of Plane Motion.	5-7
3	**Lectures: Chapter4:** - Plane motion of rigid body. **Tutorials:** • Solve the problems on the Plane Motion of Rigid Body.	8
4	**Midterm Exam.**	9
5	**Lectures: Chapter4:** - Equations of motion for rigid body. **Tutorials:** • Solve the problems on Equations of Motion.	10
6	**Lectures: Chapter 5 & 6:** - Plane motion of rigid body, energy and momentum methods. - Principle of work and energy for a rigid body. - Principle of impulse and momentum for the plane motion of a rigid body. - Conservation of angular momentum. - Mechanical vibrations. - Vibrations without damping (free vibration of particles). - Damped vibrations (damped free vibrations **Tutorials:** • Solve the problems on Principle of Work and Energy, Conservation of Momentum, undamped and damped vibration.	11-14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method														
		Lecture(online/ in class)	Interactive lectures	Flipped Classroom	Presentation	Discussion	Tutorial	Problem-solving	Brain storming	Projects	Site visits	Self-learning	Cooperative	Drawing Studio	Computer Simulation	Practical Experiments
A-Level	**A1.1**	x	x				x	x								
	A1.2	x	x			x										
	A1.3	x	x			x	x	x								
	A1.4	x	x				x									
	A1.5	x	x			x			x							
	A1.6	x	x				x									
	A1.7	x	x					x								
	A1.8	x	x					x								
	A1.9	x	x					x								
	A1.10	x	x					x								

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials
2	Online lectures and assignments

7. Student Assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written/ online)	A1.1, A1.2, A1.3, A1.4, A1.5, A1.6
2	Formative (quizzes- online quizzes- assignments)	A1.7,A1.8
3	Final Term Examination (written)	A1.1, A1.2, A1.3, A1.4, A1.5, A1.6, A1.7, A1.8, A1.9, A1.10

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written/ online)	9
2	Formative (quizzes- online quizzes- assignents)	Every week
3	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights
1	Mid Term Examination (written/ online)	15
2	Formative (quizzes- online quizzes- assignments)	15
3	Final Term Examination (written)	70
Total		100%

8. List of References

No.	Reference List
1	Erwin Kreyszig, "Advanced Engineering Mathematics” John Wiley & Sons Inc., 10th Edition, 2010.
2	Ferdinand P. Beer and E. Russell Johnston, Jr.” Vector Mechanics for Engineers” Dynamics Metric Edition adapted by G. Wayne Brown, Sir Sandford Fleming College, New York 2014.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture / Online Classroom
2	White Board
3	Data Show System
4	Presenter

10. Matrix of Knowledge and Skills of the Course:

No	Topic	Aim	LOs
1	**Lectures: Chapter 1 & 2** - Distributed forces Moment of Inertia. - Moment of Inertia in a plane. - Moment of Inertia of a rectangular area. - Polar, volume and mass moment of Inertia. - Radius of gyration of an area and mass. -The Virtual work and its applications. **Tutorials**: • Solve the problems on the Moment of Inertia Review examples of the virtual work and its applications.	1	A1.1, A1.2
2	**Lectures: Chapter3:** - Motion under central forces. - Determination of the orbit. - Dependence of the orbit shape on initial conditions. - Kinematics of rigid bodies. - Equations defining the rotation of a rigid body about a fixed axis. - Absolute and relative velocity and acceleration in plane motion. - Analysis of plane motion. **Tutorials:** • Solve the problems on the motion under central force, Orbit Shape, Kinematics of Rigid Body, Analysis of Plane Motion.	1	A1.3 ,A1.4, A1.5.1, A1.6
3	**Lectures: Chapter4:** - Plane motion of rigid body. - Equations of motion for rigid body. **Tutorials:** • Solve the problems on the Plane Motion of Rigid Body and Equations of Motion.	1	A1.7
4	**Lectures: Chapter 5 & 6:** - Plane motion of rigid body, energy and momentum methods. - Principle of work and energy for a rigid body. - Principle of impulse and momentum for the plane motion of a rigid body. - Conservation of angular momentum. - Mechanical vibrations. - Vibrations without damping (free vibration of particles). - Damped vibrations (damped free vibrations **Tutorials:** • Solve the problems on Principle of Work and Energy, Conservation of Momentum, undamped and damped vibration.	1	A1.8, A1.9, A1.10

Course: Applied Mechanics	
Program Competencies	**Course LOs**
A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.	**A1.1** Identify the Second moment (moment of Inertia). **A1.2** Identify the Product of Inertia. **A1.3** Define the Virtual work and its applications. **A1.4** Determine of the orbit shape. **A1.5** Identify the translation, Rotation and general plane motion. **A1.6** Analyze plane motion in terms of a parameters. **A1.7** Define the equations of motion of a rigid body. **A1.8** Evaluate the principle of work and energy for a rigid body. **A1.9** Apply the systems of rigid bodies. **A10.1** Evaluate the principle of impulse and momentum for the plane motion of a rigid body.

Course Coordinator: Dr. Amr Hassan Abdalla

Program coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Physics and Mathematical Engineering		
Course Code	**SCI115**		
Year/ Level	Second year- 1st semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical/Lab.
	2	-	2

2. Course Aims:

No.	Aim
1	Describe phenomena and theories of the electron in matter, the atomic structure and the tunneling effect, also identify nanotechnology and some of its applications, modern physics, x-rays and its usages, the vibrations and the waves and the thermal properties of solids.

3. Learning Outcomes (LOs):

A1.1	Identify the relation between the physical properties and the crystal structure of the solid, and the difference between classical and modern physics.
A1.2	Recognize the different between electron and photon, the different between the different type of solids, the different between the magnetic and no-magnetic material and properties of metals.
A1.3	Identify the general properties of conductors, semiconductors and insulators.
A2.1	Collect characteristics of photodiode experimentally.
A2.2	Conduct appropriate experimentation to study diffraction.
A2.3	Analyze the I-V characteristics curve of classic diode and LED.
A2.4	Determine the breakdown voltage of zener diode graphically and apply it in voltage regulator circuit.
B1.1	Outline the difference between solid state materials and their thermal, electrical and optical properties.

4. Course Contents:

No.	Topics	Week
1	**Lectures:** • Introduction about waves and Particles / Quark. Plank's Quantum Theory. Photoelectric effect. Einstein Equation • Applications of the Photoelectric Effect/Compton Effect. DE-Broglie Equation/Davisson and Germer experiment. **Labs/Tutorials:** • Analyze the I-V characteristics curve of classic diode and LED.	1-2
2	**Lectures:** • Type of crystalline materials / Production and properties the X – rays. • Bragg's law/ Space and Bravais lattice/ Point symmetry operations/ Miller indices/ Methods to identify the crystal structure. **Labs/Tutorials:** • Determine the breakdown voltage of zener.	3-4
3	**Lectures:** • Basic Atomic Structure - Bohr’s Postulates-Bohr atomic model - Classical • Electron Orbit-Angular momentum- Pauli Exclusion Principle/Energy Bands. **Labs/Tutorials:** • Collect characteristics of photodiode experimentally.	5-6
4	**Lectures:** • Introduction to semiconductor science. • The Electron Motion in Uniform Magnetic Field. • Diodes, LED, and Zener diodes. **Labs/Tutorials:** • Collect characteristics of photodiode experimentally.	7-8
5	**Midterm Exam.**	9
6	**Lectures:** • Metals-Collisions of Electron with atoms-Collisions of Photons with atoms-Electron Emission - Types of Electron Emission. **Labs/Tutorials:** • Determine the wavelength of laser experimentally by using diffraction grating.	10-11
7	**Lectures:** • The Electron Motion in constant electric Field- the Electron Motion in variable electric Field- The Electron Motion in Uniform Magnetic Field. **Labs/Tutorials:** • Determine the absorption coefficient of glass	12-13

8	**Lectures:** • Type of magnetic materials/ Ferro-, Para- and Di-Magnetic materials/ Magnetic susceptibility/ Currie's law. • The Electron Motion in Electric and Magnetic Field/Electrostatic lenses/Hull effect/Free Electron Theory-Fedman-Friend's Relation Fermi – Dirac Distribution. **Labs/Tutorials:** • Determine the wavelength of laser experimentally by using diffraction grating.	14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method														
		Lecture(Online \ in Class)	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A1.1**	x						x								
	A1.2	x						x								
	A1.3	x				x										
	A2.1	x					x									x
	A2.2	x					x									x
	A2.3						x									x
	A2.4						x									x
B-Level	**B1.1**	x				x										

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written/ online)	A1.1, A1.2, A1.3
2	Practical/ Oral Examination	A2.1, A2.2, A2.3, A2.4
3	Formative (quizzes- online quizzes- assignments)	A1.1, B1.1
4	Final Term Examination (written)	A1.1, A1.2, A1.3, B1.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written/ online)	9
2	Practical/ Oral Examination	15
3	Formative (quizzes- online quizzes- assignments)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights
1	Mid Term Examination (written/ online)	10
2	Practical/ Oral Examination	20
3	Formative (quizzes- online quizzes- assignments)	10
4	Final Term Examination (written)	60
Total		100%

8. List of References

No.	Reference List
1	R.A.Serway and J.W.Jewett ,"Physics for scientist and engineers", 6th Edition, Thomson Brooks/Cole 2014.
2	Edward M. Purcell and David J.Morin, "Electricity and Magnetism",3rd Edition, Cambridge University ,2013.
3	Larsen and Keller Education,"Solid State Physics",June 27,2019.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture / Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aim	LOs
1	**Lectures:** • Introduction about waves and Particles / Quark. Plank's Quantum Theory. Photoelectric effect. Einstein Equation • Applications of the Photoelectric Effect/Compton Effect. DE- Broglie Equation/Davisson and Germer experiment. **Labs/Tutorials:** • Analyze the I-V characteristics curve of classic diode and LED.	1	A1.1, A1.2, A1.3, A2.1, A2.2, A2.3
2	**Lectures:** • Type of crystalline materials / Production and properties the X – rays. • Bragg's law/ Space and Bravais lattice/ Point symmetry operations/ Miller indices/ Methods to identify the crystal structure. **Labs/Tutorials:** • Determine the breakdown voltage of Zener.	1	A1.1, A1.2, A2.1, A2.2, A2.4
3	**Lectures:** • Basic Atomic Structure - Bohr’s Postulates-Bohr atomic model - Classical • Electron Orbit-Angular momentum- Pauli Exclusion Principle/Energy Bands. **Labs/Tutorials:** • Collect characteristics of photodiode experimentally.	1	A1.1, A1.2, A2.1, A2.2, A2.3
4	**Lectures:** • Introduction to semiconductor science. • The Electron Motion in Uniform Magnetic Field. • Diodes, LED, and Zener diodes. **Labs/Tutorials:** • Collect characteristics of photodiode experimentally	1	A1.1, A1.2, A2.3, A2.4

5	**Midterm**	1	A1.1, A1.2, A1.3
6	**Lectures:** - Metals-Collisions of Electron with atoms-Collisions of Photons with atoms-Electron Emission - Types of Electron Emission. **Labs/Tutorials:** - Determine the wavelength of laser experimentally by using diffraction grating.	1	A1.2, A2.2, B1.1
7	**Lectures:** - The Electron Motion in constant electric Field- the Electron Motion in variable electric Field- The Electron Motion in Uniform Magnetic Field. **Labs/Tutorials:** - Determine the absorption coefficient of glass.	1	A1.2, A2.2, B1.1
8	**Lectures:** - Type of magnetic materials/ Ferro-, Para- and Di-Magnetic materials/ Magnetic susceptibility/ Currie's law. - The Electron Motion in Electric and Magnetic Field/Electrostatic lenses/Hull effect/Free Electron Theory-Fedman-Friend's Relation Fermi – Dirac Distribution. **Labs/Tutorials:** - Determine the wavelength of laser experimentally by using diffraction grating.	1	A1.2, A2.1, A2.2, B1.1

Course: Physics 3-B	
Program Competencies	**Course LOs**
A1- Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.	**A1-1** Identify the relation between the physical properties and the crystal structure of the solid, and the difference between classical and modern physics. **A1-2** Recognize the difference between the different type of solids, the different between the magnetic and non-magnetic material and properties of metals. **A1-3** Identify the general properties of conductors, semiconductors and insulators.
A2- Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.	**A2-1** Collect characteristics of photodiode experimentally. **A2-2** Conduct appropriate experimentation to study diffraction. **A2.3** Analyze the I-V characteristics curve of classic diode and LED. **A2.4** Determine the breakdown voltage of Zener diode graphically and apply it in voltage regulator circuit.
B1- Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.	**B1.1** Outline the difference between solid state materials and their thermal, electrical and optical properties.

Course Coordinator: Dr. Amany EL-Harizy

Program Coordinator: Dr. Sheriham Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Mechanical Power Engineering		
Course Code	**MPE101**		
Year/ Level	First year- 1st semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	1	3	--

2. Course aims:

No.	Aims
1, 8	Acquire the basics of Engineering and mechanical drawing and practice on conducting technical drawings of several machine parts.

3. Learning Outcomes (LOs):

A3.1	Distinguish between the materials of the parts of machines.
A3.2	Recognize the design and conduct the technical drawing of different machine parts.
A4.1	Identify the characteristics and processes related to the different machines and drawing symbols.
B2.1	Carry out samples of several machine parts using appropriate materials.
B4.1	Prepare the components of mechanical drawing adopting appropriate national and international standards and rules

4. Course Contents:

No.	Topics	Week
1	**Lecture:** - **Basic principles of engineering drawing** ○ surface finish - tolerances and fits Fasteners (bolts and nuts) **Tutorials/Lab:** - Drawing of Fasteners (bolts and nuts).	1
2	**Lecture:** - **General mechanical drawing** ○ General mechanical drawing, gears representation **Tutorials/Lab:** - General mechanical drawing and freehand sketch.	2
3	**Lecture:** - **clamp or machine vise** ○ Clamps or machine vises. **Tutorials/Lab:** - Drawing of clamps or machine vises. - Freehand sketch of clamps or machine vises.	3-4
4	**Lecture:** - **Joint or coupling** ○ Joints or couplings. **Tutorials/Lab:** - Drawing of joints or couplings. - Freehand sketch of joints or couplings.	5-6
5	**Lecture:** - **Bearing** ○ Drawing of Bearings. **Tutorials/Lab:** - Drawing of bearings. - Freehand sketch of bearings.	7-8
6	**Midterm Examination**	**9**
7	**Lecture:** - **Component of engine** ○ Drawing of Components of the engine. **Tutorials/Lab:** - Drawing of components of the engine. - Freehand sketch of components of the engine.	10-11
8	**Lecture:** - **Valves** ○ Drawing of Valves **Tutorials/Lab:** - Drawing of valves. - Freehand sketch of valves.	12-14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method														
		Lecture	Interactive lectures	Flipped Classroom	Presentation	Discussion	Tutorial	Problem-solving	Brain storming	Projects	Site visits	Self-learning	Cooperative	Drawing Studio	Computer Simulation	Practical Experiments
A-Level	A3.1	x	x			x	x	x	x			x				
	A3.2	x	x			x	x	x	x			x				
	A4.1	x	x			x	x	x	x		x	x	x			
B-Level	B2.1	x	x			x	x	x	x			x				
	B4.1	x	x			x	x	x	x			x				

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials and videos
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written)	A3.1, A3.2, A4.1, B2.1, B4.1
2	Practical/ Oral Examination	--
3	Formative (quizzes - presentation - assignments)	A3.1, A3.2, A4.1, B2.1, B4.1
4	Final Term Examination (written)	A3.1, A3.2, A4.1, B2.1, B4.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	9
2	Practical/ Oral Examination	--
3	Formative (quizzes – presentation – assignments)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	12
2	Practical/ Oral Examination	--
3	Formative (quizzes – presentation – assignments)	18
4	Final Term Examination (written)	70
Total		100%

8. List of References

No.	Reference List
1	K. L. Narayana, P. Kannaiah, and K. Venkata Reddy “Machine Drawing” New Age International (P) Ltd. 2010
2	Fatehy El-shrif, “Mechanical Drawing” El-Mansoura Univ., 1975.
3	C., Simmons, D. Maguive, and N. Phelps, “Manual of Engineering Drawing”, Elsevier Ltd. 2011
4	Ahmed El-bahlol, “Mechanical Drawing” El-Mansoura Univ., 1989.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture / Online Classroom
2	White Board
3	Data Show System
4	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aims	LOs
1	**Lecture:** ○ Basic principles of engineering drawing Surface finish - tolerances and fits Fasteners (bolts and nuts) **Tutorials/Lab:** • Drawing of Fasteners (bolts and nuts).	1,8	A3.1, A3.2, A4.1
2	**Lecture:** ○ General mechanical drawing, gears representation. **Tutorials/Lab:** • General mechanical drawing and freehand sketch.	1	A3.1, A3.2, A4.1
3	**Lecture:** ○ Clamps or machine vises. **Tutorials/Lab:** • Drawing of clamps or machine vises. • Freehand sketch of clamps or machine vises.	1	A3.1, A3.2, A4.1, B2.1, B4.1
4	**Lecture:** ○ Joints or couplings. **Tutorials/Lab:** • Drawing of joints or couplings. • Freehand sketch of joints or couplings.	1	A3.1, A3.2, A4.1, B2.1, B4.1
5	**Lecture:** ○ Drawing of Bearings. **Tutorials/Lab:** • Drawing of bearings. • Freehand sketch of bearings.	1	A3.1, A3.2, A4.1, B2.1, B4.1
6	**Midterm Examination**	1,8	A3.1, A3.2, A4.1, B2.1, B4.1
7	**Lecture:** ○ Drawing of Components of the engine. **Tutorials/Lab:** • Drawing of components of the engine. • Freehand sketch of components of the engine.	1	A3.1, A3.2, A4.1, B2.1, B4.1
8	**Lecture:** ○ Drawing of Valves. **Tutorials/Lab:** • Drawing of valves. • Freehand sketch of valves.	1	A3.1, A3.2, A4.1, B2.1, B4.1

Course: Mechanical Drawing	
Program Competencies	**Course LOs**
A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.	**A3.1** Distinguish between the materials of the parts of machines. **A3.2** Recognize the design and conduct the technical drawing of different machine parts.
A4. Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues and risk management principles.	**A4.1** Identify the characteristics and processes related to the different machines and drawing symbols.
B2. Plan, manage and carry out designs of mechanical systems and machine elements using appropriate materials both traditional means and computer-aided tools and software contemporary to the mechanical engineering field.	**B2.1** Carry out samples of several machine parts using appropriate materials.
B4. Adopt suitable national and international standards and codes; and integrate legal, economic and financial aspects to: design, build, operate, inspect and maintain mechanical equipment and systems.	**B4.1** Describe the components of mechanical drawing adopting on appropriate national and international standards and rules.

Course Coordinator: Dr. Yassen El-Sayed Yassen

Program Coordinate: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Production Engineering & Mechanical Design		
Course Code	**PRD113**		
Year/ Level	First year- 1st semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical/Lab.
	2	0	1

2. Course aims:

No.	Aim
1, 6	Identify the fundamentals of metal processing methods used to manufacture, casting and joining.

3. Learning Outcomes (LOs):

A1.1	Identify the concepts of material processing and properties.
A3.1	Apply scientific knowledge to the metal processing to solve structural engineering and mechanics problems.
B2.1	Carry out practical applications of metal casting and welding.
C3.1	Judge the optimal metal processing according to the constraints of operation, costs, safety, and reliability.

4. Course Contents:

No.	Topics	Week
1	**Lecture:** - Casting processes. **Lab:** - Metal Casting Processes.	1
2	**Lecture:** - Molding sand **Lab:** - Metal Casting Processes.	2
3	**Lecture:** - Core making and melting of metals. **Lab:** - Metal Casting Processes.	3-4
4	**Lecture:** - Gating system and risering design. **Lab:** - Metal Casting Processes.	5-6
5	**Lecture:** - Inspection and casting defects **Lab:** - Metal Casting Processes.	7-8
6	**Midterm Examination**	**9**
7	**Lecture:** - Welding positions. **Lab:** - Metal welding processes.	10
8	**Lecture:** - Welding joints **Lab:** - Metal welding processes.	11
9	**Lecture:** - Fuel gas and Arc welding processes & applications **Lab:** - Metal welding processes.	12-13
10	**Lecture:** - Resistance welding processes & applications. **Lab:** - Metal welding processes.	14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method														
		Lecture	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A1.1**	x	x	x		x		x								
	A3.1	x	x	x		x			x							
B-Level	**B2.1**	x							x			x				
C-Level	**C3.1**	x				x			x		x	x	x			

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written/ online)	A1.1, A3.1, C3.1
2	Practical/ Oral Examination	A1.1, A3.1, B2.1C3.1
3	Formative (quizzes- online quizzes- presentation)	A1.1, A3.1, C3.1
4	Final Term Examination (written)	A1.1, A3.1, C3.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written/ online)	9
2	Practical/ Oral Examination	15
3	Formative (quizzes- online quizzes- presentation)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights
1	Mid Term Examination (written/ online)	10
2	Practical/ Oral Examination	20
3	Formative (quizzes- online quizzes- presentation)	10
4	Final Term Examination (written)	60
Total		100%

8. List of References

No.	Reference List
1	Waters, T.F., "Fundamentals of Manufacturing for Engineers", Published by University College London (UCL), First Edition, 2007.
2	Timings, R.L., "Manufacturing Technology", Published by Longman Scientific & Technical, Second Edition, 2000.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture / Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No	Topic	Aim	LO's
1	**Lecture:** • Casting processes. **Lab:** • Metal Casting Processes.	1,6	A1.1, A3.1, B2.1
2	**Lecture:** • Molding sand **Lab:** • Metal Casting Processes.	1,6	A1.1, A3.1, B2.1
3	**Lecture:** • Core making and melting of metals. **Lab:** Metal Casting Processes.	1,6	A1.1, A3.1, B2.1, C3.1
4	**Lecture:** • Gating system and risering design. **Lab:** Metal Casting Processes.	1,6	A1.1, A3.1, B2.1, C3.1
5	**Lecture:** • Inspection and casting defects **Lab:** • Metal Casting Processes.	1,6	A1.1, A3.1, B2.1
6	**Lecture:** • Welding positions. **Lab:** • Metal welding processes.	1,6	A1.1, A3.1, B2.1, C3.1
7	**Lecture:** • Welding joints **Lab:** • Metal welding processes.	1,6	A1.1, A3.1, B2.1
8	**Lecture:** • Fuel gas and Arc welding processes & applications **Lab:** • Metal welding processes.	1,6	A1.1, A3.1, B2.1, C3.1
9	**Lecture:** • Resistance welding processes & applications. **Lab:** Metal welding processes.	1,6	A1.1, A3.1, B2.1, C3.1

Course: Manufacturing Engineering	
Program Competencies	**Course LOs**
A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.	**A1.1** Identify the concepts of material processing and properties.
A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.	**A3.1** Apply scientific knowledge to the metal processing to solve structural engineering and mechanics problems.
B2. Plan, manage and carry out designs of mechanical systems and machine elements using appropriate materials both traditional means and computer-aided tools and software contemporary to the mechanical engineering field.	**B2.1** Carry out practical applications of metal casting and welding.
C3. Judge the optimal solution according to the constraints of operation, costs, safety, reliability and environmental impacts.	**C3.1** Judge the optimal metal processing according to the constraints of operation, costs, safety, and reliability.

Course Coordinator: Prof. Dr. Mostafa Shaker

Prof. Dr. Ebtisam Abdel-gwad

Program Coordinate: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Civil Engineering		
Course Code	**CIV106**		
Year / Level / Semester	First year / 1st Semester		
Specialization	Major		
Teaching Hours / Bylaw 2014	**Lectures**	**Tutorial**	**Practical/Lab.**
	2	2	0

2. Course aims

No.	**Aim**
1	Acquire the basic concepts of the structural analysis of beams, frames, and trusses under different types of loads.

3. Learning Outcomes (LOs)

A1.1	Identify the structure loads, supports, and reactions.
A1.2	Identify the mechanical properties of plane cross-sections.
A1.3	Assess the structure reaction.
A1.4	Determine the mechanical properties of plane cross-sections.
A1.5	Determine the straining action on plane cross-sections
B1.1	Analyze the structures subjected to external and internal forces applicable to the mechanical and civil engineering discipline.

4. Course Contents

No.	Topic	Weeks
1	**Lectures:** • Types of structures supports and member types. • Loads and reactions of statically determinant beams. • Reactions of statically determinant frames. **Labs/Tutorials:** • Applications on beams and frames reactions.	**1-2**
2	**Lectures:** • Analysis of statically determinant beams **Labs/Tutorials:** • Applications on beams analysis	**3-4**
3	**Lectures:** • Analysis of statically determinant frames **Labs/Tutorials:** • Applications on frames analysis	**5-6**
4	**Lectures:** • Reactions of statically determinant trusses. • Analysis of statically determinant trusses using joint method • Analysis of statically determinant trusses using section method **Labs/Tutorials:** • Applications on truss reaction and trusses internal forces using joint method. • Determine trusses internal forces using section method	**7-8**
5	**Midterm Exam.**	**9**
6	**Lectures:** • Determine the mechanical properties and center of rigidity of plane cross-sections. • Determine the moment of inertia for symmetric x-section **Labs/Tutorials:** • Applications on cross-sections gravity center. • Applications on cross-sections moment of inertia	**10**
7	**Lectures:** • Determine the straining action on plane cross-sections. • Determine the normal stresses due to axial load, single moment, double moment, and combined straining action • Draw the normal stress distribution **Labs/Tutorials:** • Applications on plane cross-sections straining action. • Applications on normal stresses.	**11-13**
8	**Lectures:** • Determine and distribute shear stresses on plane cross-sections. **Labs/Tutorials:** • Applications on shear stresses.	**14**

5. Teaching and Learning Methods

LOs			Teaching and Learning Method														
			Face-to-face Lecture	**Online Lecture**	**Flipped Classroom**	**Presentation and Movies**	**Discussion**	**Tutorial**	**Problem solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning and Research**	**Cooperative**	**Discovering**	**Modeling**	**Playing**
Levels	**A**	A1.1	X	X		X	X										
		A1.2	X	X		X	X										
		A1.3	X	X		X		X	X								
		A1.4	X	X		X		X	X								
		A1.5	X	X		X		X	X								
	B	B1.1	X	X		X		X	X								

6. Teaching and Learning Methods of Disable Students

No.	Teaching Method
1	Additional Tutorials
2	Online lectures and assignments
3	Give them specific tasks.
4	Repeat the explanation of some of the material and tutorials during the office hours.

7. Student Assessment

7.1 Student Assessment Methods

No.	Assessment Method	LOs
1	Mid Term Examination (written/ online)	A1.1, A1.3 and B1.1
2	Tutorial and report assessment	A1.1, A1.2, A1.3, A1.4, A1.5, and B1.1
3	Quizzes - online quizzes	A1.1, A1.2, A1.3, A1.4, A1.5, and B1.1
4	Final Term Examination (written)	A1.1, A1.2, A1.3, A1.4, A1.5, and B1.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written/ online)	9th
2	Tutorial and report assessment	Every week
3	Quizzes - online quizzes	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights
1	Mid Term Examination (written/ online)	10
2	Tutorial and report assessment	10
3	Quizzes - online quizzes	10
4	Final Term Examination (written)	70
Total		100%

8. List of References

Course Notes	▪ The course notes were prepared by structural analysis professors in the civil engineering department in the faculty.
Essential Books (Textbooks)	▪ Wagih Mohamed El-Dakhakhni, "Theory of Structures Part 1", Dar Al-Maaref, Cairo, Egypt, 1983.
Recommended books	▪ R.C. Hibbeler, "Structural Analysis", Tenth Edition, Published by Pearson Prentice Hall, USA, 2018.

9. Facilities Required for Teaching and Learning

No.	Facility
1	Lecture / Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course

No.	Topic	Aim	LOs
1	**Lectures:** - Types of structures supports and member types. - Loads and reactions of statically determinant beams. - Reactions of statically determinant frames. **Labs/Tutorials:** - Applications on beams and frames reactions.	**1**	A1.1 A1.3 B1.1
2	**Lectures:** - Analysis of statically determinant beams **Labs/Tutorials:** - Applications on beams analysis	**1**	A1.1 A1.3 B1.1
3	**Lectures:** - Analysis of statically determinant frames **Labs/Tutorials:** - Applications on frames analysis	**1**	A1.1 A1.3 B1.1
4	**Lectures:** - Reactions of statically determinant trusses. - Analysis of statically determinant trusses using joint method - Analysis of statically determinant trusses using section method **Labs/Tutorials:** - Applications on truss reaction and trusses internal forces using joint method. - Determine trusses internal forces using section method	**1**	A1.1 A1.3 B1.1
5	**Lectures:** - Determine the mechanical properties and center of rigidity of plane cross-sections. - Determine the moment of inertia for symmetric x-section **Labs/Tutorials:** - Applications on cross-sections gravity center. - Applications on cross-sections moment of inertia.	**1**	A1.2 A1.4 A10.2
6	**Lectures:** - Determine the straining action on plane cross-sections. - Determine the normal stresses due to axial load, single moment, double moment, and combined straining action - Draw the normal stress distribution **Labs/Tutorials:** - Applications on plane cross-sections straining action. - Applications on normal stresses.	**1**	A1.2 A1.4 A1.5
7	**Lectures:** - Determine and distribute shear stresses on plane cross-sections. **Labs/Tutorials:** - Applications on shear stresses.	**1**	A1.2 A1.4 A1.5

Course: Analysis and Mechanics of Structure	
Programme LOs **The graduates of the program should be able to**	**Course LOs**
A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.	**A1.1** Identify the structure loads, supports, and reactions. **A1.2** Identify the mechanical properties of plane cross-sections. **A1.3** Assess the structure reaction. **A1.4** Determine the mechanical properties of plane cross-sections. **A1.5** Determine the straining action on plane cross-sections.
B1. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.	**B1.1** Analyze the structures subjected to external and internal forces applicable to the mechanical and civil engineering discipline.

Course Coordinator: **Dr. Shady Ragheb** ……………………

Program Coordinator: **Dr. Sherihan Abd El-Ghafour** ……………………

Head of Department: **Prof. Dr. Kamal Morad** ……………………

1. Basic Information

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Electrical Engineering		
Course Code	HUU103		
Year/ Level	First year- 1st Semester		
Specialization	Minor		
Teaching Hours	Lectures	Tutorial	Practical
	2	-	-

2. Course Aims:

No.	Aim
2	Behave professionally to necessary thinking skills for engineering standards and work to develop the profession and the community under realistic constraints such as economic, environmental, social, and sustainability.

3. Learning Outcomes (LOs):

A8.1	Communicate effectively with colleagues to recognize the basic types of Thinking.
A9.1	Use the different types of thinking to give innovative improvements of daily problems.
A10.1	Apply the different types of thinking to give modifications of a case study as the Sustainable development goals.

4. Course Contents:

No.	Topics	Week
1	**Lectures:** • The concept of thinking, creativity, memory, Improving thinking skills, the difference between thinking and Improving thinking skills, the most important characteristics of Improving thinking skills	1-2
2	**Lectures:** • The components of Improving thinking skills, the importance of thinking in our life, the role of each of the axes of the educational process in Improving thinking skills, the difference between thinking, creativity and innovation	3
3	**Lectures:** • Types of thinking, basic thinking, basic thinking skills, creative thinking, creative thinking skills, critical thinking - stages of the creative process. • A case study on Sustainable development goals.	4-6

4	**Lectures:** • The meaning of scientific thinking, complex thinking, - a map of basic thinking skills - examples of each type of thinking skills from the field of specialization.	7
5	**Lectures:** • The difference between a good thinker and a bad thinker - traits and characteristics of a critical thinker	8
6	**Midterm**	9
7	**Lectures:** • Planning - the method of solving problems in a scientific way, steps for feeling a problem and how to solve it - training in the method of problem solving through problems in the field of specialization. • A case study on the future required jobs 2030-2050.	10
8	**Lectures:** Thinking strategies (brainstorming - the theory of the six hats) and how to apply this strategy in the field of specialization.	11-12
9	**Lectures:** Various exercises in the field of specialization to develop thinking skills	13-15

5. Teaching and Learning Methods:

LOs		**Teaching and Learning Method**														
		Lecture (online/in class)	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A8-1**	x			x		x	x		x						
	A9-1	x			x		x	x		x						
	A10-1	x			x		x	x		x						

6. Teaching and Learning Methods 0f Disable Students:

No.	Teaching Method
1	Additional Tutorials
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written/ online)	A8-1, A9-1, A10-1
2	Formative (quizzes- online quizzes- presentation - …….)	A8-1, A9-1, A10-1
3	Final Term Examination (written)	A8-1, A9-1, A10-1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written/ online)	9
2	Formative (quizzes- online quizzes- presentation - …….)	Every week
3	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights
1	Mid Term Examination (written/ online)	20%
2	Formative (quizzes- online quizzes- presentation - …….)	-
4	Final Term Examination (written)	80%
Total		100%

8. List of References

No.	Reference List
1	Butterworth, J., & Thwaites, G. "Thinking Skills: Critical Thinking and Problem Solving", Cambridge University Press, (2nd ed.), 2013.
2	محمد ماهر الجمال، التفكير العلمى ودور المؤسسات التربوية فى تنميته، دار الوفاء للطباعة والنشر، القاهرة 1997
3	حسن حسين زيتون ، رؤية معاصرة في تنمية العقول المفكرة ، عالم الكتب القاهرة 2003.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture Classroom
2	Online facilities.
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No	Topic	Aim	LOs
1	**Lectures :** The concept of thinking, creativity, memory, improving thinking skills, the difference between thinking and Improving thinking skills, the most important characteristics of Improving thinking skills	2	A8-1, A9-1, A10-1
2	**Lectures:** The components of Improving thinking skills, the importance of thinking in our life, the role of each of the axes of the educational process in Improving thinking skills, the difference between thinking, creativity and innovation	2	A8-1, A9-1, A10-1
3	**Lectures:** Types of thinking, basic thinking, basic thinking skills, creative thinking, creative thinking skills, critical thinking - stages of the creative process. A case study on Sustainable development goals.	2	A8-1, A9-1, A10-1
4	**Lectures:** The meaning of scientific thinking, complex thinking, - a map of basic thinking skills - examples of each type of thinking skills from the field of specialization.	2	A8-1, A9-1, A10-1

5	**Midterm**	2	A8-1, A9-1, A10-1
6	**Lectures:** The difference between a good thinker and a bad thinker - traits and characteristics of a critical thinker	2	A8-1, A9-1, A10-1
7	**Lectures:** Planning - the method of solving problems in a scientific way, steps for feeling a problem and how to solve it - training in the method of problem solving through problems in the field of specialization. A case study on the future required jobs 2030-2050.	2	A8-1, A9-1, A10-1
8	**Lectures:** Thinking strategies (brainstorming - the theory of the six hats) and how to apply this strategy in the field of specialization.	2	A8-1, A9-1, A10-1
9	**Lectures:** Various exercises in the field of specialization to develop thinking skills	2	A8-1, A9-1, A10-1

Course: Development of Thinking Skills	
Program Competencies	**Course LOs**
A8. Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools.	**A8.1** Communicate effectively with colleagues to recognize the basic types of Thinking.
A9. Use creative, innovative and flexible thinking and acquire entrepreneurial and leadership skills to anticipate and respond to new situations.	**A9.1** Use the different types of thinking to give innovative improvements of daily problems.
A10. Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.	**A10.1** Apply the different types of thinking to give modifications of a case study as the Sustainable development goals.

Course Coordinator: Dr. Heba Youssef Soliman.

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information:

Department offering the Program	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)	
Department offering the Program	Mechanical Power Engineering	
Department Responsible for the Course	Physics and Mathematical Engineering	
Course Code	**SCI 119**	
Year/ Level	First year- 2nd semester	
Specialization	Major	
Teaching Hours	Lectures	Tutorial
	2	2

2. Course Aims:

No.	Aims
1	Acquire the essential knowledge to understand some basics of mathematics: systems of linear equations and their solutions, the linear algebra, matrices solution, vectors, vector spaces, linear independence of vectors, subspaces, bases, dimension of vector spaces and inner product spaces, linear transformations, eigenvalues and eigenvectors, the concept of Laplace transforms, inverse Laplace transform, solving differential equations, the potential of using Laplace transforms and inverse Laplace transform in solving differential equations.

3. Learning Outcomes (LOs):

A1.1	Determine the Laplace transform of functions from first principles.
A1.2	Apply basic properties of the Laplace transform such as linearity and convolution.
A1.3	Use the Laplace transforms to solve ordinary differential equations with given initial conditions.
A1.4	Categorize of the basic concepts of linear algebra.
A1.5	Solve System of Linear equations using matrices.
A1.6	Know and understand concept of vector space.
A1.7	Recognize the Eigenvalues and Eigenvector.
A1.8	Understand of the basic concepts of probability.
A5.1	Evaluate the Delta functions to model impulses and solve such models by applying the Laplace transform.
A5.2	Suggest most moderate method to solve a system of linear equations.
A5.3	Show different applications of Eigenvalues and Eigenvector.
A5.4	Use mathematical thinking for students to be self-independent in problem solving.
A10.1	Use text- books and scientific web sites to solve some problems and collect data.

4. Course Contents:

No	Topics	Week
1	**Lectures:** Chapter 1: Laplace transforms. • Definition of the Laplace transform • Properties of the Laplace transform • Inverse Laplace transform • Solving Initial Value Problems • Convolution theory • Impulses and the Dirac Delta Function **Tutorials:** • Practice of solving Laplace transform • Practice of solving inverse Laplace transform	1-5
2	**Lectures:** Chapter2: Linear Equations • Introduction to Linear Equations • Solving Linear Equations • The Gauss-Jordan algorithm • Systematic solution of Linear systems • Homogeneous systems **Tutorials:** • Apply the different methods to solve linear equations	6-7
3	**Lectures:** Chapter 3: Matrices • Matrix arithmetic • Linear transformations • Recurrence relations • Non-singular matrices • Least square solution of equation **Tutorials:** • Evaluate matrix arithmetic and linear transformations. • Solve problems on least square solution of equation**.**	8
4	**Midterm Exam.**	9
5	**Lectures:** Chapter 4: Vector Space and Subspaces • Subspaces of R^n • Linear Dependence • Basis of a Subspace • Rank and Nullity of a Matrix **Tutorials:** • Solve the problems on the basis of any vector space and the subspaces of R^n.	10-12
6	**Lectures:** Chapter 5: -Eigenvalues and Eigenvectors • Motivation	13-14

	• Definitions and examples **Tutorials:** • Calculate the Eigenvalues and Eigenvectors.	

5. Teaching and Learning Methods:

LOs		**Teaching and Learning Method**														
		Lecture(on line / in class)	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial(on line / in class)**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A1.1**	x	x													
	A1.2	x	x				x									
	A1.3	x	x	x			x									
	A1.4	x	x				x									
	A1.5	x	x	x			x	x								
	A5.1	x	x	x			x	x								
	A5.2	x	x	x			x									
	A5.3	x	x				x	x								
	A5.4	x	x				x	x								
	A10.1					x	x	x	x							

6. Teaching and Learning Methods of Disable Students:

No.	**Teaching Method**
1	Additional Tutorials
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written/ online)	A1.1, A1.2, A1.3, A1.4, A5.1, A5.1 , A5.2
2	Formative (quizzes- online quizzes- assignments)	A1.1, A1.2, A1.3, A1.4, A1.5, A1.6, A1.7, A1.8, A5.1, A5.2, A5.3, A5.4, A10.1
3	Final Term Examination (written)	A1.1, A1.2, A1.3, A1.4, A1.5, A1.6, A1.7, A1.8, A5.1, A5.2, A5.3, A5.4

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written/ online)	9
2	Formative (quizzes- online quizzes- assignments)	Every week
3	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights
1	Mid Term Examination (written/ online)	20
3	Formative (quizzes- online quizzes- assignments)	10
4	Final Term Examination (written)	70
Total		100%

8. List of References:

No.	Reference List
1	Howard Anton and Chris Rorres, “Elementary Linear Algebra”, Application Version 11th, publisher John Wiley & Sons, 2013.
2	Erwin Kreyszig:"Advanced Engineering Mathematics ”John Wiley & Sons, N.Y
3	K.A., Booth D.J.: "Engineering Mathematics Stroud ”8th ed., 2014.
4	K. A. Stroud and Dexter J. Booth, “Advanced Engineering Mathematics” Palgrave Macmillan, 2011.
5	Erwin Kreyszig, Kreyszig Textbook: “Advanced Engineering Mathematics, 10th edition- slader.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture / Online Classroom
2	White Board
3	Data Show System
4	Presenter

10. Matrix of Knowledge and Skills of the Course:

No	Topic	Aims	LOs
1	**Lectures:** Chapter 1: Laplace transforms. • Definition of the Laplace transform • Properties of the Laplace transform • Inverse Laplace transform • Solving Initial Value Problems • Convolution theory • Impulses and the Dirac Delta Function **Tutorials:** • Practice of solving Laplace transform • Practice of solving inverse Laplace transform	1	A1.1, A1.2, A1.3, A5.1
2	**Lectures:** Chapter2: Linear Equations • Introduction to Linear Equations • Solving Linear Equations • The Gauss-Jordan algorithm • Systematic solution of Linear systems • Homogeneous systems **Tutorials:** • Apply the different methods to solve linear equations	1	A1.4, A5.2
3	**Lectures:** Chapter 3: Matrices • Matrix arithmetic • Linear transformations • Recurrence relations • Non-singular matrices • Least square solution of equation **Tutorials:** • Evaluate matrix arithmetic and linear transformations. • Solve problems on least square solution of equation.	1	A1.5, A10.1
4	**Lectures:** Chapter 4: Vector Space and Subspaces • Subspaces of R^n • Linear Dependence • Basis of a Subspace • Rank and Nullity of a Matrix	1	A1.6, A5.4, A10.1

	Tutorials: - Solve the problems on the basis of any vector space and the subspaces of R^n .		
5	**Lectures:** Chapter 5: -Eigenvalues and Eigenvectors - Motivation - Definitions and examples **Tutorials:** Calculate the Eigenvalues and Eigenvectors.	1	A1.7, A5.3, A10.1

Course: Math 4-B	
Program Competencies	**Course LOs**
A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.	**A1.1** Determine the Laplace transform of functions from first principles. **A1.2** Apply basic properties of the Laplace transform such as linearity and convolution. **A1.3** Use the Laplace transforms to solve ordinary differential equations with given initial conditions. **A1.4** Categorize of the basic concepts of linear algebra. **A1.5** Solve System of Linear equations using matrices. **A1.6** Recognize concept of vector space. **A1.7** Recognize the Eigenvalues and Eigenvector. **A1.8** Understand of the basic concepts of probability.
A5. Practice research techniques and methods of investigation as an inherent part of learning.	**A5.1** Evaluate the Delta functions to model impulses and solve such models by applying the Laplace transform. **A5.2** Suggest most moderate method to solve a system of linear equations **A5.3** Show different applications of Eigenvalues and Eigenvector. **A5.4** Use mathematical thinking for students to be self-independent in problem solving.
A10. Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.	**A10.1** Use text- books and scientific web sites to solve some problems and collect data.

Course Coordinator: Dr. Ibrahim Hosney

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Mechanical Power Engineering		
Course Code	**MPE102**		
Year/ Level	First year- 2nd semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	1	--	3

2. Course aims:

No.	Aims
6	Recognize and apply the concepts of engineering and mechanical drawing using computer softwares, such as AutoCAD and SolidWorks, by conducting several applications.

3. Learning Outcomes (LOs):

A3.1	Use computer softwares in solving engineering problems.
A3.2	Apply the technical drawing using computer-aided softwares as a main step in the design process for mechanical applications.
A4.1	Utilize the computer software; AutoCAD and SolidWorks, for different drawing exercise.
B2.1	Carry out the technical drawing and three-dimensional shapes of mechanical parts using computer-aided tools and software.
B4.1	Describe the components of mechanical drawing adopting appropriate national and international standards and rules.

4. Course Contents:

No.	Topics	Week
1	**Lecture:** - **Introduction to AutoCAD** - Main tools of AutoCAD. **Lab:** - Exercises on main tools of AutoCAD.	1-3
2	**Lecture:** - **AutoCAD with assembly drawing** - Assembly drawing using AutoCAD. **Lab:** - Exercises on assembly drawing using AutoCAD.	4-8
3	**Midterm Examination**	**9**
4	**Lecture:** - **Introduction to Solid Works** - Main tools of Solid Works. **Lab:** - Exercises on main tools of SolidWorks.	10-11
5	**Lecture:** - **Solid Works with assembly drawing** - Assembly drawing using SolidWorks. **Lab:** - Exercises on assembly drawing using SolidWorks.	12-14

5. Teaching and Learning Methods:

LOs		**Teaching and Learning Method**														
		Lecture	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A3.1**	x	x			x	x	x	x			x				
	A3.2	x	x			x	x	x	x			x				
	A4.1	x	x			x	x	x	x		x	x	x			
B-Level	**B2.1**	x	x			x	x	x	x			x				
	B4.1	x	x			x	x	x	x			x				

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials and videos
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written)	A3.1, A3.2, A4.1, B2.1, B4.1
2	Practical/ Oral Examination	A3.1, A3.2, A4.1, B2.1, B4.1
3	Formative (quizzes - presentation - assignments)	A3.1, A3.2, A4.1, B2.1, B4.1
4	Final Term Examination (written)	A3.1, A3.2, A4.1, B2.1, B4.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	9
2	Practical/ Oral Examination	15
3	Formative (quizzes – presentation – assignments)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	12
2	Practical/ Oral Examination	20
3	Formative (quizzes – presentation – assignments)	8
4	Final Term Examination (written)	60
Total		100%

8. List of References

No.	Reference List
1	Alex Ruiz , and Gabi Jack "SolidWorkS 2010", Wiley Publishing, Inc., 2012
2	Randy H. Shih, " AutoCAD 2016 Tutorial", SDC publications, 2017

3	C., Simmons, D. Maguive, and N. Phelps, "Manual of Engineering Drawing", Elsevier Ltd. 2011
4	K. L. Narayana, P. Kannaiah, and K. Venkata Reddy "Machine Drawing" New Age International (P) Ltd. 2010

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture / Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topics	Aims	LOs
1	**Lecture:** • **Introduction to AutoCAD** ○ Main tools of AutoCAD. **Lab:** • Exercises on main tools of AutoCAD.	6	A3.1, A3.2, A4.1, B2.1, B4.1
2	**Lecture:** • **AutoCAD with assembly drawing** ○ Assembly drawing using AutoCAD. **Lab:** • Exercises on assembly drawing using AutoCAD.	6	A3.1, A3.2, A4.1, B2.1, B4.1
3	**Midterm Examination**	6	A3.1, A3.2, A4.1, B2.1, B4.1
4	**Lecture:** • **Introduction to Solid Works** ○ Main tools of Solid Works. **Lab:** • Exercises on main tools of SolidWorks.	6	A3.1, A3.2, A4.1, B2.1, B4.1
5	**Lecture:** • **Solid Works with assembly drawing** ○ Assembly drawing using SolidWorks. **Lab:** • Exercises on assembly drawing using SolidWorks.	6	A3.1, A3.2, A4.1, B2.1, B4.1

Course: : Mechanical Drawing using computer	
Program Competencies	**Course LOs**
A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.	**A3.1** Use computer softwares in solving engineering problems. **A3.2** Apply the technical drawing using computer-aided softwares as a main step in the design process for mechanical applications.
A4. Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues and risk management principles.	**A4.1** Utilize the computer software; AutoCAD and SolidWorks, for different drawing exercise.
B2. Plan, manage and carry out designs of mechanical systems and machine elements using appropriate materials both traditional means and computer-aided tools and software contemporary to the mechanical engineering field.	**B2.1** Carry out the technical drawing and three-dimensional shapes of mechanical parts using computer-aided tools and software.
B4. Adopt suitable national and international standards and codes; and integrate legal, economic and financial aspects to: design, build, operate, inspect and maintain mechanical equipment and systems.	**B4.1** Describe the components of mechanical drawing adopting appropriate national and international standards and rules.

Course Coordinator: Dr. Yassen El-Sayed Yassen

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Mechanical Power Engineering		
Course Code	**MPE103**		
Year/ Level	First year- 2nd semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	2	1	1

2. Course aims:

No.	Aims
1,6	Recognize and apply the principles of fluids and fluid mechanics, physical properties of fluids and their effect on flow behavior; equations of motion for incompressible ideal flow, including the special case of hydrostatics; continuity, energy, and momentum principles; control volume analysis.

3. Learning Outcomes (LOs):

A1.1	Recognize the fundamentals of fluid mechanics and transport phenomena.
A1.2	Show the mathematical forms of the fluid mechanics phenomena.
A5.1	Prepare the reports in accordance with the standard scientific guidelines.
B1.1	Apply the general laws of fluid flow in different mechanical applications.
C1.1	Assess the characteristics and processes related to the different fluid flow applications.
C5.1	Analyze the problems concerning fluid flow and its practical applications.

4. Course Contents:

No.	Topics	Week

1	**Lecture:**
	• **Introduction**
	  o The concept of fluid flow.
	  o Dimensions and units.
	Tutorials/Lab:
	• Solve problems on dimensions and units
	• Perform experiment on Fluid Properties {Liquid density, Solid density}
		1

2	**Lecture:** • **Properties of fluids** ○ Velocity, Pressure, Density, steady and unsteady flows, Specific weight, Specific gravity, State Relations for Gases and Liquids, Compressibility, Speed of Sound and Mach Number **Tutorials/Lab:** • Solve problems on properties of fluids • Perform experiment on Fluid Properties {Liquid viscosity}	2
3	**Lecture:** • **Properties of fluids** ○ Viscosity, Types of fluids, Surface Tension, Capillarity, Vapor Pressure and Cavitation **Tutorials/Lab:** • Solve problems on properties of fluids • Perform experiment on Fluid Properties {Capillary elevation}	3
4	**Lecture:** • **Fluid statics** ○ Introduction, Variation of Pressure with depth ○ Hydrostatic Pressure in an Incompressible Fluid ○ Hydrostatic Pressure in a compressible Fluid ○ Gage Pressure and Vacuum Pressure, Pascal’s law **Tutorials/Lab:** • Solve problems on fluid statics • Perform experiment on Fluid Properties {Archimedes Principle}	4
5	**Lecture:** • **Measurement of pressure** ○ The Piezometer, The Mercury Barometer, The Manometer, Mechanical measurement of high pressures ○ Hydrostatic forces on submerged surface **Tutorials/Lab:** • Solve problems on fluid statics • Perform experiment on Fluid Properties {Cavitation Demonstration}	5
6	**Lecture:** • **Buoyancy and Stability** ○ Buoyancy, Stability **Tutorials/Lab:** • Solve problems on fluid statics • Perform experiment on Fluid Properties {Barometer}	6
7	**Lecture:** • **Principles of fluid motion** ○ Classification of Fluid Flows ○ Vortex Flow ○ Basic Laws of Fluid Motion ○ Systems and Control Volumes **Tutorials/Lab:** • Solve problems on fluid motion	7

	- Perform experiment on Bernoulli's Theorem Demonstration – Osborne Reynolds' Demonstration	
8	**Lecture:** - **Integral Relations for a Control volume** ○ Mass, energy and momentum conservations **Tutorials/Lab:** - Solve problems on fluid motion - Perform experiment on Flow through Orifice and Free Jet Flow	8
9	**Midterm Examination**	**9**
10	**Lecture:** - **Application of Bernoulli's equations** ○ Orifice types, Flow rate Measurement , Pitot-Static Tube **Tutorials/Lab:** - Solve problems on fluid motion - Perform experiment on Flow Over Weirs	10

11	**Lecture:**
	- **Application of momentum equations**
	  ○ The linear momentum equation ,
	  ○ The Moment of momentum equation
	Tutorials/Lab:
	- Solve problems on fluid motion
	- Perform experiment on Flow through a venturi-meter
		11

12	**Lecture:**
	- **Flows in pipes**
	  ○ laminar and turbulent
	  ○ Laminar-flow solution, turbulent-flow solution
	Tutorials/Lab:
	- Solve problems on flows in pipes
	- Perform experiment on Impact of a Jet
		12-13

13	**Lecture:** - **Main and minor losses in a Pipes** ○ Multiple-pipe systems **Tutorials/Lab:** - Solve problems on flows in pipes - Perform experiment on Free and Forced Vortices	14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method														
		Lecture	Interactive lectures	Flipped Classroom	Presentation	Discussion	Tutorial	Problem-solving	Brain storming	Projects	Site visits	Self-learning	Cooperative	Drawing Studio	Computer Simulation	Practical Experiments
A-Level	**A1.1**	x	x			x	x	x	x			x				
	A1.2	x	x			x	x	x	x			x				
	A5.1	x	x			x	x	x	x		x	x	x			x
B-Level	**B1.1**	x	x			x	x	x	x			x				x
C-Level	**C1.1**	x	x			x	x	x	x			x			x	
	C5.1	x	x			x	x	x	x			x				x

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials and videos
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written)	A1.1, A1.2, B1.1
2	Practical/ Oral Examination	A1.1, A1.2, B1.1, C1.1, C5.1
3	Formative (quizzes–presentation– assignments)	A1.1, A1.2, A5.1, B1.1, C1.1, C5.1
4	Final Term Examination (written)	A1.1, A1.2, A5.1, B1.1, C1.1, C5.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	9
2	Practical/ Oral Examination	15
3	Formative (quizzes – presentation – assignments...)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	12
2	Practical/ Oral Examination	20
3	Formative (quizzes – presentation – assignments - …….)	8
4	Final Term Examination (written)	60
Total		100%

8. List of References

No.	Reference List
1	Frank M. White, “Fluid Mechanics”, 7th ed., McGraw-Hill, INC. 2011.
2	Irving H. Shames, “Mechanics of Fluids”, 3rd ed. McGraw-Hill, INC. 1992.
3	R. K. Bansal, "Fluid Mechanics and Hydraulic Machines", Laxmi Publications LTD, New Delhi, 2005.
4	B. R. Munson, D.F. Young and T.H. Okiishi, “Fundamentals of Fluid Mechanics”, 4th ed., John Wiley & Sons, INC. 2002.
5	M. Fogiel, "The Fluid Mech. and Dynamics Problem Solver", Research and Education Association REA, New York, 1983.
6	J. B. Evett and C. Liu, "Schaum's Solved Problems Series-2500 Solved Problems in Fluid Mechanics and Hydraulics", McGraw-Hill, INC. 1989.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture / Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aims	LOs
1	**Lecture:** - **Introduction** ○ The concept of a fluid ○ Dimensions and units **Tutorials/Lab:** - Solve problems on dimensions and units - Perform experiment on Fluid Properties {Liquid density, Solid density}	1,6	A1.1, A1.2, B1.1
2	**Lecture:** - **Properties of fluids** ○ Velocity, Pressure, Density, steady and unsteady flows, Specific weight, Specific gravity, State Relations for Gases and Liquids, Compressibility, Speed of Sound and Mach Number **Tutorials/Lab:** - Solve problems on properties of fluids - Perform experiment on Fluid Properties {Liquid viscosity}	1,6	A1.1, A1.2, B1.1
3	**Lecture:** - **Properties of fluids** ○ Viscosity, Types of fluids, Surface Tension, Capillarity, Vapor Pressure and Cavitation **Tutorials/Lab:** - Solve problems on properties of fluids - Perform experiment on Fluid Properties {Capillary elevation}	1,6	A1.1, A1.2, B1.1
4	**Lecture:** - **Fluid statics** ○ Introduction, Variation of Pressure with depth ○ Hydrostatic Pressure in an Incompressible Fluid ○ Hydrostatic Pressure in a compressible Fluid ○ Gage Pressure and Vacuum Pressure, Pascal’s law **Tutorials/Lab:** - Solve problems on fluid statics - Perform experiment on Fluid Properties {Archimedes Principle}	1,6	A1.1, A1.2, B1.1
5	**Lecture:** - **Measurement of pressure** ○ The Piezometer, The Mercury Barometer, The Manometer, Mechanical measurement of high pressures ○ Hydrostatic forces on submerged surface	1,6	A1.1, A1.2, B1.1

	Tutorials/Lab: - Solve problems on fluid statics - Perform experiment on Fluid Properties {Cavitation Demonstration}		
6	**Lecture:** - **Buoyancy and Stability** ○ Buoyancy, Stability **Tutorials/Lab:** - Solve problems on fluid statics - Perform experiment on Fluid Properties {Barometer}	1,6	A1.1, A1.2, A5.1, B1.1

7	**Lecture:**
	- **Principles of fluid motion**
	  ○ Classification of Fluid Flows
	  ○ Vortex Flow
	  ○ Basic Laws of Fluid Motion
	  ○ Systems and Control Volumes
	Tutorials/Lab:
	- Solve problems on fluid motion
	- Perform experiment on Bernoulli's Theorem Demonstration – Osborne Reynolds' Demonstration
		1,6	A1.1, A1.2, A5.1, B1.1

8	**Lecture:** - **Integral Relations for a Control volume** ○ Mass, energy and momentum conservations **Tutorials/Lab:** - Solve problems on fluid motion - Perform experiment on Flow through Orifice and Free Jet Flow	1,6	A1.1, A1.2, A5.1, B1.1, C1.1, C5.1
9	**Midterm Examination**	1,6	A1.1, A1.2, B1.1
10	**Lecture:** - **Application of Bernoulli's equations** ○ Orifice types, Flow rate Measurement, Pitot-Static Tube **Tutorials/Lab:** - Solve problems on fluid motion - Perform experiment on Flow Over Weirs	1,6	A1.1, A1.2, A5.1, B1.1, C1.1, C5.1

11	**Lecture:**
	- **Application of momentum equations**
	  ○ The linear momentum equation,
	  ○ The Moment of momentum equation
	Tutorials/Lab:
	- Solve problems on fluid motion
	- Perform experiment on Flow through a venturi-meter
		1,6	A1.1, A1.2, A5.1, B1.1, C1.1, C5.1

12	**Lecture:** - **Flows in pipes**	1,6	A1.1, A1.2,

	○ laminar and turbulent ○ Laminar-flow solution, turbulent-flow solution **Tutorials/Lab:** • Solve problems on flows in pipes • Perform experiment on Impact of a Jet		A5.1, B1.1, C1.1, C5.1
13	**Lecture:** • **Main and minor losses in a Pipes** ○ Multiple-pipe systems **Tutorials/Lab:** • Solve problems on flows in pipes • Perform experiment on Free and Forced Vortices	1,6	A1.1, A1.2, A5.1, B1.1, C1.1, C5.1

Course: Fluid Mechanics	
Program Competencies	**Course LOs**
A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.	**A1.1** Recognize the fundamentals of fluid mechanics and transport phenomena. **A1.2** Show the mathematical forms of the fluid mechanics phenomena.
A5. Practice research techniques and methods of investigation as an inherent part of learning.	**A5.1** Prepare the reports in accordance with the standard scientific guidelines.
B1. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, Solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.	**B1.1** Apply the general laws of fluid flow in different mechanical applications.
C1. Recognize the design concepts, operation and characteristics of the internal combustion engines, boilers, heat exchangers, turbomachines, and hydraulic machines.	**C1.1** Assess the characteristics and processes related to the different fluid flow applications.
C5. Select appropriate solutions for mechanical power engineering problems based on analytical and numerical techniques.	**C5.1** Analyze the problems concerning fluid flow and its practical applications.

Course Coordinator: Dr. Yassen El-Sayed Yassen

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Mechanical Power Engineering		
Course Code	**MPE104**		
Year/ Level	First year – 2nd semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	2	1	1

2. Course aims:

No.	Aims
6	Recognize and apply the basics of the thermodynamic, processes and laws besides various thermodynamic cycles applied in mechanical engineering discipline, behavior of ideal and real gases, and pure substance as well as air compressor as one of the thermodynamics applications.

3. Learning Outcomes (LOs):

A1.1	Identify the thermodynamic fundamentals and laws.
A1.2	Solve engineering problems by applying thermodynamic fundamentals and laws.
A3.1	Acquire the importance of the thermodynamic laws in the mechanical engineering discipline.
A3.2	Recognize the thermodynamic processes and cycles affecting the design of various mechanical systems.
B1.1	Analyze the thermodynamic processes involved in heat engines and reversed heat engines.
C1.1	Recognize the characteristics of ideal gases and pure substances.

4. Course Contents:

No.	Topics	Week
1	**Lecture:** • Introduction. • Definition and fundamental concepts **Tutorials/Lab:** • Solve problems on the units and energies. • Conduct experiments on thermodynamic applications system.	1-2
2	**Lecture:** • System and surroundings	3

	- Work and Heat - Types of thermodynamic systems **Tutorials/Lab:** - Solve problems on the work and heat. - Conduct experiments on thermodynamic applications system.	
3	**Lecture:** - Thermodynamic state - Thermodynamic processes - Thermodynamic cycles **Tutorials/Lab:** - Solve problems on the processes. - Conduct experiments on thermodynamic applications system.	4
4	**Lecture:** - Ideal and real gases. - Equation of state for ideal gases **Tutorials/Lab:** - Solve problems on the ideal gases. - Conduct experiments on Charl's and Boyl's laws.	5
5	**Lecture:** - The Zeroth law of thermodynamics - The first. law of thermodynamics - The general statement of the first law **Tutorials/Lab:** - Solve problems on the general statement of the first law. - Conduct experiments on energy transformation.	6
6	**Lecture:** - Application of the first law of thermodynamics to closed system. - Isobaric, isochoric, isothermal processes. **Tutorials/Lab:** - Solve problems on the processes. - Conduct experiments on energy transformation.	7
7	**Lecture:** - Adiabtic process - Polytropic process **Tutorials/Lab:** - Solve problems on the adiabatic and polytropic processes. - Conduct experiments on energy transformation.	8
8	**Midterm Examination**	**9**
9	**Lecture:** - Application of the first law of thermodynamics to open system. - Examples of steady flow open systems (Boilers, turbines, condenser, compressor, nozzle, pump, venturi and diffuser). **Tutorials/Lab:** - Solve problems on the Application of the first law of thermodynamics	10

	to open system. • Conduct experiments on adiabatic processes.	
10	**Lecture:** • Second law of thermodynamics. • Kelvin-plank statement • Clausius statement • Reversible and irreversible engines **Tutorials/Lab:** • Solve problems on reversible and irreversible engines. • Conduct experiments on Reciprocating air compressors	11
11	**Lecture:** • Entropy • Carnot cycle **Tutorials/Lab:** • Solve problems on the Carnot cycle. • Conduct experiments on Reciprocating air compressors	12
12	**Lecture:** • Pure substances. **Tutorials/Lab:** • Solve problems on pure substances. • Conduct experiments on Reciprocating air compressors	13
13	**Lecture:** • Reciprocating air compressors. **Tutorials/Lab:** • Solve problems on Reciprocating air compressors. • Conduct experiments on Reciprocating air compressors	14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method														
		Lecture	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A1.1**	x	x			x		x	x							
	A1.2	x	x			x	x	x	x							
	A3.1	x	x			x	x	x	x			x				x
	A3.2	x	x			x	x	x	x			x				x
B-Level	**B1.1**	x	x			x	x	x	x			x				x
C-Level	**C1.1**	x	x			x	x	x	x			x				

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials and videos
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written)	A1.1, A1.2, A3.1, A3.2, B1.1, C1.1
2	Practical/ Oral Examination	A1.1, A3.1, A3.2, B1.1, C1.1
3	Formative (quizzes - presentation - assignments …)	A1.1, A1.2, A3.1, A3.2, B1.1, C1.1
4	Final Term Examination (written)	A1.1, A1.2, A3.1, A3.2, B1.1, C1.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	9
2	Practical/ Oral Examination	15
3	Formative (quizzes – presentation – assignments)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	10
2	Practical/ Oral Examination	20
3	Formative (quizzes – presentation – assignments)	10
4	Final Term Examination (written)	60
Total		100%

8. List of References

No.	Reference List
1	Cengel, Y. A., & Boles, M. A. (2011). Thermodynamics: An Engineering Approach Seventh Edition.
2	Singh, O. (2003). Applied thermodynamics. New Age International.
3	Moran, M. J., Bailey, M. B., Boettner, D. D., & Shapiro, H. N. (2018). Fundamentals of engineering thermodynamics. Wiley.
4	Okeily, M. (2018) “Lectures in Thermodynamics I and II”, Mechanical Power Eng. Dept., Port Said University.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture / Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No	Topic	Aims	LOs
1	**Lecture:** • Introduction. • Definition and fundamental concepts **Tutorials/Lab:** • Solve problems on the units and energies. • Conduct experiments on thermodynamic applications system.	6	A1.1, A1.2, A3.1
2	**Lecture:** • System and surroundings • Work and Heat • Types of thermodynamic systems **Tutorials/Lab:** • Solve problems on the work and heat. • Conduct experiments on thermodynamic applications system.	6	A1.1, A1.2, A3.1, B1.1
3	**Lecture:** • Thermodynamic state • Thermodynamic processes • Thermodynamic cycles **Tutorials/Lab:** • Solve problems on the processes. • Conduct experiments on thermodynamic applications system.	6	A1.1, A1.2, A3.1, A3.2, B1.1
4	**Lecture:** • Ideal and real gases. • Equation of state for ideal gases **Tutorials/Lab:** • Solve problems on the ideal gases. • Conduct experiments on Charl’s and Boyl’s laws.	6	A1.1, A1.2, C1.1
5	**Lecture:** • The Zeroth law of thermodynamics • The first law of thermodynamics • The general statement of the first law **Tutorials/Lab:** • Solve problems on the general statement of the first law. • Conduct experiments on energy transformation.	6	A1.1, A1.2, A3.1
6	**Lecture:** Application of the first law of thermodynamics to closed system. • Isobaric, isochoric, isothermal processes **Tutorials/Lab:** • Solve problems on the processes. • Conduct experiments on energy transformation.	6	A1.1, A1.2, A3.1, A3.2, B1.1

7	**Lecture:** - Adiabtic process - Polytropic process **Tutorials/Lab:** - Solve problems on the adiabatic and polytropic processes. - Conduct experiments on energy transformation.	6	A1.1, A3.1, A3.2, B1.1
8	**Midterm Examination**	6	A1.1, A1.2, A3.1, A3.2, B1.1, C1.1
9	**Lecture:** - Application of the first law of thermodynamics to open system. - Examples of steady flow open systems (Boilers, turbines, condenser, compressor, nozzle, pump, venturi and diffuser). **Tutorials/Lab:** - Solve problems on the Application of the first law of thermodynamics to open system. - Conduct experiments on adiabatic processes.	6	A1.2, A3.2, B1.1, B3.1, C1.1
10	**Lecture:** - Second law of thermodynamics. - Kelvin-plank statement - Clausius statement - Reversible and irreversible engines **Tutorials/Lab:** - Solve problems on reversible and irreversible engines. - Conduct experiments on Reciprocating air compressors.	6	A1.1, A1.2, A3.1, B1.1
11	**Lecture:** - Entropy. - Carnot cycle **Tutorials/Lab:** - Solve problems on the Carnot cycle. - Conduct experiments on Reciprocating air compressors.	6	A1.1, A1.2, A3.2, B1.1, C1.1
12	**Lecture:** - Pure substances. **Tutorials/Lab:** - Solve problems on pure substances. - Conduct experiments on Reciprocating air compressors	6	A1.1, A1.2, C1.1
13	**Lecture:** - Reciprocating air compressors. **Tutorials/Lab:** - Solve problems on Reciprocating air compressors. - Conduct experiments on Reciprocating air compressors	6	A1.1, A1.2, A3.2, B1.1, C1.1

Course: Thermodynamic I	
Program Competencies	**Course LOs**
A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.	**A1.1** Identify the thermodynamic fundamentals and laws. **A1.2** Solve engineering problems by applying thermodynamic fundamentals and laws.
A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.	**A3.1** Acquire the importance of the thermodynamic laws in the mechanical engineering discipline. .**A3.2** Recognize the thermodynamic processes and cycles affecting the design of various mechanical systems.
B1. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, Solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.	**B1.1** Analyze the thermodynamic processes involved in heat engines and reversed heat engines.
C1. Recognize the design concepts, operation and characteristics of the internal combustion engines, boilers, heat exchangers, turbomachines and hydraulic machines.	**C1.1** Recognize the characteristics of ideal gases and pure substances.

Course Coordinator: Prof. Mohamed Atteya Okeily

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department Responsible for the Course	Production Engineering & Mechanical Design		
Department offering the Program	Mechanical Power Engineering		
Course Code	**PRD114**		
Year/ Level	First year- 2nd semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	2	1	0

2. Course Aims:

No.	Aim
4, 6	Provide theory and applications of the mechanics of materials, Identify optimal selection of the material based on its physical behavior under loads.

3. Learning Outcomes (LOs):

A1.1	Identify, and solve engineering problems by applying the concepts of mechanics of materials.
A3.1	Apply the concepts of mechanics of materials in the design process to produce economic and safe solutions.
A10.1	Acquire self and lifelong learning strategies to prepare technical reports.
B1.1	Analyze different structures and designs.
B2.1	Choose and assess the materials for designing the mechanical systems and machine elements.

4. Course Contents:

NO.	Topic	Week
1	**Lecture:** - Equilibrium of simple mechanical parts. **Tutorial:** - Solve problems on equilibrium of mechanical parts.	1
2	**Lecture:** - Normal loads-Shearing forces bending and tensional moment. **Tutorial:** - Solve problems on the analysis of stresses.	2
3	**Lecture:** Stresses in elastic bars under simple loading. **Tutorial:** - Solve problems on the analysis of stresses for elastic bars under simple loading.	3
4	**Lecture:** - Axial loading-bending & torsion-strain energy. **Tutorial:** - Solve problems on Axial loading-bending & torsion-strain energy.	4
5	**Lecture:** - Stresses of elastic bars under combined loading-Eccentric normal loading. **Tutorial:** - Solve problems on the analysis of stresses for elastic bars under combined loading-Eccentric normal loading.	5
6	**Lecture:** - Two-dimensional state of stress-Principle stresses Maximum shear stress-Mohr's circle. **Tutorial:** - Solve problems on Maximum shear stress-Mohr's circle.	6
7	**Lecture:** - Application for simple mechanical parts. **Tutorial:** - Solve problems on the analysis of simple mechanical parts.	7-8
8	**Midterm written examination**	9
9	**Lecture:** - Thin and thick cylinders – pressure vessels under the effect of pressure and temperature. **Tutorial:** - Solve problems on the pressure vessels under the effect of pressure and temperature.	10-11
10	**Lecture:** - Pressure vessel under the dynamic loading-Springs-Simple	12

	frames. **Tutorial:** • Solve problems on the pressure vessel under the dynamic loading-Springs-Simple frames.	
11	**Lecture:** • Testing of small models. **Tutorial:** • Solve problems on testing of small models.	13
12	**Lecture:** • Loading devices- Loading and elongation measurements. **Tutorial:** • Solve problems on loading devices - Loading and elongation measurements	14

5. Teaching and Learning Methods:

LOs		**Teaching and Learning Method**														
		Lecture	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A1.1**	x	x	x		x	x	x								
	A3.1	x	x	x		x	x	x	x							
	A10.1								x			x	x			
B-Level	**B1.1**	x					x	x	x				x			
	B2.1	x					x	x					x			

6. Teaching and Learning Methods of Disable Students:

No.	**Teaching Method**
1	Additional Tutorials
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written/ online)	A1.1, A3.1, B1.1, B2.1
2	Formative (quizzes- online quizzes- presentation)	A1.1, A3.1, A10.1, B1.1, B2.1
3	Final Term Examination (written)	A1.1, A3.1, B1.1, B2.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written/ online)	9
2	Formative (quizzes- online quizzes- presentation - …….)	Every week
3	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights
1	Mid Term Examination (written/ online)	13.3
2	Practical/ Oral Examination	13.3
3	Formative (quizzes- online quizzes- presentation - …….)	6.7
4	Final Term Examination (written)	66.7
Total		100%

8. List of References

No.	Reference List
1	R. C. Hibbeler, "Mechanics of Materials", 10th ed., Prentice Hall, 2016.
2	F. Beer, "Mechanics of Materials", 4th ed., McGraw-Hill, 2005.
3	E. J. Hearn, "Mechanics of Materials Volume 1", 3rd ed., Butterworth-Heinemann, 2000.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture / Online Classroom
2	White Board
3	Data Show System
4	Presenter

10. Matrix of Knowledge and Skills of the Course:

No	Topic	Aim	LOs
1	**Lecture:** - Equilibrium of simple mechanical parts. **Tutorial:** - Solve problems on equilibrium of mechanical parts.	6	A1.1, B1.1
2	**Lecture:** - Normal loads-Shearing forces bending and tensional moment. **Tutorial:** - Solve problems on the analysis of stresses.	4, 6	A1.1, A3.1, A10.1, B1.1, B2.1
3	**Lecture:** - Stresses in elastic bars under simple loading. **Tutorial:** - Solve problems on the analysis of stresses for elastic bars under simple loading.	4, 6	A1.1, A3.1, A10.1, B1.1, B2.1
4	**Lecture:** - Axial loading-bending & torsion-strain energy. **Tutorial:** - Solve problems on Axial loading-bending & torsion-strain energy.	4, 6	A1.1, A3.1, A10.1, B1.1, B2.1
5	**Lecture:** - Stresses of elastic bars under combined loading-Eccentric normal loading. **Tutorial:** Solve problems on the analysis of stresses for elastic bars under combined loading-Eccentric normal loading.	4, 6	A1.1, A3.1, A10.1, B1.1, B2.1
6	**Lecture:** - Two-dimensional state of stress-Principle stresses Maximum shear stress-Mohr's circle. **Tutorial:** Solve problems on Maximum shear stress-Mohr's circle.	4, 6	A1.1, A3.1, A10.1, B1.1, B2.1
7	**Lecture:** - Application for simple mechanical parts. **Tutorial:** Solve problems on the analysis of simple mechanical parts.	4, 6	A1.1, A3.1, A10.1, B1.1, B2.1
8	**Lecture:** - Thin and thick cylinders – pressure vessels under the effect of pressure and temperature. **Tutorial**: Solve problems on the pressure vessels under the effect of pressure and temperature.	4, 6	A1.1, A3.1, A10.1, B1.1, B2.1
9	**Lecture:** - Pressure vessel under the dynamic loading-	4, 6	A1.1, A3.1, A10.1, B1.1, B2.1

	Springs-Simple frames. **Tutorial:** Solve problems on the pressure vessel under the dynamic loading-Springs-Simple frames.		
10	**Lecture:** - Testing of small models. **Tutorial:** Solve problems on testing of small models.	4, 6	A1.1, A3.1, A10.1, B1.1, B2.1
11	**Lecture:** - Loading devices- Loading and elongation measurements. **Tutorial:** Solve problems on loading devices - Loading and elongation measurements	4, 6	A1.1, A3.1, A10.1, B1.1, B2.1

Course: Thermal and Mechanical Stress Analysis	
Program LOs	**Course LOs**
A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.	**A1.1** Identify, and solve engineering problems by applying the concepts of mechanics of materials.
A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.	**A3.1** Apply the concepts of mechanics of materials in the design process to produce economic and safe solutions.
A10. Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.	**A10.1** Acquire self and lifelong learning strategies to prepare technical reports.
B1. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.	**B1.1** Analyze different structures and designs.
B2. Plan, manage and carry out designs of mechanical systems and machine elements using appropriate materials both traditional means and computer-aided tools and software contemporary to the mechanical engineering field.	**B2.1** Choose and assess the materials for designing the mechanical systems and machine elements.

Course Coordinator: Prof. Dr. Abla El-Megharbel

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Production Engineering & Mechanical Design		
Course Code	**PRD115**		
Year/ Level	First year- 2nd semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	2	2	--

2. Course aims:

No.	aim
6, 7	Acquire the fundamentals of theory of machines: displacements, velocities, accelerations, and static and dynamic forces required, and hence, manage a proper design of mechanical linkages, cams, and geared systems.

3. Learning Outcomes (LOs):

A1.1	Identify the fundamentals of mechanisms.
B1.1	Analyze the dynamic characteristics (position, velocity, acceleration, force and torque) of mechanisms such as linkages and cams.
B1.2	Design and analyze systems by applying the concepts of dynamics and vibrations.
B2.1	Carry out and optimize the mechanisms design to perform a specified task.

4. Course Contents:

No.	Topics	Week
1	**Lecture:** • Simple Mechanisms. **Tutorial:** • Solve problems on Simple Mechanisms.	1,2
2	**Lecture:** • Velocity in mechanisms. **Tutorial:** • Solve problems on Velocity in Mechanisms.	3,4
3	**Lecture:** • Acceleration in Mechanism. **Tutorial:** • Solve problems on Acceleration in Mechanism.	5,6

4	**Lecture:** • Belt, Rope and Chain Drive. **Tutorial:** • Solve problems on Belt, Rope and Chain Drive.	7-8
5	**Midterm Exam.**	9
6	**Lecture:** • Governors. **Tutorial:** • Solve problems on Governors.	10
7	**Lecture:** • Balancing. **Tutorial:** • Solve problems on Balancing .	11,12
8	**Lecture:** Gyroscopic Couple and Processional Motion. **Tutorial:** Solve problems on Gyroscopic Couple and Processional Motion .	13,14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method														
		Lecture	Interactive lectures	Flipped Classroom	Presentation	Discussion	Tutorial	Problem-solving	Brain storming	Projects	Site visits	Self-learning	Cooperative	Drawing Studio	Computer Simulation	Practical Experiments
A-Level	A1.1	x	x	x					x							
B-Level	B1.1	x	x	x		x	x	x	x			x			x	
	B1.2	x	x	x	x	x	x	x	x					x	x	
	B2.1	x	x	x	x	x	x	x	x			x	x	x	x	

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written/ online)	A1.1, B1.1
2	Formative (quizzes – online quizzes - assignments)	A1.1, B1.1, B1.2, B2.1
3	Final Term Examination (written)	A1.1, B1.1, B1.2, B2.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written/ online)	9
2	Formative (quizzes – online quizzes - assignments)	Every week
3	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights
1	Mid Term Examination (written/ online)	15
2	Formative (quizzes – online quizzes - assignments)	15
3	Final Term Examination (written)	70
Total		100%

8. List of References

No.	Reference List
1	J R.S. Khurmi, J.K. Gupta, Theory of Machines, 2008.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture / Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aim	LOs
1	**Lecture:** • Simple Mechanisms. **Tutorial:** • Solve problems on Simple Mechanisms.	6	A1.1
2	**Lecture:** • Velocity in mechanisms. **Tutorial:** • Solve problems on Velocity in Mechanisms.	6, 7	B1.1
3	• Acceleration in Mechanism. **Tutorial:** • Solve problems on Acceleration in Mechanism.	6, 7	B1.1
4	**Lecture:** • Belt, Rope and Chain Drive. **Tutorial:** • Solve problems on Belt, Rope and Chain Drive.	6, 7	B1.1
5	**Midterm Exam.**		
6	**Lecture:** • Governors. **Tutorial:** • Solve problems on Governors.	6, 7	B1.2, B2.1
7	**Lecture:** • Balancing. **Tutorial:** • Solve problems on Balancing .	6, 7	B1.2, B2.1
8	**Lecture:** Gyroscopic Couple and Processional Motion. **Tutorial:** • Solve problems on Gyroscopic Couple and Processional Motion .	6, 7	B1.2, B2.1

Course: Machine theory	
Program Competencies	**Course LOs**
A.1 Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.	**A1.1** Identify the fundamentals of mechanisms.
B.1 Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.	**B1.1** Analyze the dynamic characteristics (position, velocity, acceleration, force and torque) of mechanisms such as linkages and cams. **B1.2** Design and analyze systems by applying the concepts of dynamics and vibrations.
B2. Plan, manage and carry out designs of mechanical systems and machine elements using appropriate materials both traditional means and computer-aided tools and software contemporary to the mechanical engineering field.	**B2.1** Carry out and optimize the mechanisms design to perform a specified task.

Course Coordinator: Dr.Eng. Mogeeb alrahman Abduelrahman

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information

Program Title	B.Sc. In Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Electrical Engineering		
Course Code	**HUF102**		
Year/ Level	First year- 2nd semester		
Specialization	Minor		
Teaching Hours	Lectures	Tutorial	Practical
	2	---	---

2. Course Aims:

No.	Aim
4	Master self-learning and life-long learning strategies and communicate effectively using different modes, tools, and languages to improve technical English writing skills and provide a technical manuscript and reports following different writing styles. More specifically the course introduces different section of a technical report and how to write each section.

3. Learning Outcomes (LOs):

A8-1	Identify the importance and usage of different types of technical report for engineers.
A8-2	Recognize the differences between the different sections of technical reports.
A8-3	Prepare accurate, clear, efficient, and comprehensive engineering technical report.
A8-4	Presents accurate, clear, efficient, and comprehensive engineering technical report.
A8-5	Explore different ideas, views, and knowledge from a range of sources to organize, collect, analyze, and evaluate information for writing a technical report.
A10-1	Refer to various literatures regarding writing styles and rules.
A10-2	Practice writing the list of references in a different format.

4. Course Contents:

No.	*Topic*	*Week*
1	Introduction	1
2	Formatting Guidelines (templates, pages, and text)	2
3	Components of a report (preliminary pages)	3-4
4	Components of a report (text of a report : introduction, main section, conclusion, recommendations)	5-7
5	Mid-term Exam	9
6	Referencing of sources and originality (author-date, and numerical referencing)	8-11
7	Planning and writing	12
8	Practice and discuss how to prepare and write a technical report.	13-14

5. Teaching and Learning Methods:

LOs		**Teaching and Learning Method**														
		Lecture (online-In class)	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A8-1**	x	x		x	x			x				x			
	A8-2	x	x		x											
	A8-3	x	x		x											
	A8-4	x	x		x											
	A8-5		x		x							x	x			
	A10-1	x	x		x				x							
	A10-2	x	x		x	x			x			x	x			

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written)	A8-1, A8-2, A8-3, A8-5, A10-1
2	Formative (quizzes – assignments)	A8-1, A8-2, A8-3, A8-4, A8-5, A10-1, A10-2
3	Final Term Examination (written)	A8-1, A8-2, A8-3, A8-4, A8-5, A10-1, A10-2

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	9th
2	Formative (quizzes – assignments)	Three times through the semester
3	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights
1	Mid Term Examination (written)	10
2	Formative (quizzes – assignments)	10
3	Final Term Examination (written)	80
Total		100%

8. List of References

No.	Reference List
1	Su-Hie Ting, and Syaharom Abdullah, *Report Writing Skills of Engineering Students*, Proceedings of The Second International Conference on the Roles of the Humanities and Social Sciences in Engineering, July 2012.
2	Ann Winckel, and Bonnie Hart, *Report Writing Style Guide For Engineering Students*, Flexible Learning Centre, University of Australia, 4th edition July 2002.

3	Nell Ann Pickett, *Technical English: Writing, Reading, and Speaking*, 8th edition, Pearson international edition, 2014.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture / Online Classroom
2	White Board
3	Data Show System
4	Sound System Facility
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aim	LO's
1	Introduction	4	A8-1
2	Formatting Guidelines (templates, pages, and text)	4	A8-2, A8-4, A10-1
3	Components of a report (preliminary pages)	4	A8-2, A8-4, A10-1
4	Components of a report (text of a report : introduction, main section, conclusion, recommendations)	4	A8-2, A8-4, A10-1
5	Mid-term Exam	4	A8-1, A8-2, A8-3, A8-5, A10-1
6	Referencing of sources and originality (author-date, and numerical referencing)	4	A10-1, A10-2
7	Planning and writing	4	A8-1, A8-3, A8-4, A10-1, A10-2
8	Practice and discuss how to prepare and write a technical report.	4	A8-1, A8-2, A8-3, A8-4, A10-1, A10-2

Course: Technical Report Writing	
Program Competencies	**Course LOs**
A8. Communicate effectively, graphically, verbally and in writing, with a range of audiences using contemporary tools.	**A8.1** Identify the importance and usage of different types of technical report for engineers. **A8.2** Recognize the differences between the different sections of technical reports. **A8.3** prepare accurate, clear, efficient, and comprehensive engineering technical report. **A8.4** Presents accurate, clear, efficient, and comprehensive engineering technical report. **A8.5** Explore different ideas, views, and knowledge from a range of sources to organize, collect, analyze, and evaluate information for writing a technical report.
A10. Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.	**A10.1** Refer to various literatures regarding writing styles and rules. **A10.2** Practice writing the list of references in a different format.

Course Coordinator: Dr. Rabab Abdel-Kader

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

SECOND YEAR

1. Basic Information

<table>
<tr><td>Program Title</td><td colspan="2">B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)</td></tr>
<tr><td>Department offering the Program</td><td colspan="2">Mechanical Power Engineering</td></tr>
<tr><td>Department Responsible for the Course</td><td colspan="2">Physics and Mathematical Engineering</td></tr>
<tr><td>Course Code</td><td colspan="2">SCI229</td></tr>
<tr><td>Year/ Level</td><td colspan="2">Second year- 1st semester</td></tr>
<tr><td>Specialization</td><td colspan="2">Minor</td></tr>
<tr><td rowspan="2">Teaching Hours</td><td>Lectures</td><td>Tutorial</td></tr>
<tr><td>2</td><td>2</td></tr>
</table>

2. Course aims:

No.	Aim
1	Identify the numerical methods to solve algebraic, transcendental, and differential equations, to calculate derivatives and integrals and to develop an understanding of error analysis for numerical methods and certain proofs.

3. Learning Outcomes (LOs):

A1.1	Identify roots using bisection, linear interpolation, Secant and/or Newton's methods.
A1.2	Solve function using an appropriate numerical method.
A1.3	Solve differential equation using an appropriate numerical method.
A1.4	Estimate a derivative at a value using an appropriate numerical method.
A1.5	Solve a linear system of equations using an appropriate numerical method.
A1.6	Recognize the error analysis for a given numerical method.
A1.7	Differentiate between algebraic and transcendental equations.
A1.8	Identify the Least squares and Lagrangian polynomials for polynomial interpolation.
A1.9	Discuss the steps necessary to solve practical problems in engineering field.

4. Course Contents:

No.	Topics	Week
1	**Lectures:** **Chapter 1:** Root finding for nonlinear equations: - The Bisection Method, - Newton's Method. - The secant Method - Muller's Method - Systems of nonlinear equations **Tutorials:** -Solve the problems on Root finding methods.	1-4
2	**Lectures:** **Chapter2**: Interpolation Theory - Polynomial Theory - Newton Divided Differences - Finite Differences and table - Oriented Interpolation Formula. - Errors in Data and Forward Differences **Tutorials:** - Discuss problems and find the possible solutions.	5-8
3	**Midterm Exam.**	9
4	**Lectures:** **Chapter 3:** - Numerical Integration - Numerical Differentiation. **Tutorials:** - Solve the problems on numerical integration and differentiation.	10-12
5	**Lectures:** **Chapter 4: -** Solutions of ordinary and partial differential equations - Finite elements - Solutions of specific engineering applications **Tutorials:** - Solve the problems.	13-14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method														
		Lecture (online\in class)	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A1.1**	x	x				x	x								
	A1.2	x				x	x	x								
	A1.3	x					x	x								
	A1.4	x				x	x	x	x							
	A1.5	x				x	x	x								
	A1.6	x	x			x	x	x	x							
	A1.7	x				x	x	x								
	A1.8	x				x	x		x							
	A1.9	x	x				x									

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written/ online)	A1.1, A1.2, A1.3, A1.5, A1.6, A1.7, A1.8
2	Formative (quizzes- online quizzes- presentation - …….)	A1.1, A1.2, A1.3, A1.4, A1.5, A1.6, A1.7, A1.8, A1.9
3	Final Term Examination (written)	A1.1, A1.2, A1.3, A1.4, A1.5, A1.6, A1.7, A1.8, A1.9

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written/ online)	9
2	Formative (quizzes- online quizzes- assignments)	Every week
3	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights
1	Mid Term Examination (written/ online)	20
2	Formative (quizzes- online quizzes- assignments)	10
3	Final Term Examination (written)	70
Total		100%

8. List of References

No.	Reference List
1	Steven C. Chapra, Numerical Methods for Engineers, 4th Ed., McGraw Hill, 2002.
2	J. Stoer and R. Bulirsch, Introduction to Numerical Analysis, Springer-Verlag, 1993.
3	Brian Bradie, A Friendly Introduction to Numerical Analysis, Pearson Prentice Hall, 2006.
4	John H. Mathews and Kurtis D. Fink, Numerical Methods using Matlab, 4th Ed., Pearson Prentice Hall, 2004.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture / Online Classroom
2	White Board
3	Data Show System
4	Presenter

10. Matrix of Knowledge and Skills of the Course:

No	Topic	Aim	LOs
1	**Lectures:** **Chapter 1:** Root finding for nonlinear equations: - The Bisection Method, - Newton’s Method. - The secant Method - Muller’s Method - Systems of nonlinear equations **Tutorials:** - Solve the problems on Root finding methods.	1	A1.1, A1.5 , A1.6
2	**Lectures:** **Chapter2:** Interpolation Theory - Polynomial Theory - Newton Divided Differences - Finite Differences - Oriented Interpolation Formula. - Errors in Data and Forward Differences **Tutorials:** - Discuss problems and find the possible solutions.	1	A1.2, A1.3, A1.6, A1.7, A1.8
3	**Midterm Exam**.	1	A1.1, A1.2, A1.3, A1.5, A1.6, A1.7, A1.8
4	**Lectures:** **Chapter 3:** - Numerical Integration - Numerical Differentiation. **Tutorials:** - Solve the problems on numerical integration and differentiation.	1	A1.3, A1.4, A1.5, A1.7, A1.9
5	**Lectures:** **Chapter 4:** - Solutions of ordinary and partial differential equations - Finite elements - Solutions of specific engineering applications **Tutorials:** -Solve the problems on specific engineering applications.	1	A1.3, A1.4, A1.6, A1.9

Course: Numerical Analysis	
Program Competencies	**Course LOs**
A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.	**A1.1** Identify roots using bisection, linear interpolation, Secant and/or Newton's methods. **A1.2** Solve function using an appropriate numerical method. **A1.3** Solve differential equation using an appropriate numerical method. **A1.4** Estimate a derivative at a value using an appropriate numerical method. **A1.5** Solve a linear system of equations using an appropriate numerical method. **A1.6** Recognize the error analysis for a given numerical method. **A1.7** Differentiate between algebraic and transcendental equations. **A1.8** Identify the Least squares and Lagrangian polynomials for polynomial interpolation. **A1.9** Discuss the steps necessary to solve practical problems in engineering field.

Course Coordinator: Dr. Youssef Aly Mohamed Baghdadi

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information:

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Mechanical Power Engineering		
Course Code	**MPE210**		
Year/ Level	Second year- 1st semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	2	1	1

2. Course aims:

No.	**Aims**
4,6	Provide the fundamentals needed to model, analyze, and solve a wide range of engineering applications involving physical properties of fluids and their effect on flow behavior; equations of motion for incompressible inviscid and viscous flows, flow in pipes and ducts besides the immersed-bodies in aerodynamic applications (airplanes, rockets), hydrodynamic applications (ships, submarines, fish), transportation (automobiles, trucks), wind engineering (buildings, bridges, wind turbines), and ocean engineering (buoys, breakwaters, cables).

3. Learning Outcomes (LOs):

A1.1	Recognize the fundamentals of fluid dynamics.
A1.2	Show the mathematical forms of the fluid dynamics phenomena.
A2.1	Describe, conduct, interpret data and analyze the experimentations related to the fluid dynamic concepts.
A10.1	Work coherently and successfully as a part of a team in assignments.
B1.1	Analyze and formulate several physical models of the fluid flow systems.
C1.1	Assess the characteristics and the processes of different fluid flow systems.
C2.1	Analyze, evaluate and enhance the materials and the design of the piping system.
C5.1	Use the analytical techniques of solution in fluid flow systems.

4. Course Contents:

No.	Topics	Week
1	**Lecture:** - **Introduction** ○ Experimental Fluid Dynamics, Analytical Fluid Dynamics, and Computational Fluid Dynamics **Tutorials/Lab:** - Solve problems on dimensional analysis. - Perform experiment on Losses of a piping system.	1

2	**Lecture:**
	- **Dimensional Analysis and Similarity**
	  ○ Dimensional analysis with applications
	  ○ Dynamics similitude with applications
	Tutorials/Lab:
	- Solve problems on Dimensional Analysis and Similarity.
	- Perform experiment on Losses of a piping system.
		2

3	**Lecture:**
	- **Flows in pipes**
	  ○ laminar and turbulent flows
	  ○ Transient flow or surge analysis: Water Hammer
	Tutorials/Lab:
	- Solve problems on Flow in pipes.
	- Perform experiment on Losses of a piping system.
		3

4	**Lecture:**
	- **Head losses in pipes**
	  ○ Parallel and series pipes
	  ○ Pipeline with pump or turbine
	Tutorials/Lab:
	- Solve problems on Flow in pipes.
	- Perform experiment on Pipe Surge and Water Hammer.
		4

5	**Lecture:**
	- **Differential Forms of the Basic Laws**
	  ○ Differential equations for Continuity equation
	  ○ Differential equations for momentum and energy equations
	Tutorials/Lab:
	- Solve problems on Flow in pipes.
	- Perform experiment on Pipe Surge and Water Hammer.
		5

6	**Lecture:** - **Navier – Stokes equations** ○ Navier – Stokes equations with applications **Tutorials/Lab:** - Solve problems on Flows in pipes. - Perform experiment on Pipe Surge and Water Hammer.	6
7	**Lecture:** - **Boundary layer theory** ○ Reynolds number and geometry effects	7-8

	○ Boundary Layer Flow over a Flat Plate **Tutorials/Lab:** • Solve problems on boundary layer theory. • Perform experiment on Pipe Surge and Water Hammer.	
8	**Midterm Examination**	**9**
9	**Lecture:** • **Boundary Layer Thicknesses** ○ Boundary layer thickness , Displacement thickness , Momentum thickness , Local Skin Friction Coefficient , Plate Skin Friction Coefficient ○ Prandtl/Blasius Boundary Layer Solutions **Tutorials/Lab:** • Solve problems on boundary layer theory. • Perform experiment on Pipe Surge and Water Hammer**.**	10
10	**Lecture:** • **Von Karman Momentum Integral Equations** ○ Flow over Immersed Curved Bodies **Tutorials/Lab:** • Solve problems on boundary layer theory • Perform experiment on lift and drag forces on an aerofoil with angle of attack.	11
11	**Lecture:** • **Drag on Immersed Bodies** ○ Boundary layer drag and lift forces – airfoil **Tutorials/Lab:** • Solve problems on boundary layer theory. • Perform experiment on lift and drag forces on an aerofoil with angle of attack.	12
12	**Lecture:** • **Potential flow theory** ○ Stream function and velocity potential **Tutorials/Lab:** • Solve problems on Potential flow theory. • Perform experiment on lift and drag forces on an aerofoil with angle of attack**.**	13
13	**Lecture:** • **Potential flow theory** ○ Potential flow with applications **Tutorials/Lab:** • Solve problems on Potential flow theory. • Perform experiment on lift and drag forces on an aerofoil with angle of attack.	14

5. Teaching and Learning Methods:

LOs		**Teaching and Learning Method**														
		Lecture	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A1.1**	x	x			x	x	x	x			x				
	A1.2	x	x			x	x	x	x			x				
	A2.1	x	x			x	x	x	x		x	x	x			x
	A10.1	x	x			x	x	x	x			x				
B-Level	**B1.1**	x	x			x	x	x	x			x				x
C-Level	**C1.1**	x	x			x	x	x	x			x			x	
	C2.1	x	x			x	x	x	x			x				x
	C5.1	x	x			x	x	x	x			x			x	

6. Teaching and Learning Methods of Disable Students:

No.	**Teaching Method**
1	Additional Tutorials and videos
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	**Assessment Method**	**LOs**
1	Mid Term Examination (written)	A1.1, A1.2, A2.1, B1.1, C2.1, C5.1
2	Practical/ Oral Examination	A1.1, A1.2, A2.1, B1.1, C2.1, C5.1
3	Formative (quizzes - presentation - assignments)	A1.1, A1.2, A2.1, A10.1, B1.1,

		C1.1, C2.1, C5.1
4	Final Term Examination (written)	A1.1, A1.2, A2.1, B1.1, C1.1, C2.1, C5.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	9
2	Practical/ Oral Examination	15
3	Formative (quizzes – presentation – assignments)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	12
2	Practical/ Oral Examination	20
3	Formative (quizzes – presentation – assignments)	8
4	Final Term Examination (written)	60
Total		100%

8. List of References

No.	Reference List
1	1- Frank M. White, “Fluid Mechanics”, 4th ed., McGraw-Hill, INC. 1999.
2	Irving H. Shames, “Mechanics of Fluids”, 3rd ed. McGraw-Hill, INC. 1992.
3	R. K. Bansal, "Fluid Mechanics and Hydraulic Machines", Laxmi Publications LTD, New Delhi, 2005.
4	B. R. Munson, D.F. Young and T.H. Okiishi, “Fundamentals of Fluid Mechanics”, 4th ed., John Wiley & Sons, INC. 2002.
5	M. Fogiel, "The Fluid Mech. and Dynamics Problem Solver", Research and Education Association REA, New York, 1983.
6	J. B. Evett and C. Liu, "Schaum's Solved Problems Series-2500 Solved Problems in Fluid Mechanics and Hydraulics", McGraw-Hill, INC. 1989.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture / Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aims	LOs
1	**Lecture:** • **Introduction** ○ Experimental Fluid Dynamics, Analytical Fluid Dynamics, and Computational Fluid Dynamics **Tutorials/Lab:** • Solve problems on dimensional analysis. • Perform experiment on Losses of a piping system.	6	A1.1, A1.2, A2.1, B1.1,
2	**Lecture:** • **Dimensional Analysis and Similarity** ○ Dimensional analysis with applications ○ Dynamics similitude with applications **Tutorials/Lab:** • Solve problems on Dimensional Analysis and Similarity. • Perform experiment on Losses of a piping system.	6	A1.1, A1.2, A2.1, A10.1, B1.1,
3	**Lecture:** • **Flows in pipes** ○ laminar and turbulent flows ○ Transient flow or surge analysis: Water Hammer **Tutorials/Lab:** • Solve problems on Flow in pipes. • Perform experiment on Losses of a piping system.	4, 6	A1.1, A1.2, A2.1, A10.1, B1.1, C1.1, C2.1, C5.1
4	**Lecture:** • **Head losses in pipes** ○ Parallel and series pipes ○ Pipeline with pump or turbine **Tutorials/Lab:** • Solve problems on Flows in pipes • Perform experiment on Pipe Surge and Water Hammer	4, 6	A1.1, A1.2, A2.1, A10.1, B1.1, C1.1, C2.1, C5.1
5	**Lecture:** • **Head losses in pipes**	4, 6	A1.1, A1.2,

	○ Parallel and series pipes ○ Pipeline with pump or turbine **Tutorials/Lab:** • Solve problems on Flow in pipes. • Perform experiment on Pipe Surge and Water Hammer.		A2.1, A10.1, B1.1, C1.1, C2.1, C5.1
6	**Lecture:** • **Navier – Stokes equations** ○ Navier – Stokes equations with applications **Tutorials/Lab:** • Solve problems on Flows in pipes. • Perform experiment on Pipe Surge and Water Hammer.	4, 6	A1.1, A1.2, A2.1, A10.1, B1.1, C1.1, C2.1, C5.1
7	**Lecture:** • **Boundary layer theory** ○ Reynolds number and geometry effects ○ Boundary Layer Flow over a Flat Plate **Tutorials/Lab:** • Solve problems on boundary layer theory. • Perform experiment on Pipe Surge and Water Hammer.	4, 6	A1.1, A1.2, A2.1, A10.1, B1.1, C5.1
8	**Midterm Examination**	4, 6	A1.1, A1.2, A2.1, A10.1, B1.1, C5.1
9	**Lecture:** • **Boundary Layer Thicknesses** ○ Boundary layer thickness , Displacement thickness , Momentum thickness , Local Skin Friction Coefficient , Plate Skin Friction Coefficient ○ Prandtl/Blasius Boundary Layer Solutions **Tutorials/Lab:** • Solve problems on boundary layer theory. • Perform experiment on Pipe Surge and Water Hammer.	4, 6	A1.1, A1.2, A2.1, A10.1, B1.1, C5.1
10	**Lecture:** • **Von Karman Momentum Integral Equations** ○ Flow over Immersed Curved Bodies **Tutorials/Lab:** • Solve problems on boundary layer theory. • Perform experiment on lift and drag forces on an aerofoil with angle of attack.	4, 6	A1.1, A1.2, A2.1, A10.1, B1.1, C5.1
11	**Lecture:**	4, 6	A1.1, A1.2,

	• **Drag on Immersed Bodies** ○ Boundary layer drag and lift forces – airfoil **Tutorials/Lab:** • Solve problems on boundary layer theory. • Perform experiment on lift and drag forces on an aerofoil with angle of attack.		A2.1, A10.1, B1.1, C5.1
12	**Lecture:** • **Potential flow theory** ○ Stream function and velocity potential **Tutorials/Lab:** • Solve problems on Potential flow theory. • Perform experiment on lift and drag forces on an aerofoil with angle of attack.	4, 6	A1.1, A1.2, A2.1, A10.1, B1.1, C5.1
13	**Lecture:** • **Potential flow theory** ○ Potential flow with applications **Tutorials/Lab:** • Solve problems on Potential flow theory. • Perform experiment on lift and drag forces on an aerofoil with angle of attack.	4, 6	A1.1, A1.2, A2.1, A10.1, B1.1, C5.1

Course: Fluid Dynamics	
Program Competencies	**Course LOs**
A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.	**A1.1** Recognize the fundamentals of fluid dynamics. **A1.2** Show the mathematical forms of the fluid dynamics phenomena.
A2. Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.	**A2.1** Describe, conduct, interpret data and analyze the experimentations related to the fluid dynamic concepts.
A10. Acquire and apply new knowledge; and practice self, lifelong and other learning strategies**.**	**A10.1** Work coherently and successfully as a part of a team in assignments.
B1. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, Solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.	**B1.1** Analyze and formulate several physical models of the fluid flow systems.
C1. Recognize the design concepts, operation and characteristics of the internal combustion engines, boilers, heat exchangers, turbomachines, and hydraulic machines.	**C1.1** Assess the characteristics and the processes of different fluid flow systems.
C2. Analyze, evaluate and enhance the performance of the HVAC systems, automatic control systems, pneumatic systems, hydraulic Systems, combustion systems, thermal and nuclear power plants.	**C2.1** Analyze, evaluate and enhance the materials and the design of the piping system.
C5. Select appropriate solutions for mechanical power engineering problems based on analytical and numerical techniques.	**C5.1** Use the analytical techniques of solution in fluid flow systems.

Course Coordinator: Dr / Yassen El-Sayed Yassen

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Mechanical Power Engineering		
Course Code	**MPE211**		
Year/ Level	second year – 1st semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	2	2	1

2. Course aims:

No.	Aims
7	Recognize and apply the concepts of entropy analysis, reversible work, and irreversibility, thermodynamic cycles, real behavior of gas, classification of gas power plant cycles and steam power plants, reversed cycles, Psychrometry, gas mixtures, combustion of fossil fuels and thermodynamic relations used to determine properties.

3. Learning Outcomes (LOs):

A1.1	Identify the thermodynamic cycles used in mechanical power engineering discipline.
A1.2	Solve problems on thermodynamic cycles by applying thermodynamic fundamentals and laws.
B1.1	Analyze and evaluate different mechanical components by applying the concepts of Thermodynamics.
C1.1	Recognize the basic thermodynamic principles of Otto, Diesel and Dual cycles.
C1.2	Recognize the design principles of gas turbine, turbojet and turboprop engines.
C1.3	Recognize the design principles of steam and gas power generation cycles.
C1.4	Recognize basic psychrometric principles to solve practical engineering problems involving air-water vapor mixtures.
C1.5	Recognize the basic thermodynamic principles to solve problems involving the chemical reactions in typical combustion applications.
C3.1	Judge the optimal compression ratio of Otto, Diesel, Dual, Brayton and Rankine cycle operation.

4. Course Contents:

No.	Topics	Week
1	**Lecture:** - Introduction. - Thermodynamic cycle - Air standard assumptions. **Tutorials/Lab:** - Solve problems on the processes. - Conduct experiments on thermodynamic applications system.	1
2	**Lecture:** - Otto cycle - The mean effective pressure. **Tutorials/Lab:** - Solve problems on the Otto cycle. - Conduct experiments on thermodynamic applications system.	2
3	**Lecture:** - Diesel cycle. - Difference between Otto a Diesel cycle. **Tutorials/Lab:** - Solve problems on the Diesel cycle. - Conduct experiments on cycle applications system.	3
4	**Lecture:** - Dual cycle - Comparison of the cycles. **Tutorials/Lab:** - Solve problems on the Dual cycle. - Conduct experiments on cycle applications system.	4
5	**Lecture:** - Introduction on gas turbine. - Gas turbine engine cycles. - Turbojet engine. - Turboprop. **Tutorials/Lab:** - Solve problems on the gas turbines. - Conduct experiments on gas turbines components.	5
6	**Lecture:** - Bryton or Joule cycle. - The optimum compression ratio **Tutorials/Lab:** - Solve problems on the Bryton cycle. - Conduct experiments on gas turbines components.	6
7	**Lecture:** - Modification to the Bryton efficiency	7

	• Inter-cooling. • Reheating. • Regenerative **Tutorials/Lab:** • Solve problems on the modification Bryton cycle. • Conduct experiments on combustion and flame types.	
8	**Lecture:** • Steam power generation cycles • Carnot vapor cycle • Types of thermal power plants. **Tutorials/Lab:** • Solve problems on the Carnot vapor cycle. • Conduct experiments on combustion and flame types.	8
9	**Midterm Examination**	**9**
10	**Lecture:** • Rankine cycle. • Comparison between Carnot and Rankine cycles. **Tutorials/Lab:** • Solve problems on the Rankine cycle. • Conduct experiments on Rankine Cycle.	10
11	**Lecture:** • Reheat Rankine cycle. **Tutorials/Lab:** • Solve problems on Reheat cycle. • Conduct experiments on Rankine Cycle.	11
12	**Lecture:** • **Gas mixtures.** **Tutorials/Lab:** • Solve problems on the gas mixture. • Conduct experiments on Rankine Cycle.	12
13	**Lecture:** • Psychrometry. **Tutorials/Lab:** • Solve problems on psychrometry. • Conduct experiments on Rankine Cycle.	13
14	**Lecture:** • Combustion. **Tutorials/Lab:** • Solve problems on combustion. • Conduct experiments on Rankine Cycle.	14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method														
		Lecture	Interactive lectures	Flipped Classroom	Presentation	Discussion	Tutorial	Problem-solving	Brain storming	Projects	Site visits	Self-learning	Cooperative	Drawing Studio	Computer Simulation	Practical Experiments
A-Level	A1.1	x	x			x			x							
	A2.1	x	x			x			x							
B-Level	B1.1	x	x			x	x	x	x							x
C-Level	C1.1	x	x			x	x	x	x			x				
	C1.2	x	x			x	x	x	x							x
	C1.3	x	x			x	x	x	x							x
	C1.4	x	x			x	x	x	x			x				
	C1.5	x	x			x	x	x	x							x
	C3.1	x	x			x	x	x	x			x				

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials and videos
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written)	A1.1, A1.2, B1.1, C1.1, C1.2, C1.3, C3.1
2	Practical/ Oral Examination	A1.1, C1.1, C1.2, C1.3, C1.4, C1.5
3	Formative (quizzes - presentation – assignments)	A1.1, A1.2, B1.1, C1.1, C1.2, C1.3, C1.4, C1.5, C3.1
4	Final Term Examination (written)	A1.1, A1.2, B1.1, C1.1, C1.2, C1.3, C1.4, C1.5, C3.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	9
2	Practical/ Oral Examination	15
3	Formative (quizzes – presentation – assignments)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	15
2	Practical/ Oral Examination	25
3	Formative (quizzes – presentation – assignments)	10
4	Final Term Examination (written)	75
Total		100%

8. List of References

No.	Reference List
1	Cengel, Y. A., & Boles, M. A. (2011). Thermodynamics: An Engineering Approach Seventh Edition.
2	Singh, O. (2003). *Applied thermodynamics*. New Age International.
3	Moran, M. J., Bailey, M. B., Boettner, D. D., & Shapiro, H. N. (2018). *Fundamentals of engineering thermodynamics*. Wiley.
4	Okeily, M. (2018) "*Lectures in Thermodynamics I and II*", Mechanical Power Eng. Dept., Port Said University.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture / Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aims	LOs
1	**Lecture:** • Introduction. • Thermodynamic cycle • Air standard assumptions. **Tutorials/Lab:** • Solve problems on the processes. • Conduct experiments on thermodynamic applications system**.**	7	A1.1, A1.2
2	**Lecture:** • Otto cycle • The mean effective pressure. **Tutorials/Lab:** • Solve problems on the Otto cycle. • Conduct experiments on cycle applications system. • Conduct experiments on thermodynamic applications system**.**	7	A1.1, A1.2, B1.1, C1.1, C3.1
3	**Lecture:** • Diesel cycle. • Difference between Otto an Diesel cycle. **Tutorials/Lab:** • Solve problems on the Diesel cycle. • Conduct experiments on cycle applications system.	7	A1.1, A1.2, B1.1, C1.1, C3.1
4	**Lecture:** • Dual cycle • Comparison of the cycles. **Tutorials/Lab:** • Solve problems on the Dual cycle. • Conduct experiments on cycle applications system.	7	A1.1, A1.2, B1.1, C1.1, C3.1
5	**Lecture:** • Introduction on gas turbine. • Gas turbine engine cycles. • Turbojet engine. • Turboprop. **Tutorials/Lab:** • Solve problems on the heat of combustion. • Conduct experiments on gas turbines components.	7	A1.1, A1.2, C1.2, C1.3
6	**Lecture:** • Bryton or Joule cycle. • The optimum compression ratio **Tutorials/Lab:** • Solve problems on the Bryton cycle. • Conduct experiments on gas turbines components.	7	A1.1, A1.2, C1.2, C1.3, C3.1
7	**Lecture:** • Factors influencing the adiabatic flame temperature.	7	A1.2, B1.1, C1.3, C1.5

	• Combustion inside a combustor. • Spray combustion. • Droplet evaporation. • The gas turbine process. **Tutorials/Lab:** • Solve problems on the burning velocity. • Conduct experiments on combustion and flame types.		
8	**Lecture:** • Steam power generation cycles • Carnot vapor cycle • Types of thermal power plants. **Tutorials/Lab:** • Solve problems on the Carnot vapor cycle. • Conduct experiments on combustion and flame types.	7	A1.1, A1.2, B1.1, C1.3
9	**Midterm Examination**	7	A1.1, A1.2, B1.1, C1.1, C1.2, C1.3, C3.1
10	**Lecture:** • Rankine cycle. • Comparison between Carnot and Rankine cycles. **Tutorials/Lab:** • Solve problems on the Rankine cycle. • Conduct experiments on Rankine Cycle.	7	A1.1, A1.2, B1.1, C1.3, C3.1
11	**Lecture:** • Reheat Rankine cycle. **Tutorials/Lab:** • Solve problems on Reheat cycle. • Conduct experiments on Rankine Cycle.	7	A1.1, A1.2, B1.1, C1.3
12	**Lecture:** • Gas mixtures. **Tutorials/Lab:** • Solve problems on the gas mixture. • Conduct experiments on Rankine Cycle.	7	A2.1, C1.4
13	**Lecture:** • Psychrometry. **Tutorials/Lab:** • Solve problems on psychrometry. • Conduct experiments on Rankine Cycle.	7	A1.1, A2.1, C1.4
14	**Lecture:** • Combustion. **Tutorials/Lab:** • Solve problems on combustion. • Conduct experiments on Rankine Cycle.	7	A1.2, C1.5

Course: Thermodynamic II	
Program Competencies	**Course LOs**
A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.	**A1.1** Identify the thermodynamic cycles used in mechanical power engineering discipline. **A1.2** Solve problems on thermodynamic cycles by applying thermodynamic fundamentals and laws.
B1. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, Solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.	**B1.1** Analyze and evaluate different mechanical components by applying the concepts of Thermodynamics.
C1. Recognize the design concepts, operation and characteristics of the internal combustion engines, boilers, heat exchangers, turbomachines and hydraulic machines.	**C1.1** Recognize the basic thermodynamic principles of Otto, Diesel and Dual cycles. **C1.2** Recognize the design principles of gas turbine, turbojet and turboprop engines. **C1.3** Recognize the design principles of steam and gas power generation cycles. **C1.4** Recognize basic psychrometric principles to solve practical engineering problems involving air-water vapor mixtures. **C1.5** Recognize the basic thermodynamic principles to solve problems involving the chemical reactions in typical combustion applications.
C3. Judge the optimal solution according to the constraints of operation, costs, safety, reliability and environmental impacts.	**C3.1** Judge the optimal compression ratio of Otto, Diesel, Dual, Brayton and Rankine cycle operation.

Course Coordinator: Prof. Mohamed Atteya Okeily

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information

<table>
<tr><td rowspan="1">Program Title</td><td colspan="3">B.SC. In Mechanical Power Engineering (Specialization Mechanical Power Engineering)</td></tr>
<tr><td>Department offering Program</td><td colspan="3">Mechanical Power Engineering</td></tr>
<tr><td>Department Responsible for the Course</td><td colspan="3">Mechanical Power Engineering</td></tr>
<tr><td>Course Code</td><td colspan="3">MPE212</td></tr>
<tr><td>Year/level</td><td colspan="3">Second year- 1st Semester</td></tr>
<tr><td>Specialization</td><td colspan="3">Major</td></tr>
<tr><td rowspan="2">Teaching Hours</td><td>Lecture</td><td>Tutorial</td><td>Practical</td></tr>
<tr><td>2</td><td>1</td><td>1</td></tr>
</table>

2. Course aims:

No.	Aims
4, 6	Acquire and apply the basic theories of different Mechanical and Thermal Measurement Devices, Tools, Methods, Calibration means, and selection considerations.

3. Learning Outcomes (LOs)

A3.1	Apply the concepts of design and operation of the fluid flow and heat transfer measurement devices.
A10.1	Apply the self-learning strategies in understanding the different type of fluid flow and heat transfer measurement devices.
B1.1	Analyze the operation of pressure velocity and temperature measurement devices especially mechanical and optical systems.
B3.1	Select the suitable measuring scheme for different types of fluid flow and heat transfer systems based on analysis.
C1.1	Recognize the concepts of design and operation of the fluid flow and heat transfer measurement devices.
C1.2	Recognize the mean behavior of compressible flows through flow visualization measurement optical devices
C3.1	Judge the optimal methods of selection of the measurement devices and techniques.

4. **Course Contents:**

No.	Topics	Week
1	**Lecture**: • Review of basic concepts of fluid flow and heat transfer, • Purpose of fluid flow and heat transfer measuring systems. • Description of the function of components used in fluid flow and heat transfer. **Tutorial / Lab:** • Solve problems on pressure measurements by Liquid U-Tube manometers • Conduct lab experiments on finding the density and viscosity of fluids.	1
2	**Lecture**: • Fluid flow characteristics, measuring of fluid density, viscosity, and pressure head. • Definition of static, dynamic, and total (stagnation) pressures. • Analyze the gauge and absolute pressures, variation of pressure with height. • Definition of static m dynamic and total head. Loses of flow energy with friction, Bernoulli, continuity, and energy equations. • The gas properties and static equations. **Tutorial / Lab:** • Solve problems on pressure measurements by Liquid U-Tube manometers • Conduct lab experiments on finding the liquid level by different devices.	2
3	**Lecture**: • Basic information about simple U-tube, differential, and inclined manometer. • Static fluid mechanics and pressure measurement **Tutorial / Lab:** • Illustrative example and solved problems • Conduct lab experiments on finding the pressure head loss by friction in different channels	3
4	**Lecture**: • Desirable attribute of fluid flow measurement by Bourdon gauge, pressure transducers, Strain Gauge, Diaphragm type manometers, Bellows, Capacitance based pressure cell, Potentiometric sensors, update electronic digital and optical devices. • Quantitative & qualitative definition of measuring errors, dependability and reliability. **Tutorial / Lab:** • Illustrative example and solved problems. • Conduct lab experiments on Design a model of pitot tube and bellow meter by environment materials • Conduct lab experiments on Calibration of pressure transducers	4
5	**Lecture**: • Basic information about velocity measuring devices, • Simple Pitot tube, Pitot Static tube, Vane Anemometer and Current meter, • Orifice meter, Nozzles, Venturi meter, and Hot wire anemometers, **Tutorial / Lab:**	5

	• Illustrative example and solved problems. • Conduct lab experiments on finding the fluid velocity by orifice, nozzle and **Venturi meters.** • Conduct lab experiments on Design a model of elbow meter by environment materials.	
6	**Lecture**: • Theory of vortex flow meter, Ultra sonic flow meter and Calorimetric flow meters for velocity measurements. • Application of different types Tachometers **Tutorial / Lab:** • Solve problems on velocity measurements by Liquid U-Tube manometers • Conduct lab experiments on Selection considerations for different measurements devices.	6
7	**Lecture**: • Coordination of Hot Wire Type Anemometer and velocity measurement. • Basics of Laser Doppler Anemometer on measuring fluid flow velocity. • Flow visualization systems and application on fluid flows**.** **Tutorial / Lab:** • Solve problems on velocity measurements. • Conduct lab experiments on Design a model of current meter by environment materials	7
8	**Lecture**: • Definition of Flow Visualization Determination of flow field for low and high-speed regimes. • Schlieren, Shadowgraph and Interferometry systems and application on supersonic flows. **Tutorial / Lab:** • Solve problems on velocity measurements by hot wire. Conduct lab experiments on Design a model of supersonic pitot tube.	8
9	**Midterm written examination**	9
10	**Lecture**: • Different types of temperature measurement devices**.** • Application of thermocouples, definition of thermocouple theory. • Types of thermocouples and thermostat. **Tutorial / Lab:** • Solve problems on temperature measurements by different types thermocouples • Conduct lab experiments on Assessment of the effect of thermocouples metal and surrounding nature on the sensitivity of the thermocouples • Conduct lab experiments on Determination of errors and calibration of thermocouples.	10
11	**Lecture**: • Definition of Seebeck Voltage, Seebeck coefficient. and Seebeck effect. • Determination of thermocouple sensitivity introduced by compensation circuit**.** **Tutorial / Lab:** • Solve problems on temperature measurements by Resistance Temperature Detector.	11

	• Conduct lab experiments on Design a model of K-Type thermocouple.	
12	**Lecture**: **Lecture**: • Application of different optical methods on temperature measurements. • Basics of Pyrometer and application in temperature measurement. • Basics of Infrared Temperature Sensors for temperature measurement. **Tutorial / Lab:** • Writing of Lap report and error estimation • Assessment of the effect of mirror type and arrangement	12
13	**Lecture**: **Lecture**: • Basic and application of Two Color-Ratio Thermometry **Tutorial / Lab:** • Writing of Lap report includes advantages and disadvantages of optical Thermometry	13-14

5. Teaching and Learning Methods:

LOs		**Teaching and Learning Method**														
		Lecture	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A3.1**	x	x			x	x	x	x			x	x			x
	A10.1	x	x			x	x	x	x			x	x			x
B-Level	**B1.1**	x	x			x	x	x	x			x	x			x
	B3.1	x	x			x	x	x	x			x	x			x
C-Level	**C1.1**	x	x			x	x	x	x			x	x			x
	C1.2	x	x			x	x	x	x			x	x			x
	C3.1	x	x			x	x	x	x			x	x			x

6. Teaching and Learning Methods of Disable Students

No.	**Teaching Method**
1	Additional Tutorials and videos
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written)	A3.1, A10.1, B1.1, B3.1, C1.1, C3.1
2	Practical/ Oral Examination	B1.1, B3.1, C1.1, C1.2, C3.1
3	Formative (quizzes - presentation - assignments)	A3.1, A10.1, B1.1, B3.1, C1.1, C1.2, C3.1
4	Final Term Examination (written)	A3.1, B1.1, B3.1, C1.1, C2.1, C3.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	9
2	Practical/ Oral Examination	15
3	Formative (quizzes – presentation – assignments)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	10
2	Practical/ Oral Examination	20
3	Formative (quizzes – presentation – assignments)	10
4	Final Term Examination (written)	60
Total		100%

8. List of References

No.	Reference List
1	White, F. M., "Fluid Mechanics", McGraw-Hill, seventh Edition 2011.
2	Baker, Bonnie, "Thermistors in Single Supply Temperature Sensing Circuits", AN685, Microchip Technology Inc., 1998.
3	Elementary Fluid Mechanics, 6th Ed., Vennard and Street, 1982, John Wiley & Sons, New York, NY, page 527.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture / Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topics	Aims	LOs
1	**Lecture**: • Review of basic concepts of fluid flow and heat transfer, • Purpose of fluid flow and heat transfer measuring systems. • Description of the function of components used in fluid flow and heat transfer. **Tutorial / Lab:** • Solve problems on pressure measurements by Liquid U-Tube manometers • Conduct lab experiments on finding the density and viscosity of fluids.	4, 6	A3.1, A10.1, B1.1, B3.1, C1,1, C3.1
2	**Lecture**: • Fluid flow characteristics, measuring of fluid density, viscosity, and pressure head. • Definition of static, dynamic, and total (stagnation) pressures. • Analyze the gauge and absolute pressures, variation of pressure with height. • Definition of static m dynamic and total head. Loses of flow energy with friction, Bernoulli, continuity, and energy equations. • The gas properties and static equations. **Tutorial / Lab:** • Solve problems on pressure measurements by Liquid U-Tube manometers • Conduct lab experiments on finding the liquid level by different devices.	4, 6	B1.1, B3.1, C1.1, C1.2
3	**Lecture**: • Basic information about simple U-tube, differential, and inclined manometer. • Static fluid mechanics and pressure measurement **Tutorial / Lab:** • Illustrative example and solved problems • Conduct lab experiments on finding the pressure head loss by friction in different channels	4, 6	A3.1, B1.1, B3.1, C1.1
4	**Lecture**: • Desirable attribute of fluid flow measurement by Bourdon gauge, pressure transducers, Strain Gauge, Diaphragm type manometers, Bellows, Capacitance based pressure cell, Potentiometric sensors, and update electronic digital and optical devices. • Quantitative & qualitative definition of measuring errors, dependability and reliability. **Tutorial / Lab:** • Illustrative example and solved problems.	4, 6	B1.1, B3.1, C1.1, C1.2, C3.1

	• Conduct lab experiments on Design a model of pitot tube and bellow meter by environment materials • Conduct lab experiments on Calibration of pressure transducers		
5	**Lecture**: • Basic information about velocity measuring devices, • Simple Pitot tube, Pitot Static tube, Vane Anemometer and Current meter, • Orifice meter, Nozzles, Venturi meter, and Hot wire anemometers, **Tutorial / Lab:** • Illustrative example and solved problems. • Conduct lab experiments on finding the fluid velocity by orifice, nozzle and **Venturi meters.** • Conduct lab experiments on Design a model of elbow meter by environment materials.	4, 6	B1.1, B3.1, C1.1, C1.2, C3.1
6	**Lecture**: • Theory of vortex flow meter, Ultra sonic flow meter and Calorimetric flow meters for velocity measurements. • Application of different types Tachometers **Tutorial / Lab:** • Solve problems on velocity measurements by Liquid U-Tube manometers • Conduct lab experiments on Selection considerations for different measurements devices.	4, 6	A10.1, B1.1, B3.1, C1.1, C1.2, C3.1
7	**Lecture**: • Coordination of Hot Wire Type Anemometer and velocity measurement. • Basics of Laser Doppler Anemometer on measuring fluid flow velocity. • Flow visualization systems and application on fluid flows. **Tutorial / Lab:** • Solve problems on velocity measurements. • Conduct lab experiments on Design a model of current meter by environment materials	4, 6	A3.2, B1.1, B3.1, C1.1, C1.2, C3.1
8	**Midterm written examination**	4, 6	A3.1, A10.1, B1.1, B3.1, C1.1, C3.1
9	**Lecture**: • Definition of Flow Visualization Determination of flow field for low and high-speed regimes. • Schlieren, Shadowgraph and Interferometry systems and application on supersonic flows. **Tutorial / Lab:** • Solve problems on velocity measurements by hot wire.	4, 6	A10.1, B1.1, B3.1, C1.1, C1.2, C3.1

	• Conduct lab experiments on Design a model of supersonic pitot tube.		
10	**Lecture**: • Different types of temperature measurement devices. • Application of thermocouples, definition of thermocouple theory. • Types of thermocouples and thermostat. **Tutorial / Lab:** • Solve problems on temperature measurements by different types thermocouples • Conduct lab experiments on Assessment of the effect of thermocouples metal and surrounding nature on the sensitivity of the thermocouples • Conduct lab experiments on Determination of errors and calibration of thermocouples.	4, 6	A3.1, B1.1, B3.1, C1.1, C1.2, C3.1
11	**Lecture**: • Definition of Seebeck Voltage, Seebeck coefficient and Seebeck effect. • Determination of thermocouple sensitivity introduced by compensation circuit. **Tutorial / Lab:** • Solve problems on temperature measurements by Resistance Temperature Detector. • Conduct lab experiments on Design a model of K-Type thermocouple.	4, 6	A3.1, B1.1, B3.1, C1.1, C1.2, C3.1
12	**Lecture**: **Lecture**: • Application of different optical methods on temperature measurements. • Basics of Pyrometer and application in temperature measurement. • Basics of Infrared Temperature Sensors for temperature measurement **Tutorial / Lab:** • Writing of Lap report and error estimation • Assessment of the effect of mirror type and arrangement	4, 6	A10.1, B1.1, B3.1, C1.1, C1.2, C3.1
13	**Lecture**: **Lecture**: • Basic and application of Two Color-Ratio Thermometry **Tutorial / Lab:** • Report includes advantages and disadvantages of optical Thermometry	4, 6	A3.2, B1.1, B3.1, C1.1, C1.2, C3.1

Course: Mechanical and Thermal Measurements	
Program Competencies	**Course LOs**
A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.	**A3.1** Apply the concepts of design and operation of the fluid flow and heat transfer measurement devices.
A10 Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.	**A10.1** Apply the self-learning strategies in understanding the different type of fluid flow and heat transfer measurement devices.
B1. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, Solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.	**B1.1** Analyze the operation of pressure velocity and temperature measurement devices especially mechanical and optical systems.
B3. Select conventional mechanical equipment according to the required performance.	**B3.1** Select the suitable measuring scheme for different types of fluid flow and heat transfer systems based on analysis.
C1. Recognize the design concepts, operation and characteristics of the internal combustion engines, boilers, heat exchangers, turbomachines and hydraulic machines.	**C1.1** Recognize the concepts of design and operation of the fluid flow and heat transfer measurement devices. **C1.2** Recognize the mean behavior of compressible flows through flow visualization measurement optical devices.
C3. Judge the optimal solution according to the constraints of operation, costs, safety, reliability and environmental impacts.	**C3.1** Judge the optimal methods of selection of the measurement devices and techniques.

Course Coordinator: Prof. Gamal Hafiz Ahmed Moustafa

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Mechanical Power Engineering		
Course Code	**MPE213**		
Year/ Level	Second year- 1st semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	--	2	--

2. Course aims:

No.	**Aims**
4, 6	Practice manually and using computer software for conducting the technical drawing for common machine parts; general mechanical drawing, vise, bearing, joint and coupling, components of engine, valves, and also drawing of engineering symbol

3. Learning Outcomes (LOs):

A3.1	Recognize the design and conduct the technical drawing of different machine parts.
A3.2	Apply the technical drawing using computer-aided softwares as a main step in the design process for mechanical applications.
A4.1	Identify the characteristics and processes related to the different machines and drawing symbols.
A4.2	Utilize the computer software; AutoCAD and SolidWorks, for different drawing exercise.
B2.1	Carry out samples of several machine parts using appropriate materials.
B2.2	Carry out the technical drawing and three-dimensional shapes of mechanical parts using computer-aided tools and software.
B4.1	Describe the components of mechanical drawing adopting on appropriate national and international standards and rules.
C1.1	Recognize the symbol of drawing for different mechanical and electrical components.
C6.1	Use the computer software (AutoCAD) and Solid Works for different drawing exercise.
C7.1	Describe the work coherently and successfully as a part of a team in assignments.

4. Course Contents:

No.	Topics	Week
1	**Computer Lab:** • **AutoCAD with assembly drawing (5 days)** • Assembly drawing exercises on AutoCAD software.	1
2	**Computer Lab:** • **SolidWorks with assembly drawing (5 days)** • Assembly drawing exercises on SolidWorks software.	2
3	**Classroom Tutorials:** • **Manual Assembly drawing (5 days)** • Assemble drawing exercises.	3
4	**Classroom Tutorials:** • **Drawing of convention and engineering symbol (5 days)** • Drawing of convention and engineering symbol (5 sheet).	4

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method														
		Lecture	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A3.1**					x	x		x							
	A3.2					x	x		x			x			x	
	A4.1					x	x		x			x			x	
	A4.2					x	x		x			x			x	
B-Level	**B2.1**				x	x	x		x			x				
	B2.2					x	x		x			x			x	
	B4.1					x	x		x			x			x	
C-Level	**C1.1**				x	x	x		x			x				
	C6.1	x	x		x	x	x		x			x			x	
	C7.1	x	x		x	x	x		x			x				

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials and videos
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written)	--
2	Practical/ Oral Examination	--
3	Formative (assignments)	A3.1, A3.2, A4.1, A4.2, B2.1, B2.2, B4.1, B4.1, C1.1, C6.1, C7.1
4	Final Term Examination (written)	--

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	--
2	Practical/ Oral Examination	--
3	Formative (assignments)	Every week
4	Final Term Examination (written)	--

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	--
2	Practical/ Oral Examination	--
3	Formative (assignments)	100
4	Final Term Examination (written)	--
Total		100%

8. List of References

No.	Reference List
1	Alex Ruiz , and Gabi Jack "SolidWorkS 2010", Wiley Publishing, Inc., 2012
2	Randy H. Shih, " AutoCAD 2016 Tutorial", SDC publications, 2017
3	C., Simmons, D. Maguive, and N. Phelps, “Manual of Engineering Drawing”, Elsevier Ltd. 2011
4	K. L. Narayana, P. Kannaiah, and K. Venkata Reddy “Machine Drawing” New Age International (P) Ltd. 2010

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture/Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aims	LOs
1	**Computer Lab:** • **AutoCAD with assembly drawing (5 days)** • Assembly drawing exercises on AutoCAD software.	**4, 6**	A3.1, A4.1, B2.1, B4.1, C6.1, C7.1
2	**Computer Lab:** • **SolidWorks with assembly drawing (5 days)** • Assembly drawing exercises on SolidWorks software.	**4, 6**	A3.1, A4.1, B2.1, B4.1, C6.1, C7.1
3	**Classroom Tutorials:** • **Manual Assembly drawing (5 days)** • Assemble drawing exercises.	**4, 6**	A3.2, A4.1, B2.2, B4.1, C7.1
4	**Classroom Tutorials:** • **Drawing of convention and engineering symbol (5 days)** • Drawing of convention and engineering symbol (5 sheet).	**4, 6**	A3.2, A4.2, B2.2, B4.1, C1.1, C7.1

Course: : Summer Training (1)	
Program Competencies	**Course LOs**
A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.	**A3.1** Recognize the design and conduct the technical drawing of different machine parts. **A3.2** Apply the technical drawing using computer-aided softwares as a main step in the design process for mechanical applications.
A4. Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues and risk management principles.	**A4.1** Identify the characteristics and processes related to the different machines and drawing symbols. **A4.2** Utilize the computer software; AutoCAD and SolidWorks, for different drawing exercise.
B2. Plan, manage and carry out designs of mechanical systems and machine elements using appropriate materials both traditional means and computer-aided tools and software contemporary to the mechanical engineering field.	**B2.1** Carry out samples of several machine parts using appropriate materials. **B2.2** Carry out the technical drawing and three-dimensional shapes of mechanical parts using computer-aided tools and software.
B4. Adopt suitable national and international standards and codes; and integrate legal, economic and financial aspects to: design, build, operate, inspect and maintain mechanical equipment and systems.	**B4.1** Describe the components of mechanical drawing adopting on appropriate national and international standards and rules.
C1. Recognize the design concepts, operation and characteristics of the internal combustion engines, boilers, heat exchangers, turbomachines, and hydraulic machines.	**C1.1** Recognize the symbol of drawing for different mechanical and electrical components.
C6. Use and develop codes using a wide range of software packages pertaining to the discipline.	**C6.1** Use the computer software (AutoCAD) and Solid Works for different drawing exercise.
C7. Exchange knowledge and skills with engineering community and industries; prepare the presentations and technaical reports.	**C7.1** Describe the work coherently and successfully as a part of a team in assignments.

Course Coordinator: Dr. Yassen El-Sayed Yassen

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical power engineering		
Department Responsible for the Course	Production Engineering & Mechanical Design		
Course Code	**PRD223**		
Year/ Level	Second year – 1st semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	2	2	--

2. Course aims:

No.	**aim**
6, 7	Identify and apply the principles of design of the machine elements, such as belts, chain drives, coupling, clutches, Brakes, gear box and hydrodynamic and hydrostatic bearings.

3. Learning Outcomes (LOs):

A1.1	Identify the machine design requirements from the point of view of usability, safety and readability.
A1.2	Solve engineering problems by applying the principles and concepts of machine element design.
A3.1	Apply engineering design processes to produce cost-effective solutions that meet specified needs of the discipline and within the principles and contexts of sustainable design and development.
B1.1	Design and analyze the machine elements applicable to the mechanical engineering discipline by applying the concepts of: solid Mechanics, Material Properties, Mechanical Design and Analysis.
B2.1	Carry out designs of machine elements using appropriate material and by traditional means.
B4.1	Adopt suitable national and international standards and codes to design the machine elements.

4. Course Contents:

No.	Topics	Week
1	**Lectures:** - Introduction and classification of Basic knowledge relevant to machine design **Labs/Tutorials:** - Solve examples regarding to that topic.	1
2	**Lectures:** - Design of power and motion transmission (Flat Belts , V-Belts) **Labs/Tutorials:** - Solve case studies for the belt design	2,3
3	**Lectures:** - Design of power and motion transmission (Chain drives , and design of couplings) **Labs/Tutorials:** - Solve case studies for the chain sprocket design	4,5
4	**Lectures:** - Design of Clutches & Design of Brakes. **Labs/Tutorials:** - Solve problems by applying different methods of Clutches & Brakes.	6-8
8	**Midterm Exam.**	**9**
5	**Lectures:** - Design of gears (Spur gears, Bevel Gears, helical gears) & Design Of gearboxes. **Labs/Tutorials:** - Solve case studies for various gearboxes.	10-11
6	**Lectures:** - Lubrication theories & hydrodynamic and hydrostatic bearings. **Labs/Tutorials:** - Selecting of the suitable bearing according to loading conditions.	12-14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method														
		Lecture	Interactive lectures	Flipped Classroom	Presentation	Discussion	Tutorial	Problem-solving	Brain storming	Projects	Site visits	Self-learning	Cooperative	Drawing Studio	Computer Simulation	Practical Experiments
A-Level	A1.1	x	x	x			x	x								
	A1.2					x	x	x								
	A3.1	x	x			x	x	x	x	x				x		
B-Level	B1.1	x	x				x	x	x	x		x				
	B2.1	x	x			x	x	x								
	B4.1	x	x							x						

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written)	A1.1, A1.2, B1.1
3	Formative (quizzes, presentation -assignments)	A1.1, A1.2, A3.1, B1.1, B2.1, B4.1
4	Final Term Examination (written)	A1.1, A1.2, A3.1, B1.1, B4.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	9
2	Formative (quizzes, presentation -assignments)	Every week
3	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights
1	Mid Term Examination (written)	15
2	Practical/ Oral Examination	--
3	Formative (quizzes, presentation -assignments)	15
4	Final Term Examination (written)	70
Total		100%

8. List of References

No.	Reference List
1	Robert L. Norton, "Machine Design : An Integrated Approach," London Pearson International Edition , 2006 , ISBN 0132020122.
2	Allen S. Hall, Alfred R. Holowenko and Herman G. Laughlin, "Schaum's outline of theory and problems of machine design," London , Tata Mcgraw-hill , 2002 , ISBN 0070483337.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture / Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aim	LOs
1	**Lectures:** • Introduction and classification of Basic knowledge relevant to machine design **Labs/Tutorials:** • Solve examples regarding to that topic.	6	A1.1, A1.2
2,3	**Lectures:** • Design of power and motion transmission (Flat Belts , V-Belts) **Labs/Tutorials:** • Solve case studies for the belt design	6, 7	A1.2, A1.3, B1.1
4,5	**Lectures:** • Design of power and motion transmission (Chain drives , and design of couplings) **Labs/Tutorials:** • Solve case studies for the chain sprocket design	6, 7	A1.2, A1.3, B1.1, B2.1
6,7	**Lectures:** • Design of Clutches & Design of Brakes. **Labs/Tutorials:** • Apply different methods of Clutches & Brakes..	6, 7	A1.2, A1.3, B1.1, B2.1
8	**Midterm exam.**	6, 7	A1.1, A1.2, B1.1
9,10	**Lectures:** • Design of gears (Spur gears, Bevel Gears, Helical Gears) & Design of Gearboxes. **Labs/Tutorials:** • Solve case studies for various gearboxes.	6, 7	A1.2, A3.1, B1.1,B2.1, B4.1
11,12	**Lectures:** • Lubrication theories & hydrodynamic and hydrostatic bearings. **Labs/Tutorials:** • Selecting of the suitable bearing according to loading conditions.	6, 7	A1.2, A3.1, B1.1,B2.1, B4.1

Course: Design of Machine Elements	
Program Competencies	**Course LOs**
A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.	**A1.1** Identify the machine design requirements from the point of view of usability, safety and readability. **A1.2** Solve engineering problems by applying the principles and concepts of machine element design.
A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.	**A3.1** Apply engineering design processes to produce cost-effective solutions that meet specified needs of the discipline and within the principles and contexts of sustainable design and development.
B1. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations**.**	**B1.1** Design and analyze the machine elements applicable to the mechanical engineering discipline by applying the concepts of: solid Mechanics, Material Properties, Mechanical Design and Analysis.
B2. Plan, manage and carry out designs of mechanical systems and machine elements using appropriate materials both traditional means and computer-aided tools and software contemporary to the mechanical engineering field.	**B2.1** Carry out designs of machine elements using appropriate material and by traditional means.
B4. Adopt suitable national and international standards and codes; and integrate legal, economic and financial aspects to: design, build, operate, inspect and maintain mechanical equipment and systems.	**B4.1** Adopt suitable national and international standards and codes to design the machine elements.

Course coordinator: Dr. Samar Elsanabary

Programme coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information

Program Title	B.Sc. In Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department Responsible for the Course	Electrical Engineering		
Department offering the Program	Mechanical Power Engineering		
Course Code	**HUU204**		
Year/ Level	Second year- 1st Semester		
Specialization	Minor		
Teaching Hours	Lectures	Tutorial	Practical/Lab.
	2	-	-

2. Course aims:

No.	Aim
2	Use contemporary engineering tools, techniques, and skills to recognize the concepts, principles, problems, and applications of marketing and management.

3. Learning Outcomes (LOs):

A7.1	Analyze the importance of social responsibility and ethics on marketing.
A7.2	Identify environmental factors that affect both global and domestic marketing decisions.
A9.1	Explain the concepts of the marketing mix in the development of marketing strategy and tactics.
A9.2	Analyze the importance of social responsibility and ethics on marketing.
A10.1	Apply essential marketing concepts to research and write a strategic marketing plan.

4. Course Contents:

No.	**Topics**	**Week**
1	**Lectures:** - An Overview of Marketing.	**1**
2	**Lectures:** - Strategic Planning for Competitive Advantage.	**2**
3	**Lectures:** - Social Responsibility, Ethics, and the Marketing Environment.	**3-4**
4	**Lectures:** - Developing a Global Vision.	**5**
5	**Lectures:** - Consumer Decision Making.	**6**
6	**Lectures:** - Business Marketing.	**7**
7	**Lectures:** Segmenting and Targeting Markets.	**8**
8	**Midterm**	**9**
9	**Lectures:** - Product Concepts.	**10**
10	**Lectures:** - Services and Non-profit Organization Marketing.	**11**
11	**Lectures:** - Marketing Channels and Supply Chain Management.	**12**
12	**Lectures:** - Advertising and Public Relations.	**13**
13	**Lectures:** - Sales Promotion and Personal Selling. - Pricing Concepts.	**14**

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method														
		Lecture (online/ in class)	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A7.1**	x			x	x							x			
	A7.2	x			x	x		x					x			
	A9.1	x			x			x	x				x			
	A9.2	x			x	x		x	x				x			
	A10.1	x			x					x						

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written/ online)	A7.1, A7.2, A9.1, A9.2
2	Practical/ Oral Examination	A7.1, A7.2, A9.1, A9.2, A10.1
3	Formative (quizzes- online quizzes- presentation)	A7.1, A7.2, A9.1, A9.2, A10.1
4	Final Term Examination (written)	A7.1, A7.2, A9.1, A9.2, A10.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written/ online)	9
2	Project	15
3	Formative (quizzes- online quizzes- presentation - ….)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights
1	Mid Term Examination (written/ online)	5
2	Project	10
3	Formative (quizzes- online quizzes- presentation - …….)	5
4	Final Term Examination (written)	80
Total		100%

8. List of References

No.	Reference List
1	Course notes
2	Essential books (text books) - Lamb, Hair and McDaniel, MKTG, South-Western Publishing .U.S.A. 2009.
3	Recommended books. - Kotler, Philip , Kevin Lane Keller ,Marketing management, Prentice hall, Europe,2008.
4	Periodicals, Web sites, etc http://marketing.about.com http://www.slideshare.net http://www.knowthis.com http://www.studymarketing.org Course Prof:Dr: - Kotler, Philip , Kevin Lane Keller ,Marketing management, Prentice hall, Europe,2008.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture / Online Classroom
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	aim	LOs
1	**Lectures:** • An Overview of Marketing.	**2**	A7.1, A7.2, A9.1, A9.2
2	**Lectures:** • Strategic Planning for Competitive Advantage.	**2**	A7.1, A7.2, A9.1, A9.2
3	**Lectures:** • Social Responsibility, Ethics, and the Marketing Environment.	**2**	A7.1, A7.2, A9.1, A9.2, A10.1
4	**Lectures:** • Developing a Global Vision.	**2**	A7.1, A9.2, A10.1
5	**Lectures:** • Consumer Decision Making.	**2**	A7.1, A7.2,A10.1
6	**Lectures:** Business Marketing.	**2**	A7.1, A9.1, A9.2, A10.1
7	**Lectures:** • Segmenting and Targeting Markets.	**2**	A7.2, A9.1, A9.2, A10.1
8	**Midterm**	**2**	A7.1, A7.2, A9.1, A9.2
9	**Lectures:** • Product Concepts	**2**	A7.1, A10.1
10	**Lectures:** • Services and Non-profit Organization Marketing.	**2**	A7.1, A7.2, A9.1, A9.2

11	**Lectures:** - Marketing Channels and Supply Chain Management.	**2**	A7.1, A9.1, A9.2, A10.1
12	**Lectures:** - Advertising and Public Relations.	**2**	A7.1, A7.2, A9.1
13	**Lectures:** - Sales Promotion and Personal Selling. Pricing Concepts.	**2**	A7.1, A7.2, A9.1, A9.2, A10.1

Course: Management and Marketing	
Program LOs	**Course LOs**
A7. Function efficiently as an individual and as a member of multi-disciplinary and multi-cultural teams.	**A7.1** Analyze the importance of social responsibility and ethics on marketing. **A7.2** Identify environmental factors that affect both global and domestic marketing decisions.
A9. Use creative, innovative and flexible thinking and acquire entrepreneurial and leadership skills to anticipate and respond to new situations.	**A9.1** Explain the concepts of the marketing mix in the development of marketing strategy and tactics. **A9.2** Analyze the importance of social responsibility and ethics on marketing.
A10. Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.	**A10.1** Apply essential marketing concepts to research and write a strategic marketing plan.

Course Coordinator: Dr. Mona Hammouda

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Mechanical Power Engineering		
Course Code	**MPE214**		
Year/ Level	Second year - 2nd semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	2	2	1

2. Course aims:

No.	**Aims**
7	Design, analyze and evaluate the performance of different combustion systems, powered by both conventional and renewable energy sources, considering the operational aspects, stabilization, efficiency, economical aspects and exhaust gases emitted to the environment.

3. Learning Outcomes (LOs):

A3.1	Apply the engineering design and requirements for the combustion systems chambers.
A4.1	Utilize contemporary technologies, health and safety requirements and environmental issues of the combustion emissions.
B1.1	Analyze the components of the combustion systems by applying the concepts of thermodynamics, heat transfer, fluid mechanics, combustion and automatic control principles.
B3.1	Select the conventional component for the combustion system according to the required performance and its behavior under a wide range flammability limit.
C1.1	Recognize the design concepts, operation and characteristics of the combustion chambers.
C2.1	Analyze and evaluate the performance of the combustion systems.
C3.1	Judge the optimal operating conditions according to the constraints of cost, safety and environmental effects of the combustion systems.
C4.1	Choose, apply and assess the newable and renewable energy resources in combustion systems.

4. Course Contents:

No.	Topics	Week
1	**Lecture:** • Introduction. • Combustion applications. • Characterizing air for combustion calculations. **Tutorials/Lab:** • Solve problems on the chemical reactions. • Conduct experiments on combustion applications system.	1
2	**Lecture:** • Combustion chemistry of a simple fuel. • Fuels and its properties. **Tutorials/Lab:** • Solve problems on the chemical reactions. • Conduct experiments on combustion applications system.	2
3	**Lecture:** • Heat of combustion and heating value. • Thermochemical calculation. **Tutorials/Lab:** • Solve problems on the chemical reactions. • Conduct experiments on combustion applications system.	3
4	**Lecture:** • Dissociation. • Chemical equilibrium. **Tutorials/Lab:** • Solve problems on the chemical reactions. • Conduct experiments on combustion applications system.	4
5	**Lecture:** • Classification of flames. • Flammability limits. • Reaction rate. • Laminar premixed flames. • Turbulent premixed flames. **Tutorials/Lab:** • Solve problems on the heat of combustion. • Conduct experiments on combustion system components.	5
6	**Lecture:** • Laminar diffusion flames. • Turbulent diffusion flames. • Jet mixing. • Stoichiometry. • Adiabatic flame temperature. **Tutorials/Lab:**	6

	• Solve problems on the burning velocity. • Conduct experiments on combustion system components.	
7	**Lecture:** • Factors influencing the adiabatic flame temperature. • Combustion inside a combustor. • Spray combustion. • Droplet evaporation. • The gas turbine process. **Tutorials/Lab:** • Solve problems on the burning velocity. • Conduct experiments on combustion and flame types.	7
8	**Lecture:** • Measurement of stability. • Water-injection technique. • Bluff-body flameholders. **Tutorials/Lab:** • Solve problems on the flame length. • Conduct experiments on flame stabilizer types.	8
9	**Midterm Examination**	**9**
10	**Lecture:** • Experimental findings on bluff-Body. • Swirler aerodynamics. • Stability by opposing jets. **Tutorials/Lab:** • Solve problems on the flame length. • Conduct experiments on flame stabilizer types.	10
11	**Lecture:** • Atomization. • The Atomization Process. • Atomizers. **Tutorials/Lab:** • Solve problems on the flame length. • Conduct experiments on spray and atomizers.	11
12	**Lecture:** • Factors Influence Atomization. • Spray Characteristics. • Spray Applications. **Tutorials/Lab:** • Solve problems on the flame length. • Conduct experiments on spray and atomizers.	12

13	**Lecture:** • Basic design features. • Combustor requirements. • Combustor types. • Simple gas turbine. **Tutorials/Lab:** • Solve problems on the flame length. • Conduct experiments on combustor types.	13
14	**Lecture:** • The main combustor components. • Wall cooling. • Boiler types. • Efficiency of combustion system. **Tutorials/Lab:** • Solve problems on combustion system efficiency. • Conduct experiments on spray and atomizers.	14

5. Teaching and Learning Methods:

LOs		**Teaching and Learning Method**														
		Lecture	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A3.1**	x	x			x			x							
	A4.1	x	x			x	x	x	x			x				x
B-Level	**B1.1**	x	x			x	x	x	x							x
	B3.1	x	x			x	x	x	x			x				x
C-Level	**C1.1**	x	x			x	x	x	x			x				
	C2.1	x	x			x	x	x	x							x
	C3.1	x	x			x	x	x	x			x				x
	C4.1	x	x			x	x	x	x			x				x

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials and videos
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written)	A4.1, B1.1, B3.1, C2.1, C3.1, C4.1
2	Practical/ Oral Examination	A4.1, C1.1, C4.1
3	Formative (quizzes – online quizzes - assignments)	A3.1, B1.1, B3.1, C1.1, C2.1, C3.1, C4.1
4	Final Term Examination (written)	A3.1, A4.1, B1.1, B3.1, C1.1, C2.1, C3.1, C4.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	9
2	Practical/ Oral Examination	15
3	Formative (quizzes – online quizzes – assignments)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	8
2	Practical/ Oral Examination	20
3	Formative (quizzes – online quizzes – assignments)	12
4	Final Term Examination (written)	60
Total		100%

8. List of References

No.	Reference List
1	Gupta H. N., “Fundamentals of Internal Combustion Engines”, Rakamal Electric Press, Delhi, 2006.
2	Dr. S.N. Saha, “Fuel Combustion Energy Technology”, Dhanpat Rai Publishing Company, 2003.
3	Mahallawy F. and Habik S. El-Din, “The Fundamentals and Technology of Combustion”, Elsevier Science Ltd., 2002.
4	Irvin Glassman, Richard A. Yetter, “Combustion”, Elsevier, 2008.
5	Gad H. M., “Lectures in Combustion Technology”, Mechanical Power Eng. Dept., Port Said University, 2020.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture / Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aims	LOs
1	**Lecture:** • Introduction. • Combustion applications. • Characterizing air for combustion calculations. **Tutorials/Lab:** • Solve problems on the chemical reactions. • Conduct experiments on combustion applications system.	**7**	A3.1, A4.1, B1.1, B3.1, C3.1
2	**Lecture:** • Combustion chemistry of a simple fuel. • Fuels and its properties. **Tutorials/Lab:** • Solve problems on the chemical reactions. • Conduct experiments on combustion applications system.	**7**	A3.1, A4.1, B3.1, C3.1, C4.1
3	**Lecture:** • Heat of combustion and heating value. • Thermochemical calculation. **Tutorials/Lab:**	**7**	A4.1, B1.1, C2.1

	• Solve problems on the chemical reactions. • Conduct experiments on combustion applications system.		
4	**Lecture:** • Dissociation. • Chemical equilibrium. **Tutorials/Lab:** • Solve problems on the chemical reactions. • Conduct experiments on combustion applications system.	**7**	A3.1, A4.1, C2.1, C3.1
5	**Lecture:** • Classification of flames. • Flammability limits. • Reaction rate. • Laminar premixed flames. • Turbulent premixed flames. **Tutorials/Lab:** • Solve problems on the heat of combustion. • Conduct experiments on combustion system components.	**7**	A3.1, A4.1, B3.1
6	**Lecture:** • Laminar diffusion flames. • Turbulent diffusion flames. • Jet mixing. • Stoichiometry. • Adiabatic flame temperature. **Tutorials/Lab:** • Solve problems on the burning velocity. • Conduct experiments on combustion system components.	**7**	A3.1, B1.1, B3.1
7	**Lecture:** • Factors influencing the adiabatic flame temperature. • Combustion inside a combustor. • Spray combustion. • Droplet evaporation. • The gas turbine process. **Tutorials/Lab:** • Solve problems on the burning velocity. • Conduct experiments on combustion and flame types.	**7**	A3.1, A4.1, B1.1, B3.1
8	**Midterm Examination**	**7**	A4.1, B1.1, B3.1, C2.1, C3.1, C4.1
9	**Lecture:**	**7**	A3.1, A4.1

	• Measurement of stability. • Water-injection technique. • Bluff-body flameholders. **Tutorials/Lab:** • Solve problems on the flame length. • Conduct experiments on flame stabilizer types.		
10	**Lecture:** • Experimental findings on bluff-Body. • Swirler aerodynamics. • Stability by opposing jets. **Tutorials/Lab:** • Solve problems on the flame length. • Conduct experiments on flame stabilizer types.	**7**	B1.1, B3.1
11	**Lecture:** • Atomization. • The Atomization Process. • Atomizers. **Tutorials/Lab:** • Solve problems on the flame length. • Conduct experiments on spray and atomizers.	**7**	A3.1, B1.1
12	**Lecture:** • Factors Influence Atomization. • Spray Characteristics. • Spray Applications. **Tutorials/Lab:** • Solve problems on the flame length. • Conduct experiments on spray and atomizers.	**7**	A3.1, B1.1
13	**Lecture:** • Basic design features. • Combustor requirements. • Combustor types. • Simple gas turbine. **Tutorials/Lab:** • Solve problems on the flame length. • Conduct experiments on combustor types.	**7**	A3.1, A4.1, B1.1, B3.1, C1.1, C3.1
14	**Lecture:** • The main combustor components. • Wall cooling. • Boiler types. • Efficiency of combustion system. **Tutorials/Lab:** • Solve problems on combustion system efficiency. • Conduct experiments on spray and atomizers.	**7**	A3.1, A4.1, B1.1, B3.1

Course: Combustion Technology	
Program Competencies	**Course LOs**
A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical, and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.	**A3.1** Apply the engineering design and requirements for the combustion systems and chambers.
A4. Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues, and risk management principles.	**A4.1** Utilize contemporary technologies, health and safety requirements and environmental issues of the combustion emissions.
B1. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, Solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.	**B1.1** Analyze the components of the combustion systems by applying the concepts of thermodynamics, heat transfer, fluid mechanics, combustion and automatic control principles.
B3. Select conventional mechanical equipment according to the required performance.	**B3.1** Select the conventional component for the combustion system according to the required performance and its behavior under a wide range flammability limit.
C1. Recognize the design concepts, operation and characteristics of the internal combustion engines, boilers, heat exchangers, turbomachines and hydraulic machines.	**C1.1** Recognize the design concepts, operation and characteristics of the combustion chambers.
C2. Analyze, evaluate and enhance the performance of the HVAC systems, automatic control systems, pneumatic systems, hydraulic Systems, combustion systems, thermal and nuclear power plants.	**C2.1** Analyze and evaluate the performance of the combustion systems.
C3. Judge the optimal solution according to the constraints of operation, costs, safety, reliability and environmental impacts.	**C3.1** Judge the optimal operating conditions according to the constraints of cost, safety and environmental effects of the combustion systems.

C4. Choose, apply and assess the newable and renewable energy resources in water desalination, power generation, heating, cooling and air conditioning applications.	**C4.1** Choose, apply and assess the newable and renewable energy resources in combustion systems.

Course Coordinator: Associate Prof. Hamada Mohamed Gad

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Mechanical Power Engineering		
Course Code	**MPE215**		
Year/ Level	Second year- 2nd semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	2	2	1

2. Course aims:

No.	**Aims**
7	Analyze, solve, and develop representative models for real heat transfer processes and systems and draw conclusions concerning process/system design.

3. Learning Outcomes (LOs):

A1.1	Identify the relation between the heat transfer and the thermodynamics.
A1.2	Apply the knowledge of mathematics and thermodynamic to derive the differential equations that govern heat conduction for different geometries.
A1.3	Solve engineering problems by applying the fundamentals and equations of heat transfer.
A3.1	Apply heat transfer fundamentals to produce cost-effective engineering design solutions that meet specified application in Mechanical engineering discipline.
B1.1	Develop thermal resistance relations for conduction and radiations problems to find the design required to meet the specified heat transfer rate.
C1.1	Recognize the key radiation process (absorption, reflection, transmission, irradiation, and radiosity)), the radiative properties (emissivity, absorptivity, and reflectivity), radiation shape factors, and rate equation (Stefan-Boltzmann law) for radiation shield design.
C3.1	Judge the optimal insulation thickness and material by combining the convection conduction modes.
C5.1	Analyze the mathematical issues associated with obtaining an exact (analytical) solution of the conduction heat transfer problems.

4. Course Contents:

No.	Topics	Week
1	**Lecture:** - **Introduction** ○ Heat and other forms of energy. ○ Modes of heat transfer. **Tutorials/Lab:** - Solve problems on modes of heat transfer - perform experiment on HT11C heat transfer service unit to investigate the steady state conduction through a uniform plan wall	1
2	**Lecture:** - **Conduction heat transfer** ○ Introduction. ○ Heat conduction though rectangular coordinates. ○ Steady heat conduction though plane wall. ○ Multilayer (composite) plane walls. **Tutorials/Lab:** - Solve problems on heat conduction though plane wall and multilayer plane walls - Perform experiment on HT11C heat transfer service unit to investigate the steady state conduction through a uniform plan wall and to apply the Fourier rate equation	2
3	**Lecture:** - **Conduction heat transfer** ○ heat conduction though cylindrical wall ○ Steady heat conduction though cylindrical wall **Tutorials/Lab:** - Solve problems on heat conduction though cylindrical wall and multilayer cylindrical walls - Perform experiments on HT11C heat transfer service unit to investigate the relationship of temperature gradient to cross-sectional area	3
4	**Lecture:** - **Conduction heat transfer** ○ Steady heat conduction though spherical wall ○ Steady heat conduction with internal heat generation ○ Critical thickness of insulation **Tutorials/Lab:** - Solve problems on heat conduction though spherical wall and multilayer spherical walls - Perform experiments on HT11C heat transfer service unit to illustrate the effect of contact resistance on thermal conduction	4

5	**Lecture:** • **Conduction heat transfer** ○ Steady heat conduction though fins **Tutorials/Lab:** • Solve problems on Steady heat conduction though fins • Perform experiments on HT11C heat transfer service unit to illustrate the effect of contact resistance on thermal conduction	5
6	**Lecture:** • **Two-Dimensional Steady Heat Conduction** ○ Numerical method ○ Solving the finite-difference equations **Tutorials/Lab:** • Solve problems two-dimensional steady heat conduction and solving the finite-difference equations • Conduct experiments on HT11C heat transfer service unit to determine the overall heat transfer coefficient for differing materials in series	6
7	**Lecture:** • **Two-Dimensional Steady Heat Conduction** ○ One-dimensional steady heat conduction ○ Verifying the accuracy of the solution **Tutorials/Lab:** • Solve problems two-dimensional steady heat conduction and verifying the accuracy of the solution • Conduct experiments on HT11C heat transfer service unit to determine the overall heat transfer coefficient for differing materials in series	7-8
8	**Midterm Examination**	**9**
9	**Lecture:** • **One-Dimensional, Transient Heat Conduction** ○ Introduction ○ System with negligible internal resistance (lumped capacitance equation) ▪ General lumped capacitance equation **Tutorials/Lab:** • Solve problems on Transient Heat Conduction and lumped capacitance equation • Conduct experiments to investigate the transient heat conduction in plan wall	10

10	**Lecture:** • **One-Dimensional, Transient Heat Conduction** o System with Finite Internal and Surface Resistances o Semi-infinite solid **Tutorials/Lab:** • Solve problems on transient heat conduction systems with finite internal and surface resistances and semi-infinite solid • Conduct experiments to investigate the transient heat conduction in cylindrical wall	11
11	**Lecture:** • **Radiation heat transfer** o Fundamental concepts ▪ radiation properties ▪ black and gray bodies o The View factor **Tutorials/Lab:** • Solve problems on radiation heat transfer fundamental concepts • Conduct experiments to investigate the transient heat conduction in sphere	12
12	**Lecture:** • **Radiation heat transfer** o Radiation heat transfer within an enclosure of black surfaces o Radiation exchange between opaque, diffuse, gray surfaces in an enclosure **Tutorials/Lab:** • Solve problems on radiation heat transfer within an enclosure of black surfaces and exchange between opaque, diffuse, gray surfaces in an enclosure. • Perform experiments on Gunt WL 460 heat transfer by radiation serves unit to validate lambert’s inverse square law	13
13	**Lecture:** • **Radiation heat transfer** o Radiation shields o Radiation effect on temperature measurements **Tutorials/Lab:** • Solve problems on radiation shields • Perform experiments on Gunt WL 460 heat transfer by radiation serves unit to validate lambert’s inverse square law	14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method														
		Lecture	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A1.1**	x	x			x	x	x	x			x				
	A1.2	x	x			x	x	x	x			x				
	A1.3	x	x			x	x	x	x			x				x
	A3.1	x	x			x	x	x	x			x				x
B-Level	**B1.1**	x	x			x	x	x	x			x				x
C-Level	**C1.1**	x	x			x	x	x	x			x			x	
	C3.1	x	x			x	x	x	x			x				x
	C5.1	x	x			x	x	x	x			x				

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials and videos
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written)	A1.1, A1.2, A1.3, A3.1, C5.1
2	Practical/ Oral Examination	A1.1, A1.2, A3.1, C1.1, C3.1, C5.1
3	Formative (quizzes - presentation - assignments)	A1.1, A1.2, A1.3, A3.1, B1.1, C1.1, C1.2, C3.1, C5.1
4	Final Term Examination (written)	A1.1, A1.2, A3.1, B1.1, C1.1, C3.1, C5.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	9
2	Practical/ Oral Examination	15
3	Formative (quizzes – presentation – assignments)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	12
2	Practical/ Oral Examination	20
3	Formative (quizzes – presentation – assignments)	8
4	Final Term Examination (written)	60
Total		100%

8. List of References

No.	Reference List
1	Frank P. Incropera and David P. DeWitt, "Introduction to Heat Transfer," 8th Edition, 2011,Published by John Wiley & Sons, Inc., New York. .
2	J. P. Holman, "Heat Transfer," 10th Edition, 2010, Published by McGraw-Hill,.
3	Cengel A .Y. "Heat transfer A Practical Approach" 2nd edition ,2002, Published by McGraw-Hill, New York

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture / Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No	Topic	Aims	LOs
1	**Lecture:** • **Introduction** o Heat and other forms of energy o Modes of heat transfer **Tutorials/Lab:** • Solve problems on modes of heat transfer • perform experiment on HT11C heat transfer service unit to investigate the steady state conduction through a uniform plan wall	7	A1.1, A1.2, A1.3, A1.3, A3.1, C5.1
2	**Lecture:** • **Conduction heat transfer** o Introduction o heat conduction though rectangular coordinates o Steady heat conduction though plane wall o Multilayer (composite) plane walls **Tutorials/Lab:** • Solve problems on heat conduction though plane wall and multilayer plane walls • Perform experiment on HT11C heat transfer service unit to investigate the steady state conduction through a uniform plan wall and to apply the Fourier rate equation	7	A1.1, A1.2, A1.3, A3.1, C5.1
3	**Lecture:** • **Conduction heat transfer** o heat conduction though cylindrical wall o Steady heat conduction though cylindrical wall **Tutorials/Lab:** • Solve problems on heat conduction though cylindrical wall and multilayer cylindrical walls • Perform experiments on HT11C heat transfer service unit to investigate the relationship of temperature gradient to cross-sectional area	7	A1.1, A1.2, A1.3, A3.1 , C5.1
4	**Lecture:** • **Conduction heat transfer** o Steady heat conduction though spherical wall o Steady heat conduction with internal heat generation o Critical thickness of insulation **Tutorials/Lab:** • Solve problems on heat conduction though spherical wall and multilayer spherical walls • Perform experiments on HT11C heat transfer service unit to illustrate the effect of contact resistance on thermal conduction	7	A1.1, A1.2, A1.3, A3.1, C5.1

5	**Lecture:** • **Conduction heat transfer** o Steady heat conduction though fins **Tutorials/Lab:** • Solve problems on Steady heat conduction though fins • Perform experiments on HT11C heat transfer service unit to illustrate the effect of contact resistance on thermal conduction	7	A1.1, A1.2, A1.3, A3.1, C5.1
6	**Lecture:** • **Two-Dimensional Steady Heat Conduction** o Numerical method o Solving the finite-difference equations **Tutorials/Lab:** • Solve problems two-dimensional steady heat conduction and solving the finite-difference equations • Conduct experiments on HT11C heat transfer service unit to determine the overall heat transfer coefficient for differing materials in series	7	A1.1, A1.2, A1.3, A3.1, C5.1
7	**Lecture:** • **Two-Dimensional Steady Heat Conduction** o One-dimensional steady heat conduction o Verifying the accuracy of the solution **Tutorials/Lab:** • Solve problems two-dimensional steady heat conduction and verifying the accuracy of the solution • Conduct experiments on HT11C heat transfer service unit to determine the overall heat transfer coefficient for differing materials in series	7	A1.1, A1.2, A1.3, A3.1, C5.1
8	**Midterm Examination**	7	A1.1,A1.2, A1.3, A3.1, C5.1
9	**Lecture:** • **One-Dimensional, Transient Heat Conduction** o Introduction o System with negligible internal resistance (lumped capacitance equation) o General lumped capacitance equation **Tutorials/Lab:** • Solve problems on Transient Heat Conduction and lumped capacitance equation • Conduct experiments to investigate the transient heat conduction in plan wall	7	A1.1, A1.2, A1.3, A3.1, B1.2, C5.1
10	**Lecture:** • **One-Dimensional, Transient Heat Conduction** o System with Finite Internal and Surface Resistances o Semi-infinite solid	7	A1.1, A1.2, A1.3, A3.1, C1.1, C3.1, C5.1

	Tutorials/Lab: • Solve problems on transient heat conduction systems with finite internal and surface resistances and semi-infinite solid • Conduct experiments to investigate the transient heat conduction in cylindrical wall		
11	**Lecture:** • **Radiation heat transfer** ○ Fundamental concepts ▪ radiation properties ▪ black and gray bodies ○ The View factor **Tutorials/Lab:** • Solve problems on radiation heat transfer fundamental concepts • Conduct experiments to investigate the transient heat conduction in sphere	7	A1.1, A1.2, A1.3, A3.1, C3.1, C5.1
12	**Lecture:** • **Radiation heat transfer** ○ Radiation heat transfer within an enclosure of black surfaces ○ Radiation exchange between opaque, diffuse, gray surfaces in an enclosure **Tutorials/Lab:** • Solve problems on radiation heat transfer within an enclosure of black surfaces and exchange between opaque, diffuse, gray surfaces in an enclosure. • Perform experiments on Gunt WL 460 heat transfer by radiation serves unit to validate lambert's inverse square law	7	A1.1, A1.2, A1.3, A3.1, C3.1,C5.1
13	**Lecture:** • **Radiation heat transfer** ○ Radiation shields ○ Radiation effect on temperature measurements **Tutorials/Lab:** • Solve problems on radiation shields • Perform experiments on Gunt WL 460 heat transfer by radiation serves unit to validate lambert's inverse square law	7	A1.1, A1.2, A1.3, A3.1, C3.1, C5.1

Course: Heat Transfer	
Program Competencies	**Course LOs**
A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.	**A1.1** Identify the relation between the heat transfer and the thermodynamics. **A1.2** Apply the knowledge of mathematics and thermodynamic to derive the differential equations that govern heat conduction for different geometries. **A1.3** Solve engineering problems by applying the fundamentals and equations of heat transfer.
A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.	**A3.1** Apply heat transfer fundamentals to produce cost-effective engineering design solutions that meet specified application in Mechanical engineering discipline.
B1. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, Solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.	**B1.1** Develop thermal resistance relations for conduction and radiations problems to find the design required to meet the specified heat transfer rate.
C1. Recognize the design concepts, operation and characteristics of the internal combustion engines, boilers, heat exchangers, turbomachines, and hydraulic machines.	**C1.1** Recognize the key radiation process (absorption, reflection, transmission, irradiation, and radiosity)), the radiative properties (emissivity, absorptivity, and reflectivity), radiation shape factors, and rate equation (Stefan-Boltzmann law) for radiation shield design.
C3. Judge the optimal solution according to the constraints of operation, costs, safety, reliability, and environmental impacts.	**C3.1** Judge the optimal insulation thickness and material by combining the convection

	conduction modes.
C5. Select appropriate solutions for mechanical power engineering problems based on analytical and numerical techniques.	**C5.1** Analyze the mathematical issues associated with obtaining an exact (analytical) solution of the conduction heat transfer problems.

Course Coordinator: Prof. Dr. Kamal Morad

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

Course Specifications:
Computer Applications in Mechanical Power Engineering

1. Basic Information

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Mechanical Power Engineering		
Course Code	**MPE216**		
Year/ Level	Second year- 2nd semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	2	-	1

2. Course aims:

No.	Aims
5, 6	Conduct Models and develop codes using a software packages by applying and integrating knowledge, understanding and skills to solve real problems pertaining to the mechanical power engineering applications.

3. Learning Outcomes (LOs):

A1.1	Formulate, and solve complex mechanical engineering problems using computer-aided softwares.
A2.1	Conduct appropriate simulation, analyze and interpret data, assess and evaluate simulation results and objective engineering judgment to draw conclusions.
B1.1	Model, analyze and design physical systems applicable to the mechanical engineering by applying the concepts of: Thermodynamics, Heat Transfer, and Fluid Mechanics.
B2.1	Choose the designs of mechanical systems using computer-aided tools and software contemporary to the mechanical engineering field.
C5.1	Select appropriate solutions for mechanical power engineering problems based on numerical techniques.
C6.1	Use and develop codes using a software packages pertaining to the mechanical engineering.

4. Course Contents:

No.	Topics	Week
1	**Lecture:** • Introduction to programming • Review for VB programming Language • MS_VB Compilers • Source Form and Program Layout • Data Types –Constants-Names and -Variables • Numeric Expressions -Character Sets **Computer lab:** • Review and solve problems on heat transfer and gas laws using MS_VB programming.	1
2	**Lecture:** • Relational Expressions (Intrinsic Logical Operators) • Input/Output • Flow control • Arrays • Sub-programs **Computer lab:** • Review and solve problems on heat transfer and gas laws using MS_VB programming.	2
3	**Lecture:** • Spread sheets - Excel • Introduction to Engineering Equation Solver (EES) **Computer lab:** • Solve problems on heat transfer and gas laws using Excel • Solve problems on heat transfer and gas laws using EES.	3
4	**Lecture:** • Numerical Solution of Equations and Iteration • Bisection Method **Computer lab:** • Solve problems on solution of equations and iteration (Bisection method) using MS_VB programming	4
5	**Lecture:** • Numerical Solution of Equations and Iteration • Newton’s Method • Secant Method **Computer lab:** • Solve problems on solution of equations and iteration (Newton’s / Secant method) using MS_VB programming. • Solve problems on solution of equations and iteration using EES	5
6	**Lecture:** • Numerical Solution of set of linear equations • Gauss reduction method **Computer lab:** • Solve problems on: solution of set of linear equations using Gauss	6

	reduction method using MS_VB programming.	
7	**Lecture:** • Numerical Solution of set of linear equations • Gauss-Seidel iteration method **Computer lab:** • Solve problems on: solution of set of linear equations using Gauss-Seidel iteration method using MS_VB programming. • Solve problems on solution of equations and iteration using EES	7
8	**Lecture:** • Numerical Integration • Trapezoidal rule • Simpson's rule **Computer lab:** • Solve problems on Integration using MS_VB programming Solve problems on integration using EES.	8
9	**Midterm Examination**	**9**
10	**Lecture:** • Numerical Solution of Ordinary Differential Equations • Numerical Differentiation - Runge-Kutta Methods for 2nd Order DE. **Computer lab:** • Solve problems on solution of ordinary differential equations using MS_VB programming.	10
11	**Lecture:** • Finite difference method and its application in heat transfer • Steady state Heat conduction with internal heat source **Computer lab:** • Solve problems on heat transfer using VB programming and EES.	11
12	**Lecture:** • Finite difference method and its application in heat transfer • Unsteady state Heat conduction with internal heat source **Computer lab:** • Solve problems on heat transfer using VB programming and EES.	12
13	**Lecture:** • Using EES to solve open system thermal power cycles • Using libraries and pure substance properties of EES **Computer lab:** • Solve problems on Brayton and Rankine cycles using EES.	13
14	**Lecture:** • Using EES to solve closed system thermal power cycles • Using subprograms in EES **Computer lab:** • Solve problems on thermal power cycles using EES.	14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method														
		Lecture	Interactive lectures	Flipped Classroom	Presentation	Discussion	Tutorial	Problem-solving	Brain storming	Projects	Site visits	Self-learning	Cooperative	Drawing Studio	Computer Simulation	Practical Experiments
A-Level	A1.1	x	x			x		x	x						x	
	A2.1	x	x			x		x	x						x	
B-Level	B1.1	x	x			x		x	x						x	
	B2.1	x	x			x		x	x						x	
C-Level	C5.1	x	x			x		x	x			x			x	
	C6.1	x	x			x		x	x			x			x	

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials and videos
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written)	A1.1, A2.1, B1.1, B2.1
2	Laboratory Examination	A1.1, A2.1, B1.1, C6.1
3	Formative (quizzes – online quizzes - assignments)	A1.1, A2.1, B1.1, B2.1, C5.1, C6.1
4	Final Term Examination	A1.1, A2.1, B1.1, B2.1, C5.1, C6.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid-Term Examination (written)	9
2	Laboratory Examination	15
3	Formative (quizzes – online quizzes – assignments)	Every week
4	Final Term Examination	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	10
2	Laboratory Examination	20
3	Formative (quizzes – online quizzes – assignments)	10
4	Final Term Examination	60
Total		100%

8. List of References:

No.	Reference List
1	Klein, S.A. and Nellis, G.F. Mastering EES , F-Chart Software, 2012.
2	Visual Basic for Applications, 2016 https://en.wikibooks.org/w/index.php?title=Visual_Basic_for_Applications&oldid=3768506
3	Hoffman, J.D., Numerical methods for Engineers and Scientists, New York, McGraw-Hill, 2007.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture/Online Classroom
2	Computer Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	aims	LOs
1	**Lecture:** • Introduction to programming • Review for VB programming Language • MS_VB Compilers • Source Form and Program Layout • Data Types –Constants-Names and -Variables • Numeric Expressions -Character Sets **Computer lab:** • Review and solve problems on heat transfer and gas laws using MS_VB programming.	6	A1.1, A2.1, B1.1, C6.1
2	**Lecture:** • Relational Expressions (Intrinsic Logical Operators) • Input/Output • Flow control • Arrays • Sub-programs **Computer lab:** • Review and solve problems on heat transfer and gas laws using MS_VB programming.	5, 6	A1.1, A2.1, B1.1, C6.1
3	**Lecture:** • Spread sheets - Excel • Introduction to Engineering Equation Solver (EES) **Computer lab:** • Solve problems on heat transfer and gas laws using Excel • Solve problems on heat transfer and gas laws using EES.	5, 6	A1.1, A2.1, B1.1, C6.1
4	**Lecture:** • Numerical Solution of Equations and Iteration • Bisection Method **Computer lab:** • Solve problems on solution of equations and iteration (Bisection method) using MS_VB programming	5, 6	A1.1, A2.1, B1.1, C6.1
5	**Lecture:** • Numerical Solution of Equations and Iteration • Newton’s Method • Secant Method **Computer lab:** • Solve problems on solution of equations and iteration (Newton’s / Secant method) using MS_VB programming. • Solve problems on solution of equations and iteration using EES	5, 6	A1.1, A2.1, B1.1, C6.1

6	**Lecture:** - Numerical Solution of set of linear equations - Gauss reduction method **Computer lab:** - Solve problems on: solution of set of linear equations using Gauss reduction method using MS_VB programming.	**5, 6**	A1.1, A2.1, B1.1, C6.1
7	**Lecture:** - Numerical Solution of set of linear equations - Gauss-Seidel iteration method **Computer lab:** - Solve problems on: solution of set of linear equations using Gauss-Seidel iteration method using MS_VB programming. - Solve problems on solution of equations and iteration using EES	**5, 6**	A1.1, A2.1, B1.1, C6.1
8	**Midterm Examination**	**5, 6**	A1.1, A2.1, B1.1, C6.1
9	**Lecture:** - Numerical Integration - Trapezoidal rule - Simpson’s rule **Computer lab:** - Solve problems on Integration using MS_VB programming - Solve problems on integration using EES.	**5, 6**	A1.1, A2.1, B1.1, C6.1
10	**Lecture:** - Numerical Solution of Ordinary Differential Equations - Numerical Differentiation - Runge-Kutta Methods for 2nd Order DE. **Computer lab:** - Solve problems on solution of ordinary differential equations using MS_VB programming.	**5, 6**	A1.1, A2.1, B1.1, C6.1
11	**Lecture:** - Finite difference method and its application in heat transfer - Steady state Heat conduction with internal heat source **Computer lab:** - Solve problems on heat transfer using VB programming and EES.	**5, 6**	A1.1, A2.1, B1.1, B2.1, C5.1, C6.1

12	**Lecture:** • Finite difference method and its application in heat transfer • Unsteady state Heat conduction with internal heat source **Computer lab:** • Solve problems on heat transfer using VB programming and EES.	**5, 6**	A1.1, A2.1, B1.1, B2.1, C5.1, C6.1
13	**Lecture:** • Using EES to solve open system thermal power cycles • Using libraries and pure substance properties of EES **Computer lab:** • Solve problems on Brayton and Rankine cycles using EES.	**5, 6**	A1.1, A2.1, B1.1, B2.1, C5.1, C6.1
14	**Lecture:** • Using EES to solve closed system thermal power cycles • Using subprograms in EES **Computer lab:** • Solve problems on thermal power cycles using EES.	**5, 6**	A1.1, A2.1, B1.1, B2.1, C5.1, C6.1

Course: Computer Applications in Mechanical Power Engineering	
Program Competencies	**Course LOs**
A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.	**A1.1** Formulate, and solve complex mechanical engineering problems using computer-aided softwares.
A2. Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.	**A2.1** Conduct appropriate simulation, analyze and interpret data, assess and evaluate simulation results and objective engineering judgment to draw conclusions.
B1. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.	**B1.1** Model, analyze and design physical systems applicable to the mechanical engineering by applying the concepts of: Thermodynamics, Heat Transfer, and Fluid Mechanics.
B2. Plan, manage and carry out designs of mechanical systems and machine elements using appropriate materials both traditional means and computer-aided tools and software contemporary to the mechanical engineering field.	**B2.1** Choose the designs of mechanical systems using computer-aided tools and software contemporary to the mechanical engineering field.
C5. Select appropriate solutions for mechanical power engineering problems based on analytical and numerical techniques.	**C5.1** Select appropriate solutions for mechanical power engineering problems based on numerical techniques.
C6. Use and develop codes using a wide range of software packages pertaining to the discipline.	**C6.1** Use and develop codes using a software packages pertaining to the mechanical engineering.

Course Coordinator: Dr. Amany Mahmoud Arafat Saif

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

Course Specifications: Machine Design

1. Basic Information

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical power engineering		
Department Responsible for the Course	Production Engineering & Mechanical Design		
Course Code	**PRD224**		
Year/ Level	Second year – 2nd Semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	2	2	--

2. Course aims:

No.	Aim
6, 7	Identify and apply the principles of design of the machine elements, such as shafts, keys, spline, welded joints, etc.

3. Learning Outcomes (LOs):

A1.1	Identify the machine design requirements from the point of view of usability, safety and readability.
A1.2	Solve engineering problems by applying the principles and concepts of machine design.
A3.1	Apply engineering design processes to produce cost-effective solutions that meet specified needs of the discipline and within the principles and contexts of sustainable design and development.
B1.1	Design and analyze the machine applicable to the mechanical engineering discipline by applying the concepts of: solid Mechanics, Material Properties, Mechanical Design and Analysis.
B2.1	Carry out designs of machine using appropriate material and by traditional means.
B4.1	Adopt suitable national and international standards and codes to design the machine.

4. Course Contents:

No.	Topics	Week
1	**Lectures:** - Machine design and design considerations **Tutorials:** - Demonstrate the difference between different stresses	1
2,3	**Lectures:** - Engineering materials in machine element design **Tutorials:** - Demonstrate the difference between material behavior and safety factor consideration	2-3
4	**Lectures:** - Theories of failure and dynamic stresses **Tutorials:** - Solve examples considering various failure theories for dynamic system	4
5,6	**Lectures:** - Design of cotter and knuckle joints **Tutorials:** - Solve examples regarding mentioned joints and similar ones.	5-6
7	**Lectures:** - Design of shafts and axels. **Tutorials:** - Solve examples to determine shaft diameter under various loading conditions	7-8
8	**Midterm**	**9**
9,10	**Lectures:** - Design of screwed joints. **Tutorials:** - Indicate procedure of designing screw joints under various working conditions.	10-11
11,12	**Lectures:** - Design of welded joints **Tutorials:** - Solve problems to estimate welding rod size to withstand loading conditions.	12-13
13	**Lectures:** - Shaft – hub-connections **Tutorials:** - Designing shaft hub connections and related designs.	14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method														
		Lecture	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A1.1**	x	x	x			x	x								
	A1.2					x	x	x								
	A3.1	x	x			x	x	x	x	x				x		
B-Level	**B1.1**	x	x				x	x	x	x		x				
	B2.1	x	x			x	x	x								
	B4.1	x	x							x						

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written, online)	A1.1, A1.2, A3.1, B1.1, B4.1
3	Formative (quizzes – presentation - online)	A1.1, A1.2, A3.1, B1.1, B2.1, B4.1
4	Final Term Examination (written)	A1.1, A1.2, A3.1, B1.1, B2.1, B4.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written, online)	9
2	Formative (quizzes – presentation - online)	Every week
3	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights
1	Mid Term Examination (written, online)	15
2	Practical/ Oral Examination	--
3	Formative (quizzes – presentation - online)	15
4	Final Term Examination (written)	70
Total		100%

8. List of References

No.	Reference List
1	Khurmi, R. S. and Gupta, J. K., 2006, “A text Book of Machine Design,” Eurasia Publishing House , India**.**
2	Kandil, A., 2009, “Design of Machine Elements,” Lecture Notes, Port Said University.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture / Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No	Topic	Aim	LOs
1	**Lectures:** • Machine design and design considerations **Tutorials:** • Demonstrate the difference between different stresses	6	A1.1
2	**Lectures:** • Engineering materials in machine element design **Tutorials:** • Demonstrate the difference between material behavior and safety factor consideration	**6,7**	A1.1, A3.1
3	**Lectures:** • Theories of failure and dynamic stresses **Tutorials:** • Solve examples considering various failure theories	**6,7**	A1.2, A3.1, B1.1
4	**Lectures:** • Design of cotter and knuckle joints **Tutorials:** • Solve examples regarding mentioned joints and similar ones.	**6,7**	A1.2, A3.1, B1.1, B2.1, B4.1
5	**Lectures:** • Design of shafts and axels. **Tutorials:** • Solve examples to determine shaft diameter under various loading conditions	**6,7**	A1.2, A3.1, B1.1, B2.1, B4.1
6	**Midterm**	**6,7**	A1.1, A1.2, A3.1, B1.1, B4.1
7	**Lectures:** • Design of screwed joints. **Tutorials:** • Indicate procedure of designing screw joints under various working conditions	**6,7**	A1.2, A3.1, B1.1, B2.1, B4.1
8	**Lectures:** • Design of welded joints **Tutorials:** • Solve problems to estimate welding rod size to withstand loading conditions.	**6,7**	A1.2, A3.1, B1.1, B2.1, B4.1
9	**Lectures:** • Shaft – hub-connections **Tutorials:** • Designing shaft hub connections and related designs.	**6,7**	A1.2, A3.1, B1.1, B2.1, B4.1
10	**Lectures:** • Marine applications. **Tutorials:** • Discuss the mentioned topics and its relation with the marine engineering	**6,7**	A1.2, A3.1, B1.1, B2.1, B4.1

Course: Machine Design	
Program Competencies	**Course LOs**
A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.	**A1.1** Identify the machine design requirements from the point of view of usability, safety and readability. **A1.2** Solve engineering problems by applying the principles and concepts of machine design.
A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.	**A3.1** Apply engineering design processes to produce cost-effective solutions that meet specified needs of the discipline and within the principles and contexts of sustainable design and development.
B1. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations**.**	**B1.1** Design and analyze the machine applicable to the mechanical engineering discipline by applying the concepts of: solid Mechanics, Material Properties, Mechanical Design and Analysis.
B2. Plan, manage and carry out designs of mechanical systems and machine elements using appropriate materials both traditional means and computer-aided tools and software contemporary to the mechanical engineering field.	**B2.1** Carry out designs of machine using appropriate material and by traditional means.
B4. Adopt suitable national and international standards and codes; and integrate legal, economic and financial aspects to: design, build, operate, inspect and maintain mechanical equipment and systems.	**B4.1** Adopt suitable national and international standards and codes to design the machine.

Course coordinator: Prof. Dr Gamal Abd El Nasser

Programme coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information

<table>
<tr><td>Program Title</td><td colspan="3">B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)</td></tr>
<tr><td>Department offering the Program</td><td colspan="3">Mechanical Power Engineering</td></tr>
<tr><td>Department Responsible for the Course</td><td colspan="3">Electrical Engineering</td></tr>
<tr><td>Course Code</td><td colspan="3">EPM212</td></tr>
<tr><td>Year/ Level</td><td colspan="3">Second year- 2nd semester</td></tr>
<tr><td>Specialization</td><td colspan="3">Minor</td></tr>
<tr><td rowspan="2">Teaching Hours</td><td>Lectures</td><td>Tutorial</td><td>Lab.</td></tr>
<tr><td>2</td><td>1</td><td>1</td></tr>
</table>

2. Course aims:

No.	**Aim**
1	Apply theories of electrical circuits such as Ohm’s Law, Kirchhoff’s current Law, and Kirchhoff’s voltage Law to analyze the electric circuits.

3. Learning Outcomes (LOs):

A1.1	Identify the concepts and theories of mathematics and sciences related to DC and AC circuits analysis: fundamental lows, analysis methods and theorems, magnetic circuits and transformer, resonance in electric circuits and semiconductor materials.
A1.2	Solve problem by applying the fundamentals of DC and AC circuits analysis: fundamental lows, analysis methods and theorems, magnetic circuits and transformer, resonance in electric circuits and semiconductor materials.
A2.1	Develop and conduct appropriate experimentation analyze and interpret data, assess and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.
B1.1	Analyze the different types of electrical circuits.

4. Course Contents:

No.	Topics	Week
1	**Lectures:** • **Fundamentals of Electrical Circuits:** Definition of: work, energy, current, voltages - electrical circuit elements - Drawing of different waveforms of current, voltage, charge – etc. **Labs/Tutorials:** • Recognition of different electric circuit components - Verification of series and parallel connections - Illustrative examples. • Conduct experiments on electric circuit components**.**	1
2	**Lectures:** • **DC circuits Analysis and their Fundamental Lows:** Ohm's laws, Kirchoff’s current and voltage laws - Illustrative examples. **Labs/Tutorials:** • Problems solving - Verify the ohm’s law for a given electrical circuit using Workbench circuit simulator and experimentally using lab equipment.	2
3	**Lectures:** • DC Electric Circuits analysis Methods:Nodal analysis method - Loop analysis method – Superposition method - Illustrative examples. **Labs/Tutorials:** • Problems solving - Verify each of the above methods for a given electrical circuit using Workbench circuit simulator and experimentally using lab equipment	3
4	**Lectures:** • **DC Electric Circuits Analysis Theorems:** Thevenin and Norton equivalentsand their transformation - Delta to Star conversion and vice versa - Illustrative examples. **Labs/Tutorials:** • Problems solving - Verify each of the above theorems for a given electrical circuit using Workbench circuit simulator and experimentally using lab equipment.	4
5	**Lectures:** • **AC Circuits Analysis:** Different AC current and voltage waves– AC circuit's analysis techniques and theories - Sinusoidal steady-state circuit analysis - Illustrative examples. **Labs/Tutorials:** • Problems solve - Verification of Illustrative examples using Workbench circuit simulator and experimentally using lab equipment.	5
6	**Lectures:** • Balanced and Unbalanced three phase systems delta and star - Illustrative examples. **Labs/Tutorials:** • Problems solving - Measurement of voltage and current in three phase connection.	6

	Lectures: • Resonance in Electric Circuits: Series resonance, Parallel resonance, Application to filters circuits, Illustrative examples**.** **Tutorial /Lab:** • Problems solving - Measurement of current with fixed supply voltage in Series resonance and Parallel resonance as a function of frequency **-** Verification of Filters circuits Illustrative examples using Workbench circuit simulator and experimentally using lab equipment.	7-8
7	**Midterm**	**9**
8	**Lectures:** • Resonance in Electric Circuits: Series resonance, Parallel resonance, Application to filters circuits, Illustrative examples**.** **Tutorial /Lab:** • Problems solving - Measurement of current with fixed supply voltage in Series resonance and Parallel resonance as a function of frequency **-** Verification of Filters Circuits Illustrative examples using Workbench circuit simulator and experimentally using lab equipment.	10
9	**Lectures** • **Magnetic circuits:** Elements of magnetic circuits, Characteristics of magnetic circuits; Illustrative examples. **Tutorial /Lab:** • Solving Problems and Verification of Filters Circuits Illustrative examples using Workbench circuit simulator and experimentally using lab equipment.	11
10	**Lectures:** • Transformers: Structure and its function • Illustrative examples. **Tutorial /Lab:** • Problems analytical solving Verification of Illustrative applications using Workbench circuit simulator and experimentally using lab equipment.	12
11	**Lectures:** • **The basic concepts of Semiconductor materials**: Basics of semiconductor material physics – Illustrative applications of semiconductor devices such as Diode application rectification circuits. **Tutorial /Lab:** • Verification of Illustrative applications using Workbench circuit simulator and experimentally using lab equipment.	13-14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method														
		Lecture(online/in class)	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A1.1**	x	x	x			x		x							x
	A1.2	x	x			x	x	x	x							x
	A2.1	x					x					x				x
B-Level	**B1.1**	x	x				x					x				x

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials
2	Online lectures and assignments

7. Student Assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written/ online)	A1.1, A1.2, A2.1, B1.1
2	Practical/ Oral Examination	A1.1, A1.2, A2.1, B1.1
3	Formative (quizzes- online quizzes- assignments)	A1.1, A1.2, A2.1, B1.1
4	Final Term Examination (written)	A1.1, A1.2, A2.1, B1.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written/ online)	9
2	Practical/ Oral Examination	15
3	Formative (quizzes- online quizzes-assignments)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights
1	Mid Term Examination (written/ online)	10
2	Practical/ Oral Examination	20
3	Formative (quizzes- online quizzes-assignments)	10
4	Final Term Examination (written)	60
Total		100%

8. List of References:

No.	Reference List
1	Alexander, C. K. and Sadiku, M. O., “Fundamentals of Electric Circuits,” 5th Edition, McGraw Hill Higher Education, 2012.
2	J. David Irwin, R. Mark Nelms, BASIC ENGINEERING CIRCUIT ANALYSIS, 11th edition, John Wiley & Sons, Inc, January 2015.
3	Roadstrum, W. H. and Wolaver, D. H., “Electrical Engineering for All Engineers”, 2nd Edition, John Wiley & Sons, 1994.
4	Fitzgerald, A. E., “Basic Electric Engineering”, McGraw – Hill, 1981.
5	Hubert, C. I., “Electric Circuits AC / DC: An Integrated Approach ”, McGraw – Hill, 1982.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topics	Aim	LOs
1	**Lectures:** - **Fundamentals of Electrical Circuits:** Definition of: work, energy, current, voltages - electrical circuit elements - Drawing of different waveforms of current, voltage, charge – etc. **Labs/Tutorials:** - Recognition of different electric circuit components - Verification of series and parallel connections experimentally using lab equipment- Illustrative examples.	1	A1.1, A1.2, A2.1
2	**Lectures:** - **DC circuits Analysis and their Fundamental Lows:** Ohm's laws, Kirchoff's current and voltage laws - Illustrative examples. **Labs/Tutorials:** - Problems solving - Verify the ohm's law for a given electrical circuit using Workbench circuit simulator and experimentally using lab equipment.	1	A1.1, A1.2, A2.1, B1.1
3	**Lectures:** - DC Electric Circuits analysis Methods:Nodal analysis method - Loop analysis method – Superposition method - Illustrative examples. **Labs/Tutorials:** - Problems solving - Verify each of the above methods for a given electrical circuit using Workbench circuit simulator and experimentally using lab equipment	1	A1.1, A1.2, A2.1, B1.1
4	**Lectures:** - **DC Electric Circuits Analysis Theorems:** Thevenin and Norton equivalentsand their transformation - Delta to Star conversion and vice versa - Illustrative examples. **Labs/Tutorials:** - Problems solving - Verify each of the above theorems for a given electrical circuit using Workbench circuit simulator and experimentally using lab equipment.	1	A1.1, A1.2, A2.1, B1.1
5	**Lectures:** - **AC Circuits Analysis:** Different AC current and voltage waves–AC circuit's analysis techniques and theories - Sinusoidal steady-state circuit analysis - Illustrative examples. **Labs/Tutorials:** - Problems solve - Verification of Illustrative examples using Workbench circuit simulator and experimentally using lab equipment.	1	A1.1, A1.2, A2.1, B1.1

6	**Lectures:** • Balanced and Unbalanced three phase systems delta and star - Illustrative examples. **Labs/Tutorials:** • Problems solving - Measurement of voltage and current in three phase connection.	1	A1.1, A1.2, A2.1, B1.1
	Lectures: • Resonance in Electric Circuits: Series resonance, Parallel resonance, Application to filters circuits, Illustrative examples. **Tutorial /Lab:** • Problems solving - Measurement of current with fixed supply voltage in Series resonance and Parallel resonance as a function of frequency - Verification of Filters circuits Illustrative examples using Workbench circuit simulator and experimentally using lab equipment.	1	A1.1, A1.2, A2.1, B1.1
7	**Midterm**	1	A1.1, A1.2, A2.1, B1.1
8	**Lectures:** • Resonance in Electric Circuits: Series resonance, Parallel resonance, Application to filters circuits, Illustrative examples. **Tutorial /Lab:** • Problems solving - Measurement of current with fixed supply voltage in Series resonance and Parallel resonance as a function of frequency - Verification of Filters Circuits Illustrative examples using Workbench circuit simulator and experimentally using lab equipment.	1	A1.1, A1.2, A2.1, B1.1
9	**Lectures** • **Magnetic circuits:** Elements of magnetic circuits, Characteristics of magnetic circuits; Illustrative examples. **Tutorial /Lab:** • Solving Problems- Verification of Filters Circuits Illustrative examples using Workbench circuit simulator and experimentally using lab equipment.	1	A1.1, A1.2, A2.1, B1.1
10	**Lectures:** • Transformers: Structure and its function • Illustrative examples. **Tutorial /Lab:** Problems analytical solving - Verification of Illustrative applications using Workbench circuit simulator and experimentally using lab equipment.	1	A1.1, A1.2, A2.1, B1.1
11	**Lectures:** • **The basic concepts of Semiconductor materials**: Basics of semiconductor material physics – Illustrative applications of semiconductor devices such as Diode application rectification circuits.	1	A1.1, A1.2, A2.1, B1.1

	Tutorial /Lab: - Verification of Illustrative applications using Workbench circuit simulator and experimentally using lab equipment.		

Course: Electrical and Electronic Engineering	
Program Competencies	**Course LOs**
A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.	**A1.1** Identify the concepts and theories of mathematics and sciences related to DC and AC circuits analysis: fundamental lows, analysis methods and theorems, magnetic circuits and transformer, resonance in electric circuits and semiconductor materials. **A1.2** Solve problem by applying the fundamentals of DC and AC circuits analysis: fundamental lows, analysis methods and theorems, magnetic circuits and transformer, resonance in electric circuits and semiconductor materials.
A2. Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.	**A2.1** Develop and conduct appropriate experimentation analyze and interpret data, assess and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.
B1. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.	**B1.1** Analyze the different types of electrical circuits.

Course Coordinator: Dr. Mai El-Adany

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information

Program Title	B.Sc. In Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department Responsible for the Course	Civil Engineering Dept. & Naval Architecture and Marine Engineering Dept.		
Department offering the Program	Mechanical Power Engineering		
Course Code	**HUF203**		
Year/ Level	Second Year- 2nd Semester		
Specialization	Minor		
Teaching Hours	Lectures	Tutorial	Practical/Lab.
	2	-	-

2. Course aims:

No.	Aim
1, 2	Behave professionally in natural science of the marine environment. Also, understand Marine Engineering Applications, Port Planning and its types. Learning about Suez Canal Marine Environment characteristics, Projects, Institutions and Authorities.

3. Learning Outcomes (LOs):

A3.1	Recognize the ethics and impacts of engineering solutions on society and the marine environment characteristics.
A3.2	Identify Suez Canal Marine Projects, Institutions and Authorities.
A3.3	Classify and identify the types of Ports and its master plans.
A3.4	Describe the different designs of port structures such as breakwaters and berths and the forces affected on them.
A7.1	Discuss Marine Engineering Applications and its Environment Pollution.
A7.2	Discuss the environmental effects of the bad planning of port master plan systems.
A10.1	Apply new knowledge and practice self about the engineering problems related to marine environment.
A10.2	Apply code of ministry of water resources and irrigation and international navigation code for designing Ports structures.

4. Course Contents:

No.	Topics	Week
1	**Lectures:** • Suez Canal Marine Environment characteristics.	1
2	Lectures: • Suez Canal Marine Projects, Institutions and Authorities.	2
3	**Lectures:** • Marine Suez Canal Marine Projects, Institutions and Authorities. Engineering Applications and its Environment Pollution.	3-5
4	**Lectures:** • Types of: Ports, Master plans, and ship.	6-8
5	**Midterm Exam**.	**9**
6	**Lectures:** • Breakwater and berths types. • Forces affected on Breakwater and berths.	10-11
7	**Lectures:** • Determining the no. of berths required for Harbor.	12
8	**Lectures:** • Determining the no. of berths required for Harbor. • Dredging and Land area of the Port.	13-14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method														
		Lecture (online/offline)	Interactive lectures	Flipped Classroom	Presentation	Discussion	Tutorial	Problem-solving	Brain storming	Projects	Site visits	Self-learning	Cooperative	Drawing Studio	Computer Simulation	Practical Experiments
A-Level	A3.1	x	x			x						x				
	A3.2	x	x	x		x						x				
	A3.3	x	x	x		x										
	A3.4	x				x										
	A7.1	x				x						x				
	A7.2	x				x						x				
	A10.1	x														
	A10.2	x														

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional video tutorials
2	Online lectures

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written/ online)	A3.1, A3.2, A3.3, A7.1, A7.2, A10.1
2	Formative (self-learning assignments)	A3.1, A3.2, A3.3, A3.4, A7.1, A7.2, A10.1, A10.2
3	Final Term Examination (written)	A3.1, A3.2, A3.3, A3.4, A7.1, A7.2, A10.1, A10.2

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written/ online)	9
2	Formative (self-learning assignments)	7
3	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights
1	Mid Term Examination (written/ online)	10%
2	Formative (quizzes- online quizzes- presentation - …….)	10%
3	Final Term Examination (written)	80%
Total		100%

8. List of References

No.	Reference List
1	European Maritime Safety Agency "Annual Overview Of Marine Casualties And Incidents 2014" (to be updated every year).
2	Bowersox, D J, Closs, D J and Cooper, M B (2007) Supply Chain Logistics Management, 2nd edn, McGraw Hill.
3	K.J. Rawson & E.C. TUPPER " Basic Ship Theory " , fifth edition , Butterworth – Heinemann, 2005
4	http://www.suezcanal.gov.eg
5	Adrian Jarvis; Port and harbour engineering, 2016.
6	Per Bruun, Port engineering, 1993.
7	Gregory Tsinker; Handbook of Port and Harbor Engineering : Geotechnical and Structural Aspects.2014.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture / Online Classroom
2	White Board
3	Data Show System
4	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aim	LOs
1	**Lectures:** • Suez Canal Marine Environment characteristics.	**1, 2**	A3.1, A10.1
2	**Lectures:** • Suez Canal Marine Projects, Institutions and Authorities.	**1, 2**	A3.1, A3.2
3	**Lectures:** • Marine Suez Canal Marine Projects, Institutions and Authorities. Engineering Applications and its Environment Pollution.	**1, 2**	A3.1, A3.2, A7.1, A10.1
4	**Lectures:** • Types of: Ports, Master plans, and ship.	**1**	A3.3, A7.2, A10.2
5	**Lectures:** • Breakwater and berths types. • Forces affected on Breakwater and berths.	**1**	A3.4, A10.2
6	**Lectures:** • Determining the no. of berths required for Harbor.	**1**	A3.4, A10.2
7	**Lectures:** • Determining the no. of berths required for Harbor. • Dredging and Land area of the Port.	**1**	A3.4, A10.2

Course: "Engineering applications in the marine environment HUF203"	
Program Competencies	**LOs**
A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.	**A3.1** Recognize the ethics and impacts of engineering solutions on society and the marine environment characteristics. **A3.2** Identify Suez Canal Marine Projects, Institutions and Authorities. **A3.3** Classify and identify the types of Ports and its master plans. **A3.4** Describe the different designs of port structures such as breakwaters and berths and the forces affected on them.
A7. Function efficiently as an individual and as a member of multi-disciplinary and multi-cultural teams.	**A7.1** Discuss Marine Engineering Applications and its Environment Pollution. **A7.2** Discuss the environmental effects of the bad planning of port master plan systems.
A10. Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.	**A10.1** Apply new knowledge and practice self about the engineering problems related to marine environment. **A10.2** Apply code of ministry of water resources and irrigation and international navigation code for designing Ports structures.

Course Coordinator: Prof. Dr. Heba El-Kilani

Assoc. Prof. /Elsayed Mohamed Galal

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information

Program Title	B.Sc. In Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department Responsible for the Course	Electrical Engineering		
Department offering the Program	Mechanical Power Engineering		
Course Code	HUF204		
Year/ Level	Second year- 2nd semester		
Specialization	Minor		
Teaching Hours	**Lectures**	**Tutorial**	**Practical/Lab.**
	2	-	-

2. Course Aims:

No.	Aim
1, 2	Provide the principles of environmental sciences, different types of pollutants, climate change and its impact on the environment, and environmental impact assessment for various institutions. It also provides the concept of Occupational safety and health and how to implement it in workplace and use of scientific information to prevent injuries and illnesses in workplace.

3. Learning Outcomes (LOs):

A4.1	Recognize the regulations and standards codes for occupational safety related to environmental issues.
A4.2	Discuss Occupational and Human health safety related to the different types of pollution, and methods of prevention.
A4.3	Define of the phenomenon of global warming, green houses, and predict future inviromenmtal hazards and their impact on the inveronment.
A6.1	Practice applying the quality assurance procedures in all environmental and occupational safety
A6.2	Apply appropriate steps to design safe systems at work and manage their risk in effective ways.
A6.3	Plan and implement techniques in professional manner to manage the risks of the most types of pollutions such as: air pollution, water pollution, chemical pollution, electromagnetic pollution.
A10.1	Identify multiple environmental factors, and their environmental impacts related to economic dimensions.
A10.2	Explore the methodes to treat environmental problems by following professional standereds, and the effects of these solutions on society.

4. Course Contents:

No.	Topic	Weeks
1	**Lecture:** Introduction to environmental science and occupational safety.	1
2	**Lecture:** Elements of environmental systems.	2
3	**Lecture:** Air pollutions, Chemical Pollution, Water Pollution, Pollution caused by acid rain and acid fog, Oil Pollution, Biological weapons, and mechanical methods to remove oil spills.	3-8
4	**Midterm Exam**	9
5	**Lecture:** Occupational and Human health and safety.	10-11
6	**Lecture:** The impact of climate change on the population.	12-13
7	**Lecture:** Assessing the environmental impact and occupational safety of industrial applications including all standard codes.	14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method														
		Face-to-Face Lecture	Online Lecture	Flipped Classroom	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Site visits	Self -learning and Research	Cooperative	Discovering	Modeling	Playing
A-Level	A4-1	x	x	x	x	x						x				
	A4-2	x	x	x	x	x						x				
	A4-3	x	x	x	x	x						x				
	A6-1	x	x	x	x	x						x				
	A6-2	x	x	x	x	x						x				
	A6-3	x	x	x	x	x				x		x				
	A10-1	x	x	x	x	x				x		x				
	A10-2	x	x	x	x	x						x				

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written/ online)	A4-1, A4-2, A6-1, A6-2
2	Tutorial, (report, discussions, and presentation assessmets)	A4-1, A4-2, A4-3, A6-1, A6-2, A10-1, A10-2
3	Final Term Examination (written)	A4-1, A4-2, A4-3, A6-1, A6-2, A10-1, A10-2

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written/ online)	9
2	Tutorial, (report, discussions, and presentation assessments)	Every week
3	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights
1	Mid Term Examination (written/ online)	10
2	Tutorial, report, discussions, and presentation assessments	10
3	Final Term Examination (written)	80
Total		100%

8. List of References

Essential Books (Text Books):	(1) تلوث البيئة في مصر –مبروك سعد النجار- الهيئة المصرية العامة للكتاب 1994 (2) التلوث مشكلة اليوم والغد- د.توفيق محمد قاسم-الهيئة المصرية العامة للكتاب1995 (3) التلوث الهوائي والبيئة – الجزء الأول-د.طلعت ابراهيم الاعوج – سلسلة العلم والحياة 1994 (4) الانسان وتلوث البيئة – محمد السيد أرناؤوط – الهيئة المصريةالعامة للكتاب 1999- (5) القانون رقم 4 لسنة 1994- بأصدار قانون في شأن حماية البيئة ولائحته التنفيذية جهاز شئون البيئة - القاهرة- 1999 (6) دليل أسس واجراءات تقييم التأثير البيئي-جهاز شئون البيئة – قطاع الادارة البيئة القاهرة-اكتوبر 1996 (7) التلوث الكهرومغناطيسي – د.عبد المقصود حجو – الهيئة المصرية العامة للكتاب 2005 السلامة والصحة المهنية – مصطفى حامد محمد الجندى **(8)** (9) أهداف ومفهوم السلامة والصحة المهنية والأحكام المنظمة لها (مقالات اكاديمية)- تعد بواسطة استاذ المقرر.
Recommended Text Books:	Eldon D. Enger, Bradley F. Smith, “Environmental Science, A study of Interrelationships”, PUBLISHER: McGraw-Hill, ISBN#: 97800-07-338327-9, 2018, 13th ed.

9. Facilities Required for Teaching and Learning:

No.	**Facility**
1	Lecture / Online Classroom
2	White Board
3	Data Show System
4	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aim	LOs
1	**Lecture:** Introduction to environmental science and occupational safety.	**1, 2**	A4.1, A6.1, A6.2, A6.3
2	**Lecture:** Elements of environmental systems.	**1, 2**	A6.1, A6.2, A6.3
3	**Lecture:** Air pollutions, Chemical Pollution, Water Pollution, Pollution caused by acid rain and acid fog, Oil Pollution, Biological weapons, and mechanical methods to remove oil spills.	**1, 2**	A4.2, A6.1, A6.2, A6.3
4	**Midterm Exam**	**1, 2**	A4.1, A4.2, A6.1, A6.2
5	**Lecture:** Occupational and Human health and safety.	**1, 2**	A6.1, A6.2, A6.3, A10.1, A10.2
6	**Lecture:** The impact of climate change on the population.	**1, 2**	A4.3, A6.1, A6.2, A6.3
7	**Lecture:** Assessing the environmental impact and occupational safety of industrial applications including all standard codes.	**1, 2**	A4.3, A6.1, A6.2, A6.3

Course: Environmental sciences and Professional safety	
Course Competencies	**LOs**
A4. Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues, and risk management principles.	**A4.1** Recognize the regulations and standards codes for occupational safety related to environmental issues. **A4.2** Discuss Occupational and Human health safety related to the different types of pollution, and methods of prevention. **A4.3** Define of the phenomenon of global warming, greenhouses, and predict future inviromenmtal hazards and their impact on the inveronment.
A6. Plan, supervise and monitor implementation of engineering projects, taking into consideration other trades requirements.	**A6.1** practice applying the quality assurance procedures in all environmental and occupational safety. **A6.2** Apply appropriate steps to design safe systems at work and manage their risk in effective ways. **A6.3** Plan and implement techniques in professional manner to manage the risks of the most types of pollutions such as: air pollution, water pollution, chemical pollution, electromagnetic pollution.
A10. Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.	**A10.1** Identify multiple environmental factors, and their environmental impacts related to economic dimensions. **A10.2** Explore the methodes to treat environmental problems by following professional standereds, and the effects of these solutions on society.

Course coordinator: Prof. Dr. Sobhy Serry

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

THIRD YEAR

1. Basic Information:

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Mechanical Power Engineering		
Course Code	**MPE322**		
Year/ Level	Third year – 1st semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	2	2	1

2. Course Aims:

No.	**Aims**
7	Acquire and apply the principles of analysis and evaluation for the performance and the operating behavior of different types of internal combustion engines.

3. Learning Outcomes (LOs):

A3.1	Apply the engineering design and requirements for the internal combustion engines operation.
A4.1	Describe contemporary technologies, health and safety requirements and environmental issues of fuels used in the internal combustion engines.
B1.1	Analyze the main components of the internal combustion engines and their cycles by applying the concepts of thermodynamics, heat transfer, fluid mechanics, combustion and automatic control principles.
B3.1	Select the conventional component for the internal combustion according to the required performance.
B4.1	Choose suitable fuel, lubricating oil, oil system and cooling method to design, build, operate, inspect, and maintain internal combustion engines.
C1.1	Recognize the operation and characteristics of the internal combustion engines.
C2.1	Analyze and evaluate the torque, power output and the performance of the internal combustion engines.
C4.1	Choose, apply and assess the newable and renewable energy resources in internal combustion engines fuels field.

4. Course Contents:

No.	Topics	Week
1	**Lecture:** • Heat engines. • Internal and external combustion engines. • Definition of the internal combustion engine. • Engines classifications. **Tutorials/Lab:** • Categorize the main engine components and classifications. • Conduct experiments on internal combustion engines types.	1
2	**Lecture:** • Terminology and abbreviations. • Engine components. • The internal combustion engines operation. **Tutorials/Lab:** • Categorize the main engine components and classifications. • Conduct experiments on internal combustion engines types.	2
3	**Lecture:** • Fuel air standard cycles. • Constant volume combustion fuel air cycle. **Tutorials/Lab:** • Solve problems on the air-standard cycles and fuel-air-standard cycles. • Conduct experiments on internal combustion engines operation.	3
4	**Lecture:** • Limited pressure fuel air cycle. • Actual cycles for internal combustion engines. **Tutorials/Lab:** • Solve problems on the air-standard cycles and fuel-air-standard cycles. • Conduct experiments on internal combustion engines operation.	4
5	**Lecture:** • Fuels for the internal combustion engines. • Requirements of the fuels. • Fuel classifications. **Tutorials/Lab:** • Solve problems on the fuel-air-standard cycles. • Conduct experiments on fuel properties.	5
6	**Lecture:** • Fuel characteristics. • Fuel properties. • Combustion of fuel. **Tutorials/Lab:** • Solve problems on the fuel chemical reaction and combustion.	6

	• Conduct experiments on fuel properties.	
7	**Lecture:** • Admission. • Admission in four stroke cycle Engine. • Major parameters influencing admission. • Charge efficiency or volumetric efficiency. **Tutorials/Lab:** • Solve problems on the charge efficiency. • Conduct experiments on charge efficiency for the internal combustion engines.	7
8	**Midterm Examination**	**8**
9	**Lecture:** • Factors affecting the volumetric efficiency. • Factors affecting the compression. • Pressure and temperature at the end of compression. **Tutorials/Lab:** • Solve problems on the charge efficiency. • Conduct experiments on charge efficiency for the internal combustion engines.	9
10	**Lecture:** • Engine testing. • Measurement of brake power. • Indicated power. • Willan’s line method. **Tutorials/Lab:** • Solve problems on the engine performance and efficiencies. • Conduct experiments on spark ignition and compression ignition engines operation and performance.	10
11	**Lecture:** • Morse test. • Motoring test. • Fuel consumption. • Measurement of air flow rate. **Tutorials/Lab:** • Solve problems on the engine performance and efficiencies. • Conduct experiments on spark ignition and compression ignition engines operation and performance.	11
12	**Lecture:** • Speed measurement. • Spark timing measurement. • Performance characteristics. • Heat balance sheet. **Tutorials/Lab:** • Solve problems on the engine performance and efficiencies.	12

	• Conduct experiments on spark ignition and compression ignition engines operation and performance.	
13	**Lecture:** • Cooling system. • Types of cooling. • Thermosiphon system. • Pump cooling. • Thermostat with pump. **Tutorials/Lab:** • Solve problems on the engine performance and efficiencies. • Conduct experiments on cooling system.	13
14	**Lecture:** • Lubrication system. • Significance of lubrication. • Lubrication in engine parts. • Lubrication systems. • Properties of lubricating oil. **Tutorials/Lab:** • Solve problems on the engine performance and efficiencies. • Conduct experiments on lubrication system.	14

5. Teaching and Learning Methods:

LOs		**Teaching and Learning Method**														
		Lecture	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A3.1**	x	x			x	x	x	x			x				x
	A4.1	x	x			x	x	x	x			x				x
B-Level	**B1.1**	x	x			x	x	x	x			x				x
	B3.1	x	x			x	x	x	x			x				x
	B4.1	x	x			x	x	x	x			x				x
C-Level	**C1.1**	x	x			x	x	x	x			x				x
	C2.1	x	x			x	x	x	x			x				x
	C4.1	x	x			x	x	x	x			x				x

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials and videos
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written)	A3.1, A4.1, B1.1, C1.1
2	Practical/ Oral Examination	A3.1, A4.1, B1.1, B3.1, B4.1, C1.1, C2.1, C4.1
3	Formative (quizzes - presentation - assignments …)	B1.1, B4.1, C1.1, C2.1, C4.1
4	Final Term Examination (written)	A3.1, A4.1, B1.1, B3.1, B4.1, C1.1, C2.1, C4.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	8
2	Practical/ Oral Examination	15
3	Formative (quizzes – presentation – assignments...)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	8
2	Practical/ Oral Examination	20
3	Formative (quizzes – presentation – assignments - …….)	12
4	Final Term Examination (written)	60
Total		100%

8. List of References:

No.	Reference List
1	Gupta H. N., "Fundamentals of Internal Combustion Engines", Rakamal Electric Press, Delhi, 2006.
2	Richard Stone, "Introduction to Internal Combustion Engines", Antony Rowe Ltd, Chippenham, Wiltshire, 1999.
3	S. Srinivasan, "Automotive Mechanics", Tata McGraw-Hill Publishing Company Limited, 2003.
4	Irvin Glassman, Richard A. Yetter, "Combustion", Elsevier, 2008.
5	Gad H. M., "Lectures in Internal Combustion Engines", Mechanical Power Eng. Dept., Port Said University, 2020.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture / Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aims	LOs
1	**Lecture:** • Heat engines. • Internal and external combustion engines. • Definition of the internal combustion engine. • Engines classifications. **Tutorials/Lab:** • Categorize the main engine components and classifications. • Conduct experiments on internal combustion engines types.	7	A3.1, B1.1, B3.1, C4.1
2	**Lecture:** • Terminology and abbreviations. • Engine components. • The internal combustion engines operation. **Tutorials/Lab:** • Categorize the main engine components and classifications. • Conduct experiments on internal combustion	7	A3.1, B1.1, B3.1, C1.1

	engines types.		
3	**Lecture:** - Fuel air standard cycles. - Constant volume combustion fuel air cycle. **Tutorials/Lab:** - Solve problems on the air-standard cycles and fuel-air-standard cycles. - Conduct experiments on internal combustion engines operation.	7	A3.1, B1.1, C1.1
4	**Lecture:** - Limited pressure fuel air cycle. - Actual cycles for internal combustion engines. **Tutorials/Lab:** - Solve problems on the air-standard cycles and fuel-air-standard cycles. - Conduct experiments on internal combustion engines operation.	7	A3.1, B1.1, C1.1
5	**Lecture:** - Fuels for the internal combustion engines. - Requirements of the fuels. - Fuel classifications. **Tutorials/Lab:** - Solve problems on the fuel-air-standard cycles. - Conduct experiments on fuel properties.	7	A3.1, A4.1, B4.1, C4.1
6	**Lecture:** - Fuel characteristics. - Fuel properties. - Combustion of fuel. **Tutorials/Lab:** - Solve problems on the fuel chemical reaction and combustion. - Conduct experiments on fuel properties.	7	A3.1, A4.1, B4.1, C4.1
7	**Lecture:** - Admission. - Admission in four stroke cycle Engine. - Major parameters influencing admission. - Charge efficiency or volumetric efficiency. **Tutorials/Lab:** - Solve problems on the charge efficiency. - Conduct experiments on charge efficiency for the internal combustion engines.	1, 2	A3.1
8	**Midterm Examination**	7	A3.1, A4.1, B1.1, C1.1
9	**Lecture:**	7	A3.1

	• Factors affecting the volumetric efficiency. • Factors affecting the compression. • Pressure and temperature at the end of compression. **Tutorials/Lab:** • Solve problems on the charge efficiency. • Conduct experiments on charge efficiency for the internal combustion engines.		
10	**Lecture:** • Engine testing. • Measurement of brake power. • Indicated power. • Willan's line method. **Tutorials/Lab:** • Solve problems on the engine performance and efficiencies. • Conduct experiments on spark ignition and compression ignition engines operation and performance.	7	A3.1, B3.1, C1.1, C2.1
11	**Lecture:** • Morse test. • Motoring test. • Fuel consumption. • Measurement of air flow rate. **Tutorials/Lab:** • Solve problems on the engine performance and efficiencies. • Conduct experiments on spark ignition and compression ignition engines operation and performance.	7	A3.1, B3.1, C1.1, C2.1
12	**Lecture:** • Speed measurement. • Spark timing measurement. • Performance characteristics. • Heat balance sheet. **Tutorials/Lab:** • Solve problems on the engine performance and efficiencies. • Conduct experiments on spark ignition and compression ignition engines operation and performance.	7	A3.1, B3.1, C1.1, C2.1
13	**Lecture:** • Cooling system. • Types of cooling. • Thermosiphon system.	7	A3.1, B3.1, B4.1

	• Pump cooling. • Thermostat with pump. **Tutorials/Lab:** • Solve problems on the engine performance and efficiencies. • Conduct experiments on cooling system.		
14	**Lecture:** • Lubrication system. • Significance of lubrication. • Lubrication in engine parts. • Lubrication systems. • Properties of lubricating oil. **Tutorials/Lab:** • Solve problems on the engine performance and efficiencies. • Conduct experiments on lubrication system.	7	A3.1, B3.1, B4.1

Course: Internal Combustion Engines	
Program Competencies	**Course LOs**
A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical, and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.	**A3.1** Apply the engineering design and requirements for the internal combustion engines operation.
A4. Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues, and risk management principles.	**A4.1** Describe contemporary technologies, health and safety requirements and environmental issues of fuels used in the internal combustion engines.
B1. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, Solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.	**B1.1** Analyze the main components of the internal combustion engines and their cycles by applying the concepts of thermodynamics, heat transfer, fluid mechanics, combustion and automatic control principles.
B3. Select conventional mechanical equipment according to the required performance.	**B3.1** Select the conventional component for the internal combustion according to the required performance.
B4. Adopt suitable national and international standards and codes; and integrate legal, economic and financial aspects to: design, build, operate, inspect and maintain mechanical equipment and systems.	**B4.1** Choose suitable fuel, lubricating oil, oil system and cooling method to design, build, operate, inspect, and maintain internal combustion engines.
C1. Recognize the design concepts, operation and	**C1.1** Recognize the operation and

characteristics of the internal combustion engines, boilers, heat exchangers, turbomachines and hydraulic machines.	characteristics of the internal combustion engines.
C2. Analyze, evaluate and enhance the performance of the HVAC systems, automatic control systems, pneumatic systems, hydraulic Systems, combustion systems, thermal and nuclear power plants.	**C2.1** Analyze and evaluate the torque, power output and the performance of the internal combustion engines.
C4. Choose, apply and assess the newable and renewable energy resources in water desalination, power generation, heating, cooling and air conditioning applications.	**C4.1** Choose, apply and assess the newable and renewable energy resources in internal combustion engines fuels field.

Course Coordinator: Associate Prof. Hamada Mohamed Gad

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information:

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Mechanical Power Engineering		
Course Code	**MPE323**		
Year/ Level	third year- 1st semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	2	2	1

2. Course aims:

No.	Aims
6, 7	Recognize and apply the principles of the heat transfer science in designing and analysis of different mechanical engineering applications such as boilers, condenser, and heat exchangers.

3. Learning Outcomes (LOs):

A1.1	Define the relation of convection heat transfer to thermodynamics and fluid dynamics.
A1.2	Apply the knowledge of mathematics (differential equations) and thermodynamics (conservation of energy) to derive the differential equation that govern convection transfer for different geometries.
A1.3	Solve engineering problem by applying engineering fundamentals, basic science and mathematics.
A3.1	Produce a cost-effective approach, taking into account economic and global requirements to select control the heat and mass transfer rates.
B1.1	Discuss the thermal performance of shell and tube heat exchangers and double-pipe heat exchanger by applying the concepts of heat transfer.
B1.2	Analyze the convection internal and external flow within heat exchangers using various convection correlations.
C1.1	Show the various classification of heat exchanger equipment and its components.
C1.2	Identify methodologies for designing a heat exchanger or for predicting the performance of an existing exchanger operating under prescribed conditions.
C3.1	Identify the performance parameters for assessing the efficiency of various heat exchanger and judge the optimal selection.
C5.1	Select the suitable solution methods for convection problems analytically and numerically based on the governing momentum, energy, and species conservation equations together with the boundary conditions.

4. Course Contents:

No.	Topics	Week
1	**Lecture:** • **Introduction to convection** o Classification of fluid flows o Fundamental transport processes o Mass transfer and fick law o Various boundary layers. o Local and average convection coefficient. **Tutorials/Lab:** • Solve problems on heat transfer coefficients and mass transfer coefficients • Conduct experiment on wind tunnel to determine the convection heat transfer coefficient	1
2	**Lecture:** • **Introduction to convection** o The boundary layer equations o Boundary layer similarity parameters o Physical Interpretation of the dimensionless parameters **Tutorials/Lab:** • Solve problems on boundary layer transition and similarity and dimensionless parameters • Conduct experiment on wind tunnel to evaluate the effect of flow rate on forced convection heat transfer coefficient	2
3	**Lecture:** • **Introduction to convection** o Boundary layers analogies o Evaporative cooling o The Reynolds analogy **Tutorials/Lab:** • Solve problems on boundary layers analogies, evaporative cooling and The Reynolds analogy • Conduct experiments on steam turbine power plant to investigate the effect of the boiler pressure and fuel mass flow rate on the torque of the turbine.	3
4	**Lecture:** • **Forced convection external flow** o The empirical method, flow over a flat plate. **Tutorials/Lab:** • Solve problems on flat plate in parallel flow • Conduct experiments to determine the convection heat transfer coefficient on flat plate	4
5	**Lecture:** • **Forced convection external flow**	5

	o Flow over a cylinder and sphere, flow across a tube bank. **Tutorials/Lab:** • Solve problems on flow across a tube bank to determine the geometry and the exit temperature of the flow • Conduct experiments to determine the convection heat transfer coefficient on flat plate	
6	**Lecture:** • **forced convection: internal flow** o Hydrodynamic consideration for internal flow, velocity and thermal boundary layers. **Tutorials/Lab:** • Solve problems on hydrodynamic considerations for internal flow and heat transfer correlations for circular Tubes • Conduct experiments on wind tunnel determine the convection heat transfer coefficient on for flow inside duct	6
7	**Lecture:** • **Forced convection: internal flow** o Laminar flow in circular tubes, convection correlations. o Convection mass transfer in circular tubes **Tutorials/Lab:** • Solve problems on convection correlations for internal flow Convection mass transfer in circular tubes • Conduct experiments on wind tunnel determine the convection heat transfer coefficient on for flow inside duct	7
8	**Midterm Examination**	**8**
9	**Lecture:** • **Natural convection** o Laminar free convection on a vertical plate o Empirical correlations for free convection. o Natural Convection from Finned Surfaces and PCBs o Natural Convection inside Enclosures **Tutorials/Lab:** • Solve problems on empirical correlations for free convection • Conduct experiments to determine the natural convection heat transfer coefficient for flow over flat plate	9
10	**Lecture:** • **Heat transfer equipment** o Classification of Heat Transfer Equipment ▪ According to heat transfer process ▪ According to Flow Arrangements ▪ According to Surface Compactness ▪ According to Construction **Tutorials/Lab:** • Solve problems on classification of heat transfer equipment. • Conduct experiments to determine the natural convection heat transfer coefficient for flow over flat plate	10

11	**Lecture:** • **Heat transfer equipment** o The overall heat-transfer coefficient o Fouling factor o Allocation of streams **Tutorials/Lab:** • Solve problems on evaluation the overall heat-transfer coefficient • Perform experiments on a heat exchanger to determine the over overall heat-transfer coefficient	11
12	**Lecture:** • **Heat transfer equipment** o Basic design equations of heat transfer equipment ▪ The log-mean temperature difference (LMTD) Method **Tutorials/Lab:** • Solve problems on evaluation the log-mean temperature difference (LMTD) Method • Make a preliminary design calculation to estimate the heat-transfer surface area required in the heat exchanger. • Perform experiments on a heat exchanger to evaluate the over overall heat-transfer coefficient	12-13
13	**Lecture:** • **Heat transfer equipment** o Basic design equations of heat transfer equipment ▪ Effectiveness (ε)-number of transfer unit (NTU), ε-NTU method o Thermal Analysis of double-pipe exchangers **Tutorials/Lab:** • Solve problems on evaluation effectiveness (ε)-number of transfer unit (NTU), ε-NTU method • Perform experiments on a heat exchanger to evaluate the over overall heat-transfer coefficient	14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method														
		Lecture	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A1.1**	x	x			x	x	x	x			x				
	A1.2	x	x			x	x	x	x			x				
	A1.3	x	x			x	x	x	x			x				
	A3.1	x	x			x	x	x	x			x				x
B-Level	**B1.1**	x	x			x	x	x	x			x				x
	B1.2	x	x			x	x	x	x			x				
C-Level	**C1.1**	x	x			x	x	x	x			x			x	
	C1.2	x	x			x	x	x	x			x			x	x
	C3.1	x	x			x	x	x	x			x				x
	C5.1	x	x			x	x	x	x			x				

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials and videos
2	Online lectures and assignments

7. Student Assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written)	A1.2, A1.3, A3.1, B1.2
2	Practical/ Oral Examination	A1.1, A1.2, A1.3, A3.1, C1.1, C1.2, C3.1, C5.1
3	Formative (quizzes - presentation - assignments …)	A1.1, A1.2, A1.4, A3.1, B1.1, B1.2, C1.1, C1.2, C3.1, C5.1
4	Final Term Examination (written)	A1.1, A1.2, A1.3, A3.1, B1.1, B1.2, C1.1, C1.2, C3.1, C5.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	8
2	Practical/ Oral Examination	15
3	Formative (quizzes – presentation – assignments...)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	12
2	Practical/ Oral Examination	20
3	Formative (quizzes – presentation – assignments - …….)	8
4	Final Term Examination (written)	60
Total		100%

8. List of References

No.	Reference List
1	Frank P. Incropera and David P. DeWitt, "Introduction to Heat Transfer," 8th Edition, 2011,Published by John Wiley & Sons, Inc., New York. .
2	J. P. Holman, "Heat Transfer," 10th Edition, 2010, Published by McGraw-Hill,.
3	Cengel A .Y. "Heat transfer A Practical Approach" 2nd edition ,2002, Published by McGraw-Hill, New York

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture / Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	aims	LOs
1	**Lecture:** • **Introduction to convection** ○ Classification of Fluid Flows ○ Fundamental Transport Processes ○ Mass transfer and fick law ○ Various Boundary layers. ○ local and average convection coefficient. **Tutorials/Lab:** • Solve problems on Heat Transfer Coefficients and Mass Transfer Coefficients • Conduct experiment on wind tunnel to determine the convection heat transfer coefficient	6	A1.1, A1.2, A1.3, A3.1, C5.1
2	**Lecture:** • **Introduction to convection** ○ The boundary layer equations ○ Boundary layer similarity parameters ○ Physical Interpretation of the dimensionless parameters **Tutorials/Lab:** • Solve problems on boundary layer transition and similarity and dimensionless parameters • Conduct experiment on wind tunnel to evaluate the effect of flow rate on forced convection heat transfer coefficient •	6	A1.1, A1.2, A1.3, A3.1, C5.1
3	**Lecture:** • **Introduction to convection** ○ Boundary layers analogies ○ Evaporative cooling ○ The Reynolds analogy	6	A1.1, A1.2, A1.3, A3.1, B1.2, C5.1

	Tutorials/Lab: - Solve problems on boundary layers analogies, evaporative cooling and The Reynolds analogy - Conduct experiments on steam turbine power plant to investigate the effect of the boiler pressure and fuel mass flow rate on the torque of the turbine.		
4	**Lecture:** - **Forced convection external flow** o The empirical method, flow over a flat plate. **Tutorials/Lab:** - Solve problems on flat plate in parallel flow - Conduct experiments to determine the convection heat transfer coefficient on flat plate	6	A1.1, A1.2, A1.3, A3.1, B1.2, C5.1
5	**Lecture:** - **Forced convection external flow** o Flow over a cylinder and sphere, flow across a tube bank. **Tutorials/Lab:** - Solve problems on flow across a tube bank to determine the geometry and the exit temperature of the flow - Conduct experiments to determine the convection heat transfer coefficient on flat plate	6	A1.1, A1.2, A1.3, A3.1, B1.2, C5.1
6	**Lecture:** - **forced convection: internal flow** o Hydrodynamic consideration for internal flow, velocity and thermal boundary layers. **Tutorials/Lab:** - Solve problems on hydrodynamic considerations for internal flow and heat transfer correlations for circular Tubes - Conduct experiments on wind tunnel determine the convection heat transfer coefficient on for flow inside duct	6	A1.1, A1.2, A1.3, A3.1, B1.2, C5.1
7	**Lecture:** - **Forced convection: internal flow** o Laminar flow in circular tubes, convection correlations. o Convection mass transfer in circular tubes **Tutorials/Lab:** - Solve problems on convection correlations for	6	A1.1, A1.2, A1.3, A3.1, B1.2, C5.1

	internal flow Convection mass transfer in circular tubes - Conduct experiments on wind tunnel determine the convection heat transfer coefficient on for flow inside duct		
8	**Midterm Examination**	6	A1.1, A1.2, A1.3, A3.1, B1.2, C5.1
9	**Lecture:** - **Natural convection** o Laminar free convection on a vertical plate o Empirical correlations for free convection. o Natural Convection from Finned Surfaces and PCBs o Natural Convection inside Enclosures **Tutorials/Lab:** - Solve problems on Empirical correlations for free convection - Conduct experiments to determine the natural convection heat transfer coefficient for flow over flat plate	6	A1.1, A1.2, A1.3, A3.1, B1.2, C5.1
10	**Lecture:** - **Heat transfer equipment** o Classification of Heat Transfer Equipment ▪ according to heat transfer process ▪ According to Flow Arrangements ▪ According to Surface Compactness ▪ According to Construction **Tutorials/Lab:** - Solve problems on classification of heat transfer equipment - Conduct experiments to determine the natural convection heat transfer coefficient for flow over flat plate	6	A1.1, A1.2, A1.3, A3.1, C1.1, C1.2 C3.1, C5.1
11	**Lecture:** - **Heat transfer equipment** o The overall heat-transfer coefficient o Fouling factor	7	A1.1, A1.2, A1.3, A3.1, B1.2, C1.2, C3.1, C5.1

	○ Allocation of streams **Tutorials/Lab:** - Solve problems on evaluation the overall heat-transfer coefficient - Perform experiments on a heat exchanger to determine the over overall heat-transfer coefficient		
12	**Lecture:** - **Heat transfer equipment** ○ Basic design equations of heat transfer equipment ▪ The log-mean temperature difference (LMTD) Method **Tutorials/Lab:** - Solve problems on evaluation the log-mean temperature difference (LMTD) Method - Make a preliminary design calculation to estimate the heat-transfer surface area required in the heat exchanger. - Perform experiments on a heat exchanger to evaluate the over overall heat-transfer coefficient	7	A1.1, A1.2, A1.3, A3.1, B1.2, C1.2 C3.1, C5.1
13	**Lecture:** - **Heat transfer equipment** ○ Basic Design Equations of heat transfer equipment ▪ Effectiveness (ε)-number of transfer unit (NTU), ε-NTU method ○ Thermal Analysis of double-pipe exchangers **Tutorials/Lab:** - Solve problems on evaluation effectiveness (ε)-number of transfer unit (NTU), ε-NTU method - Perform experiments on a heat exchanger to evaluate the over overall heat-transfer coefficient	7	A1.1, A1.2, A1.3, A3.1, B1.2, B2.2, C1.2 C3.1, C5.1

Course: Heat and Mass Transfer	
Program Competencies	**Course LOs**
A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.	**A1.1** Define the relation of convection heat transfer to thermodynamics and fluid dynamics. **A1.2** Apply the knowledge of mathematics (differential equations) and thermodynamics (conservation of energy) to derive the differential equation that govern convection transfer for different geometries. **A1.3** Solve engineering problem by applying engineering fundamentals, basic science and mathematics.
A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.	**A3.1** Produce a cost-effective approach, taking into account economic and global requirements to select control the heat and mass transfer rates.
B1. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, Solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.	**B1.1** Discuss the thermal performance of shell and tube heat exchangers and double-pipe heat exchanger by applying the concepts of heat transfer. **B1.2** Analyze the convection internal and external flow within heat exchangers using various convection correlations.
C1. Recognize the design concepts, operation and characteristics of the internal combustion engines, boilers, heat exchangers, turbomachines, and hydraulic machines.	**C1.1** Show the various classification of heat exchanger equipment and its components. **C1.2** Identify methodologies for designing a heat exchanger or for predicting the performance of an existing exchanger operating under prescribed conditions.
C3. Judge the optimal solution according to the	**C3.1** Identify the performance

constraints of operation, costs, safety, reliability, and environmental impacts.	parameters for assessing the efficiency of various heat exchanger and judge the optimal selection.
C5. Select appropriate solutions for mechanical power engineering problems based on analytical and numerical techniques.	**C5.1** Select the suitable solution methods for convection problems analytically and numerically based on the governing momentum, energy, and species conservation equations together with the boundary conditions.

Course Coordinator: Prof. Dr. Kamal Morad

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information:

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Mechanical Power Engineering		
Course Code	**MPE324**		
Year/ Level	Third year- 1st semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	2	2	

2. Course Aims:

No.	**Aims**
7	Provide the students the fundamental principles of the design and operation of the components utilized in conventional industrial and smart vibration systems.

3. Learning Outcomes (LOs):

A1.1	Show the concepts of mechanical vibrations theory.
A1.2	Distinguish between the different types of vibration systems.
A1.3	Solve engineering problems by applying mechanical vibration fundamentals.
B1.1	Formulate the mathematical differential equations and modeling schemes to derive the mathematical form of dynamic systems.
B1.2	Recognize and analyze the components used in the design of vibration systems.
C5.1	Select appropriate solutions for mechanical vibration systems based on analytical techniques.

4. Course Contents:

No.	Topics	Week
1	**Lecture:** • Introduction, definitions, and basic of vibrations.. **Tutorials:** • Solve problems on dynamics and mathematics.	1
2	**Lecture:** • Vibration and their classifications. **Tutorials:** • Solve problems on classifications of different types of vibrations	2
3	**Lecture:** • Free vibration **Tutorials:** • Solve problems on free vibrations	3
4	**Lecture:** • Forced vibrations (Harmonic and periodic) **Tutorials:** • Solve problems on harmonics and periodic	4-5
5	**Lecture:** Forced vibrations **Tutorials:** • Solve problems on forced vibrations	6
6	**Lecture:** • Transient vibrations. **Tutorials:** • Solve problems on transient vibrations	7
7	**Midterm Examination**	**8**
8	**Lecture:** • Two degree of freedom system – Multi degree of freedom system **Tutorials:** • Solve problems on two degree of freedom system	9-10
9	**Lecture:** • Two degree of freedom system – Multi degree of freedom system **Tutorials:** • Solve problems on multi degree of freedom system	11
10	**Lecture:** • Vibration measurements. **Tutorials:** • Solve problems on vibration measurements.	12
11	**Lecture:** • Application to useful mechanical vibrating systems. **Tutorials/** • Application to useful mechanical vibrating systems.	13-14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method														
		Lecture	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A1.1**	x	x			x	x		x							
	A1.2	x	x			x	x	x	x							
B-Level	**B1.1**	x	x			x	x	x	x			x				
	B1.2	x	x			x	x	x				x				
C-Level	**C5.1**	x	x			x	x	x	x			x				

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials and videos
2	Online lectures and assignments

7. Student Assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written)	A1.1, A1.2, A1.3, B1.1, B1.2, C5.1
2	Practical/ Oral Examination	A1.1, A1.2, B1.1, B1.2, C5.1
3	Formative (quizzes - presentation - assignments)	A1.2, A1.3, B1.1, C5.1
4	Final Term Examination (written)	A1.1, A1.2, A1.3, B1.1, B1.2, C5.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	8
2	Practical/ Oral Examination	15
3	Formative (quizzes – presentation – assignments...)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	10
2	Practical/ Oral Examination	--
3	Formative (quizzes – presentation – assignments - …….)	20
4	Final Term Examination (written)	70
Total		100%

8. List of References:

No.	Reference List
1	Rao, S. S. “Mechanical Vibrations in SI Units,” 6th Edition, Addison-Wesley publishing Co., 2017.
2	Thomson, W. T. and Dahleh, M. D., “Theory of Vibration with Applications,” Prentice Hall, 1997.
3	S.Graham Kelly, “Fundamentals Of Mechanical Vibrations”, second edition,McGraw Hill, 2000.
4	J.M. Krodkiewski, “MECHANICAL VIBRATION Notes”, The University of Melbourne, Department of Mechanical and Manufacturing Engineering, 2008.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture / Online Classroom
2	White Board
3	Data Show System
4	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aims	LOs
1	**Lecture:** • Introduction, definitions, and basic of vibrations. **Tutorials:** • Solve problems on dynamics and mathematics.	7	A1.1, A1.2, A1.3, B1.1
2	**Lecture:** • Vibration and their classifications. **Tutorials:** • Solve problems on classifications of different types of vibrations	7	A1.1, A1.2, A1.3, B1.1, C5.1
3	**Lecture:** • Free vibration **Tutorials:** • Solve problems on free vibrations	7	A1.1, A1.3, B1.1, C5.1
4	**Lecture:** • Forced vibrations (Harmonic and periodic) **Tutorials:** • Solve problems on harmonics and periodic	7	A1.1, A1.2, A1.3, B1.1, C5.1
5	**Lecture:** Forced vibrations **Tutorials:** • Solve problems on forced vibrations	7	A1.2, A1.3, B1.1, B1.2, C3.1
6	**Lecture:** • Transient vibrations. **Tutorials:** • Solve problems on transient vibrations	7	A1.2, B1.1, B1.2, C5.1
7	**Midterm Exam**.	7	A1.1, A1.2, A1.3, B1.1, B1.2, C5.1
8	**Lecture:** • Two-degree of freedom system and Multi-degree of freedom system. **Tutorials:** • Solve problems on two-degree of freedom system.	7	A1.3, B1.1, B1.2, C5.1
9	**Lecture:** • Two-degree of freedom system and Multi-degree of freedom system **Tutorials:** • Solve problems on multi-degree of freedom system	7	A1.2, A1.3, B1.1, B1.2, C5.1
10	**Lecture:** • Vibration measurements. **Tutorials:** • Solve problems on vibration measurements.	7	A1.1 , A1.2, A1.3, B1.1, B1.2, C5.1

11	**Lecture:** - Application of useful mechanical vibrating systems. **Tutorials/** - Solve problems on practical mechanical vibrating systems.	7	A1.1, A1.2, A1.3, B1.1, B1.2, C5.1

Course: Mechanical Vibrations	
Program Competencies	**Course LOs**
A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics	**A1.1** Show the concepts of mechanical vibrations theory. **A1.2** Distinguish between the different types of vibration systems. **A1.3** Solve engineering problems by applying mechanical vibration fundamentals.
B1. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, Solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.	**B1.1** Formulate the mathematical differential equations and modeling schemes to derive the mathematical form of dynamic systems. **B1.2** Recognize and analyze the components used in the design of vibration systems.
C5. Select appropriate solutions for mechanical power engineering problems based on analytical and numerical techniques.	**C5.1** Select appropriate solutions for mechanical vibration systems based on analytical techniques.

Course Coordinator: Dr. Gamal Abbass Zaghloul

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information

Program Title	B. Sc. in Mechanical Power Engineering		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Mechanical Power Engineering		
Course Code	**MPE326**		
Year/ Level	Third year – 1st semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	-------	--------	2

2. Course aims:

No.	Aims
3, 5	Apply engineering knowledge and skill, adapt them in a particular work environment, and provide practical skills in Labor market and in writing engineering technical reports.

3. Learning Outcomes (LOs):

A5.1	Show different types of engineering problems.
A6.1	Describe the main parameters affecting the performance of the tranning.
A7.1	Collaborate with other as a member of multi-disciplinary and multicultural teams.
A8.1	Share ideas from different resources such as textbooks, journals, and internet to develop new ideas in the tranning.
A9.1	Lead and motivate individuals to anticipate and respond to new situations in tranning.
A10.1	Categorize new knowledge; and practice self, lifelong and other learning strategies in the tranning.
B4.1	Analyze and interpret the data available in organization of the training using suitable national and international standards and codes.
C1.1	Exchange knowledge with engineering community and industry to develop the training.
C7.1	Prepare engineering drawings, computer graphics and technical reports for the training.

4. Course Contents:

No.	Topics	Week
1	• **Training in an industrial or an engineering organization and preparing a technical report.**	1-8
3	• **Preparing a presentation and Discussion**	In the second week of the first semester

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method														
		Lecture	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A5.1**				x	x					x	x				x
	A6.1				x	x					x	x				x
	A7.1				x	x					x	x				x
	A8.1				x	x					x	x				x
	A9.1				x	x					x	x				x
	A10.1				x	x					x	x				x
B-Level	**B4.1**				x	x					x	x				x
C-Level	**C1.1**				x	x					x	x				x
	C7.1				x	x					x	x				x

6. Teaching and Learning Methods of Disable Students:

No.	**Teaching Method**
1	Additional Tutorials and videos
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	**Assessment Method**	**LOs**
1	Mid Term Examination (written)	-------------------------
2	Practical/ Oral Examination	--------------------------
3	Formative (quizzes - presentation - assignments)	------------------------
4	Final Term Examination (Oral Discussion)	A5.1, A6.1, A7.1, A8.1, A9.1, A10.1, B4.1, C1.1, C7.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	--------
2	Practical/ Oral Examination	---------
3	Formative (quizzes – presentation – assignments)	-----------
4	Final Term Examination (Oral Discussion)	Decided by department Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Supervisor group assessment	10
2	Supervisor individual assessment	20
3	Examiner individual assessment	20
4	Examiner final report	50
Total		100%

8. List of References

No.	Reference List
1	Essential Books (Text Books)
2	Training Notes
3	Recommended books

9. Facilities Required for Teaching and Learning:

No.	Facility
1	An industrial or an engineering organization

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aims	LOs
1	• **Training in an industrial or an engineering organization and preparing a technical report.**	3, 5	A5.1, A6.1, A7.1, A9.1, A10.1, C1.1
2	• **Preparing a presentation and discussion**	5	A6.1, A8.1, A10.1, B4.1, C7.1

Course: Summer Training (2)	
Program Competencies	**Course LOs**
A5. Practice research techniques and methods of investigation as an inherent part of learning.	**A5.1** Show different types of engineering problems.
A6. Plan, supervise and monitor implementation of engineering projects , taking into consideration other trades requirements.	**A6.1** Describe the main parameters affecting the performance of the training.
A7. Function efficiently as an individual and as a member of multi-disciplinary and multicultural teams.	**A7.1** Collaborate with other as a member of multi-disciplinary and multicultural teams.
A8. Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools.	**A8.1** Share ideas from different resources such as textbooks, journals, and internet to develop new ideas in the training.
A9. Use creative, innovative and flexible thinking and acquire entrepreneurial and leadership skills to anticipate and respond to new situations.	**A9.1** Lead and motivate individuals to anticipate and respond to new situations in training.
A10. Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.	**A10.1** Categorize new knowledge; and practice self, lifelong and other learning strategies in the training.
B4. Adopt suitable national and international standards and codes; and integrate legal, economic and financial aspects to: design, build, operate, inspect and maintain mechanical equipment and systems.	**B4.1** Analyze and interpret the data available in organization of the training using suitable national and international standards and codes.
C1. Recognize the design concepts, operation and characteristics of internal combustion engines, boilers, heat exchangers, turbomachines and hydraulic machines.	**C1.1** Exchange knowledge with engineering community and industry to develop the training.
C7. Exchange knowledge and skills with engineering community and industries; prepare the presentations and technical reports.	**C7.1** Prepare engineering drawings, computer graphics and technical reports for the training.

Course Coordinator: Ass. Prof. Ibrahim Abdel-Rahman

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information:

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Mechanical Power Engineering		
Course Code	**HUD303**		
Year/ Level	Third year- 1st semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	2	-	-

2. Course Aims:

No.	Aims
2, 8	Relate students with the national and international standards and codes related to occupational safety, basic types of risks and methods of preventions and safety errands.

3. Learning Outcomes (LOs):

A4.1	Utilize contemporary codes of practice and standards, such as OSHA and Egyptian Labor Code and quality guidelines, health and safety requirements, environmental issues and risk management principles.
B4.1	Adopt suitable national and international standards and codes, OSHA and Egyptian Labor Code, to operate, inspect and maintain mechanical equipment and systems.

4. Course Contents:

No.	Topics	Week
1	**Lecture:** • Introduction • Occupational safety objectives • labor code	1
2	**Lecture:** • Introduction to OSHA • Occupational safety and health standards CFR29	2
3	**Lecture:** • Types of risks • (engineering- physical -biological- chemical- electrical)	3
4	**Lecture:** • Personal preventive Errands types security symbols	4
5	**Lecture:** • Recording and reporting occupational injuries and illnesses • Examples	5
6	**Lecture:** • Fire hazard, NFPA and OSHA standards	6

	- Protective methods and safety precautions.	
7	**Lecture:** - Fire hazard in oil and natural gas plants. - Protective methods and safety precautions.	7
8	**Midterm Examination**	**8**
9	**Lecture:** - Electricity hazards and preventive methods	9
10	**Lecture:** - Safety instruction in thermal power plants - Types of risks in thermal power plant - Environmental impact in thermal power plants	10
11	**Lecture:** - Environmental impact in thermal power plants - Emissions and filters and chemical treatments - Noise – material handling and storage	11
12	**Lecture:** - Chemical Hazard Communication - Material Safety Data Sheets - Flammable and combustible liquids	12
13	**Lecture:** - Cranes safety - Sling safety.	13
14	**Lecture:** - Radiation Safety - Types of radiation - Cautions for radioactive materials and radiation	14

5. Teaching and Learning Methods:

LOs		**Teaching and Learning Method**														
		Lecture	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A4.1**	x	x		x	x							x			
B-Level	**B4.1**	x	x		x	x						x	x			

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional videos
2	Online lectures and assignments

7. Student Assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written)	A4.1, B4.1
2	Practical/ Oral Examination	----
3	Formative (quizzes - presentation - assignments)	A4.1, B4.1
4	Final Term Examination (written)	A4.1, B4.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	8
2	Practical/ Oral Examination	-
3	Formative (quizzes – presentation – assignments)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	10
2	Practical/ Oral Examination	-
3	Formative (quizzes – presentation – assignments)	10
4	Final Term Examination (written)	80
Total		100%

8. List of References:

No.	Reference List
1	A. M. Arafat, “Course notes: Notes on Safety of Mechanical Equipements,” Mechanical Power Engineering Dept., 2015.
2	Gupta, A., "Industrial safety and Environment”, Firewall Media, 2006.
3	Mark Friend and James Kohn, “Fundamentals of Occupational Safety and Health”, 4th Edition, The Scarecrow Press, UK, 2007.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture/Online Classroom
2	White Board
3	Data Show System
4	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aims	LOs
1	**Lecture:** • Introduction • Occupational safety objectives • labor code	2	A4.1, B1.1
2	**Lecture:** • Introduction to OSHA • Occupational safety and health standards CFR29	2, 8	A4.1, B1.1
3	**Lecture:** • Types of risks • (engineering- physical -biological- chemical-electrical)	2	A4.1, B1.1
4	**Lecture:** • Personal preventive Errands types security symbols	2, 8	A4.1, B1.1
5	**Lecture:** • Recording and reporting occupational injuries and illnesses • Examples	2	A4.1, B1.1
6	**Lecture:** • Fire hazard, NFPA and OSHA standards • Protective methods and safety precautions.	2, 8	A4.1, B1.1
7	**Lecture:** • Fire hazard in oil and natural gas plants. • Protective methods and safety precautions.	2	A4.1, B1.1
8	**Midterm Examination**	2, 8	A4.1, B1.1
9	**Lecture:** • Electricity hazards and preventive methods	2	A4.1, B1.1
10	**Lecture:** • Safety instruction in thermal power plants • Types of risks in thermal power plant • Environmental impact in thermal power plants	2	A4.1, B1.1
11	**Lecture:** • Environmental impact in thermal power plants • Emissions and filters and chemical treatments • Noise – material handling and storage	2	A4.1, B1.1

12	**Lecture:** - Chemical Hazard Communication - Material Safety Data Sheets - Flammable and combustible liquids	2	A4.1, B1.1
13	**Lecture:** - Cranes safety - Sling safety.	2	A4.1, B1.1
14	**Lecture:** - Radiation Safety - Types of radiation - Cautions for radioactive materials and radiation	2	A4.1, B1.1

Course: Security and Safety of Mechanical Equipment	
Program Competencies	**Course LOs**
A4. Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues and risk management principles.	**A4.1** Utilize contemporary codes of practice and standards, such as OSHA and Egyptian Labor Code and quality guidelines, health and safety requirements, environmental issues and risk management principles.
B4. Adopt suitable national and international standards and codes; and integrate legal, economic and financial aspects to: design, build, operate, inspect and maintain mechanical equipment and systems.	**B4.1** Adopt suitable national and international standards and codes: OSHA and Egyptian Labor Code; and integrate legal, economic and financial aspects to operate, inspect and maintain mechanical equipment and systems.

Course Coordinator: Dr. Amany Mahmoud Arafat Saif

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information

Program Title	B.Sc. In Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department Responsible for the Course	Mechanical Power Engineering		
Department offering the Program	Mechanical Power Engineering		
Course Code	**HUU305**		
Year/ Level	Third level – 1st semester		
Specialization	Minor		
Teaching Hours	Lectures	Tutorial	Practical
	2	---	---

2. Course Aims:

No.	**Aim**
3	Work in and lead a heterogeneous team and display leadership qualities and examine the essence of leadership skills, specifically; the personal, interpersonal, group and contextual factors which affect formal and emergent leadership in groups and organizations.

3. Learning Outcomes (LOs):

A6.1	Identify leader and manager skills and values.
A6.2	Distinguish between different leadership theories (limitations and characteristics)
A6.3	Describe five key elements of leadership.
A6.4	Define the ten managerial roles based on their three categories.
A7.1	Discuss the advantages and disadvantages of working in teams
A7.2	Improve skills related to working in groups and teamwork through class activities and project.
A7.3	Discuss the role of strategic leadership in the strategic management process.
A8.1	Analyze leadership case studies.
A8.2	Prepare reports in accordance with the standard scientific guidelines for given topics.
A8.3	Present reports discussing the results and defending his/her ideas.
A9.1	Recommend methods to improve leadership skills in given case studies.
A9.2	Evaluate information through individual and group project work
A9.3	Practice decision making based on leadership theories in class activities and project.

4. Course Contents:

No.	Topics	Week
1	**Lecture:** - Introduction (leadership definition).	1
2	**Lecture:** - Leader vs Manager.	2
3	**Lecture:** - Power the key to leadership.	3-4
4	**Lecture:** - Empowerment gains and threats.	5
5	**Lecture:** - Leadership theories and models.	6-7
6	**Midterm Examination**	**8**
7	**Lecture:** - Domains of leadership strengths.	9-10
8	**Lecture:** - The five practices and ten commitments of exemplary leadership.	11-12
9	**Lecture:** - Group projects presentation.	13-14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method														
		Lecture (online-In class)	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A6.1**	X			X	X			X							
	A6.2	X			X	X			X							
	A6.3	X			X	X			X							
	A6.4	X			X	X			X	X			X			
	A7.1	X			X	X			X							
	A7.2	X			X	X			X							
	A7.3	X			X	X			X							
	A8.1	X			X	X			X	X			X			
	A8.2	X			X	X			X	X			X			
	A8.3	X			X	X			X	X			X			
	A9.1	X			X	X			X	X			X			
	A9.2	X			X	X			X	X			X			
	A9.3	X			X	X			X	X			X			

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials
2	Online lectures and documentation.

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	In class activity and assignments	A6.1, A6.2, A6.3, A6.4, A7.1, A7.2, A7.3, A8.1, A8.2, A8.3, A9.1, A9.2, A9.3
2	Group project presentation and discussion	A6.1, A6.2, A6.3, A6.4, A7.1, A7.2, A7.3, A8.1, A8.2, A8.3, A9.1, A9.2, A9.3
3	Final Term Examination (written)	A6.1, A6.2, A6.3, A6.4, A7.1, A7.2, A7.3, A8.1, A8.2, A8.3, A9.1, A9.2, A9.3

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	In class activity and assignments	Throughout the semester
2	Group project presentation and discussion	15th
3	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights
1	In class activity and assignments	10
2	Group project presentation and discussion	10
3	Final Term Examination (written)	80
Total		100%

8. List of References:

No.	Reference List
1	James Kouzes, and Barry Posner, “The Leadership Challenge”, Wiley, 6th edition, 2017, ISBN:0470651725.
2	Gareth Jones, and Jennifer George, "Contemporary Management", McGraw Hill, 11th edition 2017.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture / Online Classroom
2	White Board
3	Data Show System
4	Sound System Facility
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aim	LOs
1	**Lecture:** • Introduction (leadership definition)	3	A6-1
2	**Lecture:** • Leader vs Manager.	3	A6-1, A7-1, A7-2
3	**Lecture:** • Power the key to leadership.	3	A6-3, A7-2, A7-3, A9-1,
4	**Lecture:** • Empowerment gains and threats	3	A6-3, A7-3, A8-1
5	**Lecture:** • Leadership theories and models	3	A6-2, A8-1, A9-3
6	**Lecture:** • Domains of leadership strengths	3	A7-2, A8-1, A9-1, A9-3
7	**Lecture:** • The five practices and ten commitments of exemplary leadership	3	A6-3, A6-4, A9-3
8	**Lecture:** • Group projects presentation	3	A6-1, A6-2, A6-3, A6-4, A7-1, A7-2, A7-3, A8-1, A8-2, A8-3, A9-1, A9-2, A9-3

Course: Leadership Skills	
Program Competencies	**Course LOs**
A6. Plan, supervise and monitor implementation of engineering projects.	**A6.1** Identify leader and manager skills and values. **A6.2** Distinguish between different leadership theories (limitations and characteristics) **A6.3** Describe five key elements of leadership. **A6.4** Define the ten managerial roles based on their three categories.
A7. Function efficiently as an individual and as a member of multi-disciplinary and multi-cultural teams.	**A7.1** Discuss the advantages and disadvantages of working in teams **A7.2** Improve skills related to working in groups and teamwork through class activities and project. **A7.3** Discuss the role of strategic leadership in the strategic management process.
A8. Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools.	**A8.1** Analyze leadership case studies. **A8.2** Prepare reports in accordance with the standard scientific guidelines for given topics. **A8.3** Present reports discussing the results and defending his/her ideas.
A9. Use creative, innovative, and flexible thinking and acquire entrepreneurial and leadership skills to anticipate and respond to new situations.	**A9.1** Recommend methods to improve leadership skills in given case studies. **A9.2** Evaluate information through individual and group project work **A9.3** Practice decision making based on leadership theories in class activities and group project.

Course Coordinator: Assoc. Prof. Ibrahim Abdel-Rahman Ibrahim

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Mechanical Power Engineering		
Course Code	**MPE327**		
Year/ Level	Third year- 2nd semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	2	2	

2. Course aims:

No.	Aims
7	Describe and develop the behavior and performance of control circuits mathematically.

3. Learning Outcomes (LOs):

A1.1	Identify the, fundamentals, concepts, and principles of modern control strategy.
A1.2	Describe and formulate the dynamic behavior and performance of control circuits mathematically.
B1.1	Model and analyze the control circuits applicable to the mechanical power discipline by applying the concepts of control theory.
B4.1	Describe suitable safety and reliability aspects to operate, inspect and maintain mechanical equipment and systems using control systems.
C2.1	Describe and evaluate the role of the control circuits in enhancing the operation and performance of different mechanical systems.

4. Course Contents:

No.	Topics	Week
1	**Lecture:** - Introduction to modern control theory. **Tutorials:** - Solve problems on dynamics and mathematics.	1
2	**Lecture:** - Mathematical modeling of dynamic systems, electrical and mechanical systems. **Tutorials:** - Solve problems on mathematical models of different physical systems.	2-3
3	**Lecture:** - Transfer function and block diagrams. **Tutorials:** - Solve problems on transfer function and block diagrams.	4
4	**Lecture:** - Dynamic response in transient and steady state conditions. **Tutorials:** - Solve problems on Dynamic response in transient and steady state conditions.	5
5	**Lecture:** - Time domain performance analysis **Tutorials:** - Solve problems on time domain performance analysis.	6
6	**Lecture:** - Stability by Routh/Hurwitz criterion. **Tutorials:** - Solve problems on stability by Routh/Hurwitz criterion.	7
7	**Midterm Examination**	**8**
8	**Lecture:** - Steady state error. **Tutorials:** - Solve problems on steady state error.	9
9	**Lecture:** - Root locus introduction. **Tutorials:** - Solve problems on Root locus introduction.	10
10	**Lecture:** - Root locus techniques. **Tutorials:** - Solve problems on Root locus introduction techniques.	11

11	**Lecture:** - Root locus Applications. **Tutorials/** - Solve problems on Root locus introduction applications.	12
12	**Lecture:** - Frequency response introduction. **Tutorials/** - Solve problems on frequency response introduction.	13
13	**Lecture:** - Frequency response techniques, applications. **Tutorials/** - Solve problems on frequency response techniques and applications.	14

5. Teaching and Learning Methods:

LOs		**Teaching and Learning Method**														
		Lecture	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A1.1**	x	x			x	x	x	x							
	A1.2	x	x			x	x	x	x			x				
B-Level	**B1.1**	x	x			x	x	x	x							
	B4.1	x	x			x		x	x							
C-Level	**C1.1**	x	x			x	x					x				

6. Teaching and Learning Methods of Disable Students:

No.	**Teaching Method**
1	Additional Tutorials and videos
2	Online lectures and assignments

7. Student Assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written)	A1.1, A1.2, B1.1, B4.1, C2.1
2	Practical/ Oral Examination	-------
3	Formative (quizzes - presentation - assignments)	A1.1, A1.2, B1.1, B4.1, C2.1
4	Final Term Examination (written)	A1.1, A1.2, B1.1, B4.1, C2.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	8
2	Practical/ Oral Examination	15
3	Formative (quizzes – presentation – assignments)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	10
2	Practical/ Oral Examination	---
3	Formative (quizzes – presentation – assignments - …….)	20
4	Final Term Examination (written)	70
Total		100%

8. List of References:

No.	Reference List
1	G. F. Franklin, J. D. Powell and A. Emami-Naeini, “Feedback Control of Dynamic Systems-Pearson”, 8th Edition, 2018.
2	N. S. Nise, “Control Systems Engineering”, John Wiley, 7th Edition, 2015.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture/Online Classroom
2	White Board
3	Data Show System
4	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aims	LOs
1	**Lecture:** • Introduction to modern control theory **Tutorials:** • Solve problems on dynamics and mathematics.	7	A1.1, B4.1, C2.1
2	**Lecture:** • Mathematical modeling of dynamic systems, electrical and mechanical systems. **Tutorials:** • Solve problems on mathematical models of different physical systems	7	A1.1, A1.2, B1.1, B4.1, C2.1
3	**Lecture:** • Transfer function and block diagrams **Tutorials:** • Solve problems on transfer function and block diagrams	7	A1.1, A1.2, B1.1, B4.1, C2.1
4	**Lecture:** • Dynamic response in transient and steady state conditions **Tutorials:** • Solve problems on Dynamic response in transient and steady state conditions	7	A1.1, A1.2, B1.1, B4.1, C2.1
5	**Lecture:** Time domain performance analysis **Tutorials:** Solve problems on time domain performance analysis	7	A1.1, A1.2, B1.1, B4.1, C2.1
6	**Lecture:** • Stability by Routh/Hurwitz criterion. **Tutorials:** • Solve problems on stability by Routh/Hurwitz criterion	7	A1.1, A1.2, B1.1, B4.1, C2.1
7	**Midterm Examination**	7	A1.1, A1.2, B1.1, B4.1, C2.1
8	**Lecture:** • Steady state error **Tutorials:** • Solve problems on steady state error	7	A1.1, A1.2, B1.1, B4.1, C2.1
9	**Lecture:** • Root locus introduction **Tutorials:** • Solve problems on Root locus introduction	7	A1.1, A1.2, B1.1, B4.1, C2.1

10	**Lecture:** - Root locus techniques **Tutorials:** - Solve problems on Root locus introduction techniques.	7	A1.1, A1.2, B1.1, B4.1, C2.1
11	**Lecture:** - Root locus Applications **Tutorials/** - Solve problems on Root locus introduction applications.	7	A1.1, A1.2, B1.1, B4.1, C2.1
12	**Lecture:** - Frequency response introduction **Tutorials/** - Solve problems on frequency response introduction.	7	A1.1, A1.2, B1.1, B4.1, C2.1
13	**Lecture:** - Frequency response techniques, applications **Tutorials/** Solve problems on frequency response techniques and applications	7	A1.1, A1.2, B1.1, B4.1, C2.1

Course: Automatic Control	
Program Competencies	**Course LOs**
A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.	**A1.1** Identify the, fundamentals, concepts, and principles of modern control strategy. **A1.2** Describe and formulate the dynamic behavior and performance of control circuits mathematically.
B1. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, Solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.	**B1.1** Model and analyze the control circuits applicable to the mechanical power discipline by applying the concepts of control theory.
B4. Adopt suitable national and international standards and codes; and integrate legal, economic and financial aspects to: design, build, operate, inspect and maintain mechanical equipment and systems.	**B4.1** Describe suitable safety and reliability aspects to operate, inspect and maintain mechanical equipment and systems using control systems.
C2 Analyze, evaluate and enhance the performance of the HVAC systems, automatic control systems, pneumatic systems, hydraulic systems, combustion systems, thermal and nuclear power plants.	**C2.1** Describe and evaluate the role of the control circuits in enhancing the operation and performance of different mechanical systems.

Course Coordinator: Dr. Gamal Abbass Zaghloul

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

Course Specifications:

Use of Commercial Packages in Mechanical Power Engineering

1. Basic Information:

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Mechanical Power Engineering		
Course Code	**MPE328**		
Year/ Level	Third year- 2nd semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	2	1	1

2. Course aims:

No.	**Aims**
6, 7	Identify and utilize the commercial package for numerical solution of some sophisticated Mechanical Power Engineering problems.

3. Learning Outcomes (LOs):

A1.1	Formulate, and solve complex engineering problems using engineering fundamentals, basic science and mathematics.
A1.2	Solve complex engineering problems numerically using computer-aided softwares.
A2.1	Develop and conduct appropriate simulation, analyze and interpret data, assess and evaluate findings, using Commercial Packages.
A5.1	Practice research techniques for the simulation of thermal and fluid flow component.
A10.1	Apply new knowledge and practice self-learning strategies using Commercial Packages.
B1.1	Model, analyze, and design thermal and fluid flow systems using Commercial Packages.
B2.1	Carry out designs of mechanical systems using computer-aided tools and software.
C5.1	Select appropriate solutions for mechanical power engineering problems based on numerical simulations
C6.1	Use Commercial Packages pertaining to the mechanical power engineering discipline.

4. Course Contents:

No.	Topics	Week
1	**Lecture:** • Introduction **Tutorials/Lab:** • Using MS Excel for data analysis	1
2	**Lecture:** • Computational Fluid Dynamics (CFD) Solution Procedure. **Tutorials/Lab:** • 2D Steady Heat Conduction.	2
3	**Lecture:** • Governing Equations for CFD- I **Tutorials/Lab:** • 2D Steady Heat Conduction with Heat Generation.	3
4	**Lecture:** • Governing Equations for CFD-II. **Tutorials/Lab:** • External Flow: Flow over flat plate-I.	4
5	**Lecture:** • Mathematical Behavior of Partial Differential Equations-I **Tutorials/Lab:** • External Flow: Flow over flat plate-II	5
6	**Lecture:** • Mathematical Behavior of Partial Differential Equations-II. **Tutorials/Lab:** • External Flow: Difference between Blasius Solution and Numerical Solution-I.	6
7	**Lecture:** • Mathematical Behavior of Partial Differential Equations-III **Tutorials/Lab:** • External Flow: Difference between Blasius Solution and Numerical Solution-II.	7
8	**Midterm Examination**	**8**
9	**Lecture:** • Basic Aspects of Discretization **Tutorials/Lab:** • Convergent-Divergent Nozzle.	9
10	**Lecture:** • Grid Generation. **Tutorials/Lab:** • Convergent-Divergent Nozzle.	10

11	**Lecture:** • CFD Techniques –I. **Tutorials/Lab:** • Unsteady Heat Conduction and Convection.	11
12	**Lecture:** • CFD Techniques - II. **Tutorials/Lab:** • Unsteady Heat Conduction and Convection.	12-13
13	**Lecture:** • Solution Analysis and Representation. **Tutorials/Lab:** • Unsteady Fluid Flow and Heat Transfer in Pipes	14

5. Teaching and Learning Methods:

LOs		**Teaching and Learning Method**														
		Lecture	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A1.1**	x	x				x			x			x		x	
	A1.2	x	x				x			x			x		x	
	A2.1		x				x			x			x		x	
	A5.2	x	x				x			x			x		x	
	A10.1									x		x	x		x	
B-Level	**B1.1**		x				x			x			x		x	
	B2.1		x				x			x			x		x	
C-Level	**C5.1**		x				x			x			x		x	
	C6.1		x				x			x			x		x	

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials and videos
2	Online lectures and assignments

7. Student Assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written)	A1.1, A1.2, A2, B1.1, B2.1, C5.1, C6.1
2	Practical/ Oral Examination	A1.1, A1.2, A2.1, B1.1, B2.1, C5.1, C6.1
3	Formative (quizzes - presentation - assignments …)	A1.1, A1.2, A2.1, A5.1, A10.1, B2.1, C5.1, C6.1
4	Final Term Examination (written)	A1.1, A1.2, A2.1, B1.1, B2.1, C5.1, C6.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	8
2	Practical/ Oral Examination	15
3	Formative (quizzes – presentation – assignments)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	8
2	Practical/ Oral Examination	20
3	Formative (quizzes – presentation – assignments)	12
4	Final Term Examination (written)	60
Total		100%

8. List of References

No.	Reference List
1	Versteeg, H. K., & Malalasekera, W. (2007). An introduction to computational fluid dynamics : the finite volume method. Harlow: Prentice Hall.
2	Tannehill, J. C., Anderson, D. A. and Pletcher, R. H., 2012, “Computational Fluid Mechanics and Heat Transfer,” 3rd Edition, CRC Press Publisher, New York.
3	Cheng, T. J., 2010, “Computational Fluid Dynamics,” 2nd Edition, Cambridge University Press, New York.
4	"ANSYS FLUENT Theory Guide," Release 17.0, ANSYS, Inc., 2016.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture / Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aims	LOs
1	**Lecture:** • Introduction **Tutorials/Lab:** • Using MS Excel for data analysis	6	A1.2, A2.1, C5.1, C6.1
2	**Lecture:** • Computational Fluid Dynamics (CFD) Solution Procedure. **Tutorials/Lab:** • 2D Steady Heat Conduction.	6, 7	A1.1, A1.2, A2.1, B1.1, B2.1, C5.1, C6.1
3	**Lecture:** • Governing Equations for CFD- I **Tutorials/Lab:** • 2D Steady Heat Conduction with Heat Generation.	6, 7	A1.1, A1.2, A2.1, A5.1, A10.1, B1.1, B2.1, C5.1, C6.1
4	**Lecture:** • Governing Equations for CFD-II. **Tutorials/Lab:** • External Flow: Flow over flat plate-I.	6, 7	A1.1, A1.2, A2.1, A5.1, A10.1, B1.1, B2.1, C5.1, C6.1
5	**Lecture:** • Mathematical Behavior of Partial Differential Equations-I	6, 7	A1.1, A1.2, A2.1, A5.1, B1.1, C5.1, C6.1

	Tutorials/Lab: • External Flow: Flow over flat plate-II		
6	**Lecture:** • Mathematical Behavior of Partial Differential Equations-II. **Tutorials/Lab:** • External Flow: Difference between Blasius Solution and Numerical Solution-I.	6, 7	A1.1, A1.2, A2.1, A5.1, B1.1, C5.1, C6.1
7	**Lecture:** • Mathematical Behavior of Partial Differential Equations-III **Tutorials/Lab:** • External Flow: Difference between Blasius Solution and Numerical Solution-II.	6, 7	A1.1, A1.2, A2.1, A5.1, B1.1, C5.1, C6.1
8	**Midterm Examination**	6, 7	A1.1, A1.2, A2, B1.1, B2.1, C5.1, C6.1
9	**Lecture:** • Basic Aspects of Discretization **Tutorials/Lab:** • Convergent-Divergent Nozzle.	6, 7	A1.1, A1.2, A2.1, B1.1, B2.1, C5.1, C6.1
10	**Lecture:** • Grid Generation. **Tutorials/Lab:** • Convergent-Divergent Nozzle.	6, 7	A1.1, A1.2, A2.1, A5.1, A10.1, B1.1, B2.1, C5.1, C6.1
11	**Lecture:** • CFD Techniques –I. **Tutorials/Lab:** • Unsteady Heat Conduction and Convection.	6, 7	A1.1, A1.2, A2.1, A5.1, A10.1, B1.1, B2.1, C5.1, C6.1
12	**Lecture:** • CFD Techniques - II. **Tutorials/Lab:** • Unsteady Heat Conduction and Convection.	6, 7	A1.1, A1.2, A2.1, A5.1, A10.1, B1.1, B2.1, C5.1, C6.1
13	**Lecture:** • Solution Analysis and Representation. **Tutorials/Lab:** • Unsteady Fluid Flow and Heat Transfer in Pipes	6, 7	A1.1, A1.2, A2.1, A5.1, A10.1, B1.1, B2.1, C5.1, C6.1

Course: Use of Commercial Packages in Mechanical Power Engineering	
Program Competencies	**Course LOs**
A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.	**A1.1** Formulate, and solve complex engineering problems using engineering fundamentals, basic science and mathematics. **A1.2** Solve complex engineering problems numerically using computer-aided softwares.
A2. Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.	**A2.1** Develop and conduct appropriate simulation, analyze and interpret data, assess and evaluate findings, using Commercial Packages.
A5. Practice research techniques and methods of investigation as an inherent part of learning.	**A5.1** Practice research techniques for the simulation of thermal and fluid flow component.
A10. Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.	**A10.1** Apply new knowledge and practice self-learning strategies using Commercial Packages.
B1. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, Solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.	**B1.1** Model, analyze and design thermal and fluid flow systems using Commercial Packages.
B2. Plan, manage and carry out designs of mechanical systems and machine elements using appropriate materials both traditional means and computer-aided tools and software contemporary to the mechanical engineering field.	**B2.1** Carry out designs of mechanical systems using computer-aided tools and software.
C5. Select appropriate solutions for mechanical power engineering problems based on analytical and numerical techniques.	**C5.1** Select appropriate solutions for mechanical power engineering problems based on numerical simulations.

C6. Use and develop codes using a wide range of software packages pertaining to the discipline.	**C6.1** Use Commercial Packages pertaining to the mechanical power engineering discipline.

Course Coordinator: Dr. Mohamed Mohamed Elsakka

Program Coordiantor: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

Course Specifications: Gas dynamics

1. Basic Information:

Program Title	B.SC. In Mechanical Engineering (Specialization Mechanical Power Engineering)		
Department offering Program	Mechanical Power Engineering		
Department Responsible for the Course	Mechanical Power Engineering		
Course Code	**MPE329**		
Year/level	Third Year- 2nd Semester		
Specialization	Major		
Teaching Hours	Lecture	Tutorial	Practical
	2	1	1

2. Course Aims:

No.	**Aims**
6, 7	Recognize and analyze the fundamentals of compressible fluid flow, with an emphasis on a wide variety of steady, one-dimensional flow problems and a general understanding of the principles of multi-dimensional flow.

3. Learning Outcomes (Los):

A1.1	Analyze and define the concepts of gas dynamics.
A1.2	Classify the high-speed flow through channels. Mange the variation of pressure and Mach number along the convergent and convergent divergent channels. Describe isentropic flow through nozzles, normal and oblique shock waves, Fanno and Rayleigh flows.
B1.1	Analyze one-dimensional flow through nozzles. Velocity area relation. Flow pattern in convergent and convergent nozzles. Critical and maximum flow through nozzle. Normal and oblique shock waves, Fanno and Rayleigh flows.
B3.1	Specify the operating conditions for some mechanical applications according to the required performance.
C1.1	Recognize the elements of gas dynamic flows with friction and heat transfer.
C1.2	Recognize the mean behavior of compressible flows through flow visualization through convergent and divergent nozzles

4. Course Contents:

No.	Topics	Week
1	**Lecture**: • Review of basic concepts of fluid flow and Thermodynamics, • Purpose of compressible fluid flows. • Description the perfect gas flow through different channels. **Tutorial / Lab:** • Solve problems on gas flow properties, thermodynamics gas problems • Finding the variation of speed of sound with height from the earth surface.	1
2	**Lecture**: • Analyze the speed of sound, the relation between the speed of sound and Mach number. • Definition of Mach number, Mach angle, Mach line and Mach cone. • Analyze the relation of isentropic flows through nozzle and diffusers. • Definition of zone of action and zone of silence. • The gas dynamics table and charts. **Tutorial / Lab:** • Solve problems on speed of sound, Mach number relations. • Finding the variation of speed of sound with gas temperatures.	2
3	**Lecture**: • Basic of stagnation state for ideal gas model. • Basics of one dimension flows through nozzles. • Analyses of one dimension isentropic flow through nozzles and variation of gas properties. **Tutorial / Lab:** • Solve problems on one dimensional isentropic gas flow through nozzles. • Illustrative the flow pattern through convergent and convergent divergent nozzles.	3
4	**Lecture**: • Energy equation as a function of pressure ratio and Mach number • Critical properties of a perfect gas. The critical Mach number • Flow in a duct of varying cross sectional area, the velocity area relations. • A Choked flow in nozzle. **Tutorial / Lab:** • Illustrative example and solved problems. • Design a model of Pitot tube and bellow meter by environment materials. • Calibration of pressure transducers.	4
5	**Lecture**: • Basic definitions of normal shock waves, formation and behavior. • Simple Pitot tube and shock waves, • Definition and comparison between normal, oblique and bow shocks.	5

	Tutorial / Lab: • Illustrative example and solved problems, on normal shock waves. • Design a model of supersonic Pitot tube.	
6	**Lecture**: • Normal shock wave analysis. • Shock flow equations as a function of Mach number. • Normal Shock wave pattern in nozzles. • The Change in Entropy across a Normal Shock wave in nozzles. **Tutorial / Lab:** • Solve problems on normal shock waves using gas dynamism tables • View video on normal waves and the effect of Mach number.	6
7	**Lecture**: • Definition of oblique shock waves, Mach waves, weak and strong shocks. • Mach angle and Mach wave definition. • Oblique shock wave theory. **Tutorial / Lab:** • Solve problems on Mach waves and oblique shock waves. • View video on oblique waves and the effect of Mach number.	7
8	**Midterm written examination**	8
9	**Lecture**: • Oblique Shock and Limitation Conditions • Oblique Shock Analysis for perfect Gas **Tutorial / Lab:** • Solve problems on oblique shock and the effect of Mach number and deflection angle. • Design charts of oblique shock waves for different gases.	9
10	**Lecture**: • Definition of gas flow with friction through a constant area duct, Fanno flow. • Determination the Fanno flow applications. **Tutorial / Lab:** • Solve problems on Fanno flows. • Design a model of Fanno flows.	10
11	**Lecture**: • Definition of gas flow choking in Fanno flows. • Determination the maximum and critical length in Fanno flows. **Tutorial / Lab:** • Solve problems on Fanno flows • Design a model of Fanno tube with critical length.	11
12	**Lecture**: **Lecture**: • Analysis the compressible flow through a constant area ducts with heat transfer (Rayleigh flow) and gas dynamic relations. • Basics of Rayleigh flows and application in gas dynamics. • Basics of Rayleigh line and governing equations. **Tutorial / Lab:** • Solving problems on gas flow through a constant duct with heat	12

	transfer • Assessment of the effect of Mach number on the gas flow through a constant duct with heat transfer	
13	**Lecture: Lecture:** • Rayleigh Line in Mollier Diagram • Change in Entropy Due to Heat Transfer • Maximum Possible Heat Addition **Tutorial / Lab:** • Report includes relation of addition or removing heat with Mach numbers	13-14

5. Teaching and Learning Methods:

LOs		**Teaching and Learning Method**														
		Lecture	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A1.1**	x	x			x	x	x	x			x				x
	A1.2	x	x			x	x	x	x			x				x
	A4.1	x	x			x	x	x	x			x	x			x
	A10.1	x	x			x	x	x	x			x				x
B-Level	**B1.1**	x	x			x	x	x	x			x	x			x
	B3.1	x	x			x	x	x	x			x	x			x
C-Level	**C1.1**	x	x			x	x	x	x			x				x
	C1.2	x	x		x	x	x	x	x			x				x
	C3.1	x	x		x	x	x	x	x			x				x

6. Teaching and Learning Methods of Disable Students

No.	**Teaching Method**
1	Additional Tutorials and videos
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written)	A1.1, A1.2, B1.1, B3.1, C1.1, C1.2
2	Practical/ Oral Examination	A1.1, A1.2, B1.1, B3.1, C1.1, C1.2
3	Formative (quizzes – online quizzes - assignments)	A1.1, A1.2, B1.1, B3.1, C1.1, C1.2
4	Final Term Examination (written)	A1.1, A1.2, B1.1, B3.1, C1.1, C1.2

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	8
2	Practical/ Oral Examination	14
3	Formative (quizzes – online quizzes – assignments)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	10
2	Practical/ Oral Examination	20
3	Formative (quizzes – online quizzes – assignments)	10
4	Final Term Examination (written)	60
Total		100%

8. List of References:

No.	Reference List
1	White, F. M., 2011, "Fluid Mechanics", McGraw-Hill, seventh Edition.
2	Anderson, John D. Jr. (2003). Modern Compressible Flow (3rd ed.). McGraw-Hill Science/Engineering/Math. ISBN 0-07-242443-5
3	Liepmann, Hans W.; Roshko, A., (1995) Elements of Gasdynamics. Dover Publications. ISBN 0-486-41963-0.
4	Shapiro, Ascher H. (1953). The Dynamics and Thermodynamics of Compressible Fluid Flow, Volume 1. Ronald Press. ISBN 978-0-471-06691-0

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture/Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topics	Aims	LOs
1	**Lecture**: • Introduction • Application and History, Objectives • Thermodynamics laws and Fluid properties • Stagnation temperature • Speed of sound. **Tutorial / Lab:** • Solve problems on gas flow properties, thermodynamics gas problems • Finding the variation of speed of sound with height from the earth surface	6	A1.1, C1.1
2	**Lecture**:: One Dimensional Isentropic Flow • Introduction • Stagnation state for perfect gas. • Energy equation as function of pressure ratio. • Definition of zone of action and zone of silence. • The gas dynamics table and charts. **Tutorial / Lab:** • Solve problems on speed of sound, Mach number relations • Finding the variation of speed of sound with gas temperatures	6	A1.1, C1.1
3	**Lecture**: • Basics of one dimension flows through nozzles • Analyses of one dimension isentropic flow through nozzles and variation of gas properties • The maximum velocity • The critical Mach number **Tutorial / Lab:** • Solve problems on one dimensional isentropic gas flow through nozzles • Illustrative the flow pattern through convergent and convergent divergent nozzles	6, 7	A1.1, A1.2, B1.1, B3.1, C1.1, C1.2
4	**Lecture**: • Energy equation as a function of Mach number • Critical properties of a perfect gas. The critical pressure ratio • Flow in a duct of varying cross sectional area, the velocity area relations • A Choked flow in nozzle **Tutorial / Lab:** • Illustrative example and solved problems. • Design a model of pitot tube and bellow meter by environment materials • Calibration of pressure transducers	6, 7	A1.1, A1.2, B1.1, B3.1, C1.1, C1.2

5	**Lecture**: - Basic definitions of normal shock waves, formation and behavior. - Simple Pitot tube and shock waves, - Definition and comparison between normal, oblique and bow shocks. **Tutorial / Lab:** - Illustrative example and solved problems on normal shock waves. - Design a model of supersonic Pitot tube.	6, 7	A1.1, A1.2, B1.1, B3.1, C1.1, C1.2
6	**Lecture**: - Normal shock wave analysis. - Shock flow equations as a function of Mach number. - Normal Shock wave pattern in nozzles. - The Change in Entropy across a Normal Shock wave in nozzles. **Tutorial / Lab:** - Solve problems on normal shock waves using gas dynamism tables - View video on normal waves and the effect of Mach number.	6, 7	A1.1, A1.2, B1.1, B3.1, C1.1, C1.2
7	**Lecture**: - Definition of oblique shock waves, Mach waves, weak and strong shocks. - Mach angle and Mach wave definition. - Oblique shock wave theory. **Tutorial / Lab:** - Solve problems on Mach waves and oblique shock waves. - View video on oblique waves and the effect of Mach number	6, 7	A1.1, A1.2, B1.1, B3.1, C1.1, C1.2
8	**1 St. Midterm written examination**	6, 7	A1.1, A1.2, B1.1, B3.1, C1.1, C1.2
9	**Lecture**: - Oblique Shock and Limitation Conditions - Oblique Shock Analysis for perfect Gas **Tutorial / Lab:** - Solve problems on oblique shock and the effect of Mach number and deflection angle. - Design charts of oblique shock waves for different gases..	6, 7	A1.1, A1.2, B1.1, B3.1, C1.1, C1.2
10	**Lecture**: - Definition of gas flow with friction through a constant area ducts, Fanno flow.	6, 7	A1.1, A1.2, B1.1,

	- Determination the Fanno flow applications. **Tutorial / Lab:** - Solve problems on Fanno flows - Design a model of Fanno flows.		B3.1, C1.1, C1.2
11	**Lecture**: - Definition of gas flow choking in Fanno flows. - Determination the maximum and critical length in Fanno flows **Tutorial / Lab:** - Solve problems on Fanno flows - Design a model of Fanno tube with critical length.	6, 7	A1.1, A1.2, B1.1, B3.1, C1.1, C1.2
12	**Lecture**: **Lecture**: - Analysis the compressible flow through a constant area ducts with heat transfer (Rayleigh flow) and gas dynamic relations. - Basics of Rayleigh flows and application in gas dynamics. - Basics of Rayleigh line and governing equations **Tutorial / Lab:** - Solving problems on gas flow through a constant duct with heat transfer - Assessment of the effect of Mach number on the gas flow through a constant duct with heat transfer	6, 7	A1.1, A1.2, B1.1, B3.1, C1.1, C1.2
13	**Lecture**: **Lecture**: - Rayleigh Line in Mollier Diagram - Change in Entropy Due to Heat Transfer - Maximum Possible Heat Addition **Tutorial / Lab:** - Report includes relation of addition or removing heat with Mach numbers	6, 7	A1.1, A1.2, B1.1, B3.1, C1.1, C1.2

Course Specifications: Gas dynamics

Course: Gas dynamics	
Program Competencies	**Course LOs**
A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.	**A1.1** Analyze and define the concepts of gas dynamics. **A1.2** Classify the high-speed flow through channels. Mange the variation of pressure and Mach number along the convergent and convergent divergent channels. Describe isentropic flow through nozzles, normal and oblique shock waves, Fanno and Rayleigh flows.
B1. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, solid Mechanics, Material Processing, Material Properties، Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.	**B1.1** Analyze one-dimensional flow through nozzles. Velocity area relation. Flow pattern in convergent and convergent nozzles. Critical and maximum flow through nozzle. Normal and oblique shock waves, Fanno and Rayleigh flows.
B3. Select conventional mechanical equipment according to the required performance.	**B3.1** Specify the operating conditions for some mechanical applications according to the required performance.
C1. Recognize the design concepts, operation and characteristics of internal combustion engines, boilers, heat exchangers, turbomachines and hydraulic machines	**C1.1** Recognize the elements of gas dynamic flows with friction and heat transfer. **C1.2** Recognize the mean behavior of compressible flows through flow visualization through convergent and divergent nozzles.

Course Coordinator: Prof. Gamal Hafiz Ahmed Moustafa

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Mechanical Power Engineering		
Course Code	**MPE330**		
Year/ Level	Third year- 2nd semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	2	2	1

2. Course aims:

No.	Aims
7	Acquire the students with the principles of design, analysis and evaluation for the performance of the refrigeration and freezing systems considering the progress in integrating newable and renewable energy resources in refrigeration applications.

3. Learning Outcomes (LOs):

B1.1	Model, analyze and design of physical systems applied to refrigeration and freezing systems by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, Measurements and Instrumentation.
C1.1	Recognize the design concepts, operation and characteristics of heat exchangers and compressors used in refrigeration field.
C2.1	Analyze, evaluate and enhance the performance of the refrigeration systems.
C3.1	Judge the optimal refrigeration system according to the constraints of operation, costs, safety, reliability and environmental impacts.
C4.1	Choose, apply and assess the renewable energy resources in refrigeration applications.

4. Course Contents:

No.	Topics	Week
1	**Lecture:** • Introduction • Definitions • Classification of refrigeration systems • Applications and fields of refrigeration • Fundamentals and principles **Tutorials:** • Review and solve problems on heat transfer and gas laws and properties of pure substance. **Lab:** • Study VCR system and components	1
2	**Lecture:** • Methods of refrigeration • Sensible cooling by cold medium • Endothermic mixing of substances • Phase change processes • Expansion of liquids and gases • Thermoelectric refrigeration • Adiabatic demagnetization **Tutorials:** • Review and solve problems on heat transfer and gas laws and properties of pure substance. **Lab:** • Study VCR system and components.	2
3	**Lecture:** • Air refrigeration system. • Air reversed Carnot Cycle. • Standard air reversed Brayton Cycle. • Actual air reversed Brayton Cycle. • Modified air reversed Brayton Cycle. **Tutorials:** • Solve problems on standard air refrigeration systems. **Lab:** • Study VCR system and components.	3
4	**Lecture:** • Air craft refrigeration system. • Bootstrap refrigeration system. • Regenerative and reduced ambient systems. **Tutorials:** • Solve problems on air refrigeration systems. **Lab:** • Study VCR system and components.	4
5	**Lecture:** • Vapor compression refrigeration system.	5

	- Carnot vapor refrigeration cycle. - Standard vapor compression refrigeration System (VCRS). **Tutorials:** - Solve problems on standard VCRS. **Lab:** - Study VCR system and components**.**	
6	**Lecture:** - Vapor Compression Refrigeration System VCR with liquid suction heat exchanger LSHX. - Actual Cycle of Vapor Compression Refrigeration System. **Tutorials:** - Solve problems on modified and Actual Cycle of Vapor Compression Refrigeration System. **Lab:** - Study the effect of changing evaporator temperature on the VCR performance.	6
7	**Lecture:** - Actual Cycle of Vapor Compression Refrigeration System - Compressor volumetric efficiency and compressor total efficiency **Tutorials:** - Solve problems VCR and volumetric and total compressor efficiencies. **Lab:** - Study the effect of changing evaporator temperature on the VCR performance.	7
8	**Midterm Examination**	**8**
9	**Lecture:** - Multi-stage vapor compression refrigeration system. - Multi-stage compression with water intercooler. - Multi-stage compression with flash gas removal. - Multi-stage compression with flash intercooling. **Tutorials:** - Solve problems on Multi-stage vapor compression refrigeration system. **Lab:** - Study the effect of changing evaporator temperature on the VCR performance**.**	9
10	**Lecture:** - Multi evaporators systems - Cascade systems **Tutorials:** - Solve problems on Multi-stage vapor compression refrigeration system. **Lab:** - Study the effect of changing evaporator temperature on the VCR performance.	10

11	**Lecture:** - Renewable energy resources applied for refrigeration systems. - Absorption refrigeration system. **Tutorials:** - Solve problems on multi evaporators and cascade systems. **Lab:** - Study the absorption refrigeration system.	11
12	**Lecture:** - Absorption cycle with heat exchanger. - Steam driven combination of VCR and absorption systems. **Tutorials:** - Solve problems on VAR systems. **Lab:** - Study the absorption refrigeration system.	12
13	**Lecture:** - Refrigeration system components. - Refrigerants - Refrigeration environmental impact. **Tutorials:** - Solve problems on advanced VCR and VAR systems. **Lab:** Study the absorption refrigeration system.	13
14	**Lecture:** - Freezing Systems - Freezing time - Freezing advanced techniques. **Tutorials:** - Solve problems on advanced VCR and VAR systems. **Lab:** Study the absorption refrigeration system.	14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method														
		Lecture	Interactive lectures	Flipped Classroom	Presentation	Discussion	Tutorial	Problem-solving	Brain storming	Projects	Site visits	Self-learning	Cooperative	Drawing Studio	Computer Simulation	Practical Experiments
B-Level	B1.1	x	x			x	x	x								x
C-Level	C1.1	x	x			x	x	x				x				
	C2.1	x	x			x	x	x				x				x
	C3.1	x	x		x	x	x	x	x			x				x
	C4.1	x	x			x	x	x				x				x

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials and videos
2	Online lectures and assignments

7. Student Assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written)	B1.1, C1.1, C2.1, C3.1
2	Practical/ Oral Examination	B1.1, C1.1, C2.1, C3.1, C4.1,
3	Formative (quizzes - presentation - assignments)	B1.1, C1.1, C2.1, C3.1, C4.1,
4	Final Term Examination (written)	B1.1, C1.1, C2.1, C3.1, C4.1,

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	8
2	Practical/ Oral Examination	15
3	Formative (quizzes – presentation – assignments)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	12
2	Practical/ Oral Examination	20
3	Formative (quizzes – presentation – assignments - …….)	8
4	Final Term Examination (written)	60
Total		100%

8. List of References:

No.	Reference List
1	Hundy, G.F., Trott, A.R., and Welch, T.C., "Refrigeration and Air-conditioning", 4th edition, Butterworth Heinemann, Oxford, 2008.
2	Arora, C.P., "Refrigeration and Air-conditioning", 3rd edition, TATA-McGrawHill, 2009
3	Gupta, J.K. and Khurmi, R.S., " Textbook of Refrigeration and Air Conditioning", Distributed by S. Chand & Company Ltd., New Delhi, 2007.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture/Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aims	LOs
1	**Lecture:** • Introduction • Definitions • Classification of refrigeration systems • Applications and fields of refrigeration • Fundamentals and principles **Tutorials:** • Review and solve problems on heat transfer and gas laws and properties of pure substance. **Lab:** • Study VCR system and components.	7	B1.1
2	**Lecture:** • Methods of refrigeration • Sensible cooling by cold medium • Endothermic mixing of substances • Phase change processes • Expansion of liquids and gases • Thermoelectric refrigeration • Adiabatic demagnetization **Tutorials:** • Review and solve problems on heat transfer and gas laws and properties of pure substance. **Lab:** • Study VCR system and components.	7	B1.1
3	**Lecture:** • Air refrigeration system • Air reversed Carnot Cycle • Standard air reversed Brayton Cycle • Actual air reversed Brayton Cycle • Modified air reversed Brayton Cycle **Tutorials:** • Solve problems on standard air refrigeration systems **Lab:** • Study VCR system and components.	7	B1.1, C1.1, C2.1
4	**Lecture:** • Air craft refrigweration system • Bootstrap refrigeration system • Regenerative and reduced ambient systems **Tutorials:** • Solve problems on air refrigeration systems. **Lab:** • Study VCR system and components.	7	B1.1, C1.1, C2.1
5	**Lecture:**	7	B1.1, C1.1, C2.1

	• Vapor compression refrigeration system • Carnot vapor refrigeration cycle • Standard vapor compression refrigeration System (VCRS) **Tutorials:** • Solve problems on standard VCRS **Lab:** • Study VCR system and components.		
6	**Lecture:** • Vapor Compression Refrigeration System VCR with liquid suction heat exchanger LSHX • Actual Cycle of Vapor Compression Refrigeration System **Tutorials:** • Solve problems on modified and Actual Cycle of Vapor Compression Refrigeration System **Lab:** • Study the effect of changing evaporator temperature on the VCR performance	7	B1.1, C1.1, C2.1
7	**Lecture:** • Actual Cycle of Vapor Compression Refrigeration System • Compressor volumetric efficiency and compressor total efficiency **Tutorials:** • Solve problems VCR and volumetric and total compressor efficiencies **Lab:** • Study the effect of changing evaporator temperature on the VCR performance	7	B1.1, C1.1, C2.1
8	**Midterm Examination**	7	B1.1, C1.1, C2.1
9	**Lecture:** • Multi-stage vapor compression refrigeration system • Multi-stage compression with water intercooler • Multi-stage compression with flash gas removal • Multi-stage compression with flash intercooling **Tutorials:** • Solve problems on Multi-stage vapor compression refrigeration system **Lab:** • Study the effect of changing evaporator temperature on the VCR performance	7	B1.1, C1.1, C2.1
10	**Lecture:** • Multi evaporators systems • Cascade systems **Tutorials:** • Solve problems on Multi-stage vapor compression	7	B1.1, C1.1, C2.1

	refrigeration system **Lab:** - Study the effect of changing evaporator temperature on the VCR performance		
11	**Lecture:** - Renewable energy resources applied for refrigeration systems - Absorption refrigeration system **Tutorials:** - Solve problems on multi evaporators and cascade systems. **Lab:** - Study the absorption refrigeration system	7	B1.1, C1.1, C2.1, C3.1, C4.1
12	**Lecture:** - Absorption cycle with heat exchanger - Steam driven combination of VCR and absorption systems **Tutorials:** - Solve problems on VAR systems. **Lab:** - Study the absorption refrigeration system	7	B1.1, C1.1, C2.1, C3.1, C4.1
13	**Lecture:** - Refrigeration system components - Refrigerants - Refrigeration environmental impact **Tutorials:** - Solve problems on advanced VCR and VAR systems. **Lab:** Study the absorption refrigeration system	7	C1.1, C2.1, C3.1, C4.1
14	**Lecture:** - Freezing Systems - Freezing time - Freezing advanced techniques **Tutorials:** - Solve problems on advanced VCR and VAR systems. **Lab:** Study the absorption refrigeration system	7	C2.1, C3.1, C4.1

Course: Basics of Refrigeration and Freezing	
Program Competencies	**Course LOs**
B1. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.	**B1.1** Model, analyze and design of physical systems applied to Refrigeration and freezing systems by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, Measurements and Instrumentation.
C1. Recognize the design concepts, operation and characteristics of internal combustion engines, boilers, heat exchangers, turbomachines and hydraulic machines.	**C1.1** Recognize the design concepts, operation and characteristics of heat exchangers and compressors used in refrigeration field.
C2. Analyze, evaluate and enhance the performance of the HVAC systems, automatic control systems, pneumatic systems, hydraulic Systems, combustion systems, thermal and nuclear power plants.	**C2.1** Analyze, evaluate and enhance the performance of the refrigeration systems.
C3. Judge the optimal solution according to the constraints of operation, costs, safety, reliability and environmental impacts.	**C3.1** Judge the optimal refrigeration system according to the constraints of operation, costs, safety, reliability and environmental impacts.
C4. Choose, apply and assess the newable and renewable energy resources in water desalination, power generation, heating, cooling and air conditioning applications.	**C4.1** Choose, apply and assess the renewable energy resources in refrigeration applications.

Course Coordinator: Dr. Amany Mahmoud Arafat Saif

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information:

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Mechanical Power Engineering		
Course Code	**MPE332**		
Year/ Level	Third year- 2nd semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	2	2	0

2. Course aims:

No.	Aims
7	Distinguish different types of thermal energy resources, analyze the performance of different thermal energy technologies, and demonstrate the design of thermal energy system.

3. Learning Outcomes (LOs):

A3.1	Apply cost analysis techniques to select a cost-effective solution that meet specified needs.
B4.1	Adopt suitable national and international standards and codes; and integrate legal, economic and financial aspects to: design, build, operate, inspect and maintain mechanical equipment and systems.
C3.1	Judge the optimal design, operating conditions and number of the components according to the constraints of operation, costs, safety, reliability and environmental impacts.
C4.1	Choose, apply and assess economically renewable energy resources in power generation field.

4. Course Contents:

No.	Topics	Week
1	**Lecture: (Introduction)** • Course Grades. • Course Contents. • Course topics. • Thermal Energy Resources types. • Energy Units. • Thermal Energy Resources Availability. **Tutorials:**	1

	• Brain storming on thermal energy resources classifications and availability.	
2	**Lecture (Biofuels)** • Biomass Classification. • Biomass Characteristics. • Ultimate analysis and heating value. • Biomass Yields. • Bioenergy. • Biomass combustion technology. • Anaerobic digestion. • Factors Affecting Biogas Production. **Tutorials:** • Identify different types of Biofuels. • Calculate the yield of Biomass production. • Calculate energy of biomass combustion. • Analyze the performance of biomass energy conversion technologies. • Write a report about future biomass generation and use.	2-3
3	**Lecture (Fuel Cells)** • Working Fundamentals of fuel cells. • Fuel cells construction. • Fuel cells operation. • Type of fuel sources used in fuel cells. • Fuel Cell Types. • Performance of Fuel Cells. **Tutorials:** • Analyze the performance of fuel cells technologies.	4-5
4	**Lecture (Nuclear Energy)** • Fundamentals of Nuclear energy. • Conservation of Nuclear Energy. • Types of Nuclear Reactions. • Nuclear Reactors. • Nuclear fuel. • Nuclear Chain Reactions. **Tutorials:** • Calculate energy release of nuclear fuel chain reaction.	6-7
5	**Midterm Examination**	**8**
6	**Lecture (Solar Thermal Energy)** • Solar energy conversion systems. • Solar energy resources. • Solar thermal energy collection. • Solar thermal energy conversion to electricity. • Solar thermal system efficiency. **Tutorials:** • Design a solar thermal system to meet specific needs. • A report about different solar thermal technologies.	9-11
7	**Lecture (Geothermal Energy)**	12-13

	• Geothermal System. • Geothermal Reservoirs. • Geothermal Energy Utilization. • Performance of Geothermal power plant. • Binary Cycle Analysis. **Tutorials:** • Design a geothermal power plant. • Calculate the power plant output. • Analyze the power plant performance.	
8	**Lecture and Tutorial:** Revision	14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method														
		Lecture	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A3.1**															
B-Level	**B4.1**	x	x			x	x	x	x							x
C-Level	**C3.1**	x	x			x			x			x				
	C4.1	x	x			x	x	x	x			x				

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials and lecturing hours.

7. Student Assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written)	A3.1, C4.1
2	Formative (quizzes –Reports- presentation - assignments)	A3.1, B4.1, C3.1, C4.1
3	Final Term Examination (written)	A3.1, A4.1, B4.1, C3.1, C4.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	8
2	Formative (quizzes – presentation – assignments...)	Every week
3	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	10
2	Formative (quizzes – presentation – assignments - …….)	20
3	Final Term Examination (written)	70
Total		100%

8. List of References:

No.	Reference List
1	Yasar Demirel, “Energy: Production, Conversion, Storage, Conservation, and Coupling, ” 1st Springer Science, 2012.
2	Charles F. Kutscher, Jana B. Milford, Frank Kreith, “Principles of Sustainable Energy Systems , ” 3rd Edition, CRC Press, 2018.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture/Online Classroom
2	White Board
3	Data Show System

10. Matrix of Knowledge and Skills of the Course:

No.	Topics	Aims	LOs
1	**Lecture: (Introduction)** • Course Grades. • Course Contents. • Course topics. • Thermal Energy Resources types. • Energy Units. • Thermal Energy Resources Availability. **Tutorials:** • Brain storming on thermal energy resources classifications and availability.	7	A3.1,
2	**Lecture (Biofuels)** • Biomass Classification. • Biomass Characteristics. • Ultimate analysis and heating value. • Biomass Yields. • Bioenergy. • Biomass combustion technology. • Anaerobic digestion. • Factors Affecting Biogas Production. **Tutorials:** • Identify different types of Biofuels. • Calculate the yield of Biomass production. • Calculate energy of biomass combustion. • Analyze the performance of biomass energy conversion technologies. • Write a report about future biomass generation and use.	7	A3.1, B4.1,C3.1
3	**Lecture (Fuel Cells)** • Working Fundamentals of fuel cells. • Fuel cells construction. • Fuel cells operation. • Type of fuel sources used in fuel cells. • Fuel Cell Types. • Performance of Fuel Cells. **Tutorials:** • Analyze the performance of fuel cells technologies.	7	A3.1, B4.1,C3.1
4	**Lecture (Nuclear Energy)** • Fundamentals of Nuclear energy. • Conservation of Nuclear Energy. • Types of Nuclear Reactions. • Nuclear Reactors. • Nuclear fuel.	7	A3.1, B4.1,C3.1

	- Nuclear Chain Reactions. **Tutorials:** - Calculate energy release of nuclear fuel chain reaction.		
5	**Midterm Examination**	**7**	B4.1
6	**Lecture (Solar Thermal Energy)** - Solar energy conversion systems. - Solar energy resources. - Solar thermal energy collection. - Solar thermal energy conversion to electricity. - Solar thermal system efficiency. **Tutorials:** - Design a solar thermal system to meet specific needs. - A report about different solar thermal technologies.	7	A3.1, B4.1,C3.1
7	**Lecture (Geothermal Energy)** - Geothermal System. - Geothermal Reservoirs. - Geothermal Energy Utilization. - Performance of Geothermal power plant. - Binary Cycle Analysis. **Tutorials:** - Design a geothermal power plant. - Calculate the power plant output. - Analyze the power plant performance.	7	A3.1, B4.1,C3.1, C4.1
8	**Lecture and Tutorial:** - Revision	7	A3.1, C3.1

Course: New and Renewable Thermal Energy sources	
Program Competencies	**Course LOs**
A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.	**A3.1** Apply mechanical engineering principles to select and design of thermal energy systems.
B4. Adopt suitable national and international standards and codes; and integrate legal, economic and financial aspects to: design, build, operate, inspect and maintain mechanical equipment and systems.	**B4.1** Adopt suitable national and international standards and codes; and integrate legal, economic and financial aspects to: design, build, operate, inspect and maintain thermal Energy system.
C3 Judge the optimal solution according to the constraints of operation, costs, safety, reliability and environmental impacts.	**C3.1** Judge the optimal design, operating conditions and number of the components according to the constraints of operation, costs, safety, reliability and environmental impacts.
C4. Choose, apply and assess the newable and renewable energy resources in water desalination, power generation, heating, cooling and air conditioning applications.	**C4.1** Choose, apply and assess economically thermal renewable energy resources in power generation field.

Course Coordinator: Dr. Mohamed Mostafa Hammam

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information:

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Mechanical Power Engineering		
Course Code	**MPE331**		
Year/ Level	Third year- 2nd semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	2	2	0

2. Course aims:

No.	**Aims**
7	Distinguish different types of energy resources, analyze the performance of different energy conversion technologies, and demonstrate the design of energy system.

3. Learning Outcomes (LOs):

A3.1	Apply cost analysis techniques to select a cost-effective solution that meet specified needs.
B4.1	Adopt suitable national and international standards and codes; and integrate legal, economic and financial aspects to: design, build, operate, inspect and maintain mechanical equipment and systems.
C3.1	Judge the optimal design, operating conditions and number of the components according to the constraints of operation, costs, safety, reliability and environmental impacts.
C4.1	Choose, apply and assess economically renewable energy resources in power generation field.

4. Course Contents:

No.	**Topics**	**Week**
1	**Lecture: (Introduction)** • Course Grades. • Course Contents. • Course topics. • Energy Resources Classifications. • Energy Units. • Energy Resources Availability. **Tutorials:**	1

	• Brain storming on energy resources classifications and availability.	
2	**Lecture: (Fossil Fuels)** • Types of Fossil Fuels. • Desirable Fuel Properties. • Fusel fuel processing. • Energy conversion. • Technology of energy generation. **Tutorials:** • Identify different types of fossil fuels. • Calculate the energy release of fusel fuel combustions. • Analyze the performance of energy conversion devices.	2
3	**Lecture (Biofuels)** • Biomass Classification. • Biomass Characteristics. • Ultimate analysis and heating value. • Biomass Yields. • Bioenergy. • Biomass combustion technology. • Anaerobic digestion. • Factors Affecting Biogas Production. **Tutorials:** • Identify different types of Biofuels. • Calculate the yield of Biomass production. • Calculate energy of biomass combustion. • Analyze the performance of biomass energy conversion technologies. • Write a report about future biomass generation and use.	3
4	**Lecture (Fuel Cells)** • Working Fundamentals of fuel cells. • Fuel cells construction. • Fuel cells operation. • Type of fuel sources used in fuel cells. • Fuel Cell Types. • Performance of Fuel Cells. **Tutorials:** • Analyze the performance of fuel cells technologies.	4
5	**Lecture (Nuclear Energy)** • Fundamentals of Nuclear energy. • Conservation of Nuclear Energy. • Types of Nuclear Reactions. • Nuclear Reactors. • Nuclear fuel. • Nuclear Chain Reactions. **Tutorials:**	5

	• Calculate energy release of nuclear fuel chain reaction.	
6	**Lecture (Solar Thermal Energy)** • Solar energy conversion systems. • Solar energy resources. • Solar thermal energy collection. • Solar thermal energy conversion to electricity. • Solar thermal system efficiency. **Tutorials:** • Design a solar thermal system to meet specific needs. • A report about different solar thermal technologies.	6
7	**Lecture (Photovoltaic)** • Photovoltaic effect. • Photovoltaic Basics. • Photovoltaic Cell. • Performance characteristics of solar cell. • Photovoltaic Array. • Photovoltaic System. **Tutorials:** • Estimation of Available Solar Radiation. • PV System Sizing. • Use a commercial software to design a photovoltaic system to meet specific needs.	7
8	**Midterm Examination**	**8**
9	**Lecture (Geothermal Energy)** • Geothermal System. • Geothermal Reservoirs. • Geothermal Energy Utilization. • Performance of Geothermal power plant. • Binary Cycle Analysis. **Tutorials:** • Design a geothermal power plant. • Calculate the power plant output. • Analyze the power plant performance.	9
10	**Lecture (Wind Energy)** • Wind Energy resource assessments. • Power in the Wind. • Wind Turbines Technology. • Wind Turbines Performance. • Wind Farms. **Tutorials:** • Design a Hybrid PV-Wind to meet electrical need using a commercial software.	10

11	**Lecture: (Tidal Energy)** • Tidal Turbines operation and performance. **Tutorials:** • Brain storming on Tidal Turbines operation and performance.	11
12	**Lecture (Wave Energy)** • Wave energy system components and operations. **Tutorials:** • Brain storming on wave energy system components and operations.	12
13	**Lecture (Hydropower)** • Hydropower resources. • Types of hydraulic turbines. • Hydropower system performance. **Tutorials:** • Brain storming on hydropower resources, turbines and system performance.	13
14	**Lecture and Tutorial:** • Revision	14

5. Teaching and Learning Methods:

LOs		**Teaching and Learning Method**														
		Lecture	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A3.1**															
B-Level	**B4.1**	x	x			x	x	x	x							x
C-Level	**C3.1**	x	x			x			x			x				
	C4.1	x	x			x	x	x	x			x				

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials and lecturing hours.

7. Student Assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written)	A3.1, C4.1
2	Formative (quizzes –Reports- presentation - assignments)	A3.1, B4.1, C3.1, C4.1
3	Final Term Examination (written)	A3.1, A4.1, B4.1, C3.1, C4.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	8
2	Formative (quizzes – presentation – assignments)	Every week
3	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	10
2	Formative (quizzes – presentation – assignments)	20
3	Final Term Examination (written)	70
	Total	100%

8. List of References:

No.	Reference List
1	Yasar Demirel, “Energy: Production, Conversion, Storage, Conservation, and Coupling, ” 1st Springer Science, 2012.
2	Charles F. Kutscher, Jana B. Milford, Frank Kreith, “Principles of Sustainable Energy Systems , ” 3rd Edition, CRC Press, 2018.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture/Online Classroom
2	White Board
3	Data Show System

10. Matrix of Knowledge and Skills of the Course:

No	Topics	Aim	LOs
1	**Lecture: (Introduction)** • Course Grades. • Course Contents. • Course topics. • Energy Resources Classifications. • Energy Units. • Energy Resources Availability. **Tutorials:** • Brain storming on energy resources classifications and availability.	7	A3.1,
2	**Lecture: (Fossil Fuels)** • Types of Fossil Fuels. • Desirable Fuel Properties. • Fusel fuel processing. • Energy conversion. • Technology of energy generation. **Tutorials:** • Identify different types of fossil fuels. • Calculate the energy release of fusel fuel combustions. • Analyze the performance of energy conversion devices.	7	A3.1, B4.1,
3	**Lecture (Biofuels)** • Biomass Classification. • Biomass Characteristics. • Ultimate analysis and heating value. • Biomass Yields. • Bioenergy. • Biomass combustion technology. • Anaerobic digestion. • Factors Affecting Biogas Production. **Tutorials:** • Identify different types of Biofuels. • Calculate the yield of Biomass production. • Calculate energy of biomass combustion. • Analyze the performance of biomass energy conversion technologies. • Write a report about future biomass generation and use.	7	A3.1, B4.1, C3.1
4	**Lecture (Fuel Cells)** • Working Fundamentals of fuel cells. • Fuel cells construction. • Fuel cells operation. • Type of fuel sources used in fuel cells. • Fuel Cell Types. • Performance of Fuel Cells. **Tutorials:**	7	A3.1, B4.1,C3.1

	• Analyze the performance of fuel cells technologies.		
5	**Lecture (Nuclear Energy)** • Fundamentals of Nuclear energy. • Conservation of Nuclear Energy. • Types of Nuclear Reactions. • Nuclear Reactors. • Nuclear fuel. • Nuclear Chain Reactions. **Tutorials:** • Calculate energy release of nuclear fuel chain reaction.	7	A3.1, B4.1,C3.1
6	**Lecture (Solar Thermal Energy)** • Solar energy conversion systems. • Solar energy resources. • Solar thermal energy collection. • Solar thermal energy conversion to electricity. • Solar thermal system efficiency. **Tutorials:** • Design a solar thermal system to meet specific needs. • A report about different solar thermal technologies.	7	A3.1, B4.1,C3.1
7	**Lecture (Photovoltaic)** • Photovoltaic effect. • Photovoltaic Basics. • Photovoltaic Cell. • Performance characteristics of solar cell. • Photovoltaic Array. • Photovoltaic System. **Tutorials:** • Estimation of Available Solar Radiation. • PV System Sizing. • Use a commercial software to design a photovoltaic system to meet specific needs.	7	A3.1, B4.1,C3.1, C4.1
8	**Lecture (Geothermal Energy)** • Geothermal System. • Geothermal Reservoirs. • Geothermal Energy Utilization. • Performance of Geothermal power plant. • Binary Cycle Analysis. **Tutorials:** • Design a geothermal power plant. • Calculate the power plant output. • Analyze the power plant performance.	7	A3.1, B4.1,C3.1, C4.1
9	**Lecture (Wind Energy)** • Wind Energy resource assessments. • Power in the Wind. • Wind Turbines Technology. • Wind Turbines Performance.	7	A3.1, B4.1,C3.1, C4.1

	- Wind Farms. **Tutorials:** - Design a Hybrid PV-Wind to meet electrical need using a commercial software.		
10	**Lecture: (Tidal Energy)** - Tidal Turbines operation and performance. **Tutorials:** - Brain storming on Tidal Turbines operation and performance.	7	A3.1
11	**Lecture (Wave Energy)** - Wave energy system components and operations. **Tutorials:** - Brain storming on wave energy system components and operations.	7	A3.1
12	**Lecture (Hydropower)** - Hydropower resources. - Types of hydraulic turbines. - Hydropower system performance. **Tutorials:** - Brain storming on hydropower resources, turbines and system performance.	7	B4.1,C3.1, C4.1
13	**Lecture and Tutorial:** - Revision	7	A3.1, C3.1

Course: Energy Sources	
Program Competencies	**Course LOs**
A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.	**A3.1** Apply mechanical engineering principles to select and design energy systems.
B4. Adopt suitable national and international standards and codes; and integrate legal, economic and financial aspects to: design, build, operate, inspect and maintain mechanical equipment and systems.	**B4.1** Adopt suitable national and international standards and codes; and integrate legal, economic and financial aspects to: design, build, operate, inspect and maintain Energy system.
C3 Judge the optimal solution according to the constraints of operation, costs, safety, reliability and environmental impacts.	**C3.1** Judge the optimal design, operating conditions and number of the components according to the constraints of operation, costs, safety, reliability and environmental impacts.
C4. Choose, apply and assess the newable and renewable energy resources in water desalination, power generation, heating, cooling and air conditioning applications.	**C4.1** Choose, apply and assess economically renewable energy resources in power generation field.

Course Coordinator: Dr. Mohamed Mostafa Hamma

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information:

<table>
<tr><td>Program Title</td><td colspan="3">B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)</td></tr>
<tr><td>Department offering the Program</td><td colspan="3">Mechanical Power Engineering</td></tr>
<tr><td>Department Responsible for the Course</td><td colspan="3">Mechanical Power Engineering</td></tr>
<tr><td>Course Code</td><td colspan="3">MPE333</td></tr>
<tr><td>Year/ Level</td><td colspan="3">Third year- 2nd semester</td></tr>
<tr><td>Specialization</td><td colspan="3">Major</td></tr>
<tr><td rowspan="2">Teaching Hours</td><td>Lectures</td><td>Tutorial</td><td>Practical</td></tr>
<tr><td>2</td><td>2</td><td>0</td></tr>
</table>

2. Course aims:

No.	Aims
7	Distinguish different types of hydrodynamic energy resources, analyze the performance of different hydrodynamic energy technologies, and demonstrate the design of hydrodynamic energy system

3. Learning Outcomes (LOs):

A3.1	Apply cost analysis techniques to select a cost-effective solution that meet specified needs.
B4.1	Adopt suitable national and international standards and codes; and integrate legal, economic and financial aspects to: design, build, operate, inspect and maintain mechanical equipment and systems.
C3.1	Judge the optimal design, operating conditions and number of the components according to the constraints of operation, costs, safety, reliability and environmental impacts.
C4.1	Choose, apply and assess economically renewable energy resources in power generation field.

4. Course Contents:

No.	Topics	Week
1	**Lecture: (Introduction)** - Course Grades. - Course Contents. - Course topics. - Hydrodynamic Energy Resources Types. - Energy Units. - Hydrodynamic Energy Resources Availability. **Tutorials:** Brain storming on hydrodynamic energy resources types and availability.	1
2	**Lecture (Wind Energy)** - Wind Energy resource assessments. - Power in the Wind. - Wind Turbines Technology. - Wind Turbines Performance. - Wind Farms. **Tutorials:** - Design a wind energy system to meet electrical need using a commercial software.	2-4
3	- **Lecture (Hydropower)** - Hydropower resources. - Types of hydraulic turbines. - Hydropower system performance. **Tutorials:** - Design a hydro energy system to meet electrical need using a commercial software.	5-7
4	**Midterm Examination**	**8**
5	- **Lecture: (Tidal Energy)** - Tidal Energy resource assessments. - Output power from tidal energy resources. - Tidal Turbines operation and performance. - Cost analysis of building tidal energy systems. **Tutorials:** - Design a tidal energy system to meet electrical need using a commercial software.	9-11
6	- **Lecture (Wave Energy)** - Wave energy resource assessments. - Power extraction from wave energy. - Performance of wave power devices. **Tutorials:** - Design a wave energy system to meet electrical need using a commercial software.	12-13
7	**Lecture and Tutorial:** - Revision	14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method														
		Lecture	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A3.1**															
B-evel	**B4.1**	x	x			x	x	x	x							x
C-Level	**C3.1**	x	x			x			x			x				
	C4.1	x	x			x	x	x	x			x				

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials and lecturing hours.

7. Student Assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written)	A3.1, C4.1
2	Formative (quizzes –Reports- presentation - assignments)	A3.1, B4.1, C3.1, C4.1
3	Final Term Examination (written)	A3.1, A4.1, B4.1, C3.1, C4.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	8
2	Formative (quizzes – presentation – assignments)	Every week
3	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	10
2	Formative (quizzes – presentation – assignments)	20
3	Final Term Examination (written)	70
Total		100%

8. List of References

No.	Reference List
1	Yasar Demirel, “Energy: Production, Conversion, Storage, Conservation, and Coupling, ” 1st Springer Science, 2012.
2	Charles F. Kutscher, Jana B. Milford, Frank Kreith, “Principles of Sustainable Energy Systems , ” 3rd Edition, CRC Press, 2018.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture/Online Classroom
2	White Board
3	Data Show System

10. Matrix of Knowledge and Skills of the Course:

No.	Topics	Aims	LOs
1	**Lecture: (Introduction)** - Course Grades. - Course Contents. - Course topics. - Hydrodynamic Energy Resources Types. - Energy Units. - Hydrodynamic Energy Resources Availability. **Tutorials:** - Brain storming on hydrodynamic energy resources types and availability.	7	A3.1,
2	**Lecture (Wind Energy)** - Wind Energy resource assessments. - Power in the Wind. - Wind Turbines Technology. - Wind Turbines Performance. - Wind Farms. **Tutorials:** - Design a wind energy system to meet electrical need using a commercial software.	7	A3.1, B4.1,
3	- **Lecture (Hydropower)** - Hydropower resources. - Types of hydraulic turbines. - Hydropower system performance. **Tutorials:** Design a hydro energy system to meet electrical need using a commercial software.	7	A3.1, B4.1,C3.1
4	**Midterm Examination**	7	B4.1
5	- **Lecture: (Tidal Energy)** - Tidal Energy resource assessments. - Output power from tidal energy resources. - Tidal Turbines operation and performance. - Cost analysis of building tidal energy systems. **Tutorials:** - Design a tidal energy system to meet electrical need using a commercial software.	7	A3.1, B4.1,C3.1
6	- **Lecture (Wave Energy)** - Wave energy resource assessments. - Power extraction from wave energy. - Performance of wave power devices. **Tutorials:** - Design a wave energy system to meet electrical need using a commercial software.	7	A3.1, B4.1,C3.1
7	**Lecture and Tutorial:** - Revision	7	A3.1, C3.1

Course: New and Renewable Hydrodynamics Energy Sources	
Program Competencies	**Course LOs**
A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.	**A3.1** Apply mechanical engineering principles to select and design hydro energy systems.
B4. Adopt suitable national and international standards and codes; and integrate legal, economic and financial aspects to: design, build, operate, inspect and maintain mechanical equipment and systems.	**B4.1** Adopt suitable national and international standards and codes; and integrate legal, economic and financial aspects to: design, build, operate, inspect and maintain hydro Energy system.
C3 Judge the optimal solution according to the constraints of operation, costs, safety, reliability and environmental impacts.	**C3.1** Judge the optimal design, operating conditions and number of the components according to the constraints of operation, costs, safety, reliability and environmental impacts.
C4. Choose, apply and assess the newable and renewable energy resources in water desalination, power generation, heating, cooling and air conditioning applications.	**C4.1** Choose, apply and assess economically renewable hydro energy resources in power generation field.

Course Coordinator: Dr. Mohamed Mostafa Hammam

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information:

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department Responsible for the Course	Electrical Power Engineering		
Department offering the Program	Mechanical Power Engineering		
Course Code	**EPM322**		
Year/ Level	Third year- 2nd semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	2	1	-

2. Course aims:

No.	Aims
7	Recognize and analyze the design and the operation characteristics of the components of the power network and electrical machines applied in mechanical power engineering discipline.

3. Learning Outcomes (LOs):

A1.1	Identify the principles, and solve complex engineering problems on the electrical machines applied in mechanical power systems.
A1.2	Identify the principles, and solve complex engineering problems on the electrical machines.
B1.1	Analyze the components of the power network.
C1.1	Recognize the design concepts and operation characteristics of electrical machines applied in mechanical power systems.
C1.2	Recognize the design concepts and operation characteristics of power network.

4. Course Contents:

No.	Topics	Week
1	**Lecture:** • Introduction to Power system generation • Thermal power stations **Tutorials/Lab:** • Solve problems on the energy and exergy analyses of various components.	1
2	**Lecture:** • Hydroelectric power station (Selection of site, construction, principle of work, types of boiler and turbine, control and efficiency) .**Tutorials/Lab:** • Solve problems on hydroelectric power plant.	2
3	**Lecture:** • Power system transmission**:** Constants of overhead transmission lines (T.Ls.). Calculation of the inductance of the transmission lines. **Tutorials/Lab:** • Solve problems on inductance of transmission lines	3
4	**Lecture:** • Calculation of the capacitance of the T.Ls. **Tutorials/Lab:** • Solve problems on capacitance of transmission lines.	4
5	**Lecture:** • Performance of short transmission lines **Tutorials/Lab:** • Solve problems on short transmission lines.	5
6	**Lecture:** • Performance of medium transmission lines **Tutorials/Lab:** • Solve problems on medium transmission lines.	6
7	**Lecture:** • Overhead line insulators **Tutorials/Lab:** • Solve problems on overhead line insulators	7
8	**Midterm Examination**	**8**
9	**Lecture:** • Power system distribution **Tutorials/Lab:** • Solve problems on power system distribution.	9
10	**Lecture:** • Principles of electromechanical energy conversion: the conversion process for rotating machines, and transformers. **Tutorials/Lab:** • Solve problems on electromechanical energy conversion.	10

11	**Lecture:** • Transformer types and construction. • Single-phase transformer: Exact and approximate equivalent circuits. **Tutorials/Lab:** • Solve problems on Single-phase transformer	11
12	**Lecture:** • Transformers: • Transformer types and construction. testing, regulation and efficiency. • Thee-phase transformer: types and connection. **Tutorials/Lab:** • Solve problems on three phase transformers.	12
13	**Lecture:** • Induction Machines: • Introduction and construction of different types of induction machine. • Principles of operation of 3ph induction motor **Tutorials/Lab:** • Solve problems on Induction Machines.	13
14	**Lecture:** • **Induction Machines:** • Induction motors characteristics, equivalent circuits, testing, efficiency, and regulation. **Tutorials/Lab:** • Solve problems on Induction Machines.	14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method														
		Lecture	Interactive lectures	Flipped Classroom	Presentation	Discussion	Tutorial	Problem-solving	Brain storming	Projects	Site visits	Self-learning	Cooperative	Drawing Studio	Computer Simulation	Practical Experiments
A-Level	A1.1	x	x			x	x	x	x							
	A1.2	x	x			x	x	x	x							
B-Level	B1.1	x	x			x	x	x	x							
C-Level	C1.1	x	x			x	x	x	x							
	C1.2	x	x			x	x	x	x							

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials and videos
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written)	A1.2, B1.1, C1.2
3	Formative (quizzes - presentation - assignments)	A1.1, A1.2, B1.1, C1.1, C1.2
4	Final Term Examination (written)	A1.1, A1.2, B1.1, C1.1, C1.2

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	8
2	Tutorial & Report	Every chapter
3	Formative (quizzes – presentation – assignments)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	13.3
2	Tutorial & Report	6.7
3	Formative (quizzes – presentation –assignments)	13.3
4	Final Term Examination (written)	66.7
Total		100%

8. List of References

No.	Reference List
1	P.V. Gupta, M.L. Soni, U.S. Bhatnagar, A. Chakrabarti “A Textbook on Power System Engineering” Dhanpat Rai & Co., 2013.
2	Fitzgerald, A.E.; Kingsley, C. and Umans, S.D., "Electric Machinery" McGraw-Hill; 6th edition, 2005.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture/Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aims	LOs
1	**Lecture:** • Introduction to Power system generation • Thermal power stations **Tutorials/Lab:** • Solve problems on the energy and exergy analyses of various components.	7	A1.2, B1.1, C1.2
2	**Lecture:** • Hydroelectric power station (Selection of site, construction, principle of work, types of boiler and turbine, control and efficiency) .**Tutorials/Lab:** • Solve problems on hydroelectric power plant.	7	A1.2, B1.1, C1.2
3	**Lecture:** • Power system transmission**:** Constants of overhead transmission lines (T.Ls.). Calculation of the inductance of the transmission lines. **Tutorials/Lab:** • Solve problems on inductance of transmission lines	7	A1.2, B1.1, C1.2
4	**Lecture:** • Calculation of the capacitance of the T.Ls. **Tutorials/Lab:** • Solve problems on capacitance of transmission lines.	7	A1.2, B1.1, C1.2
5	**Lecture:** • Performance of short transmission lines **Tutorials/Lab:** • Solve problems on short transmission lines.	7	A1.2, B1.1, C1.2
6	**Lecture:** • Performance of medium transmission lines **Tutorials/Lab:** • Solve problems on medium transmission lines.	7	A1.2, B1.1, C1.2
7	**Lecture:** • Overhead line insulators **Tutorials/Lab:** • Solve problems on overhead line insulators	7	A1.2, B1.1, C1.2
8	**Midterm Examination**	7	A1.2, B1.1, C1.2
9	**Lecture:** • Power system distribution **Tutorials/Lab:**	7	A1.2, B1.1, C1.2

	• Solve problems on power system distribution		
10	**Lecture:** • Principles of electromechanical energy conversion: the conversion process for rotating machines, and transformers. **Tutorials/Lab:** • Solve problems on electromechanical energy conversion.	7	A1.1, C1.1
11	**Lecture:** • Transformer types and construction. • Single-phase transformer: Exact and approximate equivalent circuits, **Tutorials/Lab:** • Solve problems on Single-phase transformer	7	A1.1, C1.1
12	**Lecture:** • Transformers: • Transformer types and construction testing, regulation and efficiency. • Three-phase transformer: types and connection. **Tutorials/Lab:** • Solve problems on three phase transformers	7	A1.1, C1.1
13	**Lecture:** • Induction Machines: • Introduction and construction of different types of induction machine. • Principles of operation of 3ph induction motor **Tutorials/Lab:** • Solve problems on Induction Machines.	7	A1.1, C1.1
14	**Lecture:** • **Induction Machines:** • Induction motors characteristics, equivalent circuits, testing, efficiency, and regulation. **Tutorials/Lab:** Solve problems on Induction Machines.	7	A1.1, C1.1

Course: Electrical Machines and Power Networks	
Program Competencies	**Course LOs**
A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.	**A1.1** Identify the principles, and solve complex engineering problems on the electrical machines applied in mechanical power systems. **A1.2** Identify the principles, and solve complex engineering problems on the electrical machines.
B1. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, Solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.	**B1.1** Analyze the components of the power network.
C1. Recognize the design concepts, operation and characteristics of the internal combustion engines, boilers, heat exchangers, turbomachines and hydraulic machines.	**C1.1** Recognize the design concepts and operation characteristics of electrical machines applied in mechanical power systems. **C1.2** Recognize the design concepts and operation characteristics of power network.

Course Coordinator: Prof Azza Ahmed Eldesouky

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information

Program Title	B.Sc. In Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department Responsible for the Course	Electrical Engineering		
Department offering the Program	Mechanical Power Engineering		
Course Code	**HUF305**		
Year/ Level	Third year- 2nd Semester		
Specialization	Minor		
Teaching Hours	Lectures	Tutorial	Practical
	2	-	-

2. Course Aims:

No.	Aim
5	Communicate effectively using different modes, tools, and body language to improve presentation skills and achieve factors for successful presentation.

3. Learning Outcomes (LOs):

A7.1	Prepare an effective technical presentation.
A8.1	Communicate effectively with colleges to Prepare an effective presentation.
A9.1	Use creative thinking to introduce a novel ideas and contents in the presentation.
A10.1	Recognize the biggest body language blunders.
A10.2	Utilize the factors for successful presentation.
A10.3	Research for the latest finding in effective presentation skills.
A10.4	Recognize the different modern information technology tools for effective presentation.

4. Course Contents:

No.	Topics	Week
1	**Lecture:** • **Presentation fundamentals:** Definition and elements of effective presentation. Main causes of presentation failure. Modern presentation tools and software.	1-2
2	**Lecture:** • **Presentation preparation:** Importance of identifying presentation objective. Effective objective characteristics. Presentation audience identification. Preparing an idea map for your presentation.	3-5

3	**Lecture:** • **Building your presentation** • **Basic presentation elements.** Importance of developing a strong presentation opening. Various presentation body structure. Utilizing visual aids. Effective conclusion.	6-7
4	**Midterm**	8
5	**Lecture:** • **Effective Presentation Delivery** Presentation delivery methods and styles. Factors affecting delivery of presentation. Controlling presenter's characteristics. Effective Slide format (Fonts-colors- Size- Background). Fundamentals of effective audience communication. • The biggest body language blunders	9-12
6	**Lecture:** • **Group Presentation Practice** Practice presentation sessions. Each group prepares and presents an effective technical presentation. Peer evaluation and feedback is used for improving performance.	13-14

5. Teaching and Learning Methods:

LOs		**Teaching and Learning Method**														
		Lecture (online / in class)	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
	A7-1	**x**	**x**		**x**	**x**				**x**		**x**	**x**			
	A8-1	**x**	**x**			**x**				**x**		**x**	**x**			
	A9-1	**x**	**x**		**x**	**x**						**x**	**x**			
	A10-1	**x**		**x**	**x**	**x**				**x**		**x**	**x**			
	A10-2	**x**		**x**	**x**	**x**				**x**			**x**			
	A10-3	**x**		**x**	**x**	**x**				**x**		**x**				
	A10-4	**x**		**x**		**x**				**x**		**x**	**x**			

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials
2	Online lectures and assignments

7. Student Assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written/ online)	A7-1, A8-1, A9-1, A10-2, A10-3, A10-4
2	Formative (quizzes- online quizzes- presentation)	A8-1, A9-1, A10-1, A10-2, A10-3, A10-4.
3	Final Term Examination (written)	A7-1, A8-1, A9-1, A10-1, A10-2, A10-3, A10-4.

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written/ online)	8
2	Formative (quizzes- online quizzes- presentation)	Every week
3	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights
1	Mid Term Examination (written/ online)	10
2	Formative (quizzes- online quizzes- presentation - …….)	10
4	Final Term Examination (written)	80
Total		100%

8. List of References:

No.	Reference List
1	Steele, William R. "Presentation Skills 201: How to Take It to the Next Level as a Confident, Engaging Presenter", 2009, Outskirt Press.
2	Carmine Gallo "Talk Like TED", St. Martin's press 2014

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture / Online Classroom
2	Online facilities.
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No	Topic	Aim	LOs
1	**Lecture:** • **Presentation fundamentals:** Definition and elements of effective presentation. Main causes of presentation failure. Modern presentation tools and software.	5	A7.1
2	**Lecture:** • **Presentation preparation:** Importance of identifying presentation objective. Effective objective characteristics. Presentation audience identification. Preparing an idea map for your presentation.	5	A7.1, A8.1
3	**Lecture:** • **Building your presentation** • **Basic presentation elements.** Importance of developing a strong presentation opening. Various presentation body structure. Utilizing visual aids. Effective conclusion.	5	A9.1, A10.2, A10.3, A10.4
4	**Midterm**	5	A7.1, A8.1, A9.1, A10.2, A10.3, A10.4
5	**Lecture:** • **Effective Presentation Delivery** Presentation delivery methods and styles. Factors affecting delivery of presentation. Controlling presenter's characteristics. Effective Slide format (Fonts-colors- Size- Background). Fundamentals of effective audience communication. The biggest body language blunders	5	A10.1, A10.2, A10.3, A10.4
6	**Lecture:** **Group Presentation Practice** Practice presentation sessions. Each group prepares and presents an effective technical presentation. Peer evaluation and feedback is used for improving performance.	5	A8.1, A9.1, A10.1, A10.2, A10.3, A10.4

Course: Presentation skills	
Program Competencies	**Course LOs**
A7. Function efficiently as an individual and as a member of multi-disciplinary and multicultural teams.	**A7.1** Prepare an effective technical presentation.
A8. Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools.	**A8.1** Communicate effectively with colleges to Prepare an effective presentation
A9. Use creative, innovative, and flexible thinking and acquire entrepreneurial and leadership skills to anticipate and respond to new situations.	**A9.1** Use creative thinking to introduce a novel ideas and contents in the presentation
A10. Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.	**A10.1** Recognize the biggest body language blunders. **A10.2** Utilize the Factors for successful presentation. **A10.3** Research for the latest finding in effective presentation skills. **A10.4** Recognize the different modern information technology tools for effective presentation.

Course Coordinator: Dr. Heba M. Abdel-Atty

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

FOURTH YEAR

1. Basic Information

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Mechanical Power Engineering		
Course Code	**MPE436**		
Year/ Level	Fourth Year – 1st Semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	2	2	1

2. Course aims:

No.	Aims
7	Acquire and apply the principles of design, analysis of the operating behavior of turbomachines; steam turbines, gas turbines, fans, and air compressors, to increase efficiency.

3. Learning Outcomes (LOs):

A3.1	Apply some thermal and mechanical design concepts to select or produce a cost-effective solution that meets specified needs with consideration for economic and environmental aspects.
A10.1	Describe the principle working of turbomachines.
A10.2	Recognize the elements used in steam turbines, gas turbines, fans, and air compressors
A10.3	Identify the different types of turbomachines, and identify the operation required for each machine.
B1.1	Analyze the components of the different turbomachines by applying the concepts of Thermodynamics, Heat Transfer, Fluid Mechanics, and automatic control principles.
B2.1	Plan the suitable measuring scheme for pressure and velocity for different types of turbomachines.
B2.2	Analyze the problems concerning turbomachines.
B3.1	Select the conventional component for the power plant according to the required performance and its behavior under a wide range of operating conditions.
C1.1	Recognize the design concepts of elements of the turbomachines.
C1.2	Identify the operating behavior and characteristics of the turbomachines in the thermal and nuclear power plants with the variation of load.
C1.3	Identify the operating behavior and characteristics of the turbomachines with the variation of load.
C2.1	Analyze, evaluate and enhance the performance of the turbomachines.

4. Course Contents:

No.	Topics	Week
1	**Lecture:** • Introduction: Dimensional Analysis—Basic Thermodynamics and Fluid Mechanics • Introduction to Turbomachinery, Types of Turbomachines, Compressible Flow Machines • Basic Thermodynamics, Fluid Mechanics, and Definitions of Efficiency **Tutorials/Lab:** • Solve problems on the basics of Fluid mechanics and Thermodynamics. • Prepare experiments on flow ducts (Nozzle and Diffuser) to investigate the effect of the inlet flow conditions on the state of the exit flow.	1
2	**Lecture:** • Continuity Equation • The First Law of Thermodynamics • Newton’s Second Law of Motion • The Second Law of Thermodynamics: Entropy **Tutorials/Lab:** • Solve problems on the Laws of Thermodynamics and its applications on the turbomachines. • Prepare experiments on flow ducts (Nozzle and Diffuser) to investigate the effect of the inlet flow conditions on the state of the exit flow.	2
3	**Lecture:** • Nozzle and diffuser Efficiency, Energy Transfer in Turbomachinery, The Euler Turbine Equation. • Efficiency and Losses of Steam and Gas Turbines, Fans, and air Compressors **Tutorials/Lab:** • Solve problems thermal analysis on flow ducts (Nozzle and Diffuser) and Steam and Gas Turbines, Fans, and air Compressors. • Conduct experiments on flow ducts (Nozzle and Diffuser) to investigate the effect of the inlet flow conditions on the state of the exit flow.	3
4	**Lecture:** • Steam Turbines • Introduction, Steam Nozzles, Nozzle Efficiency • The Reheat Factor • Metastable Equilibrium **Tutorials/Lab:** • Solve problems thermal analysis on flow ducts (Nozzle and Diffuser) and Steam Turbines.	4

	- Conduct experiments on flow ducts (Nozzle and Diffuser) to investigate the effect of the inlet flow conditions on the state of the exit flow.	
5	**Lecture:** - Turbine Stage Design - Impulse Stage - The Impulse Steam Turbine - Reaction Turbine **Tutorials/Lab:** - Solve problems on Turbine Stage Design and Impulse Stage. - Conduct laboratory experiments relating to the determination of the turbomachine efficiency, reheat factor, and specific speed and establishment of different initial conditions, flow characteristics, and system arrangements.	5
6	**Lecture:** - Pressure Compounding (The Rateau Turbine) - Velocity Compounding (The Curtis Turbine), **Tutorials/Lab:** - Solve problems on The Impulse Steam Turbine and Reaction Turbine. - Conduct laboratory experiments relating to the determination of the turbomachine efficiency, reheat factor, and specific speed and establishment of different initial conditions, flow characteristics, and system arrangements.	6
7	**Lecture:** - Axial Flow Steam Turbines, Degree of Reaction. - Cascade design. **Tutorials/Lab:** - Solve problems on Axial Flow Steam Turbines, Degree of Reaction, and Cascade design. - Conduct laboratory experiments relating to the determination of the turbomachine efficiency, reheat factor, and specific speed and establishment of different initial conditions, flow characteristics, and system arrangements.	7
8	**Midterm Examination**	**8**
9	**Lecture:** - Axial Flow and Radial Flow Gas Turbines - Introduction to Axial Flow Turbines, - Velocity Triangles and Work Output **Tutorials/Lab:** - Solve problems on the Axial-Flow and Radial Flow Gas Turbines, Axial Flow Turbines, and Velocity Triangles and Work Output. - Conduct laboratory experiments relating to the determination of the turbomachine efficiency, reheat factor, and specific speed and establishment of different initial conditions, flow characteristics and system arrangements.	9-10

10	**Lecture:** - Degree of Reaction - Blade-Loading Coefficient, Stator (Nozzle), and Rotor Losses **Tutorials/Lab:** - Solve problems on the Degree of Reaction and Blade-Loading Coefficient, Stator (Nozzle), and Rotor Losses - Conduct laboratory experiments relating to the determination of the turbomachine efficiency, reheat factor, and specific speed and establishment of different initial conditions, flow characteristics, and system arrangements.	11
11	**Lecture:** - Radial Flow Turbine, Velocity Diagrams, and Thermodynamic Analysis - Turbine Efficiency and Application of Specific Speed. **Tutorials/Lab:** - Solve problems on Radial Flow Turbine, Velocity Diagrams, and Turbine Efficiency. - Identify and Conduct experiments on axial-flow gas turbine unit to investigate its Performance.	12
12	**Lecture:** - Axial Flow Compressors and Fans - Introduction, Velocity Diagram, Degree of Reaction, Stage Loading, Lift-and-Drag Coefficients - Cascade Nomenclature and Terminology **Tutorials/Lab:** - Solve problems on Velocity Diagram, Degree of Reaction, Stage Loading, Lift-and-Drag Coefficients of Axial Flow Compressors and Fans. - Conduct experiments on Axial Flow Compressors.	13
13	**Lecture:** - Axial Flow Compressor Characteristics. - Multi-Stage Axial Flow Compressors Performance. **Tutorials/Lab:** - Solve problems on Multi-Stage Axial Flow Compressors. - Conduct experiments on Axial Flow Compressors	14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method														
		Lecture	Interactive lectures	Flipped Classroom	Presentation	Discussion	Tutorial	Problem-solving	Brainstorming	Projects	Site visits	Self-learning	Cooperative	Drawing Studio	Computer Simulation	Practical Experiments
A-Level	A3.1	x	x			x			x							
	A10.1	x	x			x	x	x	x							
	A10.2	x	x			x	x	x	x							x
	A10.3	x	x			x	x	x	x	x						x
B-Level	B1.1	x	x			x	x	x	x							x
	B2.1	x	x			x	x	x								x
	B2.2	x	x			x	x	x	x	x		x				x
	B3.1	x	x			x	x	x	x			x				x
C-Level	C1.1	x	x			x	x	x				x				x
	C1.2	x	x			x	x	x				x				x
	C1.3	x	x			x	x	x	x			x				x
	C2.1	x	x			x	x	x	x			x				x

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials and videos
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written)	A10.1, A10.1, A10.3, B1.1, B3.1, C1.1, C2.1
2	Practical/ Oral Examination	A3.1, A10.3, B2.1, B3.1, C2.1
3	Formative (quizzes - presentation - assignments,)	A3.1, B1.1, B2.2, C1.2, C1.3
4	Final Term Examination (written)	A3.1, B1.1, B2.2, C1.1, C1.2, C1.3

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	8
2	Practical/ Oral Examination	15
3	Formative (quizzes – presentation – assignments)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	8
2	Practical/ Oral Examination	20
3	Formative (quizzes – presentation – assignments)	12
4	Final Term Examination (written)	60
Total		100%

8. List of References

No.	Reference List
1	White, F. M., “Fluid Mechanics”, Sixth Edition, McGraw-Hill, 2008.
2	Rama S.R. Gorla and Aijaz A. Khan, “Turbomachinery Design and Theory”, Marcel Dekker, Inc. 2003.
3	Sarker, D. S., “Thermal Power Plant: Design and Operation, ” 1st Edition, Elsevier, Waltham, Massachusetts, USA, 2015.
4	Nag, P. K., “Power Plant Engineering, ” 3rd Edition, Tata McGraw-Hill Inc., New Delhi, India, 2008.
5	Zohuri, B. and McDaniel, P.,“Thermodynamics in Nuclear Power Plant Systems, ” 2nd Edition, Springer International Publishing, Cham, Switzerland, 2019.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture/Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aims	LOs
1	**Lecture:** • Introduction: Dimensional Analysis—Basic Thermodynamics and Fluid Mechanics • Introduction to Turbomachinery, Types of Turbomachines, Compressible Flow Machines • Basic Thermodynamics, Fluid Mechanics, and Definitions of Efficiency **Tutorials/Lab:** • Solve problems on the basics of Fluid mechanics and Thermodynamics. • Prepare experiments on flow ducts (Nozzle and Diffuser) to investigate the effect of the inlet flow conditions on the state of the exit flow.	7	B1.1, B2.2, C1.3
2	**Lecture:** • Continuity Equation • The First Law of Thermodynamics • Newton's Second Law of Motion • The Second Law of Thermodynamics: Entropy **Tutorials/Lab:** • Solve problems on the Laws of Thermodynamics and its applications on the turbomachines. • Prepare experiments on flow ducts (Nozzle and Diffuser) to investigate the effect of the inlet flow conditions on the state of the exit flow.	7	A3.1, B1.1, B2.1, C1.1, C1.3, C2.1
3	**Lecture:** • Nozzle and diffuser Efficiency, Energy Transfer in Turbomachinery, The Euler Turbine Equation. • Efficiency and Losses of Steam and Gas Turbines, Fans, and air Compressors **Tutorials/Lab:** • Solve problems thermal analysis on flow ducts (Nozzle and Diffuser), Efficiency and Losses of Steam and Gas Turbines, Fans, and air Compressors. • Conduct experiments on flow ducts (Nozzle and Diffuser) to investigate the effect of the inlet flow conditions on the state of the exit flow.	7	A3.1, A10.1, A10.2, A10.3, B1.1, B2.1, B2.2, C1.2, C1.3
4	**Lecture:** • Steam Turbines • Introduction, Steam Nozzles, Nozzle Efficiency • The Reheat Factor • Metastable Equilibrium	7	A3.1, A10.1, A10.2, A10.3, B1.1, B2.1, B2.2,

	Tutorials/Lab: - Solve problems on Steam Turbines and The Reheat Factor. - Conduct experiments on flow ducts (Nozzle and Diffuser) to investigate the effect of the inlet flow conditions on the state of the exit flow.		C1.2, C1.3
5	**Lecture:** - Turbine Stage Design - Impulse Stage - The Impulse Steam Turbine - Reaction Turbine **Tutorials/Lab:** - Solve problems on Turbine Stage Design and Impulse Stage. - Conduct laboratory experiments relating to the determination of the turbomachine efficiency, reheat factor, and specific speed and establishment of different initial conditions, flow characteristics, and system arrangements.	7	A3.1, A10.1, A10.2, A10.3, B1.1, B2.1, B2.2, C1.2, C1.3, C2.1
6	**Lecture:** - Pressure Compounding (The Rateau Turbine) - Velocity Compounding (The Curtis Turbine), **Tutorials/Lab:** - Solve problems on The Impulse Steam Turbine and Reaction Turbine. - Conduct laboratory experiments relating to the determination of the turbomachine efficiency, reheat factor, and specific speed and establishment of different initial conditions, flow characteristics, and system arrangements.	7	B1.1, B2.1, B3.1, C1.1, C1.2, C1.3, C2.1
7	**Lecture:** - Axial Flow Steam Turbines, Degree of Reaction. - Cascade design. **Tutorials/Lab:** - Solve problems on Axial Flow Steam Turbines, Degree of Reaction, and Cascade design. - Conduct laboratory experiments relating to the determination of the turbomachine efficiency, reheat factor, and specific speed and establishment of different initial conditions, flow characteristics, and system arrangements.	7	A3.1, A10.1, B1.1, B2.1, B3.1, C1.1, C1.3
8	**Midterm Examination**	7	A10.1, A10.1, A10.3, B1.1, B3.1, C1.1, C2.1

9	**Lecture:** - Axial Flow and Radial Flow Gas Turbines - Introduction to Axial Flow Turbines, - Velocity Triangles and Work Output **Tutorials/Lab:** - Solve problems on the Axial-Flow and Radial Flow Gas Turbines, Axial Flow Turbines, and Velocity Triangles and Work Output. - Conduct laboratory experiments relating to the determination of the turbomachine efficiency, reheat factor, and specific speed and establishment of different initial conditions, flow characteristics, and system arrangements.	7	A10.2, B1.1, C1.1, C1.2, C2.1
10	**Lecture:** - Degree of Reaction - Blade-Loading Coefficient, Stator (Nozzle), and Rotor Losses **Tutorials/Lab:** - Solve problems on the Degree of Reaction and Blade-Loading Coefficient, Stator (Nozzle), and Rotor Losses - Conduct laboratory experiments relating to the determination of the turbomachine efficiency, reheat factor, and specific speed and establishment of different initial conditions, flow characteristics, and system arrangements.	7	B1.1, B2.2, B3.1, C1.1, C1.2, C2.1
11	**Lecture:** - Radial Flow Turbine, Velocity Diagrams, and Thermodynamic Analysis - Turbine Efficiency and Application of Specific Speed. **Tutorials/Lab:** - Solve problems on Radial Flow Turbine, Velocity Diagrams, and Turbine Efficiency. - Identify and Conduct experiments on axial-flow gas turbine unit to investigate its Performance.	7	A3.1, B1.1, B2.1, B3.1, C1.1, C1.3, C2.1
12	**Lecture:** - Axial Flow Compressors and Fans - Introduction, Velocity Diagram, Degree of Reaction, Stage Loading, Lift-and-Drag Coefficients - Cascade Nomenclature and Terminology **Tutorials/Lab:** - Solve problems on Velocity Diagram, Degree of Reaction, Stage Loading, Lift-and-Drag Coefficients of Axial Flow Compressors and Fans.	7	A3.1, A10.1, A10.3, B1.1, C1.1, C1.3, C2.1

	• Conduct experiments on Axial Flow Compressors.		
13	**Lecture:** • Axial Flow Compressor Characteristics. • Multi-Stage Axial Flow Compressors Performance. **Tutorials/Lab:** • Solve problems on Multi-Stage Axial Flow Compressors. • Conduct experiments on Axial Flow Compressors	7	A3.1, B1.1, B2.2, C1.1, C1.2, C1.3, C1.2.

Course: Turbomachines	
Program Competencies	**Course LOs**
A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical, and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.	**A3.1** Apply some thermal and mechanical design concepts to select or produce a cost-effective solution that meets specified needs with consideration for economic and environmental aspects.
A10. Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.	**A10.1** Describe the principle working of turbomachines. **A10.2** Recognize the elements used in steam turbines, gas turbines, fans, and air compressors. **A10.3** Identify the different types of turbomachines and identify the operation required for each machine.
B1. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, Solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.	**B1.1** Analyze the components of the different turbomachines by applying the concepts of Thermodynamics, Heat Transfer, Fluid Mechanics, and automatic control principles.
B2 Plan, manage, and carry out designs of mechanical systems and machine elements using appropriate **materials** both traditional means and computer-aided tools and software contemporary to the mechanical engineering field.	**B2.1** Plan the suitable measuring scheme for pressure and velocity for different types of turbomachines. B2.2 Analyze the problems concerning turbomachines.

B3. Select conventional mechanical equipment according to the required performance.	**B3.1** Select the conventional component for the power plant according to the required performance and its behavior under a wide range of operating conditions.
C1. Recognize the design concepts, operation, and characteristics of the internal combustion engines, boilers, heat exchangers, turbomachines, and hydraulic machines.	**C1.1** Recognize the design concepts of elements of the turbomachines. **C1.2** Identify the operating behavior and characteristics of the turbomachines in the thermal and nuclear power plants with the variation of load. **C1.3** Identify the operating behavior and characteristics of the turbomachines with the variation of load.
C2. Analyze, evaluate and enhance the performance of the HVAC systems, automatic control systems, pneumatic systems, hydraulic systems, combustion systems, thermal and nuclear power plants.	**C2.1** Analyze, evaluate, and enhance the performance of the turbomachines.

Course Coordinator: Prof Dr. Atef M. Alam-Aldin

Program Coordinator: Sherihan Abd El0Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information:

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Mechanical Power Engineering		
Course Code	**MPE437**		
Year/ Level	Fourth year- 1st semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	2	2	1

2. Course Aims:

No.	Aims
4, 7	Acquire the students with the basic skills to analyse, control, and measure the performance of hydraulic machines.

3. Learning Outcomes (LOs):

A1.1	Formulate, and solve complex hydraulic machines problems by applying engineering fundamentals, basic science and mathematics.
A2.1	Conduct appropriate experimentation, analyze and interpret data, assess and evaluate findings and objective engineering judgment to draw conclusions.
B1.1	Model, and analyze hydraulic machines by applying the concepts of Thermodynamics, Heat Transfer, Fluid Mechanics, solid Mechanics, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.
B3.1	Select Pumps and Turbines according to the required performance.
B4.1	Adopt suitable national and international standards and codes to design, operate, inspect, and maintain hydraulic machines.
C1.1	Recognize the design concepts, operation and characteristics of hydraulic machines.
C2.1	Analyze, evaluate and enhance the performance of hydraulic Systems.
C4.1	Apply and assess renewable energy resources (waterpower) in power generation.
C7.1	Exchange knowledge and skills with engineering community and industries; prepare the presentations and technical reports.

4. Course Contents:

No.	Topics	Week
1	**Lecture:** • Hydraulic Machines-Course specification • Introduction • Basic Definitions • Classification of Hydraulic Machines • History of Hydraulic machines • Applications of Hydraulic machines • Review of the Fluid Mechanics **Tutorials:** • Solve problems on the applications of continuity, momentum, and energy equations. **Lab:** • A visit to the hydraulic lab to identify various turbines in the lab.	1
2	**Lecture:** • Classifications of Hydraulic Machines • Positive displacement Machines • Rotodynamic machines • One-dimensional theory • Euler head • The application of Euler's equation to radial flow machines. • The application of Euler's equation to axial flow machines. **Tutorials:** • Solve problems on the applications of continuity, momentum, and energy equations. **Lab:** • A visit to the hydraulic lab to identify various turbines in the lab.	2
3	**Lecture:** • Introduction to water turbines • Hydropower generation • Hydropower in Egypt • Hydraulic turbine classification **Tutorials:** • Solve problems on the applications of continuity, momentum, and energy equations. **Lab:** • Identify various components of Pelton wheel. • Conduct experiment to estimate the efficiency of Pelton wheel.	3
4	**Lecture:** • Impulse turbines • Pelton wheel (Composition, Layout, Working theory, Classification, Performance) • Turgo turbine • Cross-flow turbine • Governing system for Pelton wheel	4

	• Example **Tutorials:** • Solve problems on Pelton turbines. **Lab:** • Identify various components of Pelton wheel. • Conduct experiment to estimate the efficiency of Pelton wheel.	
5	**Lecture:** • Introduction • Reaction T. Installation • Reaction T. classification • Francis turbines • Degree of reaction • Axial Flow Turbines • Propeller Turbines • Kaplan Turbines • Bulb Turbine • Governing system for Francis turbine **Tutorials:** • Solve problems on reaction turbines. **Lab:** • Conduct experiments on Francis turbine model to estimate the performance of it under different guide vane angles.	5-6
6	**Lecture:** • Brief review on the previous studies • Introduction to Pumps • Pumping theory • Classifications of pumps • Non-positive displacement pumps • Positive displacement pumps. **Tutorials:** • Solve problems on reaction turbines. **Lab:** • Conduct experiments on Gear pump performance.	7
7	**Midterm Examination**	**8**
8	**Lecture:** • Non-positive displacement pumps • Introduction to rotodynamic pumps • Classifications of Rotodynamic pumps • Components of Rotodynamic pumps • The centrifugal pumps • Classifications of centrifugal pumps • Velocity triangles • Some useful assumptions • Effect of outlet blade angle **Tutorials:** • Solve problem on centrifugal pump velocity triangles and Euler head.	9

	Lab: • Conduct experiments on centrifugal pump performance.	
9	**Lecture:** • Rotodynamic pump Manometric head • Rotodynamic pump performance • Losses in rotodynamic pumps • Commence speed of rotodynamic pumps. **Tutorials:** • Solve problems on centrifugal pump manometric head. **Lab:** • Conduct experiments on centrifugal pump operating point.	10
10	**Lecture:** • Typical installation of a dynamic pump • Pump performance characteristics • System characteristics • Arrangements of two similar pumps • Arrangements of two dis-similar pumps • The specific speed • Axial flow pump • Axial pump performances • NPSH • Cavitation in rotodynamic pumps **Tutorials/Lab:** • Solve problems on centrifugal pump performance curves. • Solve problems on axial flow pumps curves. • Solve problems on system characteristics. • Solve problems on pump cavitation. **Lab:** • Conduct experiments on centrifugal pump operating point.	11-12
11	**Lecture:** • Cavitation continued • What is a safe NPSH margin? • Flow Control Method • Pump operation and stop procedures. • Data for purchasing a pump. • Testing of pumps in laboratories • Hydraulic machine model and principles of similarity **Tutorials:** • Solve problems on the principle of similarity. **Lab:** • Conduct experiments on centrifugal pump operating point.	13-14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method														
		Lecture	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A1.1**	x	x		x	x	x		x							
	A2.1								x							x
B-Level	**B1.1**	x	x			x	x		x							
	B3.1	x	x			x	x		x							
	B4.1	x	x			x	x		x		x					x
C-Level	**C1.1**	x	x			x	x				x					x
	C2.1	x	x			x	x									
	C4.1	x	x		x	x	x									x
	C7.1				x	x						x	x			

6. Teaching and Learning Methods of Disable Students:

No.	**Teaching Method**
1	Additional Tutorials and videos
2	Online lectures and assignments

7. Student Assessment:

7.1 Student Assessment Methods:

No.	**Assessment Method**	**LOs**
1	Mid Term Examination (written)	A1.1, B1.1, B3.1, B4.1, B4.2, C1.1, C2.1, C4.1
2	Practical/ Oral Examination	A2.1, C7.1
3	Formative (quizzes - presentation - assignments)	A1.1, B1.1, B3.1, B4.1, B4.2, C1.1, C2.1, C4.1
4	Final Term Examination (written)	A1.1, B1.1, B3.1, B4.1, B4.2, C1.1, C2.1, C4.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	8
2	Practical/ Oral Examination	15
3	Formative (quizzes – presentation – assignments)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	8
2	Practical/ Oral Examination	20
3	Formative (quizzes – presentation – assignments)	12
4	Final Term Examination (written)	60
Total		100%

8. List of References:

No.	Reference List
1	C.P. Kothandaraman et al., “Fluid Mechanics and Machinery”, New Age publication, 2nd ed., 2007.
2	J. F. Douglas , J. Gasiorek , J. Swaffield , “Fluid Mechanics” , Prentice Hall, 5 edition, 2005.
3	Frank M. White, "Fluid Mechanics", 4th ed., McGraw-Hill, INC. 1999.
4	R. S., Khurmi, “A Textbook of Hydraulics, Fluid mechanics and Hydraulic Machines”, S. Chand & Company LTD., 2003.
5	I. J., Karassik, J. P., Messina, P., Cooper, and C. C., Heald,” Pump Handbook”, 3rd ed., MacGraw-Hill, 2001.
6	Mahesh Kumar, “Fluid Mechanics and Hydraulic Machines,” Pearson India Education Services Pvt. Ltd, 2019.
7	F. M., El-Otla “Hydraulic Machines, course notes 1997”, Suez Canal University, 1997.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture/Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No	Topics	Aims	LOs
1	**Lecture:** • Hydraulic Machines-Course specification • Introduction • Basic Definitions • Classification of Hydraulic Machines • History of Hydraulic machines • Applications of Hydraulic machines • Review of the Fluid Mechanics **Tutorials:** • Solve problems on the applications of continuity, momentum, and energy equations. **Lab:** • A visit to the hydraulic lab to identify various turbines in the lab.	7	A1.1
2	**Lecture:** • Classifications of Hydraulic Machines • Positive displacement Machines • Rotodynamic machines • One-dimensional theory • Euler head • The application of Euler's equation to radial flow machines. • The application of Euler's equation to axial flow machines. **Tutorials:** • Solve problems on the applications of continuity, momentum, and energy equations. **Lab:** • A visit to the hydraulic lab to identify various turbines in the lab.	7	A1.1, A2.1, B1.1
3	**Lecture:** • Introduction to water turbines • Hydropower generation • Hydropower in Egypt • Hydraulic turbine classification **Tutorials:** • Solve problems on the applications of continuity, momentum, and energy equations. **Lab:** • Identify various components of Pelton wheel. • Conduct experiment to estimate the efficiency of Pelton wheel.	4, 7	A1.1, A2.1, B1.1,
4	**Lecture:** • Impulse turbines • Pelton wheel (Composition, Layout, Working theory, Classification, Performance)	4, 7	A1.1, A2.1, B1.1, B3.1,

	- Turgo turbine - Cross-flow turbine - Governing system for Pelton wheel - Example **Tutorials:** - Solve problems on Pelton turbines. **Lab:** - Identify various components of Pelton wheel. - Conduct experiment to estimate the efficiency of Pelton wheel.		B4.1, C1.1, C2.1, C4.1
5	**Lecture:** - Introduction - Reaction T. Installation - Reaction T. classification - Francis turbines - Degree of reaction - Axial Flow Turbines - Propeller Turbines - Kaplan Turbines - Bulb Turbine - Governing system for Francis turbine **Tutorials:** - Solve problems on reaction turbines. **Lab:** - Conduct experiments on Francis turbine model to estimate the performance of it under different guide vane angles.	4, 7	A1.1, A2.1, B1.1, B3.1, B4.1, C1.1, C2.1, C4.1, C7.1
6	**Lecture:** - Brief review on the previous studies - Introduction to Pumps - Pumping theory - Classifications of pumps - Non-positive displacement pumps - Positive displacement pumps. **Tutorials:** - Solve problems on reaction turbines. **Lab:** - Conduct experiments on Gear pump performance.	4, 7	A1.1, A2.1, B1.1, B3.1, B4.1, C1.1, C2.1, C4.1
8	**Lecture:** - Non-positive displacement pumps - Introduction to rotodynamic pumps - Classifications of Rotodynamic pumps - Components of Rotodynamic pumps - The centrifugal pumps - Classifications of centrifugal pumps - Velocity triangles - Some useful assumptions - Effect of outlet blade angle	4, 7	A1.1, A2.1, B1.1, B3.1, B4.1, C1.1, C2.1, C4.1

	Tutorials: • Solve problem on centrifugal pump velocity triangles and Euler head. **Lab:** • Conduct experiments on centrifugal pump performance.		
9	**Lecture:** • Rotodynamic pump Manometric head • Rotodynamic pump performance • Losses in rotodynamic pumps • Commence speed of rotodynamic pumps. **Tutorials:** • Solve problems on centrifugal pump manometric head. **Lab:** Conduct experiments on centrifugal pump operating point.	4, 7	A1.1, B1.1, B3.1, B4.1, C1.1, C2.1, C4.1
10	**Lecture:** • Typical installation of a dynamic pump • Pump performance characteristics • System characteristics • Arrangements of two similar pumps • Arrangements of two dis-similar pumps • The specific speed • Axial flow pump • Axial pump performances • NPSH • Cavitation in rotodynamic pumps **Tutorials:** • Solve problems on centrifugal pump performance curves. • Solve problems on axial flow pumps curves. • Solve problems on system characteristics. • Solve problems on pump cavitation. **Lab:** • Conduct experiments on centrifugal pump operating point.	4, 7	A1.1, A2.1, B1.1, B3.1, B4.1, C1.1, C2.1, C4.1
11	**Lecture:** • Cavitation continued • What is a safe NPSH margin? • Flow Control Method • Pump operation and stop procedures. • Data for purchasing a pump. • Testing of pumps in laboratories • Hydraulic machine model and principles of similarity **Tutorials:** • Solve problems on the principle of similarity. **Lab:** • Conduct experiments on centrifugal pump operating point.	4, 7	A1.1, B1.1, B3.1, B4.1, C1.1, C2.1, C4.1

Course: Hydraulic Machines	
Program Competencies	**Course LOs**
A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.	**A1.1** Identify, formulate, and solve complex hydraulic machines problems by applying engineering fundamentals, basic science and mathematics.
A2. Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.	**A2.1** Conduct appropriate experimentation, analyze and interpret data, assess and evaluate findings and and objective engineering judgment to draw conclusions.
B1. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.	**B1.1** Model, and analyze hydraulic machines by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, solid Mechanics, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.
B3. Select conventional mechanical equipment according to the required performance.	**B3.1** Select Pumps and Turbines according to the required performance.
B4. Adopt suitable national and international standards and codes; and integrate legal, economic and financial aspects to: design, build, operate, inspect and maintain mechanical equipment and systems.	**B4.1** Adopt suitable national and international standards and codes to: design, operate, inspect, and maintain hydraulic machines.
C1. Recognize the design concepts, operation and characteristics of internal combustion	**C1.1** Recognize the design concepts, operation and

engines, boilers, heat exchangers, turbomachines and hydraulic machines.	characteristics of hydraulic machines.
C2. Analyze, evaluate and enhance the performance of the HVAC systems, automatic control systems, pneumatic systems, hydraulic Systems, combustion systems, thermal and nuclear power plants.	**C2.1** Analyze, evaluate and enhance the performance of hydraulic Systems.
C4. Judge the optimal solution according to the constraints of operation, costs, safety, reliability and environmental impacts.	**C4.1** Apply and assess renewable energy resources (water power) in power generation.
C7. Exchange knowledge and skills with engineering community and industries; prepare the presentations and technical reports.	**C7.1** Exchange knowledge and skills with engineering community and industries; prepare the presentations and technical reports.

Course Coordinator: Assoc. Prof. Dr. Mohamed El-Ghandour El-Ghandour

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Mechanical Power Engineering		
Course Code	**MPE438**		
Year/ Level	Fourth year- 1st semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	2	2	1

2. Course Aims:

No.	**Aims**
7	Acquire the students with the principles of design, analysis and evaluation for the performance of the air-conditioning and ventilation systems considering the progress in integrating renewable energy resources in HVAC applications.

3. Learning Outcomes (LOs):

B1.1	Model, analyze and design of physical systems applied to HVAC systems by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, Measurements and Instrumentation.
B2.1	Plan, manage and carry out designs of HVAC systems using appropriate both traditional means and computer-aided tools and software contemporary to the air conditioning and ventilation field.
B4.1	Adopt suitable national and international standards and codes such as ASHRAE standards; and integrate financial aspects to design the mechanical HVAC systems.
C2.1	Analyze, evaluate and enhance the performance of the HVAC systems.
C3.1	Judge the optimal air conditioning system according to the constraints of operation, costs, safety, reliability and environmental impacts.
C4.1	Choose, apply and assess the newable and renewable energy resources in heating, cooling and air conditioning applications.
C6.1	Use and develop codes using a wide range of software packages pertaining to the HVAC field.

4. Course Contents:

No.	Topics	Week
1	**Lecture:** • Introduction • Air Psychrometry • Psychrometric Properties • Psychrometric chart • Comfort Condition **Tutorials:** • Solve problems on air psychrometric properties. **Lab:** • Conduct experiments on study and measure psychrometric properties and processes.	1
2	**Lecture:** • Psychrometric Processes. • Air mixing process • Sensible heating and cooling • Humidification and dehumidification processes **Tutorials:** • Solve problems on psychrometric processes. **Lab:** • Conduct experiments on study and measure psychrometric properties and processes.	2
3	**Lecture:** • Air Conditioning Systems • A summer air conditioning system with a zero by-pass factor • A summer air conditioning system with a nonzero by-pass factor • A summer air conditioning system with reheat coil for high latent cooling load applications **Tutorials:** • Solve problems on summer air conditioning systems **Lab:** • Conduct experiments on study performance of AC system.	3
4	**Lecture:** • Indirect evaporative air cooling system. • Winter Air-Conditioning systems • All year (complete) air conditioning system **Tutorials:** • Solve problems on winter air conditioning systems • Solve problems on all year air conditioning systems **Lab:** • Conduct experiments on study performance of AC system	4
5	**Lecture:** • Heating **versus** cooling load calculations. • Methods of estimating cooling and heating loads • Cooling Load Calculations	5

	• Sensible and Latent heat gains • ASHRAE cooling load factors and specifications **Tutorials:** • Solve problems on air conditioning load calculations **Lab:** • Conduct experiments on study performance of AC system	
6	**Lecture:** • Heating Load Calculations • Passive Air Conditioning Techniques. • Integrating newable and renewable energy resources in air conditioning applications. • Energy efficient building Concept **Tutorials:** • Solve problems on AC load calculations **Lab:** • Develop code using software packages (MS-VB/ EES) to perform air conditioning load calculations	6-7
8	**Midterm Examination**	**8**
9	**Lecture:** • General classification of air conditioning systems • Selection of air conditioning system • All air systems • All water systems • Air-water systems • Unitary refrigerant air conditioning systems **Tutorials:** • Solve problems on selecting air conditioning system **Lab:** • Identify air conditioning system components	9
10	**Lecture:** • Conditioned space air duct system. • Air distribution performance. • Design of air distribution system. • Types of air distribution devices • Airflow patterns inside conditioned space • Selection of supply air outlets **Tutorials:** • Solve problems on air distribution system design. **Lab:** • Identify air conditioning system components	10
11	**Lecture:** • Design of air conditioning Ducts • Velocity method • Equal friction method • Static regain method • Performance of duct system • System balancing and optimization	11-12

	Tutorials: • Solve problems on air conditioning duct design. **Lab:** • Identify air conditioning system components	
12	**Lecture:** • Air flow in ventilating and conditioning ducts • The flow energy Equation • Pressure loss from friction in fitting, piping and ducts • Design of low velocity system **Tutorials:** • Solve problems on pressure losses and fan total power in air conditioning duct system. **Lab:** • Develop a code using software packages (MS-VB/ EES/…) to perform air conditioning duct design and calculations	13-14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method														
		Lecture	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
B-Level	**B1.1**	x	x			x	x	x								x
	B2.1	x	x			x	x	x	x							x
	B4.1	x	x			x	x	x	x			x				
C-Level	**C2.1**	x	x			x	x	x				x				
	C3.1	x	x		x	x	x	x				x				x
	C4.1	x	x			x	x	x	x			x				x
	C6.1	x	x			x	x	x				x				x

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials and videos
2	Online lectures and assignments

7. Student Assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written)	B1.1, B2.1, B4.1, C2.1, C3.1
2	Practical/ Oral Examination	B1.1, B2.1,B4.1, C2.1, C3.1, C4.1,
3	Formative (quizzes - presentation - assignments,)	A3.1, B1.1, B3.1, C2.1, C3.1, C4.1
4	Final Term Examination (written)	A3.1, B1.1, B3.1, C2.1, C3.1, C4.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	8
2	Practical/ Oral Examination	15
3	Formative (quizzes – presentation – assignments...)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	12
2	Practical/ Oral Examination	20
3	Formative (quizzes – presentation – assignments - …….)	8
4	Final Term Examination (written)	60
Total		100%

8. List of References

No.	Reference List
1	Hundy, G.F., Trott, A.R., and Welch, T.C., "Refrigeration and Air-conditioning”, 4th edition, Butterworth Heinemann, Oxford, 2008.
2	Arora, C.P., “Refrigeration and Air-conditioning”, 3rd edition, TATA-McGrawHill, 2009
3	Gupta, J.K. and Khurmi, R.S., “ Textbook of Refrigeration and Air Conditioning”, Distributed by S. Chand & Company Ltd., New Delhi, 2007.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture/Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aims	LOs
1	**Lecture:** • Introduction • Air Psychrometry • Psychrometric Properties • Psychrometric chart • Comfort Condition **Tutorials:** • Solve problems on air psychrometric properties. **Lab:** • Conduct experiments on study and measure psychrometric properties and processes.	7	B1.1
2	**Lecture:** • Psychrometric Processes. • Air mixing process • Sensible heating and cooling • Humidification and dehumidification processes **Tutorials:** • Solve problems on psychrometric processes. **Lab:** • Conduct experiments on study and measure psychrometric properties and processes.	7	B1.1
3	**Lecture:** • Air Conditioning Systems • A summer air conditioning system with a zero by-pass factor • A summer air conditioning system with a nonzero by-pass factor • A summer air conditioning system with reheat coil for high latent cooling load applications **Tutorials:** • Solve problems on summer AC systems **Lab:** • Conduct experiments on study performance of air conditioning system.	7	B1.1, B2.1, B4.1, C2.1

4	**Lecture:** - Indirect evaporative air cooling system. - Winter Air-Conditioning systems - All year (complete) air conditioning system **Tutorials:** - Solve problems on winter air conditioning systems - Solve problems on all year air conditioning systems **Lab:** - Conduct experiments on study performance of AC system	7	B1.1, B2.1, B4.1, C2.1
5	**Lecture:** - Heating **versus** cooling load calculations. - Methods of estimating cooling and heating loads - Cooling Load Calculations - Sensible and Latent heat gains - ASHRAE cooling load factors and specifications **Tutorials:** - Solve problems on air conditioning load calculations **Lab:** - Conduct experiments on study performance of air conditioning system	7	B1.1, B2.1, B4.1, C2.1
6	**Lecture:** - Heating Load Calculations - Passive Air Conditioning Techniques. **Tutorials:** - Solve problems on air conditioning load calculations **Lab:** - Develop code using software packages (MS-VB/ EES) to perform air conditioning load calculations	7	B2.1, B4.1, C2.1, C3.1, C4.1, C6.1
7	**Lecture:** - Integrating newable and renewable energy resources in air conditioning applications. - Energy efficient building Concept **Tutorials:** - Solve problems on air conditioning load calculations **Lab:** - Develop code using software packages (MS-VB/ EES) to perform air conditioning load calculations	7	B2.1, B4.1, C2.1, C3.1, C4.1, C6.1
8	**Midterm Examination**	7	B1.1, B2.1, B4.1, C2.1, C3.1
9	**Lecture:** - General classification of air conditioning systems - Selection of air conditioning system	7	B2.1, B4.1, C2.1, C3.1, C6.1

	- All air systems - All water systems - Air-water systems - Unitary refrigerant air conditioning systems **Tutorials:** - Solve problems on selecting air conditioning system **Lab:** - Identify air conditioning system components		
10	**Lecture:** - Conditioned space air duct system. - Air distribution performance. - Design of air distribution system. - Types of air distribution devices - Airflow patterns inside conditioned space - Selection of supply air outlets **Tutorials:** - Solve problems on air distribution system design. **Lab:** - Identify air conditioning system components	7	B1.1, B2.1, B4.1, C2.1, C3.1, C6.1
11	**Lecture:** - Design of air conditioning Ducts - Velocity method - Equal friction method **Tutorials:** - Solve problems on air conditioning duct design. **Lab:** - Identify air conditioning system components	7	B1.1, B2.1, B4.1, C2.1, C3.1, C6.1
12	**Lecture:** - Static regain method - Performance of duct system - System balancing and optimization **Tutorials:** - Solve problems on air conditioning duct design. **Lab:** Identify air conditioning system components	7	B1.1, B2.1, B4.1, C2.1, C3.1, C6.1
13	**Lecture:** - Air flow in ventilating and conditioning ducts - The flow energy Equation **Tutorials:** - Solve problems on air flow in AC duct system. **Lab:** - Develop a code using software packages (MS-VB/ EES/…) to perform air conditioning duct design and calculations	7	B1.1, B2.1, B4.1, C2.1, C3.1, C6.1

14	**Lecture:** • Pressure loss from friction in fitting, piping and ducts • Design of low velocity system **Tutorials:** • Solve problems on pressure losses and fan total power in air conditioning duct system. **Lab:** Develop a code using software packages (MS-VB/ EES/…) to perform air conditioning duct design and calculations	7	B1.1, B2.1, B4.1, C2.1, C3.1, C6.1

Course: Ventilation and Air Conditioning	
Program Competencies	**Course LOs**
B1. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.	**B1.1** Model, analyze and design of physical systems applied to HVAC systems by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, Measurements and Instrumentation.
B2. Plan, manage and carry out designs of mechanical systems and machine elements using appropriate materials both traditional means and computer-aided tools and software contemporary to the mechanical engineering field.	**B2.1** Plan, manage and carry out designs of HVAC systems using appropriate both traditional means and computer-aided tools and software contemporary to the air conditioning and ventilation field.
B4. Adopt suitable national and international standards and codes; and integrate legal, economic and financial aspects to: design, build, operate, inspect and maintain mechanical equipment and systems.	**B4.1** Adopt suitable national and international standards and codes such as ASHRAE standards; and integrate financial aspects to design the mechanical HVAC systems.
C2. Analyze, evaluate and enhance the performance of the HVAC systems, automatic control systems, pneumatic systems, hydraulic Systems, combustion systems, thermal and nuclear power plants.	**C2.1** Analyze, evaluate and enhance the performance of the HVAC systems.
C3. Judge the optimal solution according to the constraints of operation, costs, safety, reliability and environmental impacts.	**C3.1** Judge the optimal air conditioning system according to the constraints of operation, costs, safety, reliability and environmental impacts.

C4. Choose, apply and assess the newable and renewable energy resources in water desalination, power generation, heating, cooling and air conditioning applications.	**C4.1** Choose, apply and assess the newable and renewable energy resources in heating, cooling and air conditioning applications.
C6. Use and develop codes using a wide range of software packages pertaining to the discipline.	**C6.1** Use and develop codes using a wide range of software packages pertaining to the HVAC field.

Course Coordinator: Dr. Amany Mahmoud Arafat Saif

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information:

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Mechanical Power Engineering		
Course Code	**MPE442**		
Year/ Level	Fourth year – 1st semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	2	2	-

2. Course aims:

No.	**Aims**
4, 7	Design, analyze and evaluate the performance of different internal combustion engines, powered by both conventional and renewable energy sources, considering the operational, maintenance, economical, safety, and environmental aspects.

3. Learning Outcomes (LOs):

A3.1	Apply the engineering design and requirements for the combustion stages and parameters in the internal combustion engines.
A10.1	Acquire and apply new knowledge for converting the internal combustion engines to use natural gas.
B1.1	Analyze the main components of the carburetion system and injection systems in internal combustion engines by applying the concepts of thermodynamics, heat transfer, fluid mechanics, combustion and automatic control principles.
B3.1	Select the conventional component for the internal combustion engines testing and performance.
B4.1	Choose suitable fuel, injection system to design, build, operate, inspect, and maintain internal combustion engines.
C1.1	Recognize the operation and characteristics of the internal combustion engines.
C2.1	Analyze and valuate the combustion stages and operating parameters of the internal combustion engines.
C3.1	Judge the optimal solution according to the constraints of operation, costs, safety, reliability and environmental impacts for the fuel used in the internal combustion engines.
C7.1	Exchange knowledge and skills with engineering community and industries based on the fuel and injection systems in the engines and prepare the presentations and technical reports.

4. Course Contents:

No.	Topics	Week
1	**Lecture:** • Introduction. • Method of study on engine cycle. • Actual and fuel air standard cycles in spark ignition engines. **Tutorials/Lab:** • Solve problems on the engine performance and efficiencies.	1
2	**Lecture:** • Ideal inlet and exhaust processes. • Engine performance (parameters). • Thermodynamics revision. **Tutorials/Lab:** • Solve problems on the engine performance and efficiencies.	2
3	**Lecture:** • Ignition limits. • Stages of combustion in spark ignition engines. • Effect of engine variables in ignition lag. **Tutorials/Lab:** • Solve problems on the stages of combustion in S.I. engines.	3
4	**Lecture:** • Effect of engine variables in flame propagation. • Detonation. • Effects of detonation. • Effect of engine variables on detonation. **Tutorials/Lab:** • Solve problems on the stages of combustion in spark ignition engines.	4
5	**Lecture:** • Combustion in compression ignition engines. • Stages of combustion in compression ignition engines. • Delay period or ignition lag. **Tutorials/Lab:** • Solve problems on the stages of combustion in compression ignition engines.	5
6	**Lecture:** • Variables affecting the delay period. • Diesel knock. • Methods of controlling diesel knock. • Reduction of diesel knock. **Tutorials/Lab:** Solve problems on the stages of combustion in compression ignition engines.	6
7	**Lecture:**	7

	• Carburetion. • Properties of the air-petrol mixtures. • Mixture requirements for steady state operation. • A simple or elementary carburetor. **Tutorials/Lab:** • Solve problems on the carburetion systems.	
8	**Midterm Examination**	**8**
9	**Lecture:** • Complete carburetor. • Calculation of the air to fuel ratio for a simple carburetor. **Tutorials/Lab:** • Solve problems on the carburetion systems.	9
10	**Lecture:** • Fuel injection systems. • Requirements of a diesel injection system. • Types of injection systems. • Fuel pump. **Tutorials/Lab:** • Solve problems on the engine fuel injection systems.	10
11	**Lecture:** • Types of fuel injectors. • Types of nozzles. • Quantity of fuel per cycle and size of nozzle orifice. • Electronic gasoline injection system. **Tutorials/Lab:** • Solve problems on the engine fuel injection systems.	11
12	**Lecture:** • Vehicular fuels source and properties. • Natural gas as vehicular fuel. **Tutorials/Lab:** • Solve problems on the fuel and natural gas engine operation.	12
13	**Lecture:** • Natural gas vehicles. • Gasoline and diesel engines conversion. **Tutorials/Lab:** • Solve problems on the fuel and natural gas engine operation.	13
14	**Lecture:** • Natural gas vehicles components. • Feasibility study of engine conversion. **Tutorials/Lab:** • Solve problems on the fuel and natural gas engine operation.	14

5. Teaching and Learning Methods:

LOs		**Teaching and Learning Method**														
		Lecture	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A3.1**	x	x			x	x	x	x			x				x
	A10.1	x	x			x	x	x	x			x				x
B-Level	**B1.1**	x	x			x	x	x	x			x				x
	B3.1	x	x			x	x	x	x			x				x
	B4.1	x	x			x	x	x	x			x				x
C-Level	**C1.1**	x	x			x	x	x	x			x				x
	C2.1	x	x			x	x	x	x			x				x
	C3.1	x	x			x	x	x	x			x				x
	C7.1	x	x			x		x				x				x

6. Teaching and Learning Methods of Disable Students:

No.	**Teaching Method**
1	Additional Tutorials and videos
2	Online lectures and assignments

7. Student Assessment:

7.1 Student Assessment Methods:

No.	**Assessment Method**	**LOs**
1	Mid Term Examination (written)	A3.1, B1.1, B3.1, C1.1, C2.1
2	Practical/ Oral Examination	-
3	Formative (quizzes - presentation - assignments)	A3.1, A10.1, B1.1, B3.1, B4.1, C1.1, C2.1, C3.1, C7.1
4	Final Term Examination (written)	A3.1, A10.1, B1.1, B3.1, B4.1, C1.1, C2.1, C3.1, C7.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	8
2	Practical/ Oral Examination	-
3	Formative (quizzes – presentation – assignments)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	10
2	Practical/ Oral Examination	-
3	Formative (quizzes – presentation – assignments)	20
4	Final Term Examination (written)	70
Total		100%

8. List of References:

No.	Reference List
1	Gupta H. N., "Fundamentals of Internal Combustion Engines", Rakamal Electric Press, Delhi, 2006.
2	Irvin Glassman, Richard A. Yetter, "Combustion", Elsevier, 2008.
3	S. Srinivasan, "Automotive Mechanics", Tata McGraw-Hill Publishing Company Limited, 2003.
4	Gad H. M., "Lectures in Combustion Systems", Mechanical Power Eng. Dept., Port Said University, 2020.
5	S. P. Sen, "Internal Combustion Engine Theory and Practice by, 1977.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture/Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aims	LOs
1	**Lecture:** • Introduction. • Method of study on engine cycle. • Actual and fuel air standard cycles in spark ignition engines. **Tutorials/Lab:** • Solve problems on the engine performance and efficiencies.	4	A3.1, B3.1, C1.1
2	**Lecture:** • Ideal inlet and exhaust processes. • Engine performance (parameters). • Thermodynamics revision. **Tutorials/Lab:** • Solve problems on the engine performance and efficiencies.	7	A3.1, B3.1, C1.1
3	**Lecture:** • Ignition limits. • Stages of combustion in spark ignition engines. • Effect of engine variables in ignition lag. **Tutorials/Lab:** • Solve problems on the stages of combustion in S.I. engines.	4, 7	A3.1, C1.1, C2.1
4	**Lecture:** • Effect of engine variables in flame propagation. • Detonation. • Effects of detonation. • Effect of engine variables on detonation. **Tutorials/Lab:** • Solve problems on the stages of combustion in spark ignition engines.	4, 7	A3.1, C1.1, C2.1
5	**Lecture:** • Combustion in compression ignition engines. • Stages of combustion in compression ignition engines. • Delay period or ignition lag. **Tutorials/Lab:** • Solve problems on the stages of combustion in compression ignition engines.	4, 7	A3.1, C1.1, C2.1
6	**Lecture:** • Variables affecting the delay period. • Diesel knock. • Methods of controlling diesel knock. • Reduction of diesel knock. **Tutorials/Lab:**	4, 7	A3.1, C1.1, C2.1

	• Solve problems on the stages of combustion in compression ignition engines.		
7	**Lecture:** • Carburetion. • Properties of the air-petrol mixtures. • Mixture requirements for steady state operation. • A simple or elementary carburetor. **Tutorials/Lab:** • Solve problems on the carburetion systems.	4, 7	B1.1
8	**Midterm Examination**	7	A3.1, B1.1, B3.1, C1.1, C2.1
9	**Lecture:** • Complete carburetor. • Calculation of the air to fuel ratio for a simple carburetor. **Tutorials/Lab:** • Solve problems on the carburetion systems.	4, 7	B1.1
10	**Lecture:** • Fuel injection systems. • Requirements of a diesel injection system. • Types of injection systems. • Fuel pump. **Tutorials/Lab:** • Solve problems on the engine fuel injection systems.	4, 7	B1.1, B4.1, C7.1
11	**Lecture:** • Types of fuel injectors. • Types of nozzles. • Quantity of fuel per cycle and size of nozzle orifice. • Electronic gasoline injection system. **Tutorials/Lab:** • Solve problems on the engine fuel injection systems.	4, 7	B1.1, B4.1, C7.1
12	**Lecture:** • Vehicular fuels source and properties. • Natural gas as vehicular fuel. **Tutorials/Lab:** • Solve problems on the fuel and natural gas engine operation.	4, 7	A10.1, B3.1, B4.1, C3.1, C7.1
13	**Lecture:** • Natural gas vehicles. • Gasoline and diesel engines conversion. **Tutorials/Lab:** • Solve problems on the fuel and natural gas engine operation.	4, 7	A10.1, B3.1, B4.1, C3.1, C7.1

14	**Lecture:** - Natural gas vehicles components. - Feasibility study of engine conversion. **Tutorials/Lab:** - Solve problems on the fuel and natural gas engine operation.	4, 7	A10.1, B3.1, B4.1, C3.1, C7.1

Course: Combustion Systems	
Program Competencies	**Course LOs**
A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical, and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.	**A3.1** Apply the engineering design and requirements for the combustion stages and parameters in the internal combustion engines.
A10. Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.	**A10.1** Acquire and apply new knowledge for converting the internal combustion engines to use natural gas.
B1. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, Solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.	**B1.1** Analyze the main components of the carburetion system and injection systems in internal combustion engines by applying the concepts of thermodynamics, heat transfer, fluid mechanics, combustion and automatic control principles.
B3. Select conventional mechanical equipment according to the required performance.	**B3.1** Select the conventional component for the internal combustion engines testing and performance.
B4. Adopt suitable national and international standards and codes; and integrate legal, economic and financial aspects to: design, build, operate, inspect and maintain mechanical equipment and systems.	**B4.1** Choose suitable fuel, injection system to design, build, operate, inspect, and maintain internal combustion engines.
C1. Recognize the design concepts, operation and characteristics of the internal combustion engines, boilers, heat exchangers, turbomachines and hydraulic machines.	**C1.1** Recognize the operation and characteristics of the internal combustion engines.
C2. Analyze, evaluate and enhance the performance of the HVAC systems, automatic control systems, pneumatic systems, hydraulic Systems, combustion systems, thermal and nuclear power plants.	**C2.1** Analyze and valuate the combustion stages and operating parameters of the internal combustion engines.
C3. Judge the optimal solution according to the	**C3.1** Judge the optimal solution

constraints of operation, costs, safety, reliability and environmental impacts..	according to the constraints of operation, costs, safety, reliability and environmental impacts for the fuel used in the internal combustion engines.
C7. Exchange knowledge and skills with engineering community and industries; prepare the presentations and technical reports.	**C7.1** Exchange knowledge and skills with engineering community and industries based on the fuel and injection systems in the engines and prepare the presentations and technical reports.

Course Coordinator: Associate Prof. Hamada Mohamed Gad

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information:

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Mechanical Power Engineering		
Course Code	**MPE443**		
Year/ Level	Fourth year- 1st semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	2	2	-

2. Course aims:

No.	Aims
4, 7	Design, analysis and evaluation for the performance and the operating behavior of compressors, evaporators, water chillers, condensers, oil separators, and control systems used in refrigeration systems.

3. Learning Outcomes (LOs):

A3.1	Apply engineering design concepts of evaporators, condensers, compressors and water chillers that meet specified needs with consideration for economical, reliable and environmental aspects as appropriate to the refrigeration systems.
A10.1	Practice self and lifelong learning strategies.
B1.1	Analyze and design the evaporators, condensers and compressors by applying the concepts of: Thermodynamics, Heat Transfer, and Fluid Mechanics principles.
B3.1	Select the conventional refrigeration system according to the application, operating and climate conditions, and required performance.
B3.2	Select the compressors, evaporators, water chillers, condensers and control valves for the refrigeration systems according to the required performance and its behavior under a wide range of operating condition.
B4.1	Integrate economic aspects to design, operate, inspect and maintain refrigeration equipment and systems.
C1.1	Recognize the applications and the operation characteristics of different refrigeration systems.
C1.2	Recognize the design principles and operation characteristics of different types of

	compressors used in refrigeration systems.
C1.3	Identify the design concepts and operating characteristics of the evaporators, condensers and oil separators.
C2.1	Analyze and evaluate the performance of the refrigeration systems and its equipment.
C3.1	Judge the optimal design, and operating conditions of the compressors and evaporators of the refrigeration systems according to the constraints of operation, costs, safety, reliability and environmental impacts.
C7.1	Prepare technical reports and presentations on some topics related to the refrigeration systems and its equipment.

4. Course Contents:

No.	Topics	Week
1	**Lecture:** • Preface. • Introduction about refrigeration systems. **Tutorials/Lab:** • Solve problems on refrigeration systems.	1
2	**Lecture:** • Ice refrigeration. • Dry Ice refrigeration. • Evaporative Refrigeration. **Tutorials/Lab:** • Solve problems on refrigeration systems.	2
3	**Lecture:** • Steam Ejector Refrigeration. • Thermoelectric Refrigeration. **Tutorials/Lab:** • Solve problems on refrigeration systems.	3
4	**Lecture:** • Gas Refrigeration. • Vapor Compression Refrigeration (VCR). • Multi-Evaporator VCR. • Cascade VCR. • Absorption Refrigeration. **Tutorials/Lab:** • Solve problems on refrigeration systems.	4
5	**Lecture:** • Types of Compressors. • Positive Displacement Compressors.	5

	• Reciprocating Compressor (RC): Principles of Operation and Design. • Clearance Volumetric Efficiency. **Tutorials/Lab:** • Solve problems on reciprocating compressors.	
6	**Lecture:** • Effect of Clearance Volume on Polytropic Work. • Types of Losses in Reciprocating Compressors. • Re-Expansion Process. **Tutorials/Lab:** • Solve problems on reciprocating compressors.	6
7	**Lecture:** • Throttling Effects of Valves. • Leakage Loss. • Principle Dimensions of Reciprocating Compressor. • Performance Characteristics of Reciprocating Compressor. **Tutorials/Lab:** • Solve problems on reciprocating compressors.	7
8	**Midterm Examination**	**8**
9	**Lecture:** • Types of Reciprocating Compressors: - Hermetic type, - Semi-Hermetic type, and - Open type. • Rotary Compressors: - Rolling Piston Type, - Rotating Vane type, - Screw Type (Twin Screw), and - Scroll Type. **Tutorials/Lab:** • Solve problems on reciprocating compressors.	9
10	**Lecture:** • Compressor Lubrication. • Solubility Behavior of the Refrigerant in Oil: - Immiscible Refrigerants, - Completely Miscible Refrigerants, and - Partially Miscible Refrigerants • Oil Separators. • Types of Oil Separators: - Conventional-Type, and - Helical-Type. **Tutorials/Lab:** • Solve problems on the design parameters of reciprocating compressors.	10

11	**Lecture:** • Evaporators. • Types of Evaporator According to the Heat Transfer Mode: - Natural-Convection Type, and - Forced-Convection Type. • Types of Evaporators According to the Construction: - Stamped Plate Type, - Finned-Tube Type, - Shell-and-Tube Type, and - Shell-and-Coil Type. • Types of Shell-and-Tube Evaporator: - Flooded Type, and - Direct-Expansion (Dry) Type. **Tutorials/Lab:** • Solve problems on the design of the shell-and-tube evaporator.	11
12	**Lecture:** • Heat Transfer in Evaporators. • Effect of Oil in Refrigerant on Heat Transfer and Pressure Drop in Evaporators. • Factors affecting Evaporator Design. • Water Chillers. • Types of Water Chillers: - Air-Cooled Water Chiller, and - Water-Cooled Water Chiller. **Tutorials/Lab:** • Solve problems on the design of the shell-and-tube evaporator.	12
13	**Lecture:** • Condensers. • Types of Condensers: - Air-Cooled Condensers, - Water-Cooled Condensers, and - Evaporative Condensers. • Heat Transfer in Condensers. • Wilson Plot. **Tutorials/Lab:** • Solve problems on the design of the shell-and-tube condensers.	13
14	**Lecture:** • Refrigerant Control. • Types of Expansion Devices: - Thermostatic Expansion Valve, - Automatic Expansion Valve, and - Capillary Tube Metering Device. • Defrost Control. • Types of Defrost Control:	14

	- Off-Cycle Type, - Hot Gas Type, and - Electric heater Type. **Tutorials/Lab:** • Review on compressor and evaporator problems.	

5. Teaching and Learning Methods:

LOs		**Teaching and Learning Method**														
		Lecture	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A3.1**	x	x				x	x	x			x				
	A10.1											x				
B-Level	**B1.1**	x	x			x	x	x	x							
	B3.1	x	x			x			x			x				
	B3.2	x	x				x	x	x							
	B4.1	x	x			x										
C-Level	**C1.1**	x	x			x						x				
	C1.2	x	x			x	x	x								
	C1.3	x	x			x	x	x								
	C2.1	x	x				x	x								
	C3.1	x	x			x			x							
	C7.1				x											

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials and videos
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written)	A3.1, B1.1, B3.1, C2.1, C3.1
2	Practical/ Oral Examination	-----
3	Formative (presentation - assignments)	A3.1, B1.1, B3.1, B3.2, C1.1, C1.2, C1,3, C7.1
4	Final Term Examination (written)	A3.1, B1.1, B3.1, B3.2, B4.1, C1.1, C1.2, C1,3, C2.1, C3.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	8
2	Practical/ Oral Examination	15
3	Formative (presentation – assignments – discussion)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	10
2	Practical/ Oral Examination	--
3	Formative (presentation – assignments – discussion)	20
4	Final Term Examination (written)	70
Total		100%

8. List of References:

No.	Reference List
1	Andrew, D. A., and Carl, H. T., “Modern Refrigeration and Air Conditioning,” 18th Edition, The GoodHeart-Willcox Company, Inc., 2013.
2	Dincer, Ibrahim, and Mehmet Kanoglu, “Refrigeration Systems and Applications,” 2nd Edition, Wiley, New York, 2010.
3	Arora, C. P., “Refrigeration and Air Conditioning, ” 3rd Edition, Tata McGraw-Hill Inc., New Delhi, India, 2009.
4	El-Morsy, M., “Lectures in Systems and Equipments of Refrigeration,” Mechanical Power Eng. Dep., Port Said University, 2018.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture/Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aims	LOs
1	**Lecture:** • Preface. • Introduction about refrigeration systems. **Tutorials/Lab:** • Solve problems on refrigeration systems.	7	C1.1
2	**Lecture:** • Ice refrigeration. • Dry Ice refrigeration. • Evaporative Refrigeration. **Tutorials/Lab:** • Solve problems on refrigeration systems.	7	A10.1, B3.1, B4.1, C1.1, C2.1, C7.1
3	**Lecture:** • Steam Ejector Refrigeration. • Thermoelectric Refrigeration. **Tutorials/Lab:** • Solve problems on refrigeration systems.	4, 7	A10.1, B3.1, B4.1, C1.1, C2.1, C7.1
4	**Lecture:** • Gas Refrigeration. • Vapor Compression Refrigeration (VCR). • Multi-Evaporator VCR. • Cascade VCR. • Absorption Refrigeration. **Tutorials/Lab:** • Solve problems on refrigeration systems.	4, 7	A10.1, B3.1, B4.1, C1.1, C2.1, C7.1
5	**Lecture:** • Types of Compressors. • Positive Displacement Compressors. • Reciprocating Compressor (RC): Principles of Operation and Design. • Clearance Volumetric Efficiency. **Tutorials/Lab:** • Solve problems on reciprocating compressors.	4, 7	A3.1, A10.1, B1.1, B4.1, C1.2, C2.1, C7.1

6	**Lecture:** • Effect of Clearance Volume on Polytropic Work. • Types of Losses in Reciprocating Compressors. • Re-Expansion Process. **Tutorials/Lab:** • Solve problems on reciprocating compressors.	4, 7	A3.1, A10.1, B1.1, B4.1, C1.2, C2.1, C7.1
7	**Lecture:** • Throttling Effects of Valves. • Leakage Loss. • Principle Dimensions of Reciprocating Compressor. • Performance Characteristics of Reciprocating Compressor. **Tutorials/Lab:** • Solve problems on reciprocating compressors.	4, 7	A3.1, B1.1, B3.2, B4.1, C1.2, C2.1, C3.1
8	**Midterm Examination**	7	A3.1, B1.1, B3.1, C2.1, C3.1
9	**Lecture:** • Types of Reciprocating Compressors: - Hermetic type, - Semi-Hermetic type, and - Open type. • Rotary Compressors: - Rolling Piston Type, - Rotating Vane type, - Screw Type (Twin Screw), and - Scroll Type. **Tutorials/Lab:** • Solve problems on reciprocating compressors.	4, 7	A10.1, B3.2, B4.1, C1.2, C3.1, C7.1
10	**Lecture:** • Compressor Lubrication. • Solubility Behavior of the Refrigerant in Oil: - Immiscible Refrigerants, - Completely Miscible Refrigerants, and - Partially Miscible Refrigerants • Oil Separators. • Types of Oil Separators: - Conventional-Type, and - Helical-Type. **Tutorials/Lab:** • Solve problems on the design parameters of reciprocating compressors.	4, 7	A10.1, B3.2, B4.1, C1.2, C1.3, C3.1, C7.1
11	**Lecture:**	14, 7	A10.1, B3.2,

	• Evaporators. • Types of Evaporator According to the Heat Transfer Mode: - Natural-Convection Type, and - Forced-Convection Type. • Types of Evaporators According to the Construction: - Stamped Plate Type, - Finned-Tube Type, - Shell-and-Tube Type, and - Shell-and-Coil Type. • Types of Shell-and-Tube Evaporator: - Flooded Type, and - Direct-Expansion (Dry) Type. **Tutorials/Lab:** • Solve problems on the design of the shell-and-tube evaporator.		B4.1, C1.3, C3.1, C7.1
12	**Lecture:** • Heat Transfer in Evaporators. • Effect of Oil in Refrigerant on Heat Transfer and Pressure Drop in Evaporators. • Factors affecting Evaporator Design. • Water Chillers. • Types of Water Chillers: - Air-Cooled Water Chiller, and - Water-Cooled Water Chiller. **Tutorials/Lab:** • Solve problems on the design of the shell-and-tube evaporator.	4, 7	A3.1, B1.1, B3.2, B4.1, C1.3, C2.1, C3.1
13	**Lecture:** • Condensers. • Types of Condensers: - Air-Cooled Condensers, - Water-Cooled Condensers, and - Evaporative Condensers. • Heat Transfer in Condensers. • Wilson Plot. **Tutorials/Lab:** • Solve problems on the design of the shell-and-tube condensers.	4, 7	A3.1, B1.1, B3.2, B4.1, C1.3, C2.1, C3.1, C7.1
14	**Lecture:** • Refrigerant Control. • Types of Expansion Devices: - Thermostatic Expansion Valve, - Automatic Expansion Valve, and	7	B3.2, B4.1, C3.1

	- Capillary Tube Metering Device. • Defrost Control. • Types of Defrost Control: - Off-Cycle Type, - Hot Gas Type, and - Electric heater Type. **Tutorials/Lab:** Review on compressor and evaporator problems.		

Course: Systems and Equipment of Refrigeration	
Program Competencies	**Course LOs**
A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.	**A3.1** Apply engineering design concepts of evaporators, condensers, compressors and water chillers that meet specified needs with consideration for economical, reliable and environmental aspects as appropriate to the refrigeration systems.
A10. Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.	**A10.1** Practice self and lifelong learning strategies.
B1. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, Solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.	**B1.1** Analyze and design the evaporators, condensers and compressors by applying the concepts of: Thermodynamics, Heat Transfer, and Fluid Mechanics principles.
B3. Select conventional mechanical equipment according to the required performance.	**B3.1** Select the conventional refrigeration system according to the application, operating and climate conditions, and required performance. **B3.2** Select the compressors, evaporators, water chillers, condensers and control valves for the refrigeration systems according to the required performance and its behavior under a wide range of operating condition.
B4. Adopt suitable national and international standards and codes; and integrate legal, economic and financial aspects to: design, build, operate, inspect and maintain mechanical equipment and systems.	**B4.1** Integrate economic aspects to design, operate, inspect and maintain refrigeration equipment and systems.
C1. Recognize the design concepts, operation and characteristics of the internal combustion engines, boilers, heat exchangers, turbomachines and hydraulic machines.	**C1.1** Recognize the applications and the operation characteristics of different refrigeration systems. **C1.2** Recognize the design principles and operation characteristics of

	different types of compressors used in refrigeration systems. **C1.3** Identify the design concepts and operating characteristics of the evaporators, condensers and oil separators.
C2. Analyze, evaluate and enhance the performance of the HVAC systems, automatic control systems, pneumatic systems, hydraulic systems, combustion systems, thermal and nuclear power plants.	**C2.1** Analyze and evaluate the performance of the refrigeration systems and its equipment.
C3. Judge the optimal solution according to the constraints of operation, costs, safety, reliability and environmental impacts.	**C3.1** Judge the optimal design, and operating conditions of the compressors and evaporators of the refrigeration systems according to the constraints of operation, costs, safety, reliability and environmental impacts.
C7. Exchange knowledge and skills with engineering community and industries; prepare the presentations and technical reports.	**C7.1** Prepare technical reports and presentations on some topics related to the refrigeration systems and its equipment.

Course Coordinator: Dr. Sherihan Abdel-Ghafour

Program Coordinator: Dr. Sherihan Abdel-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information:

<table>
<tr><td>Program Title</td><td colspan="3">B. Sc. in Mechanical Power Engineering</td></tr>
<tr><td>Department offering the Program</td><td colspan="3">Mechanical Power Engineering</td></tr>
<tr><td>Department Responsible for the Course</td><td colspan="3">Mechanical Power Engineering</td></tr>
<tr><td>Course Code</td><td colspan="3">MPE444</td></tr>
<tr><td>Year/ Level</td><td colspan="3">Fourth year- 1st semester</td></tr>
<tr><td>Specialization</td><td colspan="3">Major</td></tr>
<tr><td rowspan="2">Teaching Hours</td><td>Lectures</td><td>Tutorial</td><td>Practical</td></tr>
<tr><td>2</td><td>2</td><td>-</td></tr>
</table>

2. Course aims:

No.	Aims
4, 7	Recognize the design criteria of automatic sprinkler systems, detection, alarm and control in smoke, design by performance and analysis of protection failure; and apply numerical methods to analyze the flow of water pipe networks, faded spraying water, two phase and non-Newtonen flow in pipes and computational fluid dynamics programs.

3. Learning Outcomes (LOs):

A3.1	Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.
A10.1	Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.
B1.1	Analyze, and design water works for firefighting using the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, solid Mechanics, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.
B3.1	Select firefighting equipment according to the required performance.
B4.1	Adopt suitable national and international standards and codes; and integrate legal, economic and financial aspects to: design, build, operate, inspect and maintain firefighting equipment and systems.
C1.1	Recognize the design concepts, operation and characteristics of hydraulic system.
C2.1	Analyze, evaluate the performance of hydraulic Systems, and combustion systems.
C3.1	Judge the optimal solution according to the constraints of operation, costs,

	safety, reliability and environmental impacts.
C7.1	Exchange knowledge and skills with engineering community and industries; prepare the presentations and technical reports.

4. Course Contents:

No.	Topics	Week
1	**Lecture:** • The Safety Fundamentals analysis of fire. **Tutorials:** • Solve problems on principles and applications of the design of fire safety in buildings.	1
2	**Lecture:** • The principles and applications of the design of fire safety in buildings **Tutorials:** • Solve problems on principles and applications of the design of fire safety in buildings.	2
3	**Lecture:** • Fire modeling and dynamics of fires **Tutorials:** • Solve problems on Fire modeling and dynamics of fires.	3-4
4	**Lecture:** • Basics of numerical methods • Basic topics in basic fire and combustion. **Tutorials:** • Solve problem on basics of numerical methods and basic topics in basic fire and combustion.	5-6
5	**Lecture:** • Fire protection systems. **Tutorials:** • Solve problem on basics of numerical methods and basic topics in basic fire and combustion.	**7**
6	**Midterm Examination**	**8**
7	**Lecture:** • Automatic sprinkler systems **Tutorials:** • Solve problems on Automatic sprinkler systems.	9
8	**Lecture:** • Review of numerical methods to analyze the flow of water pipe networks **Tutorials:** • Solve problems on numerical methods to analyze the flow of water pipe networks.	10-11

9	**Lecture:** • Faded spraying water. • Two phase and non-Newtonian flow in pipes and simulation. **Tutorials:** • Solve problems on faded spraying water and simulation of two-phase flow and non-Newtonian flow in pipes.	12
10	**Lecture:** • Detection, alarm and control in smoke - Design by performance **Tutorials:** • Solve problems on Detection, alarm and control in smoke - Design by performance.	12-13
11	**Lecture:** • Analysis of protection failure - Special problems **Tutorials:** • Solve problems on Detection, alarm and control in smoke - Design by performance.	14

5. Teaching and Learning Methods:

LOs		**Teaching and Learning Method**														
		Lecture	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A3.1**	x	x			x	x									
	A10.1							x	x	x	x	x	x			
B-Level	**B1.1**	x	x			x	x		x							
	B3.1	x	x			x	x		x							
	B4.1	x	x			x	x		x		x					x
C-Level	**C1.1**	x	x			x	x				x					x
	C2.1	x	x			x	x				x					
	C3.1	x	x		x	x	x									x
	C7.1				x			x	x	x	x	x				

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials and videos
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written)	A3.1, A10.1, B1.1, B3.1, B4.1, C1.1, C2.1, C3.1
2	Practical/ Oral Examination	C7.1
3	Formative (quizzes - presentation - assignments)	A3.1, A10.1, B1.1, B3.1, B4.1, C1.1, C2.1, C3.1
4	Final Term Examination (written)	A3.1, A10.1, B1.1, B3.1, B4.1, C1.1, C2.1, C3.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	8
2	Practical/ Oral Examination	15
3	Formative (quizzes – presentation – assignments)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	15
2	Formative (quizzes – presentation – assignments)	15
3	Final Term Examination (written)	70
Total		100%

8. List of References:

No.	Reference List
1	Sad Habic, "Notes on Design of Fire-fighting systems", Mechanical Power Eng. Dep., Port Said University, 2015.
2	National Fire Alarm and Signaling Code, Edition 2019.
3	Paul Stollard, "Fire from First Principles: A design guide to international building fire safety", 4th Edition, Routledge, 2014.
4	Colin S. Todd, "The Design, Installation ‹Commissioning and maintenance of Fire Detection and Fire Alarm Systems in Non-domestic Premise", BSI British Standards Institution, 2013.
5	Dennis P. Nolan, "Fire Fighting Pumping Systems at Industrial Facilities", William Andrew; 1st edition, 1999.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture/Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topics	Aims	LOs
1	**Lecture:** • The Safety Fundamentals analysis of fire. **Tutorials:** • Solve problems on principles and applications of the design of fire safety in buildings.	7	A3.1, A10.1
2	**Lecture:** • The principles and applications of the design of fire safety in buildings **Tutorials:** • Solve problems on principles and applications of the design of fire safety in buildings.	7	A3.1, A10.1
3	**Lecture:** • Fire modeling and dynamics of fires **Tutorials:** • Solve problems on Fire modeling and dynamics of fires.	4, 7	A3.1, A10.1, B1.1, B3.1, B4.1, C1.1, C2.1, C3.1
4	**Lecture:**	4, 7	A3.1, A10.1,

	• Basics of numerical methods • Basic topics in basic fire and combustion. **Tutorials:** • Solve problem on basics of numerical methods and basic topics in basic fire and combustion.		B1.1, B3.1, B4.1, C1.1, C2.1, C3.1
5	**Lecture:** • Fire protection systems. **Tutorials:** • Solve problem on basics of numerical methods and basic topics in basic fire and combustion.	4, 7	A3.1, A10.1, B1.1, B3.1, B4.1, C1.1, C2.1, C3.1
6	**Lecture:** • Automatic sprinkler systems **Tutorials:** • Solve problems on Automatic sprinkler systems.	4, 7	A3.1, A10.1, B1.1, B3.1, B4.1, C1.1, C2.1, C3.1
7	**Lecture:** • Review of numerical methods to analyze the flow of water pipe networks **Tutorials:** • Solve problems on numerical methods to analyze the flow of water pipe networks.	4, 7	A3.1, A10.1, B1.1, B3.1, B4.1, C1.1, C2.1, C3.1
8	**Lecture:** • Faded spraying water. • Two phase and non-Newtonian flow in pipes and simulation. **Tutorials:** • Solve problems on faded spraying water and simulation of two-phase flow and non-Newtonian flow in pipes.	4, 7	A3.1, A10.1, B1.1, B3.1, B4.1, C1.1, C2.1, C3.1
9	**Lecture:** • Detection, alarm and control in smoke - Design by performance **Tutorials:** • Solve problems on Detection, alarm and control in smoke - Design by performance.	4, 7	A3.1, A10.1, B1.1, B3.1, B4.1, C1.1, C2.1, C3.1
10	**Lecture:** • Analysis of protection failure - Special problems **Tutorials:** • Solve problems on Detection, alarm and control in smoke - Design by performance.	4, 7	A3.1, A10.1, B1.1, B3.1, B4.1, C1.1, C2.1, C3.1

Course: Design of Fire-Fighting Systems	
Program Competencies	**Course LOs**
A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.	**A3.1** Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.
A10. Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.	**A10.1** Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.
B1. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.	**B1.1** Analyze and design water works for firefighting using the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, solid Mechanics, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.
B3. Select conventional mechanical equipment according to the required performance.	**B3.1** Select firefighting equipment according to the required performance.
B4. Adopt suitable national and international standards and codes; and integrate legal, economic and financial aspects to: design, build, operate, inspect and maintain mechanical equipment and systems.	**B4.1** Adopt suitable national and international standards and codes; and integrate legal, economic and financial aspects to: design, build, operate, inspect and maintain

	firefighting equipment and systems.
C1. Recognize the design concepts, operation and characteristics of internal combustion engines, boilers, heat exchangers, turbomachines and hydraulic machines.	**C1.1** Recognize the design concepts, operation and characteristics of hydraulic system.
C2. Analyze, evaluate and enhance the performance of the HVAC systems, automatic control systems, pneumatic systems, hydraulic Systems, combustion systems, thermal and nuclear power plants.	**C2.1** Analyze, evaluate the performance of hydraulic Systems, and combustion systems.
C3. Judge the optimal solution according to the constraints of operation, costs, safety, reliability and environmental impacts.	**C3.1** Judge the optimal solution according to the constraints of operation, costs, safety, reliability and environmental impacts.
C7. Exchange knowledge and skills with engineering community and industries; prepare the presentations and technical reports.	**C7.1** Exchange knowledge and skills with engineering community and industries; prepare the presentations and technical reports.

Course Coordinator: Prof. Dr. Sad Eldeen Habic

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information:

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Mechanical Power Engineering		
Course Code	**HUD404**		
Year/ Level	Fourth year- 1st semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	2	0	0

2. Course Aims:

No.	**Aims**
7	Distinguish different types of energy resources, analyze the performance of different energy conversion technologies, and demonstrate the design of energy system.

3. Learning Outcomes (LOs):

A3.1	Apply cost analysis techniques to select a cost-effective solution that meet specified needs.
A4.1	Utilize contemporary economic theories, standards, and guidelines, and risk management principles.
B4.1	Adopt suitable national and international standards and codes; and integrate legal, economic and financial aspects to: design, build, operate, inspect and maintain mechanical equipment and systems.
C3.1	Judge the optimal design, operating conditions and number of the components according to the constraints of operation, costs, safety, reliability and environmental impacts.
C4.1	Choose, apply and assess economically renewable energy resources in power generation field.

4. Course Contents:

No.	Topics	Week
1	**Lecture: (Introduction)** • Course Grades. • Course Contents. • Course topics. • Power Generation Financing.	1
2	**Lecture: (Cost analysis)** • Annual Fixed Charges. • Cost of Money Use. • Calculations of different Schedule of Payments	2
3	• **Lecture (Fixed and Operating Annual Costs)** • Inflation. • Depreciation. • Taxes and insurance. • Annual Operating Costs.	3
4	• **Lecture (Methods of Economic Selection)** • Annual Costs. • Total Annual Cost Method. • Influence of Fixed-Charge Rate. • Influence of Annual Operating Costs.	4
5	• **Lecture (Other Methods of Economic Selection)** • Total Life Cycle Cost (TLCC). • Net Present Value (NPV). • Internal Rate of Return (IRR). • Simple payback period (SBP). • Levelized Cost of Energy (LCOE).	5
6	• **Lecture (Load Curves)** • Maximum Demand. • Energy demand factors. • System Peak demand. • Load curve plotting. • Load Curves of Different Consumer Groups.	6
7	• **Lecture (Types of Load Curves)** • Average Load Curve. • Load Factor. • Capacity Factor. • Utilization factor.	7
8	**Midterm Examination**	**8**
9	• **Lecture (Selection of Power Plant)** • Site and Equipment Selection. • Cost of increase in Efficiency. • Equipment Costs Estimates. • Economy of Scale. • Total Plant equipment Costs.	9

10	• **Lecture (Selection of Plant)** • Capacity Selection. • Availability. • Load Curtailment. • Reserve Capacity.	10
11	• **Lecture: (Power Station Performance and Operation Characteristics)** • Performance Characteristics. • Heat and Incremental Rates. • Conditions of Maximum efficiency.	11
12	• **Lecture (Load Division)** • Station Incremental Rate. • Capacity Scheduling. • Hydraulic station Operation.	12
13	• **Lecture (Energy Rates)** • General Rate Form. • Various rate forms. • Rate Design.	13
14	• **Lecture (Revision)**	14

5. Teaching and Learning Methods:

LOs		**Teaching and Learning Method**														
		Lecture	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A3.1**	x	x			x		x	x							x
	A4.1	x	x			x		x								x
B-Level	**B4.1**	x	x			x		x	x							x
C-Level	**C3.1**	x	x			x			x			x				
	C4.1	x	x			x		x	x			x				

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials and lecturing hours.

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written)	A3.1, A4.1, C4.1
2	Formative (quizzes - presentation - assignment)	A3.1, A4.1, B4.1, C3.1, C4.1
3	Final Term Examination (written)	A3.1, A4.1, B4.1, C3.1, C4.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	8
2	Formative (quizzes – presentation – assignments)	Every week
3	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	10
2	Formative (quizzes – presentation – assignments)	10
3	Final Term Examination (written)	80
Total		100%

8. List of References:

No.	Reference List
1	Daniel S. Kirschen and Goran Strbac, “Fundamentals of Power System Economics, ” 2nd Edition, Wiley, 2018.
2	Yates, J. K., “Engineering Economics, ” 3rd Edition, CRC Press, 2016.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture/Online Classroom
2	White Board
3	Data Show System

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aims	LOs
1	**Lecture:** • Course Grades. • Course Contents. • Course topics. • Power Generation Financing.	7	B4.1, C3.1, C4.1
2	**Lecture:** • Annual Fixed Charges. • Cost of Money Use. • Calculations of different Schedule of Payments	7	B4.1, C3.1, C4.1
3	**Lecture:** • Inflation. • Depreciation. • Taxes and insurance. • Annual Operating Costs.	7	A3.1, A4.1, B4.1
4	**Lecture:** • Annual Costs. • Total Annual Cost Method. • Influence of Fixed-Charge Rate. • Influence of Annual Operating Costs.	7	A3.1, B4.1, C3.1
5	**Lecture:** • Total Life Cycle Cost (TLCC). • Net Present Value (NPV). • Internal Rate of Return (IRR). • Simple payback period (SBP). • Levelized Cost of Energy (LCOE).	7	A3.1, A4.1
6	**Lecture:** • Maximum Demand. • Energy demand factors. • System Peak demand. • Load curve plotting. • Load Curves of Different Consumer Groups.	7	A3.1, C3.1, C4.1
7	**Lecture:** • Average Load Curve. • Load Factor. • Capacity Factor.	7	A3.1, B4.1, C3.1
8	**Midterm Examination**	7	A3.1, A4.1, C4.1
9	**Lecture:** • Site and Equipment Selection. • Cost of increase in Efficiency. • Equipment Costs Estimates.	7	B4.1, C3.1, C4.1

	• Economy of Scale.		
10	**Lecture:** • Capacity Selection. • Availability. • Load Curtailment. • Reserve Capacity.	7	A3.1, A4.1, B4.1, C3.1, C4.1
11	**Lecture:** • Performance Characteristics. • Heat and Incremental Rates. • Conditions of Maximum efficiency.	7	A3.1, A4.1, B4.1, C3.1, C4.1
12	**Lecture:** • Station Incremental Rate. • Capacity Scheduling. • Hydraulic station Operation.	7	A3.1, A4.1, B4.1, C3.1, C4.1
13	**Lecture:** • General Rate Form. • Various rate forms. • Rate Design.	7	A3.1, A4.1, B4.1, C3.1, C4.1

Course: Energy Economics	
Program Competencies	**Course LOs**
A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.	**A3.1** Apply cost analysis techniques to select a cost-effective solution that meet specified needs.
A4. Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues and risk management principles.	**A4.1** Utilize contemporary economic theories, standards, and guidelines, and risk management principles.
B4. Adopt suitable national and international standards and codes; and integrate legal, economic and financial aspects to: design, build, operate, inspect and maintain mechanical equipment and systems.	**B4.1** Adopt suitable national and international standards and codes; and integrate legal, economic and financial aspects to: design, build, operate, inspect and maintain mechanical equipment and systems.
C3 Judge the optimal solution according to the constraints of operation, costs, safety, reliability and environmental impacts.	**C3.1** Judge the optimal design, operating conditions and number of the components according to the constraints of operation, costs, safety, reliability and environmental impacts.
C4. Choose, apply and assess the newable and renewable energy resources in water desalination, power generation, heating, cooling and air conditioning applications.	**C4.1** Choose, apply and assess economically renewable energy resources in power generation field.

Course Coordinator: Dr. Mohamed Mostafa Hammam

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Mechanical Power Engineering		
Course Code	**MPE440**		
Year/ Level	Fourth year- 2nd semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	2	2	1

2. Course Aims:

No.	**Aims**
7	Acquire and apply the principles of analysis and evaluation for the performance and the operating behavior of different types of thermal and nuclear power plants.

3. Learning Outcomes (LOs):

A3.1	Apply some thermal and mechanical design concepts to select or produce a cost-effective solution that meet specified needs with consideration for economic and environmental aspects.
B1.1	Analyze the components of the power plants by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, combustion and automatic control principles.
B3.1	Select the conventional component for the power station according to the required performance and its behavior under a wide range of operating condition.
C1.1	Recognize the design concepts of boilers, feedwater heaters, turbomachines, combustion chambers, intercoolers, regenerators, reheaters and nuclear reactors.
C1.2	Identify the operating behavior and characteristics of the components of thermal and nuclear power plants with the variation of load.
C2.1	Analyze, evaluate and enhance the performance of the thermal and nuclear power plants.
C3.1	Judge the optimal design, operating conditions and number of the components according to the constraints of operation, costs, safety, reliability and environmental impacts.
C4.1	Choose, apply and assess the newable and renewable energy resources in power generation field.

4. Course Contents:

No.	Topics	Week
1	**Lecture:** • Newable and renewable energy resources in Egypt. • Thermal power plants in Egypt. • Future of the power plants in Egypt. • Basics of energy and exergy analyses of the thermal power plants and components. **Tutorials/Lab:** • Solve problems on the energy and exergy analyses of various components. • Conduct experiments on steam turbine power plant to investigate the effect of the boiler pressure and fuel mass flow rate on the torque of the turbine.	1
2	**Lecture:** • Revision on steam turbine power plant. • Revision on co-generation plant. **Tutorials/Lab:** • Solve problems on steam turbine power plant. • Conduct experiments on steam turbine power plant to investigate the effect of the boiler pressure and fuel mass flow rate on the torque of the turbine.	2
3	**Lecture:** • Auxiliary components of the steam turbine power plants. • Principles of optimal design and operation of the steam turbine power plant components. **Tutorials/Lab:** • Solve problems on steam turbine power and co-generation plants. • Conduct experiments on steam turbine power plant to investigate the effect of the boiler pressure and fuel mass flow rate on the torque of the turbine.	3
4	**Lecture:** • Techniques of Load Control in steam turbine power plant. **Tutorials/Lab:** • Solve problems on steam turbine power and co-generation plants. • Conduct experiments on steam turbine power plant to investigate the effect of the boiler pressure and fuel mass flow rate on the torque of the turbine.	4
5	**Lecture:** • Basics of Gas Turbine power plant. **Tutorials/Lab:** • Solve problems on gas turbine power plant. • Conduct experiments on steam turbine power plant to investigate the effect of the boiler pressure and fuel mass flow rate on the torque of	5

	the turbine.	
6	**Lecture:** • Modifications of gas turbine power plant. • Techniques of load control in gas turbine power plant. **Tutorials/Lab:** • Solve problems on gas turbine power plant. • Conduct experiments on steam turbine power plant to investigate the effect of the boiler pressure and fuel mass flow rate on the torque of the turbine.	6
7	**Lecture:** • Gas turbine blade cooling. • Water and steam injection in the gas turbines power plant. **Tutorials/Lab:** • Solve problems on gas turbine power plant with blade cooling and water & steam injection. • Conduct experiments on axial flow gas turbine unit to investigate the effect of the load change on the torque of the turbine and the efficiencies of the unit components.	7
8	**Midterm Examination**	**8**
9	**Lecture:** • Design considerations of gas turbine power plant components: - Gas turbine combustor, and - Compressor **Tutorials/Lab:** • Solve problems on the matching of the gas turbine plant components. • Conduct experiments on axial flow gas turbine unit to investigate the effect of the load change on the torque of the turbine and the efficiencies of the unit components.	9
10	**Lecture:** • Combined cycle power plants. • Basic arrangements of combined gas-steam turbine power plant. • T-Q diagram and binch points • Methods of load control in combined gas-steam turbine power plant. **Tutorials/Lab:** • Solve problems on combined gas-steam turbine power plants. • Conduct experiments on axial flow gas turbine unit to investigate the effect of the load change on the torque of the turbine and the efficiencies of the unit components.	10
11	**Lecture:** • Fluidized bed combustion. • Gasification process and Lurgi Gasifier. • Combined cycle power plant integrated with fluidized-bed combustion system / gasification system.	11

	Tutorials/Lab: - Solve problems on combined gas-steam turbine power plants. - Conduct experiments on axial flow gas turbine unit to investigate the effect of the load change on the torque of the turbine and the efficiencies of the unit components.	
12	**Lecture:** - Nuclear energy. - Main components of nuclear reactor. - Pressurized water Reactor nuclear power plant and technique of load control. - Boiling water Reactor nuclear power plant and technique of load control. - Gas-cooled reactor nuclear power plant. - Liquid metal- cooled reactor nuclear power plant. **Tutorials/Lab:** - Solve problems on steam turbine power plants with pressurized water reactor. - Conduct experiments on axial flow gas turbine unit to investigate the effect of the load change on the torque of the turbine and the efficiencies of the unit components.	12-13
13	**Lecture:** - Thermal power plants utilizing renewable energy resources. **Tutorials/Lab:** - Solve problems on combined gas-steam turbine power plants integrated with concentrated solar power systems.	14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method														
		Lecture	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A3.1**	x	x			x			x							
B-Level	**B1.1**	x	x			x	x	x	x							x
	B3.1	x	x			x	x	x	x			x				x
C-Level	**C1.1**	x	x			x	x	x				x				
	C1.2	x	x			x	x	x								x
	C2.1	x	x			x	x	x	x			x				x
	C3.1	x	x			x			x			x				
	C4.1	x	x			x	x	x	x			x				

6. Teaching and Learning Methods of Disable Students:

No.	**Teaching Method**
1	Additional Tutorials and videos
2	Online lectures and assignments

7. Student Assessment:

7.1 Student Assessment Methods:

No.	**Assessment Method**	**LOs**
1	Mid Term Examination (written)	B1.1, B3.1, C2.1, C3.1
2	Practical/ Oral Examination	A3.1, B1.1, C2.1, C4.1
3	Formative (quizzes – assignments – discussion)	A3.1, B1.1, B3.1, C2.1, C3.1, C4.1
4	Final Term Examination (written)	A3.1, B1.1, B3.1, C2.1, C3.1, C4.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	8
2	Practical/ Oral Examination	15
3	Formative (quizzes – assignments – discussion)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	8
2	Practical/ Oral Examination	20
3	Formative (quizzes – assignments – discussion)	12
4	Final Term Examination (written)	60
Total		100%

8. List of References:

No.	Reference List
1	Zohuri, B. and McDaniel, P.,“Thermodynamics in Nuclear Power Plant Systems, ” 2nd Edition, Springer International Publishing, Cham, Switzerland, 2019.
2	Sarker, D. S., “Thermal Power Plant: Design and Operation, ” 1st Edition, Elsevier, Waltham, Massachusetts, USA, 2015.
3	Nag, P. K., “Power Plant Engineering, ” 3rd Edition, Tata McGraw-Hill Inc., New Delhi, India, 2008.
4	Lamarsh, J. and Baratta, A., “Introduction to Nuclear Engineering, ” 3rd Edition, Pearson Education Limited, Massachusetts, USA, 2014.
5	Mikhael, N. N., “Lectures in Thermal Power Plants” Mechanical Power Eng. Dept., Port Said University, 2012.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture/Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aims	LOs
1	**Lecture:** • Newable and renewable energy resources in Egypt. • Thermal power plants in Egypt. • Future of the power plants in Egypt. • Basics of energy and exergy analyses of the thermal power plants and components. **Tutorials/Lab:** • Solve problems on the energy and exergy analyses of various components. • Conduct experiments on steam turbine power plant to investigate the effect of the boiler pressure and fuel mass flow rate on the torque of the turbine.	7	B1.1, C2.1, C4.1
2	**Lecture:** • Revision on steam turbine power plant. • Revision on co-generation plant. **Tutorials/Lab:** • Solve problems on steam turbine power plant. • Conduct experiments on steam turbine power plant to investigate the effect of the boiler pressure and fuel mass flow rate on the torque of the turbine.	7	B1.1, C1.1, C2.1
3	**Lecture:** • Auxiliary components of the steam turbine power plants. • Principles of optimal design and operation of the steam turbine power plant components. **Tutorials/Lab:** • Solve problems on steam turbine power and co-generation plants. • Conduct experiments on steam turbine power plant to investigate the effect of the boiler pressure and fuel mass flow rate on the torque of the turbine.	7	A3.1, B1.1, B3.1, C1.2, C2.1, C3.1
4	**Lecture:** • Techniques of Load control in steam turbine power plant. **Tutorials/Lab:** • Solve problems on steam turbine power and co-generation plants. • Conduct experiments on steam turbine power plant to investigate the effect of the boiler pressure and fuel mass flow rate on the torque of the turbine.	7	B1.1, B3.1, C1.2
5	**Lecture:** • Basics of Gas Turbine power plant. **Tutorials/Lab:**	7	B1.1, B3.1, C1.1, C2.1

	• Solve problems on gas turbine power plant. • Conduct experiments on steam turbine power plant to investigate the effect of the boiler pressure and fuel mass flow rate on the torque of the turbine.		
6	**Lecture:** • Modifications of Gas turbine power plant. • Techniques of load control in gas turbine power plant. **Tutorials/Lab:** • Solve problems on gas turbine power plant. • Conduct experiments on steam turbine power plant to investigate the effect of the boiler pressure and fuel mass flow rate on the torque of the turbine.	7	A3.1, B1.1, B3.1, C1.1, C1.2, C2.1
7	**Lecture:** • Gas turbine blade cooling. • Water and steam injection in the gas turbines power plant. **Tutorials/Lab:** • Solve problems on gas turbine power plant with blade cooling and water & steam injection. • Conduct experiments on axial flow gas turbine unit to investigate the effect of the load change on the torque of the turbine and the efficiencies of the unit components.	7	A3.1, B1.1, B3.1, C1.1, C2.1, C3.1
8	**Midterm Examination**	7	B1.1, B3.1, C2.1, C3.1
9	**Lecture:** • Design considerations of gas turbine power plant components: - Gas turbine combustor, and - Compressor **Tutorials/Lab:** • Solve problems on the matching of the gas turbine plant components. • Conduct experiments on axial flow gas turbine unit to investigate the effect of the load change on the torque of the turbine and the efficiencies of the unit components.	7	A3.1, B3.1, C1.1, C1.2, C2.1, C3.1
10	**Lecture:** • Combined cycle power plants. • Basic arrangements of combined gas-steam turbine power plant. • T-Q diagram and binch points • Methods of load control in combined gas-steam turbine power plant.	7	A3.1, B1.1, B3.1, C1.1, C1.2, C2.1, C3.1

	Tutorials/Lab: • Solve problems on combined gas-steam turbine power plants. • Conduct experiments on axial flow gas turbine unit to investigate the effect of the load change on the torque of the turbine and the efficiencies of the unit components.		
11	**Lecture:** • Fluidized bed combustion. • Gasification process and Lurgi Gasifier. • Combined cycle power plant integrated with fluidized-bed combustion system / gasification system. **Tutorials/Lab:** • Solve problems on combined gas-steam turbine power plants. • Conduct experiments on axial flow gas turbine unit to investigate the effect of the load change on the torque of the turbine and the efficiencies of the unit components.	7	A3.1, B3.1, C1.1, C2.1, C4.1

12	**Lecture:**
	• Nuclear energy.
	• Main components of nuclear reactor.
	  • Pressurized water Reactor nuclear power plant and technique of load control.
	  • Boiling water Reactor nuclear power plant and technique of load control.
	  • Gas-cooled reactor nuclear power plant.
	  • Liquid metal- cooled reactor nuclear power plant.
	Tutorials/Lab:
	  • Solve problems on steam turbine power plants with pressurized water reactor.
	  • Conduct experiments on axial flow gas turbine unit to investigate the effect of the load change on the torque of the turbine and the efficiencies of the unit components.
		7	A3.1, C1.1, C1.2, C3.1, C4.1

13	**Lecture:**
	  • Thermal power plants utilizing renewable energy resources.
	Tutorials/Lab:
	  • Solve problems on combined gas-steam turbine power plants integrated with concentrated solar power systems.
		7	A3.1, B1.1, C1.1, C3.1, C4.1

Course: Thermal and Nuclear Power Plants	
Program Competencies	**Course LOs**
A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.	**A3.1** Apply some thermal and mechanical design concepts to select or produce a cost-effective solution that meet specified needs with consideration for economic and environmental aspects.
B1. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, Solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.	**B1.1** Analyze the components of the power plants by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, combustion and automatic control principles.
B3. Select conventional mechanical equipment according to the required performance.	**B3.1** Select the conventional component for the power plant according to the required performance and its behavior under a wide range of operating condition.
C1. Recognize the design concepts, operation and characteristics of the internal combustion engines, boilers, heat exchangers, turbomachines and hydraulic machines.	**C1.1** Recognize the design concepts of boilers, feedwater heaters, turbomachines, combustion chambers, intercoolers, regenerators, reheaters and nuclear reactors. **C1.2** Identify the operating behavior and characteristics of the components of thermal and nuclear power plants with the variation of

	load.
C2. Analyze, evaluate and enhance the performance of the HVAC systems, automatic control systems, pneumatic systems, hydraulic Systems, combustion systems, thermal and nuclear power plants.	**C2.1** Analyze, evaluate and enhance the performance of the thermal and nuclear power plants.
C3. Judge the optimal solution according to the constraints of operation, costs, safety, reliability and environmental impacts.	**C3.1** Judge the optimal design, operating conditions and number of the components according to the constraints of operation, costs, safety, reliability and environmental impacts.
C4. Choose, apply and assess the newable and renewable energy resources in water desalination, power generation, heating, cooling and air conditioning applications.	**C4.1** Choose, apply and assess the newable and renewable energy resources in power generation field.

Course Coordinator: Dr. Sherihan Abdel-Ghafour

Program Coordinator: Dr. Sherihan Abdel-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information:

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Mechanical Power Engineering		
Course Code	**MPE441**		
Year/ Level	Fourth year- 2nd semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	2	2	1

2. Course aims:

No.	Aims
7	Design, analyse, control, and measure the performance of hydraulic and pneumatic circuits and its components.

3. Learning Outcomes (LOs):

A1.1	Solve hydraulic and pneumatic problems using engineering fundamentals, basic science and mathematics.
A2.1	Conduct appropriate experimentation, analyze and interpret data, evaluate findings to draw conclusions.
A3.1	Apply engineering design processes to produce solutions that meet specified needs with consideration for economic, and environmental aspects, and as appropriate to the discipline and within the principles and contexts of sustainable design.
A4.1	Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues and risk management principles.
B1.1	Analyze hydraulic and pneumatic circuits by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, solid Mechanics, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.
B3.1	Select components (pump, valve, pipe, hose, fittings, and accessories) according to the required performance.
B4.1	Adopt suitable national and international standards and codes to size, design, operate, inspect, and maintain hydraulic and pneumatic circuits and its components.

C1.1	Recognize the design concepts, operation and characteristics of hydraulic and pneumatic circuits and its components.
C2.1	Analyze, evaluate and enhance the performance of hydraulic and pneumatic systems.
C3.1	Judge the optimal solution according to the constraints of operation, costs, safety, reliability and environmental impacts.

4. Course Contents:

No.	Topics	Week
1	**Lecture:** • Introduction & Classification of fluid power systems. • Governing equations • Main component of pneumatic and hydraulic systems **Tutorials:** • Solve problems on the applications of the basic principles to hydraulic systems. **Lab:** • Test the performance of plunger pump without air vessel.	1
2	**Lecture:** • Introduction of positive and non – positive pumps • Reciprocating pumps • Rotary pumps (Gear pumps, Vane and piston pumps) • Introduction to compressors **Tutorials:** • Solve problems on the applications of the basic principles to hydraulic systems. **Lab:** • Test the performance of plunger pump without air vessel.	2-3
3	**Lecture:** • Introduction to actuators • Linear actuators (cylinders) • Motors (rotating actuators) **Tutorials:** • Solve problems on positive displacement pumps. **Lab:** • Test the performance of plunger pump without air vessel.	4-5
4	**Lecture:** • Introduction to valves • Directional control valves **Tutorials:** • Solve problems on positive displacement pumps. **Lab:** • Test the performance of plunger pump with air vessel.	6-7
5	**Midterm Examination**	**8**

6	**Lecture:** - Pressure control valves - Flow control valves - Proportional valves - Servo valves **Tutorials:** - Solve problems on actuators. **Lab:** - Test the performance of plunger pump with air vessel.	9
7	**Lecture:** - Hydraulic fluids - Air preparation - Pipes, tubes, and fittings - Fittings **Tutorials:** - Solve problems on actuators. **Lab:** - Test the performance of plunger pump with air vessel.	10
8	**Lecture:** - Accessories - Intensifiers - accumulators **Tutorials:** - Solve problems on hydraulic and pneumatic circuits. **Lab:** - Test the performance of a reciprocating compressor.	11
9	**Lecture:** - Design of simple hydraulic and pneumatic circuits **Tutorials/Lab:** - Solve problems on hydraulic and pneumatic circuits. **Lab:** - Test the performance of a reciprocating compressor.	12-13
10	**Lecture:** - Maintenances and safety of hydraulic and pneumatic circuits **Tutorials:** - Solve problems on hydraulic and pneumatic circuits. **Lab:** - Test the performance of a reciprocating compressor.	14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method														
		Lecture	Interactive lectures	Flipped Classroom	Presentation	Discussion	Tutorial	Problem-solving	Brain storming	Projects	Site visits	Self-learning	Cooperative	Drawing Studio	Computer Simulation	Practical Experiments
A-Level	A1.1	x	x			x	x		x							
	A2.1								x							x
	A3.1	x	x			x	x									
	A3.1	x	x			x	x									
B-Level	B1.1	x	x			x	x		x							
	B2.1	x	x			x	x									
	B3.1	x	x			x	x		x							
	B4.1	x	x			x	x		x		x					x
C-Level	C1.1	x	x			x	x				x					x
	C2.1	x	x			x	x									
	C3.1	x	x		x	x	x									x

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials and videos
2	Online lectures and assignments

7. Student Assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written)	A1.1, A3.1, A4.1, B1.1, B2.1, B3.1, B4.1, C1.1, C2.1, C3.1
2	Practical/ Oral Examination	A2.1
3	Formative (quizzes - presentation - assignments)	A1.1, A3.1, A4.1, B1.1, B2.1, B3.1, B4.1, C1.1, C2.1, C3.1
4	Final Term Examination (written)	A1.1, A3.1, A4.1, B1.1, B2.1, B3.1, B4.1, C1.1, C2.1, C3.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	8
2	Practical/ Oral Examination	15
3	Formative (quizzes – presentation – assignments)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	8
2	Practical/ Oral Examination	20
3	Formative (quizzes – presentation – assignments)	12
4	Final Term Examination (written)	60
Total		100%

8. List of References:

No.	Reference List
1	Esposito, A., “Fluid Power with Applications” Prentice-Hall INT., 7th edition, 2009.
2	Doddannavar, R., and Barnard A., “Practical Hydraulic Systems: Operation and Troubleshooting for Engineers and Technicians”, 1st Edition, Elsevier, 2005.
3	Rabie, M., “Fluid Power Engineering”, McGraw-Hill Companies, Inc., 2009.
4	Cundiff, S., “Fluid power circuits and controls: fundamentals and applications”, (Mechanical engineering series), CRC Press, 2001.
5	Chapple, P., “Principles of Hydraulic System Design”, 2nd edition, Momentum Press, LLC, 2015.
6	Qin Zhan, “Basics of Hydraulic Systems Second Edition,” 2nd edition, Taylor & Francis Group, LLC, 2018.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture/Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topics	Aims	LOs
1	**Lecture:** - Introduction & Classification of fluid power systems. - Governing equations - Main component of pneumatic and hydraulic systems **Tutorials:** - Solve problems on the applications of the basic principles to hydraulic systems. **Lab:** - Test the performance of plunger pump without air vessel.	7	A1.1
2	**Lecture:** - Introduction of positive and non – positive pumps - Reciprocating pumps - Rotary pumps (Gear pumps, Vane and piston pumps) - Introduction to compressors **Tutorials:** - Solve problems on the applications of the basic principles to hydraulic systems. **Lab:** - Test the performance of plunger pump without air vessel.	7	A1.1, A2.1, A3.1, A4.1, B1.1, B2.1, B3.1, B4.1, C1.1, C2.1, C3.1
3	**Lecture:** - Introduction to actuators - Linear actuators (cylinders) - Motors (rotating actuators) **Tutorials:** - Solve problems on positive displacement pumps. **Lab:** - Test the performance of plunger pump without air vessel.	7	A1.1, A2.1, A3.1, A4.1, B1.1, B2.1, B3.1, B4.1, C1.1, C2.1, C3.1
4	**Lecture:** - Introduction to valves - Directional control valves **Tutorials:** - Solve problems on positive displacement pumps. **Lab:** - Test the performance of plunger pump with air	7	A1.1, A3.1, A4.1, B1.1, B2.1, B3.1, B4.1, C1.1, C2.1, C3.1

	vessel.		
5	**Lecture:** - Pressure control valves - Flow control valves - Proportional valves - Servo valves **Tutorials:** - Solve problems on actuators. **Lab:** - Test the performance of plunger pump with air vessel.	7	A1.1, A3.1, A4.1, B1.1, B2.1, B3.1, B4.1, C1.1, C2.1, C3.1
6	**Lecture:** - Hydraulic fluids - Air preparation - Pipes, tubes, and fittings - Fittings **Tutorials:** - Solve problems on actuators. **Lab:** - Test the performance of plunger pump with air vessel.	7	A1.1, A3.1, A4.1, B1.1, B2.1, B3.1, B4.1, C1.1, C2.1, C3.1
7	**Lecture:** - Accessories - Intensifiers - accumulators **Tutorials:** - Solve problems on hydraulic and pneumatic circuits. **Lab:** Test the performance of a reciprocating compressor.	7	A1.1, A3.1, A4.1, B1.1, B2.1, B3.1, B4.1, C1.1, C2.1, C3.1
8	**Lecture:** - Design of simple hydraulic and pneumatic circuits **Tutorials/Lab:** - Solve problems on hydraulic and pneumatic circuits. **Lab:** Test the performance of a reciprocating compressor.	7	A1.1, A3.1, A4.1, B1.1, B2.1, B3.1, B4.1, C1.1, C2.1, C3.1
9	**Lecture:** - Maintenances and safety of hydraulic and pneumatic circuits **Tutorials:** - Solve problems on hydraulic and pneumatic circuits. **Lab:** Test the performance of a reciprocating compressor.	7	A1.1, A3.1, A4.1, B1.1, B2.1, B3.1, B4.1, C1.1, C2.1, C3.1

Course: Pneumatic and Hydraulic Systems	
Program Competencies	**Course LOs**
A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.	**A1.1** Solve hydraulic and pneumatic problems using engineering fundamentals, basic science and mathematics.
A2. Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.	**A2.1** Conduct appropriate experimentation, analyze and interpret data, evaluate findings to draw conclusions.
A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.	**A3.1** Apply engineering design processes to produce solutions that meet specified needs with consideration for economic, and environmental aspects, and as appropriate to the discipline and within the principles and contexts of sustainable design.
A4. Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues and risk management principles.	**A4.1** Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues and risk management principles.
B1. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.	**B1.1** Analyze hydraulic and pneumatic circuits by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, solid Mechanics, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.
B3. Select conventional mechanical equipment according to the required performance.	**B3.1** Select components (pump, valve, pipe, hose, fittings, and accessories) according to the required performance.
B4. Adopt suitable national and international standards and codes; and integrate legal,	**B4.1** Adopt suitable national and international standards and codes to

economic and financial aspects to: design, build, operate, inspect and maintain mechanical equipment and systems.	size, design, operate, inspect, and maintain hydraulic and pneumatic circuits and its components.
C1. Recognize the design concepts, operation and characteristics of internal combustion engines, boilers, heat exchangers, turbomachines and hydraulic machines.	**C1.1** Recognize the design concepts, operation and characteristics of hydraulic and pneumatic circuits and its components.
C2. Analyze, evaluate and enhance the performance of the HVAC systems, automatic control systems, pneumatic systems, hydraulic Systems, combustion systems, thermal and nuclear power plants.	**C2.1** Analyze, evaluate and enhance the performance of hydraulic and pneumatic systems.
C3. Judge the optimal solution according to the constraints of operation, costs, safety, reliability and environmental impacts.	**C3.1** Judge the optimal solution according to the constraints of operation, costs, safety, reliability and environmental impacts.

Course Coordinator: Assoc. Prof. Dr. Mohamed El-Ghandour El-Ghandour

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information:

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Mechanical Power Engineering		
Course Code	**MEP447**		
Year/ Level	Fourth year- 2nd semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	2	2	--

2. Course aims:

No.	Aims
9	Carry out preliminary designs of mechanical power systems, investigate their performance and solve their essential operational problems using Computational Fluid Dynamics.

3. Learning Outcomes (LOs):

A3.1	Apply some thermal and mechanical concepts to design mechanical power engineering components using CFD simulations.
A5.1	Practice research techniques and methods of CFD investigation.
B1.1	Analyze the components of the power plants by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, combustion and automatic control principles.
B3.1	Select the conventional component for the power station according to the required performance and its behavior under a wide range of operating condition.
C1.1	Recognize the design concepts of boilers, feedwater heaters, turbomachines, combustion chambers, intercoolers, regenerators, reheaters and nuclear reactors.
C1.2	Identify the operating behavior and characteristics of the components of thermal and nuclear power plants with the variation of load.
C2.1	Analyze, evaluate and enhance the performance of the thermal and nuclear power plants.
C3.1	Judge the optimal design, operating conditions and number of the components according to the constraints of operation, costs, safety, reliability and environmental impacts.
C4.1	Choose, apply and assess the newable and renewable energy resources in power generation field.

4. Course Contents:

No.	Topics	Week
1	**Lecture:** • Introduction. **Tutorials/Lab:** • Meshing tutorial.	1
2	**Lecture:** • Governing equations. **Tutorials/Lab:** • Internal flow tutorial.	2
3	**Lecture:** • Turbulence modeling **Tutorials/Lab:** • External flow around an airfoil tutorial.	3
4	**Lecture:** • Boundary conditions. **Tutorials/Lab:** • Axisymmetric flow tutorial.	4
5	**Lecture:** • Modeling of heat transfer. **Tutorials/Lab:** • Shell and tube heat exchanger tutorial.	5
6	**Lecture:** • Modeling of rotating elements. **Tutorials/Lab:** • Multiple reference frame tutorial.	6
7	**Lecture:** • Modeling of heat transfer. **Tutorials/Lab:** • Shell and tube heat exchanger tutorial.	7
8	**Midterm Examination**	**8**
9	**Lecture:** • Modeling of compressible flow **Tutorials/Lab:** • Compressible flow tutorial.	9
10	**Lecture:** • Multiphase. **Tutorials/Lab:** • Multiphase.	10-11
12	**Lecture:** • Modeling of combustion. **Tutorials/Lab:** • Modeling of combustion.	12-14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method														
		Lecture	Interactive lectures	Flipped Classroom	Presentation	Discussion	Tutorial	Problem-solving	Brain storming	Projects	Site visits	Self-learning	Cooperative	Drawing Studio	Computer Simulation	Practical Experiments
A-Level	A3.1	x	x				x	x		x			x		x	
	A5.1		x				x	x		x			x		x	
B-Level	B1.1		x				x	x		x			x		x	
	B2.1		x				x	x		x			x		x	
	B3.1		x				x	x		x			x		x	
C-Level	C2.1		x				x	x		x			x		x	
	C3.2		x				x	x		x			x		x	
	C5.1	x	x				x	x		x			x		x	
	C6.1		x				x	x		x			x		x	

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials and videos
2	Online lectures and assignments

7. Student Assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written)	A3.1, A5.1, B1.1, B2.1, B3.1, C2.1, C3.1, C5.1, C6.1
2	Practical/ Oral Examination	A3.1, A5.1, B1.1, B2.1, B3.1, C2.1, C3.1, C5.1, C6.1
3	Formative (quizzes - presentation - assignments)	A3.1, A5.1, B1.1, B2.1, B3.1, C2.1, C3.1, C5.1, C6.1
4	Final Term Examination (written)	A3.1, A5.1, B1.1, B2.1, B3.1, C2.1, C3.1, C5.1, C6.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	8
2	Practical/ Oral Examination	15
3	Formative (quizzes – presentation – assignments)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	8
2	Practical/ Oral Examination	---
3	Formative (quizzes – presentation – assignments)	22
4	Final Term Examination (written)	70
Total		100%

8. List of References:

No.	Reference List
1	Versteeg, H. K., & Malalasekera, W., 2007, “An introduction to computational fluid dynamics: the finite volume method,” Harlow: Prentice Hall.
2	Tannehill, J. C., Anderson, D. A. and Pletcher, R. H., 2012, “Computational Fluid Mechanics and Heat Transfer,” 3rd Edition, CRC Press Publisher, New York.
3	Cheng, T. J., 2010, “Computational Fluid Dynamics,” 2nd Edition, Cambridge University Press, New York.
4	"ANSYS FLUENT Theory Guide," Release 17.0, ANSYS, Inc., 2016.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture/Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aims	LOs
1	**Lecture:** - Introduction. **Tutorials/Lab:** - Meshing tutorial.	9	A3.1, A5.1, B1.1, B3.1, C3.1, C5.1, C6.1
2	**Lecture:** - Governing equations. **Tutorials/Lab:** - Internal flow tutorial.	9	A3.1, A5.1, B1.1, B3.1, C3.1, C5.1, C6.1
3	**Lecture:** - Turbulence modeling **Tutorials/Lab:** - External flow around an airfoil tutorial.	9	A3.1, A5.1, B1.1, B3.1, C3.1, C5.1, C6.1
4	**Lecture:** - Boundary conditions. **Tutorials/Lab:** - Axisymmetric flow tutorial..	9	A3.1, A5.1, B1.1, B3.1, C3.1, C5.1, C6.1
5	**Lecture:** - Modeling of heat transfer. **Tutorials/Lab:** - Shell and tube heat exchanger tutorial.	9	A3.1, A5.1, B1.1, B3.1, C3.1, C5.1, C6.1
6	**Lecture:** - Modeling of rotating elements. **Tutorials/Lab:** - Multiple reference frame tutorial.	9	A3.1, A5.1, B1.1, B2.1, B3.1, C2.1, C3.1, C5.1, C6.1
7	**Lecture:** - Modeling of heat transfer. **Tutorials/Lab:** - Shell and tube heat exchanger tutorial.	9	A3.1, A5.1, B1.1, B2.1, B3.1, C2.1, C3.1, C5.1, C6.1
8	**Midterm Examination**	9	A3.1, A5.1, B1.1, B2.1, B3.1, C2.1, C3.1, C5.1, C6.1
9	**Lecture:** - Modeling of compressible flow. **Tutorials/Lab:** - Compressible flow tutorial.	9	A3.1, A5.1, B1.1, B3.1, C3.1, C5.1, C6.1
10	**Lecture:** - Multiphase. **Tutorials/Lab:** - Multiphase.	9	A3.1, A5.1, B1.1, B3.1, C3.1, C5.1, C6.1
12	**Lecture:** - Modeling of combustion. **Tutorials/Lab:** - Modeling of combustion.	9	A3.1, A5.1, B1.1, B3.1, C3.1, C5.1, C6.1

Course: Computational Fluid Dynamics	
Program Competencies	**Course LOs**
A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.	**A3.1** Apply some thermal and mechanical concepts to design mechanical power engineering components using CFD simulations.
A5. Practice research techniques and methods of investigation as an inherent part of learning.	**A5.1** Practice research techniques and methods of CFD investigation.
B1. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, Solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.	**B1.1** Analyze the Heat Transfer, Fluid Mechanics, and combustion components using CFD.
B2. Plan, manage and carry out designs of mechanical systems and machine elements using appropriate materials both traditional means and computer-aided tools and software contemporary to the mechanical engineering field.	**B2.1** Plan, manage and carry out designs of mechanical systems using CFD software.
B3. Select conventional mechanical equipment according to the required performance.	**B3.1** Select the conventional component based on CFD simulations.
C2. Analyze, evaluate and enhance the performance of the HVAC systems, automatic control systems, pneumatic systems, hydraulic Systems, combustion systems, thermal and	**C2.1** Analyze, evaluate and enhance the performance of mechanical power engineering components using CFD software.

nuclear power plants.	
C3. Judge the optimal solution according to the constraints of operation, costs, safety, reliability and environmental impacts.	**C3.1** Judge the optimal solution according to the constraints of operation, costs, safety, reliability and environmental impacts by analyzing the CFD results.
C5. Select appropriate solutions for mechanical power engineering problems based on analytical and numerical techniques.	**C5.1** Select appropriate solutions for mechanical power engineering problems using CFD software.
C6. Use and develop codes using a wide range of software packages pertaining to the discipline.	**C6.1** Use CFD codes for the simulations of Mechanical Power Engineering problems.

Course Coordinator: Dr. Mohamed Mohamed Elsakka

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information:

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Mechanical Power Engineering		
Course Code	**MPE 445**		
Year/ Level	Fourth year- 2nd semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	2	2	----

2. Course Aims:

No.	**Aims**
7	Design the main internal combustion engine parts, evaluate the forces and stresses acting on them, and Specify the safe design parameter and operating condition.

3. Learning Outcomes (LOs):

A3.1	Apply thermal and mechanical design concepts to engine parts and select or produce a cost-effective solution that meet specified needs with consideration for economic and environmental aspects.
A5.1	Practice research techniques of exploring the newly designed engine parts.
B1.2	Analyze and design the main components of engine parts by applying the concepts of: Thermodynamics, Heat Transfer, and combustion sciences.
B2.1	Plan for the designs of engine parts relying on the dimensions and 3D modelling and carry out the stresses analysis on these parts.
B3.1	Select the conventional component for the internal combustion engines according to the required performance and its behavior under a wide range of operating condition.
C2.1	Analyze, evaluate and enhance the performance of the combustion in engines.
C3.2	Judge the optimal design, operating conditions and number of the engine components according to the constraints of operation, costs, safety, and reliability.
C5.1	Select convenient solution for engine problems relying on the analytical and numerical studies on engine parts.
C6.1	Identify codes using a wide range of software packages pertaining to the discipline.

4. Course Contents:

No.	Topics	Week
1	**Lecture:** • Classifications of Internal Combustion Engines (ICEs) • Main components of ICEs • Discussion **Tutorials/Lab:** • Identify some components of a real engine and discuss the material of each.	1
2	**Lecture:** • Engine crank mechanism kinematics and load • Motion and acceleration of the piston • Forces acting on the reciprocating parts • Discussion **Tutorials/Lab:** • Solve problems on the forces acting on piston-crank mechanism • Demonstrate actual piston-crank mechanism	2
3	**Lecture:** • Liner types • Liner dimensions • Stresses acting on the cylinder’s liner • discussion **Tutorials/Lab:** • Solve problems on the forces acting on piston-crank mechanism. • Demonstrate different between actual wet and dry liners.	3
4	**Lecture:** • Bending stress acting on cylinder’s liner • Liner deflection • Fastening force and stresses • Pressure of the sealing ring • discussion **Tutorials/Lab:** • Solve problems on cylinder’s liner	4
5	**Lecture:** • Piston function • Piston components • Materials for piston • Design considerations for piston components • discussion **Tutorials/Lab:** • Solve problems on the design of piston’s crown and skirt • Distinguish between different piston designs.	5

6	**Lecture:** - Thermal tolerance in piston design - Piston-ring clearance - Discussion **Tutorials/Lab:** - Solve problems on the design of pistons.	6
7	**Lecture:** - Design of piston ring - Design of piston pin - Discussion **Tutorials/Lab:** - Solve problems on the design of piston's ring and pin.	7
8	**Midterm Examination**	**8**
9	**Lecture:** - Design considerations of a newly designed pistons for Gasoline and diesel engines - discussion **Tutorials/Lab:** - Distinguish between old and new piston materials and design	9
10	**Lecture:** - Connecting rod function - Materials for connecting rod - Design considerations for connecting rod. - Dimensions of the connecting rod - Discussion **Tutorials/Lab:** - Distinguish between different real connecting rod materials	10
11	**Lecture:** - Dimensions of the crankpin at the big end - Size of the bolts securing the big end cap. - Thickness of the big end cap - Discussion **Tutorials/Lab:** - Solve problems on connecting rod design	11
12	**Lecture:** - Function and materials for the crankshaft - Bearing pressures and stresses - Design of crank web - Discussion **Tutorials/Lab:** - Solve problems on crankshaft's design	12-13

13	**Lecture:** • Design of engine valves • Rocker arms • Difference between Variable Valve Timing and Variable Valve Lift. • Discussion **Tutorials/Lab:** • Solve problems on the dimensions of the valves. • Demonstrate different valves attached to the piston.	14

5. Teaching and Learning Methods:

LOs		**Teaching and Learning Method**														
		Lecture	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A3.1**	x	x			x			x							
	A5.1	x	x									x				
B-Level	**B1.2**	x	x			x	x	x	x							x
	B2.1	x	x			x	x	x	x			x			x	x
	B3.1	x	x			x			x						x	
C-Level	**C2.1**	x	x			x	x	x								
	C3.2	x	x			x	x	x								
	C5.1	x	x			x	x	x	x			x			x	x
	C6.1		x			x			x			x			x	

6. Teaching and Learning Methods of Disable Students:

No.	**Teaching Method**
1	Additional Tutorials and videos
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written)	B1.2, B3.1, C2.1, C3.2
2	Practical/ Oral Examination	A3.1, B1.2, B3.1, C3.2
3	Formative (quizzes - presentation - assignments)	A3.1, B1.2, C3.2
4	Final Term Examination (written)	A3.1, B1.2,B2.1, B3.1, C2.1, C3.2

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	8
2	Practical/ Oral Examination	15
3	Formative (quizzes – presentation – assignments)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	10
2	Practical/ Oral Examination	--
3	Formative (quizzes – presentation – assignments)	20
4	Final Term Examination (written)	70
Total		100%

8. List of References

No.	Reference List
1	R. S. Khurmi and J. K. Gupta, A Textbook of Machine Design, Eurasia Publishing House (PVT.) LTD., 2005.
2	Peter Childs, Mechanical Design, Butterworth-Heinemann, 2004.
3	H. N. Gupta, Fundamentals of Internal Combustion Engines, Prentice-Hall Of India Pvt. Limited, 2006.
4	Shyam K. Agrawal, Internal Combustion Engines, New Age International, 2006.
5	Willard W. Pulkrabek, Engineering Fundamentals of the Internal Combustion Engine, Prentice Hall, online.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture/Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aims	LOs
1	**Lecture:** • Classifications of Internal Combustion Engines (ICEs) • Main components of ICEs • Discussion **Tutorials/Lab:** • Identify some components of a real engine and discuss the material of each.	7	B1.2, A3.1
2	**Lecture:** • Engine crank mechanism kinematics and load • Motion and acceleration of the piston • Forces acting on the reciprocating parts • Discussion **Tutorials/Lab:** • Solve problems on the forces acting on piston-crank mechanism • Demonstrate actual piston-crank mechanism	7	B1.2
3	**Lecture:** • Liner types • Liner dimensions • Stresses acting on the cylinder’s liner • discussion **Tutorials/Lab:** • Solve problems on the forces acting on piston-crank mechanism. • Demonstrate different between actual wet and dry liners.	7	A3.1, B3.1, C3.2, C2.1
4	**Lecture:** • Bending stress acting on cylinder’s liner • Liner deflection • Fastening force and stresses • Pressure of the sealing ring	7	A3.1, B1.2, C3.2

	- discussion **Tutorials/Lab:** - Solve problems on cylinder’s liner		
5	**Lecture:** - Piston function - Piston components - Materials for piston - Design considerations for piston components - discussion **Tutorials/Lab:** - Solve problems on the design of piston’s crown and skirt - Distinguish between different piston designs.	7	A3.1, B1.2, B3.1, C2.1
6	**Lecture:** - Thermal tolerance in piston design - Piston-ring clearance - Discussion **Tutorials/Lab:** - Solve problems on the design of pistons.	7	A3.1, B1.2, B3.1, C2.1
7	**Lecture:** - Design of piston ring - Design of piston pin - Discussion **Tutorials/Lab:** - Solve problems on the design of piston’s ring and pin.	7	A3.1, B1.2, B3.1, C2.1
8	**Midterm Examination**	7	B1.2, B3.1, C2.1, C3.2
9	**Lecture:** - Design considerations of a newly designed pistons for Gasoline and diesel engines - discussion **Tutorials/Lab:** - Distinguish between old and new piston materials and design	7	A5.1, B2.1, C3.2, C5.1
10	**Lecture:** - Connecting rod function - Materials for connecting rod - Design considerations for connecting rod. - Dimensions of the connecting rod - Discussion **Tutorials/Lab:** - Distinguish between different real connecting rod	7	A3.1, B1.2, B2.1, B3.1, C5.1

	materials		
11	**Lecture:** • Dimensions of the crankpin at the big end • Size of the bolts securing the big end cap. • Thickness of the big end cap • Discussion **Tutorials/Lab:** • Solve problems on connecting rod design	7	A3.1, B1.2, B2.1, B3.1, C5.1
12	**Lecture:** • Function and materials for the crankshaft • Bearing pressures and stresses • Design of crank web • Discussion **Tutorials/Lab:** • Solve problems on crankshaft's design	7	A3.1, B1.2, B3.1, C5.1,
13	**Lecture:** • Design of engine valves • Rocker arms • Difference between Variable Valve Timing and Variable Valve Lift. • Discussion **Tutorials/Lab:** • Solve problems on the dimensions of the valves. • Demonstrate different valves attached to the piston.	7	B2.1, C2.1, C5.1, C6.1

Course: Internal combustion engine design	
Program Competencies	**Course LOs**
A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.	**A3.1** Apply thermal and mechanical design concepts to engine parts and select or produce a cost-effective solution that meet specified needs with consideration for economic and environmental aspects.
A5. Practice research techniques and methods of investigation as an inherent part of learning.	**A5.1** Practice research techniques of exploring the newly designed engine parts.
B1. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, Solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.	**B1.2** Analyze and design the main components of engine parts by applying the concepts of: Thermodynamics, Heat Transfer, and combustion sciences.
B2. Plan, manage and carry out designs of mechanical systems and machine elements using appropriate materials both traditional means and computer-aided tools and software contemporary to the mechanical engineering field.	**B2.1** Plan for the designs of engine parts relying on the dimensions and 3D modelling and carry out the stresses analysis on these parts.
B3. Select conventional mechanical equipment according to the required performance.	**B3.1** Select the conventional component for the internal combustion engines according to the required performance and its behavior under a wide range of operating condition.
C2. Analyze, evaluate and enhance the performance	**C2.1** Analyze, evaluate and enhance

of the HVAC systems, automatic control systems, pneumatic systems, hydraulic Systems, combustion systems, thermal and nuclear power plants.	the performance of the combustion in engines.
C3. Judge the optimal solution according to the constraints of operation, costs, safety, reliability and environmental impacts.	**C3.2** Judge the optimal design, operating conditions and number of the engine components according to the constraints of operation, costs, safety, reliability.
C5. Select appropriate solutions for mechanical power engineering problems based on analytical and numerical techniques.	**C5.1** Select convenient solution for engine problems relying on the analytical and numerical studies on engine parts.
C6. Use and develop codes using a wide range of software packages pertaining to the discipline.	**C6.1** Identify using a software packages related to the discipline.

Course Coordinator: Dr. Moustafa Shehata

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information:

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Mechanical Power Engineering		
Course Code	**MPE446**		
Year/ Level	Fourth year – 2nd semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	2	2	-

2. Course Aims:

No.	**Aims**
7	Analyze and assessing the efficiency of the air-conditioning systems experiencing different types of flow and heat transfer situations.

3. Learning Outcomes (LOs):

A3.1	Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for economic, environmental, and comfortable condition aspects.
A5.1	Practice research techniques and methods of investigation as an inherent part of learning.
B1.1	Analyze the performance of each type of air conditioning systems.
B2.1	Carry out designs of air conditioning systems theoretically.
B3.1	Select conventional equipment for the air conditioning system according to the required performance.
C2.1	Analyze, evaluate and enhance the performance of the HVAC systems.
C3.1	Judge the optimal solution according to the constraints of operation, costs, safety, reliability and environmental impacts.
C5.1	Select appropriate solutions for air conditioning problems based on analytical techniques.
C6.1	Identify codes using a wide range of software packages pertaining to the discipline.

4. Course Contents:

No.	Topics	Week
1	**Lecture:** - **Introduction (Types of room air conditioning systems)** ○ Classification of room air conditioning systems **Tutorials/Lab:** - Solve problems on room air conditioning systems.	1
2	**Lecture:** - **Air measurements in air conditioning and ventilation systems** ○ Design of air conditioning and ventilation systems **Tutorials/Lab:** - Solve problems on air conditioning and ventilation systems.	2
3	**Lecture:** - **Types of Air conditioning systems** ○ Central Air Conditioner. ○ Ductless Mini-Split ○ Window Air Conditioner. ○ Portable Air Conditioner ○ Floor Mounted AC **Tutorials/Lab:** - Solve problems on types of Air conditioning systems.	3
4	**Lecture:** - **Types of Air conditioning systems** ○ Floor Mounted AC ○ Hybrid / Dual Fuel Air Conditioner. ○ Smart Air Conditioner. ○ Geothermal Air Conditioner **Tutorials/Lab:** - Solve problems on types of Air conditioning systems.	4
5	**Lecture:** ○ Central Air conditioning systems ○ Design of Central Air conditioning systems. **Tutorials/Lab:** - Solve problems on Central Air conditioning systems.	5
6	**Lecture:** - **Air Conditioning Load Calculations** ○ Cooling Load Calculations and Principles **Tutorials/Lab:** - Solve problems on Cooling Load Calculations.	6
7	**Lecture:** - **Conditioning Load Calculations** ○ Heating load Calculations and Principles **Tutorials/Lab:** - Solve problems on Heating load Calculations.	7
8	**Midterm Examination**	**8**

9	**Lecture:** - **Car air conditioning system** ○ The Components of an Automotive Air Conditioning System **Tutorials/Lab:** - Solve problems on Automotive Air Conditioning System.	9
10	**Lecture:** - **Equipments in air conditioning and ventilation systems** ○ Design of air conditioning **Tutorials/Lab:** - Solve problems on air conditioning.	10
11	**Lecture:** - **Equipments in air conditioning and ventilation systems** ○ Design of_ventilation systems **Tutorials/Lab:** - Solve problems on ventilation systems	11
12	**Lecture:** - **Air handling distribution systems and duct design** ○ Design of_air handling distribution systems ○ Design of air duct systems **Tutorials/Lab:** - Solve problems on air duct systems.	12-13
13	**Lecture:** - **Control systems in Air – conditioning equipment** ○ Control Techniques in Heating, Ventilating and Air Conditioning **Tutorials/Lab:** - Solve problems on Control Techniques.	14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method														
		Lecture	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A3.1**	x	x			x	x	x	x			x				
	A5.1	x	x			x	x	x	x			x				
B-Level	**B1.1**	x	x			x	x	x	x			x				
	B2.1	x	x			x	x	x	x			x				
	B3.1	x	x			x	x	x	x			x				
C-Level	**C2.1**	x	x			x	x	x	x			x			x	
	C3.1	x	x			x	x	x	x			x				
	C5.1	x	x			x	x	x	x			x				
	C6.1	x	x			x	x	x	x			x				

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials and videos
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written)	A3.1, B1.1, B2.1
2	Practical/ Oral Examination	A3.1, C2.1, C3.1, C5.1
3	Formative (quizzes - presentation - assignments)	A3.1, A5.1, B1.1, B2.1, B3.1, C2.1, C3.1, C5.1, C6.1
4	Final Term Examination (written)	A3.1, B1.1, B2.1, B3.1, C2.1, C3.1, C5.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	8
2	Practical/ Oral Examination	15
3	Formative (quizzes – presentation – assignments)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	20
2	Practical/ Oral Examination	--
3	Formative (quizzes – presentation – assignments)	10
4	Final Term Examination (written)	70
Total		100%

8. List of References

No.	Reference List
1	G.F., Hundy, A.R., Trott and T.C., Welch, " Refrigeration, Air Conditioning and Heat Pumps", Butterworth Heinemann, Oxford, 5th edition 2016.
2	W.F., Stoecker, and J.W., Jones, "Refrigeration and Air-Conditioning", McGrawHill Corp., 2nd edition, 1989.
3	Arora, C.P., "Refrigeration and Air-conditioning", TATA McGraw-Hill, 2nd edition, 2006.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture/Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aims	LOs
1	**Lecture:** - **Introduction (Types of room air conditioning systems)** ○ Classification of room air conditioning systems **Tutorials/Lab:** - Solve problems on room air conditioning systems	7	A3.1, A5.1, A6.1, C3.1, C4.1
2	**Lecture:** - **Air measurements in air conditioning and ventilation systems** ○ Design of air conditioning and ventilation systems **Tutorials/Lab:** - Solve problems on air conditioning and ventilation systems.	7	A3.1, A5.1, A6.1, C4.1

3	**Lecture:**
	- **Types of Air conditioning systems**
	  ○ Central Air Conditioner.
	  ○ Ductless Mini-Split
	  ○ Window Air Conditioner.
	  ○ Portable Air Conditioner
	  ○ Floor Mounted AC
	Tutorials/Lab:
	- Solve problems on types of Air conditioning systems.
		7	A3.1, A5.1, B1.1, B2.1, C1.1, C2.1, C3.1, C4.1

4	**Lecture:**
	- **Types of Air conditioning systems**
	  ○ Floor Mounted AC
	  ○ Hybrid / Dual Fuel Air Conditioner.
	  ○ Smart Air Conditioner.
	  ○ Geothermal Air Conditioner
	Tutorials/Lab:
	- Solve problems on types of Air conditioning systems.
		7	A3.1, A5.1, A6.1, B1.1, C2.1, C3.1, C4.1

5	Lecture: - Central Air conditioning systems ○ Design of Central Air conditioning systems. **Tutorials/Lab:** - Solve problems on Central Air conditioning	7	A3.1, A5.1, A6.1, B1.1, B2.1, B3.1, C2.1, C3.1

	systems		
6	**Lecture:** • **Air Conditioning Load Calculations** ○ Cooling Load Calculations and Principles **Tutorials/Lab:** • Solve problems on Cooling Load Calculations.	7	A3.1, A5.1, A6.1, B1.1, B2.1, C1.1, C2.1, C3.1, C4.1
7	**Lecture:** • **Conditioning Load Calculations** ○ Heating load Calculations and Principles **Tutorials/Lab:** • Solve problems on Heating load Calculations	7	A3.1, A5.1, A6.1, B1.1, B2.1, C1.1, , C4.1
8	**Midterm Examination**	7	A3.1, A5.1, B2.1, C1.1, C2.1, C3.1, C4.1
9	**Lecture:** • **Car air conditioning system** ○The Components of an Automotive Air Conditioning System **Tutorials/Lab:** • Solve problems on Automotive Air Conditioning System.	7	A3.1, A5.1, A6.1, B1.1, B2.1, C1.1,
10	**Lecture:** • **Equipments in air conditioning and ventilation systems** ○ Design of air conditioning **Tutorials/Lab:** • Solve problems on air conditioning.	7	A3.1, A5.1, A6.1, B1.1, B2.1, C1.1, C2.1, C3.1, C4.1
11	**Lecture:** • **Equipments in air conditioning and ventilation systems** ○ Design of ventilation systems **Tutorials/Lab:** • Solve problems on ventilation systems	7	A3.1, A5.1, A6.1, B1.1, B2.1, C1.1, C2.1, C3.1, C4.1
12	**Lecture:** • **Air handling distribution systems and duct design** ○ Design of air handling distribution systems ○ Design of air duct systems **Tutorials/Lab:**	7	A3.1, A5.1, A6.1, B1.1, B2.1, C1.1, C2.1 , C4.1

	• Solve problems on air duct systems.		
13	**Lecture:** • **Control systems in Air – conditioning equipments** ○ Control Techniques in Heating, Ventilating and Air Conditioning **Tutorials/Lab:** • Solve problems on Control Techniques.	7	A3.1, A5.1, A6.1, B1.1, B2.1,B3.1, C1.1, C2.1, C3.1, C4.1

Course: Systems and Equipment of Air Conditioning	
Program Competencies	**Course LOs**
A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.	**A3.1** Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for economic, environmental, and comfortable condition aspects.
A5. Practice research techniques and methods of investigation as an inherent part of learning.	**A5.1** Practice research techniques and methods of investigation as an inherent part of learning.
B1. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, Solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.	**B1.1** Analyze the performance of each type of air conditioning systems.
B2. Plan, manage and carry out designs of mechanical systems and machine elements using appropriate materials both traditional means and computer-aided tools and software contemporary to the mechanical engineering field.	**B2.1** Carry out designs of air conditioning systems theoretically.
B3. Select conventional mechanical equipment according to the required performance.	**B3.1** Select conventional equipment for the air conditioning system according to the required performance.
C2. Analyze, evaluate and enhance the	**C2.1** Analyze, evaluate and enhance

performance of the HVAC systems, automatic control systems, pneumatic systems, hydraulic Systems, combustion systems, thermal and nuclear power plants.	the performance of the HVAC systems.
C3. Judge the optimal solution according to the constraints of operation, costs, safety, reliability and environmental impacts.	**C3.1** Judge the optimal solution according to the constraints of operation, costs, safety, reliability and environmental impacts.
C5. Select appropriate solutions for mechanical power engineering problems based on analytical and numerical techniques.	**C5.1** Select appropriate solutions for air conditioning problems based on analytical techniques.
C6. Use and develop codes using a wide range of software packages pertaining to the discipline.	**C6.1** Identify codes using a wide range of software packages pertaining to the discipline.

Course Coordinator: Dr. Yasser Elhenawy

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information:

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Mechanical Power Engineering		
Course Code	**MPE450**		
Year/ Level	Fourth year- 2nd semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	2	2	-

2. Course Aims:

No.	**Aims**
6, 7	Recognize, analyze and estimate the performance of different types of compressors.

3. Learning Outcomes (LOs):

A4.1	Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues, and risk management principles.
A5.1	Practice research techniques and methods of investigation as an inherent part of learning.
A10.1	Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.
B4.1	Adopt suitable national and international standards and codes; and integrate legal, economic and financial aspects to: design, build, operate, inspect and maintain mechanical equipment and systems.
C1.1	Recognize the design concepts, operation and characteristics of internal combustion engines, boilers, heat exchangers, turbomachines, and hydraulic machines.
C2.1	Analyze, evaluate, and enhance the performance of the HVAC systems, automatic control systems, pneumatic systems, hydraulic Systems, combustion systems, thermal and nuclear power plants.
C3.1	Judge the optimal solution according to the constraints of operation, costs, safety, reliability, and environmental impacts.
C7.1	Exchange knowledge and skills with engineering community and industries; prepare the presentations and technical reports.

4. Course Contents:

No.	Topics	Week
1	**Lecture:** • Introduction of compressors. **Tutorials:** • Solve problems on Reciprocating compressors.	1
2	**Lecture:** • Reciprocating compressors **Tutorials:** • Solve problems on Reciprocating compressors.	2
3	**Lecture:** • Volumetric efficiency • Performance of reciprocating compressors **Tutorials:** • Solve problems on Reciprocating compressors.	3
4	**Lecture:** • Curves indicator • Effect of clearance volume **Tutorials:** • Solve problems on Reciprocating compressors.	4
5	**Lecture:** • Multi-stage reciprocating compressors. **Tutorials:** • Solve problems on multi-stage reciprocating compressors.	**5**
6	**Lecture:** • Intermediate cooling. **Tutorials:** • Solve problems on reciprocating compressors	**6**
7	**Lecture:** • Rotary compressors. **Tutorials:** • Solve problems on rotary compressors.	**7**
8	**Midterm Examination**	**8**
9	**Lecture:** • Dynamic Compressors • Centrifugal compressors **Tutorials:** • Solve problems on dynamic compressors.	9
10	**Lecture:** • Static and total pressure • Curves speed and operating theory **Tutorials:** • Solve problems on dynamic compressors.	10
11	**Lecture:** • losses and efficiency • Slip coefficient.	11

	Tutorials: - Solve problems on dynamic compressors.	
12	**Lecture:** - Axial compressors **Tutorials:** - Solve problems on axial compressors.	12
13	**Lecture:** - Curves speed - The degree of reaction **Tutorials:** - Solve problems on axial compressors.	13
14	**Lecture:** - Compressor’s characteristics - Unsteady operating of compressors. **Tutorials:** Solve problems on axial compressors.	14

5. Teaching and Learning Methods:

LOs		**Teaching and Learning Method**														
		Lecture	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A4.1**	x	x			x	x									
	A5.1				x	x	x	x	x	x	x	x	x			
	A10.1							x	x	x	x	x	x			
B-Level	**B4.1**	x	x			x	x		x		x					x
C-Level	**C1.1**	x	x			x	x				x					x
	C2.1	x	x			x	x				x					
	C3.1	x	x		x	x	x									x
	C7.1				x			x	x	x	x	x				

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials and videos
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written)	A4.1, A5.1, B4.1, C1.1, C2.1, C3.1
3	Formative (quizzes - presentation - assignments)	A4.1, A5.1, A10.1, B4.1, C1.1, C2.1, C3.1, C7.1
4	Final Term Examination (written)	A4.1, A5.1, B4.1, C1.1, C2.1, C3.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	8
2	Formative (quizzes – presentation – assignments)	Every week
3	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	15
2	Formative (quizzes – presentation – assignments)	15
3	Final Term Examination (written)	70
Total		100%

8. List of References:

No.	Reference List
1	René Van den Braembussche, “Design and Analysis of Centrifugal Compressors,” ASME Press and John Wiley & Sons Ltd, 2019.
2	Ascher H. Shapiro, John wily and Sons, “The dynamics and thermodynamic of compressible fluid flow”, 2nd Edition,1990.
3	P. E. Royce N. Brown, “Compressors: Selection and Sizing”, Elsevier, 3rd ed, 1997.
4	Paul Hanlon, “ Compressor Handbook”, McGraw-Hill Handbooks, 1st ed, 2001.
5	Heinz P. Bloch, “A Practical Guide to Compressor Technology”, John Wiley & Sons, 2nd ed, 2006.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture/Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topics	Aims	LOs
1	**Lecture:** • Introduction of compressors **Tutorials:** • Solve problems on Reciprocating compressors.	6	A4.1, A5.1, A10.1, B4.1, C1.1, C2.1, C3.1
2	**Lecture:** • Reciprocating compressors **Tutorials:** • Solve problems on Reciprocating compressors.	6	A4.1, A5.1, A10.1, B4.1, C1.1, C2.1, C3.1
3	**Lecture:** • Volumetric efficiency • Performance of reciprocating compressors **Tutorials:** • Solve problems on Reciprocating compressors	6	A4.1, A5.1, A10.1, B4.1, C1.1, C2.1, C3.1
4	**Lecture:** • Curves indicator • Effect of clearance volume **Tutorials:** • Solve problems on Reciprocating compressors.	7	A4.1, A5.1, A10.1, B4.1, C1.1, C2.1, C3.1
5	**Lecture:** • Multi-stage reciprocating compressors. **Tutorials:** • Solve problems on multi-stage reciprocating compressors.	7	A4.1, A5.1, A10.1, B4.1, C1.1, C2.1, C3.1
6	**Lecture:** • Intermediate cooling. **Tutorials:** • Solve problems on reciprocating compressors.	7	A4.1, A5.1, A10.1, B4.1, C1.1, C2.1, C3.1
7	**Lecture:** • Rotary compressors. **Tutorials:** • Solve problems on rotary compressors.	7	A4.1, A5.1, A10.1, B4.1, C1.1, C2.1, C3.1

9	**Lecture:** • Dynamic Compressors • Centrifugal compressors **Tutorials:** • Solve problems on dynamic compressors.	7	A4.1, A5.1, A10.1, B4.1, C1.1, C2.1, C3.1
10	**Lecture:** • Static and total pressure • Curves speed and operating theory **Tutorials:** • Solve problems on dynamic compressors.	7	A4.1, A5.1, A10.1, B4.1, C1.1, C2.1, C3.1
11	**Lecture:** • losses and efficiency • Slip coefficient. **Tutorials:** • Solve problems on dynamic compressors.	7	A4.1, A5.1, A10.1, B4.1, C1.1, C2.1, C3.1
12	**Lecture:** • Axial compressors **Tutorials:** • Solve problems on axial compressors.	7	A4.1, A5.1, A10.1, B4.1, C1.1, C2.1, C3.1
13	**Lecture:** • Curves speed - The degree of reaction **Tutorials:** Solve problems on axial compressors.	7	A4.1, A5.1, A10.1, B4.1, C1.1, C2.1, C3.1
14	**Lecture:** • Compressor’s characteristics • Unsteady operating of compressors. **Tutorials:** Solve problems on axial compressors.	7	A4.1, A5.1, A10.1, B4.1, C1.1, C2.1, C3.1

Course: Compressors	
Program Competencies	**Course LOs**
A4. Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues and risk management principles.	**A4.1** Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues, and risk management principles.
A5. Practice research techniques and methods of investigation as an inherent part of learning.	**A5.1** Practice research techniques and methods of investigation as an inherent part of learning.
A10. Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.	**A10.1** Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.
B4. Adopt suitable national and international standards and codes; and integrate legal, economic and financial aspects to: design, build, operate, inspect and maintain mechanical equipment and systems.	**B4.1** Adopt suitable national and international standards and codes; and integrate legal, economic and financial aspects to: design, build, operate, inspect and maintain mechanical equipment and systems.
C1. Recognize the design concepts, operation and characteristics of internal combustion engines, boilers, heat exchangers, turbomachines and hydraulic machines.	**C1.1** Recognize the design concepts, operation and characteristics of internal combustion engines, boilers, heat exchangers, turbomachines, and hydraulic machines.
C2. Analyze, evaluate and enhance the performance of the HVAC systems, automatic control systems, pneumatic systems, hydraulic Systems, combustion systems, thermal and nuclear power plants.	**C2.1** Analyze, evaluate, and enhance the performance of the HVAC systems, automatic control systems, pneumatic systems, hydraulic Systems, combustion systems, thermal and nuclear power plants.
C3. Judge the optimal solution according to the constraints of operation, costs, safety, reliability and environmental impacts.	**C3.1** Judge the optimal solution according to the constraints of operation, costs, safety, reliability, and environmental impacts.
C7. Exchange knowledge and skills with engineering community and industries; prepare the presentations and technical reports.	**C7.1** Exchange knowledge and skills with engineering community and industries; prepare the presentations and technical reports.

Course Coordinator: Assoc. Prof. Dr. Mohamed El-Ghandour El-Ghandour

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Mechanical Power Engineering		
Course Code	**MPE448**		
Year/ Level	Fourth year – 2^{nd} semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	2	2	-

2. Course aims:

No.	Aims
6, 7	Integrate knowledge and apply skills from different subjects and available computer software to solve real problems in engines maintenance.

3. Learning Outcomes (LOs):

A4.1	Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues and risk management principles in the engine maintenance workshops.
A5.1	Practice research techniques and methods of investigation in solving the troubleshooting in the engines.
A10.1	Acquire and apply new knowledge for the engine injection, cooling, and lubrication systems maintenance.
B4.1	Choose suitable maintenance schadual techniques for engine maintenance.
C1.1	Recognize the operation of the internal combustion engines.
C2.1	Analyze and enhance the performance of the internal combustion engines.
C3.1	Judge the optimal solution according to the constraints of operation, costs, safety, reliability and environmental impacts for the trouble shootings in the internal combustion engines.
C7.1	Exchange knowledge and skills with engineering community based on the engine maintenance.

4. Course Contents:

No.	Topics	Week
1	**Lecture:** • Types of maintenance and safety consideration **Tutorials/Lab:** • Prepare a presentation on the maintenance types and safety consideration in maintenance.	1, 2
2	**Lecture:** • Petrol engines. **Tutorials/Lab:** • Solve the trouble shootings in the petrol engines.	3, 4
3	**Lecture:** • Petrol fuel feed systems. **Tutorials/Lab:** • Solve the trouble shootings in the petrol fuel feed systems.	5, 6
4	**Lecture:** • Operation of diesel engines. **Tutorials/Lab:** • Solve the trouble shootings in the operation of diesel engines.	7
5	**Midterm Examination**	**8**
6	**Lecture:** • Diesel fuel feed systems. **Tutorials/Lab:** • Solve the trouble shootings in the diesel fuel feed systems.	9, 10
7	**Lecture:** • Lubrication systems. **Tutorials/Lab:** • Solve the trouble shootings in the lubrication systems.	11
8	**Lecture:** • Cooling systems. **Tutorials/Lab:** • Solve the trouble shootings in the cooling systems.	12
9	**Lecture:** • Engine Tuning. **Tutorials/Lab:** • Solve the trouble shootings in the engines and steps of overhaul.	13, 14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method														
		Lecture	Interactive lectures	Flipped Classroom	Presentation	Discussion	Tutorial	Problem-solving	Brain storming	Projects	Site visits	Self-learning	Cooperative	Drawing Studio	Computer Simulation	Practical Experiments
A-Level	A4.1	x	x		x	x	x	x	x			x				x
	A5.1	x	x		x	x	x	x	x			x				x
	A10.1	x	x			x	x	x	x			x				x
B-Level	B4.1	x	x		x	x	x	x	x			x				x
C-Level	C1.1	x	x			x	x	x	x			x				x
	C2.1	x	x			x	x	x	x			x				x
	C3.1	x	x		x	x	x	x	x			x				x
	C7.1	x	x			x		x				x				x

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials and videos
2	Online lectures and assignments

7. Student Assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written)	A4.1, A5.1, A10.1, B4.1, C1.1, C2.1, C3.1
2	Practical/ Oral Examination	-
3	Formative (quizzes - presentation - assignments)	A4.1, A5.1, A10.1, B4.1, C1.1, C2.1, C3.1, C7.1
4	Final Term Examination (written)	A4.1, A5.1, A10.1, B4.1, C1.1, C2.1, C3.1, C7.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	8
2	Practical/ Oral Examination	-
3	Formative (quizzes – presentation – assignments)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	10
2	Practical/ Oral Examination	-
3	Formative (quizzes – presentation – assignments)	20
4	Final Term Examination (written)	70
Total		100%

8. List of References:

No.	Reference List
1	Gupta H. N., “Fundamentals of Internal Combustion Engines”, Rakamal Electric Press, Delhi, 2006.
2	S. P. Sen, “Internal Combustion Engine Theory and Practice by, 1977.
3	S. Srinivasan, “Automotive Mechanics”, Tata McGraw-Hill Publishing Company Limited, 2003.
4	Richard Stone, “Introduction to Internal Combustion Engines”, Antony Rowe Ltd, Chippenham, Wiltshire, 1999.
5	Gad H. M., “Lectures in Maintenance of the Engines”, Mechanical Power Eng. Dept., Port Said University, 2020.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture/Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aims	LOs
1	**Lecture:** • Types of maintenance and safety consideration **Tutorials/Lab:** • Prepare a presentation on the maintenance types and safety consideration in maintenance.	6, 7	A4.1, B4.1, C1.1, C3.1
2	**Lecture:** • Petrol engines. **Tutorials/Lab:** • Solve the trouble shootings in the petrol engines.	6, 7	A5.1, C1.1, C2.1, C3.1
3	**Lecture:** • Petrol fuel feed systems. **Tutorials/Lab:** • Solve the trouble shootings in the petrol fuel feed systems.	6, 7	A5.1, A10.1, C1.1, C2.1, C3.1
4	**Lecture:** • Operation of diesel engines. **Tutorials/Lab:** • Solve the trouble shootings in the operation of diesel engines.	6, 7	A5.1, C1.1, C2.1, C3.1
5	**Midterm Examination**	6, 7	A4.1, A5.1, A10.1, B4.1, C1.1, C2.1, C3.1
6	**Lecture:** • Diesel fuel feed systems. **Tutorials/Lab:** • Solve the trouble shootings in the diesel fuel feed systems.	6, 7	A5.1, A10.1, C1.1, C2.1, C3.1
7	**Lecture:** • Lubrication systems. **Tutorials/Lab:** • Solve the trouble shootings in the lubrication systems.	6, 7	A5.1, A10.1, C1.1, C2.1, C3.1
8	**Lecture:** • Cooling systems. **Tutorials/Lab:** • Solve the trouble shootings in the cooling systems.	6, 7	A5.1, A10.1, C1.1, C2.1, C3.1
9	**Lecture:** • Engine Tuning. **Tutorials/Lab:** • Solve the trouble shootings in the engines and steps of overhaul.	6, 7	A4.1, A5.1, A10.1, B4.1, C1.1, C2.1, C3.1, C7.1

Course: Maintenance of the Engines	
Program Competencies	**Course LOs**
A4. Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues and risk management principles.	**A4.1** Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues and risk management principles in the engine maintenance workshops.
A5. Practice research techniques and methods of investigation as an inherent part of learning.	**A5.1** Practice research techniques and methods of investigation in solving the troubleshooting ing the engines.
A10. Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.	**A10.1** Acquire and apply new knowledge for the engine injection, cooling and lubrication systems maintenance.
B4. Adopt suitable national and international standards and codes; and integrate legal, economic and financial aspects to: design, build, operate, inspect and maintain mechanical equipment and systems.	**B4.1** Choose suitable maintenance schadual techniques for engine maintenance.
C1. Recognize the design concepts, operation and characteristics of the internal combustion engines, boilers, heat exchangers, turbomachines and hydraulic machines.	**C1.1** Recognize the operation of the internal combustion engines.
C2. Analyze, evaluate and enhance the performance of the HVAC systems, automatic control systems, pneumatic systems, hydraulic Systems, combustion systems, thermal and nuclear power plants.	**C2.1** Analyze and enhance the performance of the internal combustion engines.
C3. Judge the optimal solution according to the	**C3.1** Judge the optimal solution

constraints of operation, costs, safety, reliability and environmental impacts.	according to the constraints of operation, costs, safety, reliability and environmental impacts for the trouble shootings in the internal combustion engines.
C7. Exchange knowledge and skills with engineering community and industries; prepare the presentations and technical reports.	**C7.1** Exchange knowledge and skills with engineering community based on the engine maintenance.

Course Coordinator: Associate Prof. Hamada Mohamed Gad

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information:

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Mechanical Power Engineering		
Course Code	**MPE449**		
Year/ Level	Fourth year – 2nd semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical
	2	2	-

2. Course aims:

No.	Aims
6, 7	Investigate the performance parameters for assessing the efficiency of a water treatment plants and to develop methodologies for designing the parameters effect on the performance of water treatment plants operating under prescribed conditions

3. Learning Outcomes (LOs):

A4.1	Utilize contemporary technologies, health and safety requirements, and environmental issues in the water desalination and treatment field.
A5.1	Practice research techniques and methods of investigation as an inherent part of learning.
A10.1	Acquire and apply new knowledge; and practice self, lifelong learning strategies.
B4.1	integrate legal, economic and financial aspects to: design, build, and operate the water desalination and treatment systems.
C1.1	Recognize the design concepts, operation and characteristics of the different equipment used in water desalination and treatment systems.
C2.1	Analyze, and evaluate the performance of the water desalination and treatment systems.
C3.1	Judge the optimal solution according to the constraints of operation, costs, safety, reliability and environmental impacts.
C7.1	Prepare the presentations and technical reports.

4. Course Contents:

No.	Topics	Week
1	**Lecture:** • **Introduction to water desalination and treatment** ○ Classification of water treatment processes ○ Fundamental transport processes ○ Classification of water desalination processes **Tutorials/Lab:** • Solve problems on water desalination and treatment processes	1
2	**Lecture:** • **Sea water desalination methods** ○ Design of thermal desalination plants **Tutorials/Lab:** • Solve problems on thermal desalination plants.	2
3	**Lecture:** • **Sea water desalination methods** ○ Design of membrane desalination plants **Tutorials/Lab:** • Solve problems on membrane desalination plants.	3
4	**Lecture:** • **Desalination by ion exchange** ○ desalination by ion exchange technique **Tutorials/Lab:** • Solve problems on ion exchange methods for water desalination.	4
5	**Lecture:** • **Reverse osmosis** ○ Design of reverse osmosis plants for brackish water and seawater. **Tutorials/Lab:** • Solve problems on ion exchange methods for water desalination.	5
6	**Lecture:** • **Combination distillation processes** ○ Classification of distillation processes **Tutorials/Lab:** • Solve problems on distillation processes.	6
7	**Lecture:** • **Combination distillation processes** ○ Applications of distillation methods **Tutorials/Lab:** • Solve problems on different distillation methods	7
8	**Midterm Examination**	**8**
9	**Lecture:**	9

	• **Desalination using combined power cycles.** ○ Design of conventional desalination methods with power plants. **Tutorials/Lab:** • Solve problems on combined cycles between desalination and power plants.	
10	**Lecture:** • **Introduction to water treatment** ○ Classification of water treatment process ▪ according to chemical ▪ According to Physical ▪ According to Physio-chemical ▪ According to Biological **Tutorials/Lab:** • Solve problems on classification of water treatment process.	10
11	**Lecture:** • **Industrial water treatment** ○ Boiler water treatment processes ○ Cooling water treatment processes **Tutorials/Lab:** • Solve problems on industrial water treatment	11
12	**Lecture:** • **Water treatment technologies** ○ Chemical treatment ○ Physical treatment **Tutorials/Lab:** • Solve problems on water treatment technologies	12-13
13	**Lecture:** • **Water treatment technologies** ○ Biological treatment ○ Physio-chemical treatment **Tutorials/Lab:** • Solve problems on water treatment technologies.	14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method														
		Lecture	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A4.1**	x	x			x	x	x	x			x				
	A5.1	x	x			x	x	x	x			x				
	A10.1	x	x			x	x	x	x			x				
B-Level	**B4.1**	x	x			x	x	x	x			x				
C-Level	**C1.1**	x	x			x	x	x	x			x			x	
	C2.1	x	x			x	x	x	x			x			x	
	C3.1	x	x			x	x	x	x			x				
	C7.1	x	x			x	x	x	x			x				

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials and videos
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written)	A4.1, B4.1, C1.1, C2.1, C3.1
2	Practical/ Oral Examination	A4.1, B4.1, C1.1, C2.1, C3.1
3	Formative (quizzes - presentation - assignments)	A4.1, A5.1, A10.1, B4.1, C1.1, C2.1, C3.1, C7.1
4	Final Term Examination (written)	A4.1, B1.1, B4.1, C1.1, C2.1, C3.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written)	8
2	Practical/ Oral Examination	15
3	Formative (quizzes – presentation – assignments)	Every week
4	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights (%)
1	Mid Term Examination (written)	12
2	Practical/ Oral Examination	-
3	Formative (quizzes – presentation – assignments)	8
4	Final Term Examination (written)	70
Total		100%

8. List of References:

No.	Reference List
1	H. T. El-Dessouky and H. M. Ettouney, Fundamentals of salt water desalination. Elsevier, 2002.
2	N. N. Li, A. G. Fane, W. S. W. Ho, and T. Matsuura, “Advanced membrane technology“ John Wiley & Sons, Inc., Hoboken, New Jersey, 2008.
3	John A., William, D. and Beckman, A., "Solar Engineering of Thermal Processes", New York, USA: John Wiley; 1980.

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture/Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topic	Aims	LOs
1	**Lecture:** • **Introduction to water desalination and treatment** ○ Classification of water treatment processes ○ Fundamental transport processes ○ Classification of water desalination processes **Tutorials/Lab:** • Solve problems on water desalination and treatment processes	6	A4.1, A5.1, A10.1
2	**Lecture:** • **Sea water desalination methods** ○ Design of thermal desalination plants **Tutorials/Lab:** • Solve problems on thermal desalination plants.	6, 7	A4.1, A5.1, A10.1, B4.1, C1.1
3	**Lecture:** • **Sea water desalination methods** ○ Design of membrane desalination plants **Tutorials/Lab:** • Solve problems on membrane desalination plants.	6, 7	A4.1, A5.1, A10.1, B4.1, C1.1, C3.1, C7.1
4	**Lecture:** • **Desalination by ion exchange** ○ desalination by ion exchange technique **Tutorials/Lab:** • Solve problems on ion exchange methods for water desalination.	6, 7	A4.1, A5.1, A10.1, B4.1, C1.1, C3.1, C7.1
5	**Lecture:** • **Reverse osmosis** ○ Design of reverse osmosis plants for brackish water and seawater. **Tutorials/Lab:** • Solve problems on reverse osmosis plants to design the geometry, the exit and inlet temperature of the flow, and permeate flux.	6, 7	A4.1, A5.1, A10.1, B4.1, C1.1, C3.1, C7.1
6	**Lecture:** • **Combination distillation processes** ○ Classification of distillation processes **Tutorials/Lab:** • Solve problems on distillation processes.	6, 7	A4.1, A5.1, A10.1

7	**Lecture:** - **Combination distillation processes** ○ Applications of distillation methods **Tutorials/Lab:** - Solve problems on different distillation methods	6, 7	A4.1, A5.1, A10.1
8	**Midterm Examination**	6, 7	A4.1, B4.1, C1.1, C2.1, C3.1
9	**Lecture:** - **Desalination using combined power cycles** ○ Design of conventional desalination methods with power plants. **Tutorials/Lab:** - Solve problems on combined cycles between desalination and power plants.	6, 7	A4.1, A5.1, A10.1, B4.1, C1.1, C3.1, C7.1

10	**Lecture:**
	- **Introduction to water treatment**
	  ○ Classification of water treatment process
	    ▪ according to chemical
	    ▪ According to Physical
	    ▪ According to Physio-chemical
	    ▪ According to Biological
	Tutorials/Lab:
	- Solve problems on classification of water treatment process.
		6, 7	A4.1, A5.1, A10.1, C1.1

11	**Lecture:**
	- **Industrial water treatment**
	  ○ Boiler water treatment processes
	  ○ Cooling water treatment processes
	Tutorials/Lab:
	- Solve problems on industrial water treatment
		6, 7	A4.1, A5.1, A10.1, C1.1

12	**Lecture:**
	- **Water treatment technologies**
	  ○ Chemical treatment
	  ○ Physical treatment
	Tutorials/Lab:
	- Solve problems on water treatment technologies
		6, 7	A4.1, A5.1, A10.1, C1.1

13	**Lecture:**
	- **Water treatment technologies**
	  ○ Biological treatment
	  ○ Physio-chemical treatment
	Tutorials/Lab:
	- Solve problems on water treatment technologies
		6, 7	A4.1, A5.1, A10.1, C1.1

Course: Water Desalination and Treatment	
Program Competencies	**Course LOs**
A4. Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues and risk management principles.	**A4.1** Utilize contemporary technologies, health and safety requirements, and environmental issues in the water desalination and treatment field.
A5. Practice research techniques and methods of investigation as an inherent part of learning.	**A5.1** Practice research techniques and methods of investigation as an inherent part of learning.
A10. Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.	**A10.1** Acquire and apply new knowledge; and practice self, lifelong learning strategies.
B4. Adopt suitable national and international standards and codes; and integrate legal, economic and financial aspects to: design, build, operate, inspect and maintain mechanical equipment and systems.	**B4.1** integrate legal, economic and financial aspects to: design, build, and operate the water desalination and treatment systems.
C1. Recognize the design concepts, operation and characteristics of the internal combustion engines, boilers, heat exchangers, turbomachines and hydraulic machines.	**C1.1** Recognize the design concepts, operation and characteristics of the different equipment used in water desalination and treatment systems.
C2. Analyze, evaluate and enhance the performance of the HVAC systems, automatic control systems, pneumatic systems, hydraulic Systems, combustion systems, thermal and nuclear power plants.	**C2.1** Analyze, and evaluate the performance of the water desalination and treatment systems.
C3. Judge the optimal solution according to the constraints of operation, costs, safety, reliability and environmental impacts..	**C3.1** Judge the optimal solution according to the constraints of operation, costs, safety, reliability and environmental impacts.

C7. Exchange knowledge and skills with engineering community and industries; prepare the presentations and technical reports.	**C7.1** Prepare the presentations and technical reports.

Course Coordinator: Dr. Yasser Elhenawy

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad

1. Basic Information

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Production Engineering & Mechanical Design		
Course Code	**PRD456**		
Year/ Level	Fourth year- 1st semester		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical/Lab.
	2	2	--

2. Course Aims:

No.	Aim
2	Demonstrate the basics of legislations and contracts, the aggregate planning, plant organization, product design, and plant productivity and identify the ethics of engineering professions.

3. Learning Outcomes (LOs):

A3.1	Identify and apply the concepts of production system, plant organization, and quality.
B4.1	Evaluate the suitable job and experience schemes for various industrial applications.
C3.1	Analyze different case study problems and find optimal solutions.

4. Course Contents:

No.	Topics	Week
1	**Lecture:** • Introduction Industrial development **Tutorial:** • Tutorial on Production systems.	1,2
2	**Lecture:** • Production system. **Tutorial:** • Tutorial on Production systems.	3
3	**Lecture:** • Plant organization **Tutorial:** • Tutorial on plant organization.	4
4	**Lecture:** • Production design and development. **Tutorial:**	5

	- Tutorial on Production design and development	
5	**Lecture:** - Quality and quality methods in organization **Tutorial:** - Tutorial on quality methods in organization.	6,7
6	**Midterm**	**8**
7	**Lecture:** - Productivity and Industrial low and Relations **Tutorial:** - Tutorial on Productivity and Industrial low and Relations.	9
8	**Lecture:** - Applications PERT-Linear programming **Tutorial:** - Tutorial on PERT-Linear programming.	10
9	**Lecture:** - Assignment and Inventory systems- B.E.B **Tutorial:** - Tutorial on Inventory systems- B.E.B.	11
10	**Lecture:** - Location and Plant layout. **Tutorial:** - Tutorial on Inventory systems- B.E.B.	12
11	**Lecture:** - Time and motion study. **Tutorial:** - Tutorial on Time and motion study.	13
15	**Lecture:** - Depreciation- materials economics. **Tutorial:** - Tutorial on Depreciation- materials economics.	14

5. Teaching and Learning Methods:

LOs		Teaching and Learning Method														
		Lecture (in class- online)	Interactive lectures	Flipped Classroom	Presentation	Discussion	Tutorial	Problem-solving	Brain storming	Projects	Site visits	Self-learning	Cooperative	Drawing Studio	Computer Simulation	Practical Experiments
A-Level	A3.1	x	x	x		x	x	x	x							
B-Level	B4.1	x	x	x		x	x	x	x			x				
C-Level	C3.1	x	x	x		x	x	x	x			x				

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials
2	Online lectures and assignments

7. Student Assessment:

7.1 Student Assessment Methods:

No.	Assessment Method	LOs
1	Mid Term Examination (written/ online)	A3.1, B4.1
2	Practical/ Oral Examination	A3.1, B4.1, C3.1
3	Formative (quizzes- online quizzes- assignments)	A3.1, B4.1, C3.1
4	Final Term Examination (written)	A3.1, B4.1, C3.1

7.2 Assessment Schedule:

No.	Assessment Method	Weeks
1	Mid Term Examination (written/ online)	8
2	Formative (quizzes- online quizzes- assignments)	Every week
3	Final Term Examination (written)	Decided by Faculty Council

7.3 Weighting of Assessments:

No.	Assessment Method	Weights
1	Mid Term Examination (written/ online)	15
2	Formative (quizzes- online quizzes- assignments)	15
3	Final Term Examination (written)	70
Total		100%

8. List of References:

No.	Reference List
1	A. Ravindran, K.M.Raysdell, C.V. Reklaitis; Engineering optimization- Methods and Applications, second edition, John Willy & Sons Inc., 2006.
2	Kjell B.Zandin; Maynard's; Industrial Engineering Handbook, Fifth Ed., McGraw-Hill Standard Handbooks , 2004.
3	Brian Atkins , Adrian Brooks; Total Facilities Management, Blackwell Science 2001.
4	www.digitalengineeringlibrary.com
5	كتاب هندسة القوانين و التشريعات, www.iegroup2011.blogspot.com, http://law-pedia.com

9. Facilities Required for Teaching and Learning:

No.	Facility
1	Lecture Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

10. Matrix of Knowledge and Skills of the Course:

No.	Topics	Aims	LOs
1	**Lecture:** • Introduction Industrial development **Tutorial:** • Tutorial on Production systems.	2	A3.1, B4.1
2	**Lecture:** • Production system. **Tutorial:** • Tutorial on Production systems.	2	A3.1, B4.1
3	**Lecture:** • Plant organization **Tutorial:** • Tutorial on plant organization.	2	A3.1, B4.1
4	**Lecture:**	2	

	- Production design and development. **Tutorial:** - Tutorial on Production design and development		
5	**Lecture:** - Quality and quality methods in organization **Tutorial:** - Tutorial on quality methods in organization.	2	A3.1, B4.1
6	**Midterm**	**2**	
7	**Lecture:** - Productivity and Industrial low and Relations **Tutorial:** - Tutorial on Productivity and Industrial low and Relations.	2	A3.1, B4.1
8	**Lecture:** - Applications PERT-Linear programming **Tutorial:** - Tutorial on PERT-Linear programming.	2	A3.1, B4.1, C3.1
9	**Lecture:** - Assignment and Inventory systems- B.E.B **Tutorial:** - Tutorial on Inventory systems- B.E.B.	2	A3.1, B4.1, C3.1
10	**Lecture:** - Location and Plant layout. **Tutorial:** - Tutorial on Inventory systems- B.E.B.	2	A3.1, B4.1, C3.1
11	**Lecture:** - Time and motion study. **Tutorial:** - Tutorial on Time and motion study.	2	A3.1, B4.1, C3.1
12	**Lecture:** - Depreciation- materials economics. **Tutorial:** - Tutorial on Depreciation- materials economics.	2	A3.1, B4.1, C3.1

Course: Industrial and legislation regulating	
Program Competencies	**Course LOs**
A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.	**A3.1** Identify and apply the concepts of production system, plant organization, quality.
B4. Adopt suitable national and international standards and codes; and integrate legal, economic and financial aspects to: design, build, operate, inspect and maintain mechanical equipment and systems.	**B4.1** Evaluate the suitable job and experience schemes for various industrial applications.
C3. Judge the optimal solution according to the constraints of operation, costs, safety, reliability and environmental impacts.	**C3.1** Analyze different case study problems and find optimal solutions.

Course Coordinator: Dr. Mohamed Abass Zaghloul Mousa

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Abla Elmegharbel

1. Basic Information

Program Title	B. Sc. in Mechanical Engineering (Specialization: Mechanical Power Engineering)		
Department offering the Program	Mechanical Power Engineering		
Department Responsible for the Course	Mechanical Power Engineering		
Course Code	**MPE439**		
Year/ Level	Fourth year- First term & Second term		
Specialization	Major		
Teaching Hours	Lectures	Tutorial	Practical/Lab.
	-	-	4

2. Course aims:

No.	Aim
2, 9	Carry out preliminary designs of mechanical power system, investigate their performance and solve their essential operational problems.

3. Learning Outcomes (LOs):

A1.1	Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, and basic science.
A2.1	Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.
A3.1	Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects.
A4.1	Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues and risk management principles.
A5.1	Practice research techniques and methods of investigation as an inherent part of learning.
A6.1	Plan, supervise and monitor implementation of engineering projects, taking into consideration other trades requirements.
A7.1	Function efficiently as an individual and as a member of multi-disciplinary and multicultural teams.
A8.1	Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools.
A9.1	Use creative, innovative and flexible thinking and acquire entrepreneurial and leadership skills.
A10.1	Acquire and apply new knowledge; and practice self, lifelong strategies.
B1.1	Model, analyze and design physical systems applicable to the mechanical power engineering discipline by applying the basic sciences.
B2.1	Plan, manage and carry out designs of mechanical systems using appropriate

	materials both traditional means and computer-aided tools and software contemporary to the mechanical engineering field.
B3.1	Select conventional mechanical equipment according to the required performance.
C2.1	Analyze, evaluate and enhance the performance of a mechanical power system.
C3.1	Judge the optimal solution according to the constraints of operation, costs, safety, reliability and environmental impacts.
C5.1	Select appropriate solutions for mechanical power engineering problems based on experimental, analytical and numerical techniques.
C7.1	Exchange knowledge and skills with engineering community and industries; prepare the presentations and technical reports.

4. Course Contents:

Project Description and implémentation Procédures	**Total Horus**	**Lecture Horus**	**Practical /Tutorial Horus**
❖ **Project Description:** Various projects are offered by the department in the Mechanical Power Engineering specialization areas. Students are encouraged to team up and work on projects together. The projects that are offered are selected to be realistic problems with reasonable difficulty. Students are guided by their advisors to do literature search in the area of the problem and to learn about different approaches and solutions. The second semester is dedicated to detailed design and implementation of the project. The design should be test, debugged and documented. An oral presentation about the project in given at the end of the second semester. In the presentation all members of the team should be ready to explain design detail and answer equations raised by the judgment committee. ❖ **Project Implementation Procedures:** 1. All project topics are announced from department in the beginning of the first term. 2. Projects are distributed on student groups, taking into account students' wishes, if possible. Each project group consists of at least two students and maximum 6 students, can be increased to 7 students after the approval of the department council in case of necessity. 3. A detailed project proposal not exceeding 5 double-spaced pages submitted from each group to the department within two	112	0	112

weeks of the start of the project course. This proposal will be reviewed and evaluated by the concern supervisor.

4. Arranging Meetings: in order to accomplish assigned tasks from proposal, all group members should visit their supervisor weekly. Also each students group should decide the meeting day and time with their supervisor in the first week
5. Frequently progress report not exceeding 10 double-spaced pages shall be submitted at least three times per semester. An oral presentation will take place for each report.
6. Four weeks after the end of the exam of the second semester will be dictated for completing the project (practical implementation and final report writing).
7. Final report will be submitted, reviewed and evaluated by the project supervisor.
8. Evaluation Committee Members are elected by department. This group consists of three professors, including project supervisor.
9. An oral presentation of the final report to be conducted and the team should be ready to explain design detail and answer equations raised by the judgment committee (at least one external examiner).

- **Brief list of topics to be covered :**

Topic 1:	Choose a project and write a proposal.
Topic 2:	Initial student presentations: project title, description, motivation and aims.
Topic 3:	Project planning, process, management activities, work breakdown, time estimation, milestones, activity sequencing, activity network, scheduling, Gantt charts and re-planning.
Topic 4:	Literature survey: search and review, tracing the information, critical evaluation, writing literature review, ethics and responsibilities.
Topic 5:	Project development.
Topic 6:	Assistance in writing the progress report. Student presentations: project proposal: problem definition, objectives, justification, and approach
Topic 7:	Final presentation and final report (committee)

Total	112	0	112

5. Teaching and Learning Methods:

LO’s		Teaching and Learning Method														
		Lecture (online/in class)	**Interactive lectures**	**Flipped Classroom**	**Presentation**	**Discussion**	**Tutorial**	**Problem-solving**	**Brain storming**	**Projects**	**Site visits**	**Self-learning**	**Cooperative**	**Drawing Studio**	**Computer Simulation**	**Practical Experiments**
A-Level	**A1.1**		x	x		x				x						
	A2.1					x								x	x	x
	A3.1		x	x		x						x	x			
	A4.1		x	x	x	x				x						
	A5.1				x	x						x				
	A6.1		x	x		x				x						
	A7.1												x			
	A8.1		x	x	x	x										
	A9.1												x			
	A10.1											x				
B-Level	**B1.1**		x	x		x			x	x		x				
	B2.1		x	x		x								x	x	
	B3.1		x	x		x									x	x
C-Level	**C2.1**		x	x		x				x						
	C3.1		x	x		x				x					x	x
	C5.1		x	x		x									x	x
	C7.1				x							x				

6. Teaching and Learning Methods of Disable Students:

No.	Teaching Method
1	Additional Tutorials
2	Online lectures and assignments

7. Student assessment:

7.1 Student Assessment Methods:

No	Assessment Method	LOs
1	Meeting Attendance Level	To assess discipline, dedication to the project.
2	Seminars	To assess presentation skills, and student creativity.
3	Reports.	To assess ability to gather information, perform computation, problem solving and do technical writing.
4	Activities during project implementation.	To assess ability to work in group, communication skills, apply analytical and creative thinking and ability to construct circuits on breadboards and perform electrical measurements and test them with meters and oscilloscopes, and the ability to handle real circuit simulators.
5	Final Oral examination and seminar	To assess presentation skills, student understanding of the project and student creativity and innovations and different aspects of the concerning LOs.

7.2 Weighting of Assessments:

Assessment Method	Percentage
Committee Evaluation	60
Supervisors assessment during the project development **1.** Students ability of communication (report and presentation). **2.** Team work (professionalism, cooperation and ethical behavior). **3.** The scientific and technical aspects and achievements.	40
Total	100%

7.3 Committee Evaluation Criteria:

In principle, the evaluators will assess a student's overall achievements by:

1. Examining the **report** they submit,
2. Observing the **presentation and demonstration** they make,
3. Asking questions and requesting for further clarifications as appropriate.

Evaluation Areas: There are two main areas of evaluation:

No.	Evaluation Areas	Percentage
1	**Discussion of the Study** 1. The students' understanding of the background of the project and the analysis that related to the work. 2. There is clear evidence that the student understands the methodology of study and the details (Tools and Techniques) of project implementation conforming to the project objectives. 3. There is clear evidence that indicates the student understands the results.	30%
2	**Total Project Quality** 1. The extent to which the project topic is: recent, professional, and appropriate for undergraduate level work. 2. The overall quality of the project writing is sufficient in length to discuss all aspects of results and relates results back to previous studies (review of literature). 3. The results are adequately organized, well written, will discussed. 4. All of the references are recent and complete. 5. The quality of the presentation	30%

8. List of References

No.	Reference List
1	**Essential Books (Text Books):** Depend on the project.
2	**Recommended Books:** Depend on the project.

9. Facilities Required for Teaching and Learning:

No.	**Facility**
1	Lecture / Online Classroom
2	Lab Facilities
3	White Board
4	Data Show System
5	Presenter

Course: Project	
Program Competencies	**Course LOs**
A1. Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, basic science and mathematics.	**A1.1** Identify, formulate, and solve complex engineering problems by applying engineering fundamentals, and basic science.
A2. Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.	**A2.1** Develop and conduct appropriate experimentation and/or simulation, analyze and interpret data, assess and evaluate findings, and use statistical analyses and objective engineering judgment to draw conclusions.
A3. Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects as appropriate to the discipline and within the principles and contexts of sustainable design and development.	**A3.1** Apply engineering design processes to produce cost-effective solutions that meet specified needs with consideration for global, cultural, social, economic, environmental, ethical and other aspects.
A4. Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues and risk management principles.	**A4.1** Utilize contemporary technologies, codes of practice and standards, quality guidelines, health and safety requirements, environmental issues and risk management principles.
A5. Practice research techniques and methods of investigation as an inherent part of learning.	**A5.1** Practice research techniques and methods of investigation as an inherent part of learning.
A6. Plan, supervise and monitor implementation of engineering projects, taking into consideration other trades requirements.	**A6.1** Plan, supervise and monitor implementation of engineering projects, taking into consideration other trades requirements.
A7. Function efficiently as an individual and as a member of multi-disciplinary and multicultural teams.	**A7.1** Function efficiently as an individual and as a member of multi-disciplinary and multicultural teams.

A8. Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools.	**A8.1** Communicate effectively – graphically, verbally and in writing – with a range of audiences using contemporary tools.
A9. Use creative, innovative and flexible thinking and acquire entrepreneurial and leadership skills to anticipate and respond to new situations.	**A9.1** Use creative, innovative and flexible thinking and acquire entrepreneurial and leadership skills.
A10. Acquire and apply new knowledge; and practice self, lifelong and other learning strategies.	**A10.1** Acquire and apply new knowledge; and practice self, lifelong strategies.
B1. Model, analyze and design physical systems applicable to the specific discipline by applying the concepts of: Thermodynamics, Heat Transfer, Fluid Mechanics, solid Mechanics, Material Processing, Material Properties, Measurements, Instrumentation, Control Theory and Systems, Mechanical Design and Analysis, Dynamics and Vibrations.	**B1.1** Model, analyze and design physical systems applicable to the mechanical power engineering discipline by applying the basic sciences.
B2. Plan, manage and carry out designs of mechanical systems and machine elements using appropriate materials both traditional means and computer-aided tools and software contemporary to the mechanical engineering field.	**B2.1** Plan, manage and carry out designs of mechanical systems using appropriate materials both traditional means and computer-aided tools and software contemporary to the mechanical engineering field.
B3. Select conventional mechanical equipment according to the required performance.	**B3.1** Select conventional mechanical equipment according to the required performance.
C2. Analyze, evaluate and enhance the performance of the HVAC systems, automatic control systems, pneumatic systems, hydraulic systems, combustion systems, thermal and nuclear power plants.	**C2.1** Analyze, evaluate and enhance the performance of a mechanical power system.
C3. Judge the optimal solution according to the constraints of operation, costs, safety, reliability and environmental impacts.	**C3.1** Judge the optimal solution according to the constraints of operation, costs, safety, reliability and environmental impacts.

C5. Select appropriate solutions for mechanical power engineering problems based on analytical and numerical techniques.	**C5.1** Select appropriate solutions for mechanical power engineering problems based on experimental, analytical and numerical techniques.
C7. Exchange knowledge and skills with engineering community and industries; prepare the presentations and technical reports.	**C7.1** Exchange knowledge and skills with engineering community and industries; prepare the presentations and technical reports.

Program Coordinator: Dr. Sherihan Abd El-Ghafour

Head of Department: Prof. Dr. Kamal Morad