Program Specification

For

Master of Science Degree

in

Mechanical Power Engineering

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For
Master of Science Degree in
Mechanical Power Engineering

A- Basic Information

1- Program title: MS.c in Mechanical Power Engineering.

2- Program type: **Single** [✓] **Double** [ ] **Multiple** [ ]

3- Department (s): Mechanical Power Engineering.
Coordinator: Dr. Yassen El-Sayed Yassen
Assistance Coordinator:
External evaluator(s): NA
4- Last date of program specifications approval: Bylaw 2000.

B- Professional Information

1- Graduate Attributes:

After completing the program, the graduate would able to be:

A. Proficiency in the application of the basics and the methodologies of scientific research and the use of its different tools to serve professional practice in the field of Mechanical Power Engineering.
B. Apply the analytical approach and using it in the field of Mechanical Power engineering, as well as the topics that affect his/her professional practice.
C. Apply the specialized knowledge integrated with and the use of appropriate engineering tools, such as, computational facilities, laboratory equipment, necessary for his / her professional practice and project management.
D. Specialized engineering concepts related to his / her professional practice in the field of Mechanical Power Engineering.
E. Show awareness of current problems and modern visions in the field of Mechanical Power Engineering.
F. Identify professional problems and find solutions for it.
G. Mastery of an appropriate range of specialized professional and intellectual skills and the use of appropriate technology means to carry out a research study, writing a scientific methodology plain. Add new information to the knowledge and write scientific paper.
H. Communicate effectively and lead team works effectively.
I. Take good decisions in different professional contexts
J. Employ available resources to achieve and maintain the highest benefit
K. Show awareness of his / her role in community development and environmental conservation

in the light of the global and regional variables

L. Display professional responsibilities and ethical, societal and cultural concerns.

M. Recognize the need to engage to develop him / her academically and being able to learn continuously in the field of Mechanical Power Engineering.

2- Program Aims:

The graduate of the Master program must be able to:

1. Gain a depth of knowledge, understanding, and methodologies of scientific research including professional skills, pertinent software and appropriate technological means to make decisions, employ available resources efficiently, develop new skills to deal with high level complex problems, and engage in continuous learning practice in the field of Mechanical Power engineering.
2. Demonstrate sufficient essential knowledge and a deep understanding of concepts, theories, and practice in the field of Mechanical Power engineering, as well as the topics that affect his/her professional practice.
3. Apply the analytical approaches and its technological professional skills to develop techniques for identifying, formulating, solving, analyzing, and designing Mechanical Power engineering problems.
4. Communicate and lead team works effectively through professional system considering the detrimental impact of the engineer role on society, environment, societal and cultural concerns.
5. Demonstrate knowledge of contemporary, current, and advanced engineering issues related to Mechanical Power engineering problems.
6. Adopt basics and principles of quality and fundamentals of ethical & legal professional practice of scientific research in the field of Mechanical Power engineering.
7. Carry out a research study and writing a scientific methodology plain and add new information to the knowledge and write scientific paper.

3- Graduate Attributes with Program Aims

Program Aims	Graduates Attributes
1. Gain a depth of knowledge, understanding and methodologies of scientific research including professional skills, pertinent software and appropriate technological means to make decisions, employ available resources efficiently, develop new skills to deal with a high-level complex problems, and engage in continuous learning practice in the field of Mechanical Power engineering.	A, G, J, and I
2. Demonstrate sufficient essential knowledge and a deep understanding of concepts, theories, and practice in the field of Mechanical Power engineering, as well as the topics that affect his/her professional practice.	C and G
3. Apply the analytical approaches and its technological professional skills to develop techniques for identifying, formulating, solving, analyzing, designing, and analyze risks	B and F

of the professional practice in Mechanical Power engineering.	
4. Communicate and lead team works effectively through professional system considering the detrimental impact of the engineer role on society, environment, societal and cultural concerns.	H, K, and L
5. Demonstrate knowledge of contemporary, current, and advanced engineering issues related to Mechanical Power engineering problems.	D
6. Adopt basics and principles of quality and fundamentals of ethical & legal professional practice of scientific research in the field of Mechanical Power engineering.	M
7. Carry out a research study and writing a scientific methodology plain and add new information to the knowledge and write scientific paper.	N

4- Intended Learning Outcomes (ILOs) for the whole program

Mechanical Power Egineering Master Program is designed to achieve the above objectives through the following Intended **Learning Outcomes (ILOs)**:

A. Knowledge and understanding			
NAQAAE Academic Reference Standards (ARS)	**ILOs**	**Graduate Attributes**	**Courses Covering such ILOs (by code)**
A1. Theories, basics and specialized knowledge in the field of learning, as well as the subjects that affect his/her professional practice.	a1-1 Demonstrate sufficient essential knowledge and a deep understanding of the concepts and theories of **Mathematics and Computational Techniques** appropriate to their areas of specialization in mechanical power engineering.	A, C, F	SCI600, SCI601, SCI603, SCI604, SCI605, MEP602, MEP607, MEP512, MEP500, MEP571, MEP568
	a1-2 Understand the theories, basics and specialized knowledge in the field of **Fluid Mechanics and Hydraulics**.		MEP601, MEP603, MEP604, MEP606, MEP607, MEP614, MEP616, MEP510, MEP511, MEP512, MEP519, MEP522, MEP585, MEP564
	a1-3 Understand the theories, basics and specialized knowledge in the field of **Thermodynamics, and Internal Combustion engine.**		MEP600, MEP605, MEP616, MEP500, MEP573, MEP572, MEP521, MEP564
	a1-4 Understand the theories, basics and specialized knowledge in the field of **Heat and Mass Transfer**.		MEP611, MEP612, MEP615, MEP508, MEP514, MEP578
	a1-5 Understand the theories, basics and specialized knowledge in the field of **Turbo-Machinery and Aero-Dynamics**.		MEP608, MEP609, MEP610, MEP518, MEP528, MEP557
	a1-6 Exhibit ability to in detail, creatively, with a high level of clarity and authority, using scientific scrutiny and adequate tools identify, explain, analyze and assess issues pertinent to a MS.c thesis in the research field, within which the thesis project is placed.	A, B, C, D, E, F, H, I, J,K, L,M	Thesis
A2- Mutual relation between professional aspects of professional practice and its effects on the Environment.	a2-1 Discuss Social effects of mechanical power egineering technologies.	J	MEP602, EP608, MEP614, MEP616, MEP518, MEP585, MEP571, MEP568, Thesis
	a2-2 Recognize the interaction between mechanical power technologies and surrounding		MEP601, MEP603, MEP604, MEP606, MEP607, MEP614, MEP616, MEP512, MEP528,

	environment		MEP557, MEP519,Thesis
A3- Main scientific advances in the field of specialization.	a3-1 Classify the Potential applications of advanced mechanical power egineering systems.	D, F, L	MEP600, MEP604, MEP605, MEP606, MEP607, MEP611, MEP612, MEP615, MEP512, MEP528, MEP557, Thesis
	a3-2 Report new advances in analysis and design methodologies in mechanical power engineering and its application paradigms.		MEP604, MEP606, MEP607, MEP614, MEP512, Thesis
	a3-3 Discuss the recent and update developments in the most important themes related to mechanical power engineering		MEP604, MEP606, MEP611, MEP612, MEP615, MEP512, Thesis
A4- Fundamentals of ethical & legal professional practice in the field of specialization.	a4-1 Recognize ethnical and professional responsibility issues arising in the practice of the engineering profession.	K	Thesis
A5- Basics and principles of quality in professional practice in the field of specialization.	a5-1 Explain Quality Assurance concepts of different mechanical power components and systems development phases.	F, H, I	MEP604, MEP608, MEP609, MEP611, MEP612, MEP615 , MEP518, MEP528, MEP557, MEP519, MEP585, Thesis
A6- Basics and ethics of scientific research	a6-1 Recognize Basics and ethics of scientific research.	K,N	Thesis
B. Intellectual skills			
B1- Analyze and evaluate the information in the field of specialization, and relate it to solve problems.	b1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to mechanical power engineering.	B, C	MEP600, MEP601, MEP602, MEP603, MEP604, MEP605, MEP606, MEP607, MEP608, MEP609, MEP610, MEP611, MEP612, MEP614, MEP615, MEP616, MEP510, MEP511, MEP512, MEP518, MEP528, MEP557, MEP500, MEP508, MEP514, MEP573, MEP572, MEP519, MEP522, MEP585, MEP521, MEP578, MEP564, MEP571, MEP568
	b1-2 Interpret, analyze, and evaluate a given system specification information and relate it to the design of the required system.		MEP606, MEP609, MEP611, MEP528, MEP557, MEP573, MEP572, MEP521, Thesis
B2- Solve specialized problems with lack of some data and variables, (incomplete data).	b2-1 Apply broad knowledge of modern computational methods and think critically to solve unstructured problems (with incomplete data) related to mechanical power engineering.	B, C, E	MEP600, MEP602, MEP605, MEP610, MEP612, MEP615, MEP510, MEP511, MEP508, MEP514, MEP522, MEP578, Thesis

B3- Link and integrate diverse knowledge to solve professional problems.	b3-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems.	B, C, E, H, I	MEP601, MEP603, MEP604, MEP606, MEP607, MEP608, MEP609, MEP610, MEP611, MEP614, MEP615, MEP616, MEP518, MEP528, MEP557, MEP500, MEP519, MEP585, MEP564, MEP571, MEP568
B4- Conduct a research study and/or writing systematic scientific study about Research problem.	b4-1 Write an research plain to conduct applied research.	A, D, E, F,N	MEP573, MEP572, MEP521, Thesis
	b4-2 Perform applied research on industrial and societal concerns problems related to mechanical power engineering field (thesis).		Thesis
B5- Assess risks in professional practice in the field of specialization.	b5-1 Evaluate pros and cons of given methodologies for mechanical power engineering systems development.	J, K	MEP608, MEP609, MEP611, MEP614, MEP615, MEP616, MEP512, MEP518, MEP528, MEP557, MEP519, MEP585, Thesis
B6- Plan for performance development in the field of practice.	b6-1 Plane to guide progress in his / her professional career.	C, L	Thesis
B7- Take professional decisions in different professional practical contexts.	b7-1 Acquire decision making capabilities in different situation when facing problems related to analysis, design and development mechanical power engineering systems.	H	Thesis
C. Professional and practical skills			
C1- Master the basic as well as the latest professional skills in the field of specialization.	c1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering techniques, skills, and tools.	A, B, C, D, E, F	MEP600, MEP601, MEP602, MEP603, MEP604, MEP605, MEP606, MEP607, MEP608, MEP609, MEP610, MEP611, MEP612, MEP614, MEP615, MEP616, MEP510, MEP511, MEP512, , MEP518, MEP528, MEP557, MEP500, MEP508, MEP514, MEP573, MEP572, MEP519, MEP585, MEP522, MEP521, MEP578, MEP564, MEP571, MEP568, Thesis
C2- Write and evaluate technical and professional reports.	c.2-1 Write and evaluate a professional report on specialized related to mechanical power engineering technical matters.	A, L,N	MEP600, MEP601, MEP603, MEP604, MEP605, MEP606, MEP607, MEP608, MEP609, MEP610, MEP611, MEP612, MEP614, MEP615, MEP616, MEP510, MEP511, MEP512, MEP518, MEP528, MEP557, MEP500, MEP508, MEP514, MEP573, MEP572, MEP519,

			MEP585, MEP522, MEP521, MEP578, MEP564, MEP571, MEP568, Thesis
C3- Evaluate means and tools available in the field of practice.	c3-1 Evaluate methods and tools reported in a specified published articles and researches concerning specified problem related to mechanical power egineering field.	A, E, F, H, I	MEP602, MEP610, MEP612, MEP614, MEP616, Thesis
D. General and transferrable skills			
D1- Communicate effectively using all methods.	d1-1 Express professional and communication skills to innovate and to interact with the scientific community, research team and technocrats involved in multinational companies at global level in the related fields to mechanical power egineering.	G	Thesis
D2- Use information technology to improve his/her professional practice.	d2-1 Use state-of-the-art computer aided design tools for solving mechanical power engineering problems.	A, F, I, L	MEP600, MEP601, MEP603, MEP604, MEP605, MEP606, MEP607, MEP608, MEP609, MEP610, MEP611, MEP612, MEP614, MEP615, MEP616, MEP510, MEP511, MEP512, MEP518, MEP528, MEP557, MEP500, MEP508, MEP514, MEP573, MEP572, MEP519, MEP585, MEP522, MEP521, MEP578, MEP564, MEP571, MEP568, Thesis
	d2-2 Employ the information technology skills to serve his / her career development.		Thesis
D3- Apply self evaluation and define personal educational needs.	d3-1 Apply self evaluation and specify his educational needs related to mechanical power egineering aspects.	L	Thesis
D4- Set evaluation criteria and benchmarks for others.	d4-1 Design standards to evaluate others performance.	G, K	MEP500, MEP508, MEP514, MEP573, MEP572, MEP521, MEP578, MEP564, MEP571, MEP568, Thesis
D5- Use different sources to obtain knowledge and information.	d5-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	C, L	MEP600, MEP601, MEP602, MEP603, MEP604, MEP605, MEP606, MEP607, MEP608, MEP609, MEP610, MEP611, MEP612, MEP614, MEP615, MEP616, MEP510, MEP511, MEP512, MEP518, MEP528, MEP557, MEP519, MEP585, MEP522, Thesis

D6- Lead a team in familiar professional context.	d6-1 Practice team working, and lead teams in specified professional jobs.	G	Thesis
D7- Manage time effectively.	d7-1 Manage time perfectly.	G, I	Thesis
D8- Learn independently and seek continuous learning.	d8-1 Express a strong foundation of continuous learning so they can maintain their technical competency.	L	MEP602, MEP604, MEP606, MEP609, MEP611, MEP616, Thesis
	d8-2 Seek continuous learning through continuous education, organizing and participating in seminars, workshops, national and international conferences.		MEP608, MEP616, MEP510, MEP511, MEP512, MEP518, MEP528, MEP557, MEP522, MEP585, MEP578 MEP508, MEP514

5- Program Academic Reference Standards (ARS)

The external references for standards considered in the development of this program were the Academic Reference Standards (ARS) for postgraduate programs prepared by the National Authority for Quality Assurance and Accreditation (NAQAAE) on 2009. These standards set out the attributes and academic characteristics that are expected to be achieved by the end of the program.

6- Program Structure and Contents:

5.1 Program Duration: a minimum of 2 years & a maximum of 5 years (including one year of preparatory courses)

5.2 Program Structure:

Awarding a Master Degree in Mechanical Power Engineering required the study of courses amounting to 18 hours weekly for one academic year. 9 hours of them are devoted to department basic requirements. The other 9 hours constitute specialized courses are selected by the supervision team and approved by the department council. These courses are chosen from among the 600 – level and are directly related to the topic of his research. As well as students can study some courses from 500 – level, if ray the supervisor and department of that importance. Also, required for awarding the Master Degree in Mechanical Power Engineering is the execution of scientific research that terminated by writing a thesis containing the research results and its complete analysis and defending it successfully.

- Grades for all postgraduate courses as well as the overall grade are evaluated as follows:

Distinction	90% or more
Very Good	80% - less than 90%
Good	70% - less than 80%
Pass	60% - less than 70%

- The student fails if he enters the exam and gets less than 60% of the total mark. If a student fails in a certain course repeats all exams courses, for one year only.

5.3 Program Contents (Courses):

- **Department Basic Requirements Courses:**

Course Code	Course Title	Course Hours/Week	Marks Written Exam
MEP 607	Advanced Fluid Mechanics and Thermodynamics	3	100
MEP 616	Advanced Measurements	3	100
Elective Course**			
SCI 600	Advanced Engineering Mathematics (1)	3	100
SCI 601	Advanced Engineering Mathematics (2)	3	100
SCI 603	Engineering Numerical Analysis	3	100
SCI 604	Engineering Probabilities and Statistics	3	100
SCI 605	Finite Element Methods	3	100

** Select only one course.

- **Specialized Requirements Courses***:**

Course Code	Course Title	Course Hours/Week	Marks Written Exam
MEP 600	Combustion Engineering	3	100
MEP 601	Advanced Fluid Dynamics	3	100
MEP 602	Multi-phase flow	3	100
MEP 603	Water Power Engineering	3	100
MEP 604	Unsteady Flow Of Fluid	3	100
MEP 605	Jet Propulsion	3	100
MEP 606	Turbulent Flow	3	100
MEP 608	Aerodynamics (2)	3	100
MEP 609	Advanced Turbo Mechanics	3	100
MEP 610	Gas Dynamics (2)	3	100
MEP 611	Heat Transfer By Conduction	3	100
MEP 612	Heat Transfer By Convection	3	100
MEP 614	Boundary Layer Theory	3	100
MEP 615	Heat Transfer By Radiation	3	100
MEP518	Aerodynamics (1)	3	100
MEP528	Heat Transfer in Industrial Furnaces and Boilers	3	100
MEP512	Control of Pumps	3	100
MEP557	Solar Energy	3	100
MEP511	Pump Selection	3	100
MEP510	Operation and Maintenance of Pumps	3	100
MEP519	Gase Dynamics (1)	3	100
MEP500	Transient Combustion	3	100
MEP508	Pump Design (1)	3	100
MEP514	Pump Design (2)	3	100
MEP573	Gas Turbine and Diesel Engine Power Plants	3	100
MEP522	Compressors and Pumps	3	100
MEP585	Water Desalination	3	100

MEP521	Gas and Steam Turbines	3	100
MEP572	Steam power plants	3	100
MEP578	Pneumatic and Hydraulic systems	3	100
MEP564	Advanced Thermodynamic	3	100
MEP571	Foundations and Vibrations of Engines	3	100
MEP568	Automatic control in engines	3	100

*** Select only three courses related to the research topic.

7- Evaluation of program intended learning outcomes:

- Written examinations for the preparatory year after 30 weeks.
- An examiners committee is approved by the faculty council (including at least one external examiner). The evaluation of the thesis and the discussion is carried out in an open session.

8- Program Matrix:

The following table explains the ILO's (of the current program) – Course (main ILOs) matrix.

Program Matrix: ILO's (of the current program) – Course (main ILOs) matrix.

Courses Codes	MEP																																	SCI					Thesis
	600	601	602	603	604	605	606	607	608	609	610	611	612	614	615	616	510	511	512	518	528	557	519	500	508	514	573	522	585	521	572	578	564	571	568	600	601	603	604	605	
ILOs																																									
a1-1			x					x											x				x	x										x	x	x	x	x	x	x	
a1-2		x		x	x		x	x						x		x	x	x	x									x	x				x							
a1-3	x					x										x								x			x			x	x		x							
a1-4												x	x		x										x	x						x								
a1-5									x	x	x									x	x	x																		
a1-6																																									x
a2-1			x						x					x		x				x			x						x					x	x						x
a2-2		x		x	x		x	x						x		x			x		x	x																		x
a3-1	x				x	x	x					x	x		x				x		x	x																		x
a3-2					x		x	x						x					x																					x
a3-3					x		x					x	x		x				x																					x
a4-1																																									x
a5-1				x								x	x	x	x	x				x	x	x	x						x											x
a6-1																																									x
b1-1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x						
b1-2										x		x									x	x					x			x	x									x
b2-1	x		x			x					x		x		x		x	x							x	x		x				x								x
b3-1		x		x	x		x	x	x	x	x	x		x	x	x				x	x	x	x	x					x				x	x	x					
b4-1																											x			x	x										x
b4-2																																									x
b5-1									x	x		x		x	x	x			x	x	x	x	x						x											x
b6-1																																									x
b7-1																																									x
c1-1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x						x
c2-1	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x						x
c3-1			x								x		x	x		x																									x
d1-1																																									x
d2-1	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x						x
d2-2																																									x
d3-1																																									x
d4-1																								x	x	x	x				x	x	x	x	x						x
d5-1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x					x	x												x
d6-1																																									x
d7-1																																									x
d8-1			x		x		x			x		x				x																									x
d8-2																x	x	x	x	x	x	x			x	x		x	x			x									

- ***Program Coordination Committee:***

Programme coordinator: **Dr. Yassen El-Sayed Yassen**

Head of the Department: **Prof. Dr. Kamal Ameen Murad**

Date:

Course Specification

Program on which the course is given	M. Sc. in Mechanical Power Engineering
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering
Department offering the course	Mechanical Power Engineering
Academic year/Level	1st year
Date of specification approval	***2020***

A- Basic Information

Title: Transient Combustion	**Code Symbol**: MEP500	
Lecture	3 hours	
Tutorial		
Laboratory		
Total	3 hours	Bylaw 2000

B- Professional Information

1- Course Aims:

The aims of this course are to provide the post graduate student, upon completing the course programme, with the basic knowledge and skills of definitions, principles and applications of transient combustion and the problems associated with it.

2- Course Objectives

On completion of this course, the post graduate student should have sufficient broad knowledge in mechanical engineering to:

1- The course aims at acquiring the student combustion technology.
2- Studying the variable parameters affecting the transient combustion.
3- Modeling kinetics.
4- Flame propagation.
5- Studying the types of atomizers.
6- Transport phenomena and it's related to combustion model.
7- Computational methods to flame propagation.

3- Intended Learning Outcomes (ILOs)

NAQAAE Academic Reference Standards (ARS)	Program ILOs	Course ILOs
A. Knowledge and understanding		
A1. Theories, basics and specialized knowledge in the field of learning, as well as the subjects that affect his/her professional practice.	a1-1 Demonstrate sufficient essential knowledge and a deep understanding of the theories, basics and specialized knowledge in the field of **Internal Combustion Engines**. a1-3 Demonstrate sufficient essential knowledge and a deep understanding of the theories, basics and specialized knowledge in the field of **Thermal Power Plants**.	a1-1-1 Understand basics of tansient combustion. a1-3-1 Understand the Understand the transport phenomena and its related to kinetic mechanism to support more knowledge for internal combustion engines.
B. Intellectual skills		
B1- Define and analyze problems in the field of specialization and sorting them according to priorities	b1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to mechanical power engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to transient combustion and mechanical power engineering.
B3- Analytical reading researches and subjects relevant to the field of specialization**.**	b3-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems.	b3-1-1 Select the suitable solution methods (Analytical technique and modern computational) for predict flame structure.

C. Professional and practical skills		
C1- Apply professional skills in the field of specialization.	c1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering techniques, skills, and tools.	c1-1-1 Apply the knowledge of mathematics to transient combustion problems.
C2- Write professional reports.	c.2-1 Write and evaluate a professional report on specialized related to mechanical power engineering technical matters.	c2-1-1 Write and evaluate a professional report on transient combustion problems.
D. General and transferable skills		
D2- Use information technology to improve his/her professional practice.	d2-1 Use state-of-the-art computer aided design tools for solving mechanical power engineering problems.	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to transient combustion.
D4- Use different sources to obtain knowledge and information.	d4-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about transient combustion.

4- Course Contents

Week No.	*Topic*	*Total Hours*	*Contact hrs*			*Course ILOs Covered (By No.)*
			Lec.	Tut.	Lab.	
Week-1 and 2	Mathematical model of droplet vaporization	6	6	-	-	a1-1, a1-3
Week-3 and 4	Fuel atomizer	6	6	-	-	a1-1, a1-3, b-1-1, b3-1
Week-5 and 6	Introduction to chemical kinetics and equilibrium. - Kinetic theory	6	6	-	-	a1-1, a1-3, b1-1, c1-1
Week-7 and 8	Introduction to chemical kinetics and equilibrium. - Chemical and reaction kinetics	6	6	-	-	a1-1, a1-3, b1-1, c1-1
Week-9 and 11	Transport phenomena. - Viscosity.	6	6	-	-	a1-1, a1-3, b3-1, c2-1
Week-12 and 14	Transport phenomena. - Conductivity and diffusivity.	6	6	-	-	a1-1, a1-3, b1-1, c2-1
Week-15 and 17	Laminar flame propagation, theory and applications.	6	6	-	-	a1-1, a1-3, b3-1, c2-1
Week-18 and 19	Kinetic model and its applications.	6	6	-	-	a1-1, a1-3, b1-1, c2-1, d2-1
Week-20 and 22	Review of computational methods and kinetic mechanism.	9	9	-	-	a1-1, a1-3, b1-1, c2-1, d2-1
Week-23 and 24	Ignition of mixture and flammability limits.	9	6	-	3	a1-1, a1-3, b1-1, c2-1, d4-1
Week-25 and 26	Transient combustion and its control in spark ignition engines.	6	6	-	-	a1-1, a1-3, b1-1, c2-1, d2-1, d4-1
Week-27 and 28	Oil fired system and its applications.	9	6	-	3	a1-1, a1-3, b1-1, c2-1, d2-1, d4-1
Week-29 and 30	Mathematical model for spark ignition.	9	6	-	3	a1-1, a1-3, b1-1, c2-1, d2-1, d4-1

5- Relationship between the course and the programme

Field	National Academic Reference Standard(NARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Programme Academic Standards that the course contribute in achieving	A1 (a1-a3)	B1 & B3	C1 & C2	D1 & D4

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Disccretionry subjects	Total
---	---	**30%**	**70%**	---	---	---	**100%**

7- Course Topics.

Topic No.	Topic	Weeks
1st	Flames and chemical kinetics	1-6
2nd	Transport phenomena and flame propagation	7-12
3rd	Kinetic models, computational methods and kinetic mechanism	13-18
4th	Ignition mixtures and transient combustion	19-24
5th	Oil fired system and fuel atomization	25-30

8- ILOs Matrix Topics

Course Intended Learning Outcomes (ILOs)		Course topics				
		1st	2nd	3rd	4th	5th
Knowledge & Understanding	a1-2-1 Understand basics of transient combustion.	x	x	x	x	x
	a1-3-1Understand the Understand the transport phenomena and its related to kinetic mechanism to support more knowledge for internal combustion engines.	x	x	x	x	x
Intellectual Skills	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to transient combustion and mechanical power engineering.	x	x	x	x	x

	b3-1-1 Select the suitable solution methods (Analytical technique and modern computational) for predict flame structure.	x	x	x	x	x
Professional Skill	c1-1-1 Apply the knowledge of mathematics transient combustion problems.	x	x	x	x	x
	c2-1-1 Write and evaluate a professional report on transient combustion problems.	x	x	x	x	x
General Skills	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to transient combustion.				x	x
	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about tansient combustion.				x	x

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		Teaching and Learning Method												
		Lecture	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Site visits	Self learning	Cooperative	Discovering	Modelling	Playing
Knowledge & understanding	a1-1-1	x												
	a1-3-1	x				x								
Intellectual Skills	b1-1-1	x				x								
	b3-1-1	x				x			x					
Professional Skills	c1-1-1	x				x	x		x	x	x	x		
	c2-1-1	x				x								
General Skills	d2-1-1		x	x		x			x	x	x			
	d4-1-1		x	x					x	x	x			

10- Teaching and learning method for low capacity and outstanding Student

For low capacity students	Assign a portion of the office hours for those students.
	Give them specific tasks.
	Repeat the explanation of some of the material and tutorials.
	Assign a teaching assistance to follow up the performance of these groups of students.
For outstanding Students	Hand out project assignments to those students.
	Give them some research topics to be searched using the internet and conduct presentation.
	Encourage them to take parts in the running research projects.

11- Assessment

11.1 Assessment Methods

Course Intended Learning Outcome (ILOs)		Assessment Methods											
		Written Exam	Oral Exam	Tutorial Assessment	Project Assessment	Model Assessment	Report Assessment	Quiz assessment	Presentation Assessment	Discussion	Laboratory Test	Home Exm	Monitoring
Knowledge & Understanding	a1-1-1	x											
	a1-3-1	x											
Intellectual Skills	b1-1-1	x											
	b3-1-1	x											
Professional Skills	c1-1-1	x											
	c2-1-1	x											
General Skills	d2-1-1	x											
	d4-1-1	x											

11.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	32 th
Mid term written Examination	---	
Quizzes	---	
laboratory examination	---	
Oral examination	---	
Semester work	---	
Total	100%	

12- Facilities required for teaching and learning

Teaching aids like, lecture room with audio-visual facilities, white board.

13- List of references:

"An Introduction to Combustion" By: Stephen Turns, 2nd Edition, 2000
Publisher: McGraw Hill Comp.

- "The John Zink Combustion Handbook" By: Charles Baukal, CRC
- "Introduction to Combustion Phenomena"

By: Murty Kanury, Gordon & Breach

- "Fundamentals and Technology of Combustion" By: El-Mahallawy and Habik, Elsevier 2002

Course coordinator: Prof. Saad Habik
Programme coordinator: Saad Habik
Head of the Department: Prof. Kamal Morad

Date:

Course Specification

Program on which the course is given	M. Sc. in Mechanical Power Engineering
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering
Department offering the course	Mechanical Power Engineering
Academic year/Level	1st year
Date of specification approval	***2020***

A- Basic Information

Title: Pump Design (1)	**Code Symbol**: **MEP 508**	
Lecture	3 hours	
Tutorial & Laboratory		
Total	3 hours	Bylaw 2000

B- Professional Information

1- Course Aims:

The aims of this course are to provide the student, upon completing the Mechanical Power Engineering Program, with the basic knowledge and skills of pump design, and classifications of different pump types. Design of centrifugal pump includes shaft, impeller, and casing. Moreover, the course covers topics such as: Pumps classification, theory, design, selection, and performance.

2- Course Objectives

1- **Demonstration of the knowledge and understanding of the importance of pump design.**
2- **Recognizability of diferent types of pumps.**
3- **Evaluation of the performance of diffrent pumps.**
4- **Analysis of different pumps problems and suggesing solution forsuch problems.**

3- Intended Learning Outcomes (ILOs)

NAQAAE Academic Reference Standards (ARS)	Program ILOs	Course ILOs
A. Knowledge and understanding		
A1. Theories, basics and specialized knowledge in the field of learning, as well as the subjects that affect his/her professional practice.	a1-4 Demonstrate sufficient essential knowledge and a deep understanding of the theories, basics and specialized knowledge in the field of **Fluids Engineering and Pumping**.	a-1-4-1 Define the concepts of physical meaning and phenomena are used in pump design. a1-4-2 Classify the types of pumps.
B. Intellectual skills		
B1- Analyze and evaluate the information in the field of specialization, and relate it to solve problems.	b1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to mechanical power engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to pump design based on the flow equations analysis and size.
B2- Solve specialized problems in the field of practice.	b2-1 Apply broad knowledge of modern computational methods and think critically to solve unstructured problems (with incomplete data) related to mechanical power engineering.	b2-1-1 Select the suitable solution methods (Analytical technique and modern computational) for design of pump problems based on the dimension analysis.
C. Professional and practical skills		
C1- Apply professional skills in the field of specialization.	c1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to pump design problems,

	solutions, using latest engineering techniques, skills, and tools.	using latest engineering techniques, skills, and tools.
C2- Write professional reports.	c.2-1 Write and evaluate a professional report on specialized related to mechanical power engineering technical matters.	c2-1-1 Write and evaluate a professional report on Pump Construction and Instrumentation (shaft, impeller, and vanes).
D. General and transferrable skills		
D2- Use information technology to improve his/her professional practice.	d2-1 Use state-of-the-art computer aided design tools for solving mechanical power engineering problems.	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to pump design.
D4- Use different sources to obtain knowledge and information.	d4-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about pump design.
D8- Learn independently and seek continuous learning.	d8-2 Seek continuous learning through continuous education, organizing and participating in seminars, workshops, national and international conferences.	d8-2-1 Exhibit the ability to learn more about pump design.

4- Course Contents

Week No.	Topic	Total Hours	Contact hrs			Course ILOs Covered (By No.)
			Lec.	Tut.	Lab.	
Week-1 : 4	Revision of classification and performance of different pump types	12	12	–	–	a1-4-1, a1-4-2, b1-1-1, c1-1-1, c2-1-1, d2-1-1, d4-1-1
Week-5 : 8	Design of centrifugal pumps	12	12	–	–	a1-4-1, a1-4-2, b1-1-1, c1-1-1, c2-1-1, d2-1-1, d4-1-1
Week-9 : 15	Design of pump shaft and impeller dimensions	12	12	–	–	a1-4-1, b1-1-1, b2-1-1, c1-1-1, c2-1-1, d2-1-1, d4-1-1, d8-2-1
Week-16 : 20	Design of impeller vanes	12	12	–	–	a1-4-1, a1-4-2, b1-1-1, c1-1-1, d2-1-1, d4-1-1
Week-21 : 24	Diffuser design	12	12	–	–	a1-4-1, a1-4-2, b1-1-1, c1-1-1, d2-1-1, d4-1-1
Week-25 : 30	Design of pump casing	12	12	–	–	a1-4-1, b1-1-1, b2-1-1, c1-1-1, c2-1-1, d2-1-1, d4-1-1, d8-2-1
Total		**72**	**72**	–	–	

5- Relationship between the course and the programme

Field	National Academic Reference Standard(NARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Programme Academic Standards that the course contribute in achieving	A1 (a1-4)	B1 (b1-1), B2 (b2-1)	C1 (c1-1), C2 (c2-1)	D2 (d2-1), D4 (d4-1), D8 (d8-2)

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	**Mathematics and Basic Sciences**	**Basic Engineering Science**	**Applied Engineering And Design**	**Computer Applications and ICT**	**Projects and practice**	**Disccretionry subjects**	**Total**
---	**---**	**30%**	**50%**		**20%**		**100 %**

7- Course Topics.

Topic No.	Topic	Weeks
1st	Revision of classification and performance of different pump types	1-4
2nd	Design of centrifugal pumps	5-8
3rd	Design of pump shaft and impeller dimensions	9-16
4th	Design of impeller vanes, Diffuser design	17-24
5th	Design of pump casing	25-30

8- ILOs Matrix Topics

Course Intended Learning Outcomes (ILOs)		Course topics				
		1st	2nd	3rd	4th	5th
Knowledge & Understanding	a-1-4-1 Define the concepts of physical meaning and phenomena are used in pump design.	x	x	x	x	x
	a1-4-2 Classify the types of pumps.	x	x	x		
Intellectual Skills	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to pump design based on the flow equations analysis and size.	x	x	x	x	x
	b2-1-1 Select the suitable solution methods (Analytical technique and modern computational) for design of pump problems based on the dimension analysis.			x	x	
Professional Skill	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to pump design problems, using latest engineering techniques, skills, and tools.	x	x	x	x	x
	c2-1-1 Write and evaluate a professional report on Pump Construction and Instrumentation (shaft, impeller, and vanes).	x	x			x

General Skills	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to pump design.	x	x	x	x	x
	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about pump design.	x	x	x	x	x
	d8-2-1 Exhibit the ability to learn more about pump design.			x	x	

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		Teaching and Learning Method												
		Lecture	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Site visits	Self learning	Cooperative	Discovering	Modelling	Playing
Knowledge & understanding	a1-4-1	x		x										
	a1-4-2	x		x		x								
Intellectual Skills	b1-1-1	x		x	x	x								
	b2-1-1	x		x	x	x			x					
Professional Skills	c1-1-1			x	x	x	x		x	x	x			
	c2-1-1	x		x	x	x								
General Skills	d2-1-1	x		x	x	x			x	x	x			
	d4-1-1			x	x				x	x	x			
	d8-2-1			x	x				x	x	x			

10- Teaching and learning method for low capacity and outstanding Student

For low capacity students	Assign a portion of the office hours for those students.
	Give them specific tasks.
	Repeat the explanation of some of the material and

	tutorials.
	Assign a teaching assistance to follow up the performance of these groups of students.
For outstanding Students	Hand out project assignments to those students.
	Give them some research topics to be searched using the internet and conduct presentation.
	Encourage them to take parts in the running research projects.

11- Assessment

11.1 Assessment Methods

Course Intended Learning Outcome (ILOs)		Assessment Methods											
		Wirtten Exam	Oral Exam	Tutorial Assessment	Project Assessment	Model Assessment	Report Assessment	Quiz assessment	Presentation Assessment	Discussion	Laboratory Test	Home Exm	Monitoring
Knowledge & Understanding	a1-4-1	x											
	a1-4-2	x											
Intellectual Skills	b1-1-1	x											
	b2-1-1	x											
Professional Skills	c1-1-1	x											
	c2-1-1	x											
General Skills	d2-1-1	x											
	d4-1-1	x											
	d8-2-1	x											

11.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	32 th
Mid term written Examination	---	
Quizzes	---	
laboratory examination	---	

Oral examination	---	
Semester work	---	
Total	100%	

12- Facilities required for teaching and learning

Teaching aids like, lecture room with audio-visual facilities, white board.

13- List of references:

13.1- Course Notes & Presentations

13.2- Essential Books (Text Books)

1- A., Esposito, "Fluid Power with Applications", 7th ed., Pearson Education, 2009.

2- R. S., Khurmi, "A Textbook of Hydraulics, Fluid mechanics and Hydraulic Machines", S. Chand & Company LTD., 2003.

3- I. J., Karassik, J. P., Messina, P., Cooper, and C. C., Heald," Pump Handbook", 3rd ed., MacGraw-Hill, 2001.

Course coordinator. Prof. / Abdoelhady Elabady

Head of the Department: Prof. Kamal Ameen Murad

Date:

Course Specification

Program on which the course is given	M. Sc. in Mechanical Power Engineering
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering
Department offering the course	Mechanical Power Engineering
Academic year/Level	first year
Date of specification approval	***2020***

A- Basic Information

Title: Operation and Maintenance of Pumps	**Code Symbol**: **MEP510**	
Lecture	3 hours	
Tutorial		
Laboratory		
Total	3 hours	Bylaw 2003

B- Professional Information

1- Course Aims:

The major aim of this course is to understand the basic concepts of operation and maintenance of pumps, with the basic knowledge and skills of the concepts and principles of fluid dynamics and hydraulics. To help the post graduate students to add more information about pumps classification and range of applications, pumps sealing and the mechanical seals with the theory of operation, pump types, types of impeller rotors, pump materials used for the construction of different pump components with standard specifications, and pump data sheets. Also, get more knowledge about the pump testing, operation, accessories, and maintenance of pumps and its engineering application. Analysis pumps maintenance and testing with range of applications. Discuss the all phenomena associated with such type of pump drawings and evaluation at bids and different parameters.

2- Course Objectives

1- Demonstration of the knowledge and understanding of the importance of study of operation and maintenance of pumps.
2- Definitions of the pump troubles and ways of maintenance and repair as related to practical applications.
3- Reconcilability of the different maintenance of pumps with different applications.
4- Analysis of different pump testing problems.

3- Intended Learning Outcomes (ILOs)

NAQAAE Academic Reference Standards (ARS)	Program ILOs	Course ILOs
A. Knowledge and understanding		
A1. Theories, basics and specialized knowledge in the field of learning, as well as the subjects that affect his/her professional practice.	a1-4 Demonstrate sufficient essential knowledge and a deep understanding of the theories, basics and specialized knowledge in the field of **Fluids Engineering and Pumping**.	a-1-4-1 Define the concepts of physical meaning and phenomena are used in operation and maintenance of pumps.
B. Intellectual skills		
B1- Analyze and evaluate the information in the field of specialization, and relate it to solve problems.	b1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to mechanical power engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to operation and maintenance of pumps based on the flow equations analysis.
B2- Solve specialized problems in the field of practice.	b2-1 Apply broad knowledge of modern computational methods and think critically to solve unstructured problems (with incomplete data) related to mechanical power engineering.	b2-1-1 Select the suitable solution methods (Analytical technique and modern computational) for design of pump data sheets problems based on the flow equations analysis.
C. Professional and practical skills		
C1- Apply professional skills in the field of specialization.	c1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to operation and maintenance

	solutions, using latest engineering techniques, skills, and tools.	of pumps problems, using latest engineering techniques, skills, and tools.
C2- Write professional reports.	c.2-1 Write and evaluate a professional report on specialized related to mechanical power engineering technical matters.	c2-1-1 Write and evaluate a professional report on pumps sealing, materials, and accessories.
D. General and transferrable skills		
D2- Use information technology to improve his/her professional practice.	d2-1 Use state-of-the-art computer aided design tools for solving mechanical power engineering problems.	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to operation and maintenance of pumps.
D4- Use different sources to obtain knowledge and information.	d4-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about operation and maintenance of pumps.
D7- Learn independently and seek continuous learning.	d7-2 Seek continuous learning through continuous education, organizing and participating in seminars, workshops, national and international conferences.	d7-2-1 Exhibit the ability to learn more about operation and maintenance of pumps.

4- Course Contents

Week No.	*Topic*	*Total Hours*	*Contact hrs*			*Course ILOs Covered (By No.)*
			Lec.	Tut.	Lab.	
Week-1 and 2	Pumps Classification and Range of Applications	6	6	–	–	a1-4-1, b1-1-1, c1-1-1, c2-1-1, d2-1-1, d4-1-1

Week-3 and 4	Pumps Sealing and the Mechanical seals with the theory of Operation	6	6	–	–	a1-4-1, b1-1-1, c1-1-1, c2-1-1, d2-1-1, d4-1-1
Week-5 and 6	Pump Types	6	6	–	–	a1-4-1, b1-1-1, c1-1-1, c2-1-1, d2-1-1, d4-1-1
Week-7 and 8	Types of Impeller Rotors	6	6	–	–	a1-4-1, b1-1-1, c1-1-1, c2-1-1, d2-1-1, d4-1-1
Week-9 and 10	Pump Materials used for the Construction of different Pump components with standard specifications	6	6	–	–	a1-4-1, b1-1-1, c1-1-1, c2-1-1, d2-1-1, d4-1-1
Week-11 and 12	Starting and Stopping Procedures for Pumps with low specific speeds	6	6	–	–	a1-4-1, b1-1-1, c1-1-1, c2-1-1, d2-1-1, d4-1-1
Week-13 and 14	Daily, semi annual and annual inspection and maintenance of different Types of Pumps	6	6	–	–	a1-4-1, b1-1-1, c1-1-1, c2-1-1, d2-1-1, d4-1-1
Week-15 and 16	Pump Troubles and ways of maintenance and Repair	6	6	–	–	a1-4-1, b1-1-1, c1-1-1, d2-1-1, d4-1-1, d7-2-1
Week-17 and 19	Pump Testing	9	9	–	–	a1-4-1, b1-1-1, b2-1-1, c1-1-1, d2-1-1, d4-1-1, d7-2-1
Week-20 and 21	Tabling of Results and Improving the Performance	6	6	–	–	a1-4-1, b1-1-1, c1-1-1, d2-1-1, d4-1-1, d7-2-1
Week-22 and 23	Accessories	6	6	–	–	a1-4-1, b1-1-1, c1-1-1, d2-1-1, d4-1-1, d7-2-1
Week-24 and 26	Maintenance	9	9	–	–	a1-4-1, b1-1-1, c1-1-1, d2-1-1, d4-1-1, d7-2-1
Week-27 and 28	Pump Data Sheets	6	6	–	–	a1-4-1, b1-1-1, b2-1-1, c1-1-1, d2-1-1, d4-1-1
Week-29 and 30	Pump Drawings and Evaluation at Bids	6	6	–	–	a1-4-1, b1-1-1, b2-1-1, c1-1-1, d2-1-1, d4-1-1
Total		**90**	**90**	–	–	

5- Relationship between the course and the programme

Field	National Academic Reference Standard(NARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Programme Academic Standards that the course contribute in achieving	A1 (a1-4)	B1 (b1-1), B2 (b2-1)	C1 (c1-1), C2 (c2-1)	D2 (d2-1), D4 (d4-1), D7 (d7-2)

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Disccretionry subjects	Total
---	---	**30%**	**70%**	---	---	---	**100%**

7- Course Topics.

Topic No.	Topic	Weeks
1st	Pumps Classification	1-6
2nd	Pump Types	7-12
3rd	Pump Testing	13-18
4th	Operation and Maintenance of Pumps	19-24
5th	Pump Data Sheets	25-30

8- ILOs Matrix Topics

Course Intended Learning Outcomes (ILOs)		Course topics				
		1st	2nd	3rd	4th	5th
Knowledge & Understanding	a1-4-1 Define the concepts of physical meaning and phenomena are used in operation and maintenance of pumps.	x	x	x	x	x
Intellectual Skills	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to operation and maintenance of pumps based on the flow equations analysis.	x	x	x	x	x
	b2-1-1 Select the suitable solution methods (Analytical technique and modern computational) for design of pump data sheets problems based on the flow equations analysis.					x

Professional Skill	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to operation and maintenance of pumps problems, using latest engineering techniques, skills, and tools.	x	x	x	x	x
	c2-1-1 Write and evaluate a professional report on pumps sealing, materials, and accessories.	x	x	x		
General Skills	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to operation and maintenance of pumps.	x	x	x	x	x
	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about operation and maintenance of pumps.	x	x	x	x	x
	d7-2-1 Exhibit the ability to learn more about operation and maintenance of pumps.				x	

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)	Teaching and Learning Method												
	Lecture	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Site visits	Self learning	Cooperative	Discovering	Modelling	Playing

Knowledge & understanding	a1-4-1	x		x										
Intellectual Skills	b1-1-1	x		x	x	x								
	b2-1-1	x		x	x	x			x					
Professional Skills	c1-1-1			x	x	x	x		x	x	x			
	c2-1-1	x		x	x	x								
General Skills	d2-1-1	x		x	x	x			x	x	x			
	d4-1-1			x	x				x	x	x			
	d7-2-1			x	x				x	x	x			

10- Teaching and learning method for low capacity and outstanding Student

For low capacity students	Assign a portion of the office hours for those students.
	Give them specific tasks.
	Repeat the explanation of some of the material and tutorials.
	Assign a teaching assistance to follow up the performance of these groups of students.
For outstanding Students	Hand out project assignments to those students.
	Give them some research topics to be searched using the internet and conduct presentation.
	Encourage them to take parts in the running research projects.

11- Assessment

11.1 Assessment Methods

Course Intended Learning Outcome (ILOs)		Assessment Methods											
		Wirtten Exam	Oral Exam	Tutorial Assessment	Project Assessment	Model Assessment	Report Assessment	Quiz assessment	Presentation Assessment	Discussion	Laboratory Test	Home Exm	Monitoring
Knowledge & Understanding	a1-4-1	x											
Intellectual Skills	b1-1-1	x											
	b2-1-1	x											
Professional Skills	c1-1-1	x											

	c2-1-1	x											
General Skills	d2-1-1	x											
	d4-1-1	x											
	d7-2-1	x											

11.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	32 th
Mid term written Examination	---	
Quizzes	---	
laboratory examination	---	
Oral examination	---	
Semester work	---	
Total	100%	

12- Facilities required for teaching and learning

Teaching aids like, lecture room with audio-visual facilities, white board.

13- List of references:

Essential Books (Text Books)

1- Peter K. Bridn, "Hydraulic Fluids", John Wiley & Sons, Inc. New York, 1996.
2- Larry W. Mays, “Hydraulic Design Handbook”, McGraw-Hill, 2004.

Recommended Books

1- Peter Chapple, "Principles of Hydraulic System Design", Coxmoor Publishing Company, 2003.

Course Coordinator : Prof. Dr. Fawzy Mohamed El-Otla

Head of Department : Prof. Dr. Kamal Ameen Morad

Date :

Course Specification

Program on which the course is given	M. Sc. in Mechanical Power Engineering
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering
Department offering the course	Mechanical Power Engineering
Academic year/Level	first year
Date of specification approval	***2020***

A- Basic Information

Title: Pump Selections	**Code Symbol**: **MEP511**	
Lecture	3 hours	
Tutorial		
Laboratory		
Total	3 hours	Bylaw 2003

B- Professional Information

1- Course Aims:

The major aim of this course is to understand the basic concepts of pump selections, with the basic knowledge and skills of the concepts and principles of fluid dynamics and hydraulics. To help the post graduate students to add more information about rotary and displacement pump types, manufacture philosophy, specification and conditions of select pumps, maintenance and operating economics, and pump data sheets. Also, get more knowledge about the Owner's philosophy, Consulting engineer philosophy, Number of pumping units, and accessories and its engineering application. Analysis pumps maintenance and testing with range of applications. Discuss the all phenomena associated with such type of pump drawings and evaluation at bids and different parameters.

2- Course Objectives

1- Demonstration of the knowledge and understanding of the importance of study of pump selections.
2- Definitions of the rotary and displacement pump types and ways of specification and conditions as related to practical applications.
3- Reconcilability of the different maintenance of pumps with different applications.
4- Analysis of different pump drawings and evaluation at bids problems.

3- Intended Learning Outcomes (ILOs)

NAQAAE Academic Reference Standards (ARS)	Program ILOs	Course ILOs
A. Knowledge and understanding		
A1. Theories, basics and specialized knowledge in the field of learning, as well as the subjects that affect his/her professional practice.	a1-2 Understand the theories, basics and specialized knowledge in the field of **Fluid Mechanics and Hydraulics**.	a-1-2-1 Define the concepts of physical meaning and phenomena are used in pump selections.
B. Intellectual skills		
B1- Analyze and evaluate the information in the field of specialization, and relate it to solve problems.	b1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to mechanical power engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to pump selections based on the flow equations analysis.
B2- Solve specialized problems with lack of some data and variables, (incomplete data).	b2-1 Apply broad knowledge of modern computational methods and think critically to solve unstructured problems (with incomplete data) related to mechanical power engineering.	b2-1-1 Select the suitable solution methods (Analytical technique and modern computational) for design of pump data sheets problems based on the flow equations analysis.
C. Professional and practical skills		
C1- Master the basic as well as the latest professional skills in the	c1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to pump selections problems,

field of specialization.	solutions, using latest engineering techniques, skills, and tools.	using latest engineering techniques, skills, and tools.
C2- Write and evaluate technical and professional reports.	c.2-1 Write and evaluate a professional report on specialized related to mechanical power engineering technical matters.	c2-1-1 Write and evaluate a professional report on manufacture philosophy.
D. General and transferrable skills		
D2- Use information technology to improve his/her professional practice.	d2-1 Use state-of-the-art computer aided design tools for solving mechanical power engineering problems.	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to pump selections.
D5- Use different sources to obtain knowledge and information.	d5-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about pump selections.
D8- Learn independently and seek continuous learning.	d8-2 Seek continuous learning through continuous education, organizing and participating in seminars, workshops, national and international conferences.	d8-2-1 Exhibit the ability to learn more about pump selections.

4- Course Contents

Week No.	***Topic***	***Total Hours***	***Contact hrs***			***Course ILOs Covered (By No.)***
			Lec.	**Tut.**	**Lab.**	
Week-1 and 2	Rotary pump types	6	6	–	–	a1-2-1, b1-1-1, c1-1-1, d2-1-1, d5-1-1, d8-2-1

Week-3 and 4	Displacement pump types	6	6	–	–	a1-2-1, b1-1-1, c1-1-1, d2-1-1, d5-1-1, d8-2-1
Week-5 and 6	Owner's philosophy	6	6	–	–	a1-2-1, b1-1-1, c1-1-1, d2-1-1, d5-1-1
Week-7 and 8	Manufacture's philosophy	6	6	–	–	a1-2-1, b1-1-1, c1-1-1, d2-1-1, d5-1-1
Week-9 and 10	Consulting engineer philosophy	6	6	–	–	a1-2-1, b1-1-1, c1-1-1, d2-1-1, d5-1-1
Week-11 and 12	Number of pumping units	6	6	–	–	a1-2-1, b1-1-1, c1-1-1, d2-1-1, d5-1-1
Week-13 and 14	Section conditions	9	9	–	–	a1-2-1, b1-1-1, c1-1-1, c2-1-1, d2-1-1, d5-1-1, d8-2-1
Week-15 and 16	Discharge conditions	6	6	–	–	a1-2-1, b1-1-1, c1-1-1, c2-1-1, d2-1-1, d5-1-1, d8-2-1
Week-17 and 19	Specifications	6	6	–	–	a1-2-1, b1-1-1, c1-1-1, c2-1-1, d2-1-1, d5-1-1, d8-2-1
Week-20 and 21	Prime movers	6	6	–	–	a1-2-1, b1-1-1, c1-1-1, c2-1-1, d2-1-1, d5-1-1, d8-2-1
Week-22 and 23	Accessories	6	6	–	–	a1-2-1, b1-1-1, c1-1-1, c2-1-1, d2-1-1, d5-1-1, d8-2-1
Week-24 and 26	Maintenance	6	6	–	–	a1-2-1, b1-1-1, c1-1-1, d2-1-1, d5-1-1, d8-2-1
Week-27 and 28	Operating economics	6	6	–	–	a1-2-1, b1-1-1, c1-1-1, d2-1-1, d5-1-1, d8-2-1
Week-29 and 30	Pump data sheets, pump drawings, evaluation of bids	9	9	–	–	a1-2-1, b1-1-1, b2-1-1, c2-1-1, d2-1-1, d5-1-1
Total		**90**	**90**	–	–	

5- Relationship between the course and the programme

Field	National Academic Reference Standard(NARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Programme Academic Standards that the course contribute in achieving	A1 (a1-2)	B1 (b1-1), B2 (b2-1)	C1 (c1-1), C2 (c2-1)	D2 (d2-1), D4 (d5-1), D7 (d8-2)

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Disccretionry subjects	Total
---	---	**30%**	**70%**	---	---	---	**100%**

7- Course Topics.

Topic No.	Topic	Weeks
1st	Rotary and Displacement Pump Types	1-6
2nd	Manufacture Philosophy	7-12
3rd	Specification and Conditions of Select Pumps	13-18
4th	Maintenance and Operating Economics	19-24
5th	Pump Data Sheets	25-30

8- ILOs Matrix Topics

Course Intended Learning Outcomes (ILOs)		Course topics				
		1st	2nd	3rd	4th	5th
Knowledge & Understanding	a1-2-1 Define the concepts of physical meaning and phenomena are used in operation and maintenance of pumps.	x	x	x	x	x
Intellectual Skills	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to operation and maintenance of pumps based on the flow equations analysis.	x	x	x	x	x
	b2-1-1 Select the suitable solution methods (Analytical technique and modern computational) for design of pump data sheets problems based on the flow equations analysis.					x
Professional Skill	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to operation and maintenance of pumps problems, using latest engineering techniques, skills, and tools.	x	x	x	x	x

	c2-1-1 Write and evaluate a professional report on pumps sealing, materials, and accessories.			x		
General Skills	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to operation and maintenance of pumps.	x	x	x	x	x
	d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about operation and maintenance of pumps.	x	x	x	x	x
	d8-2-1 Exhibit the ability to learn more about operation and maintenance of pumps.	x	x		x	

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		Teaching and Learning Method												
		Lecture	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Site visits	Self learning	Cooperative	Discovering	Modelling	Playing
Knowledge & understanding	a1-2-1	x		x										
Intellectual Skills	b1-1-1	x		x	x	x								
	b2-1-1	x		x	x	x			x					
Professional Skills	c1-1-1			x	x	x	x		x	x	x			
	c2-1-1	x		x	x	x								
General Skills	d2-1-1	x		x	x	x			x	x	x			
	d5-1-1			x	x				x	x	x			
	d7-2-1			x	x				x	x	x			

10- Teaching and learning method for low capacity and outstanding Student

For low capacity students	Assign a portion of the office hours for those students.
	Give them specific tasks.
	Repeat the explanation of some of the material and tutorials.
	Assign a teaching assistance to follow up the performance of these groups of students.
For outstanding Students	Hand out project assignments to those students.
	Give them some research topics to be searched using the internet and conduct presentation.
	Encourage them to take parts in the running research projects.

11- Assessment

11.1 Assessment Methods

Course Intended Learning Outcome (ILOs)		Assessment Methods											
		Wirtten Exam	Oral Exam	Tutorial Assessment	Project Assessment	Model Assessment	Report Assessment	Quiz assessment	Presentation Assessment	Discussion	Laboratory Test	Home Exm	Monitoring
Knowledge & Understanding	a1-2-1	x											
Intellectual Skills	b1-1-1	x											
	b2-1-1	x											
Professional Skills	c1-1-1	x											
	c2-1-1	x											
General Skills	d2-1-1	x											
	d5-1-1	x											
	d8-2-1	x											

11.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	32 th
Mid term written Examination	---	
Quizzes	---	
laboratory examination	---	
Oral examination	---	
Semester work	---	
Total	100%	

12- Facilities required for teaching and learning

Teaching aids like, lecture room with audio-visual facilities, white board.

13- List of references:

Essential Books (Text Books)

1- Peter K. Bridn, "Hydraulic Fluids", John Wiley & Sons, Inc. New York, 1996.
2- Larry W. Mays, “Hydraulic Design Handbook”, McGraw-Hill, 2004.

Recommended Books

1- Peter Chapple, "Principles of Hydraulic System Design", Coxmoor Publishing Company, 2003.

Course Coordinator : Prof. Dr. Ahmed Sharaf Abdelhmeed

Head of Department : Prof. Dr. Kamal Ameen Morad

Date :

Course Specification

Program on which the course is given	M. Sc. in Mechanical Power Engineering
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering
Department offering the course	Mechanical Power Engineering
Academic year/Level	first year
Date of specification approval	***2020***

A- Basic Information

Title: Controls of Pumps	**Code Symbol**: **MEP 512**	
Lecture	3 hours	
Tutorial		
Laboratory		
Total	3 hours	Bylaw 2003

B- Professional Information

1- Programme Aims:

In our treatment of control of pumps, we have two major objectives. In addition to obtaining an understanding of the control system types that underline the control of pumps, we wish to show the means of how to do calculations to describe it. This course is devoted primarily to achieving the former objective. Physical origin discussed, and relevant dimensionless parameters viewed and discussed too.

With conceptual foundations, established, subsequent chapters used to develop useful tools for controls of pumps, control system types, system essentials, sensing and measuring elements. The course present methods for constant speed control, valves and valves elements, operation and valve types, control valves and the components. In addition, the course describes methods for determining flow characteristics through valves, pressure recovery and cavitation, activators and control systems, multi orifice and types.

2- Graduate Attributes:

1- the first objective is to cover the basic principles of controls of pumps and to present a wealth of real-world engineering applications to give students a feel for engineering practice .
2- Is to develop an understanding of controls of pumps phenemena, examine the control system types that govern the sensing and measuring elements, constant speed control. Valves and valves elements, operation and valves types, control valves and the components that are applicable to flow of different fluids and determine important parameters associated with these types.

3- Is to learn how to estimate flow characteristics through valves in order to perform analyses on practical systems experiencing different types of flow under different practical conditions.
4- Is to use requisite practical inputs for computing pressure recovery and cavitations.
5- Is to delineate pertinent activators and control systems, multi orifice and types for any process or system involving different types of flow.
6- The student should be able to develop representative models for real processes and system and draw from the conclusions diagrams and figures concerning process system according to their design or performance from the attendant analysis.

3- Intended Learning Outcomes (ILOs) for the whole program:

NAQAAE Academic Reference Standards (ARS)	Programme ILOs that the course contribute in achieving	Course ILOs
A. Knowledge & Understanding		
A1 [Theories, basics and specialized knowledge in the field of the controls of pumps as well as the subjects that affect his/her professional practice] & A3 [Main scientific advances in the field of the controls of pumps]	**a1-1** The basic theories and principles of some other engineering and mechanical engineering disciplines providing support to mechanical power disciplines. **a3-1** Characteristics and properties of materials relevant to practical engineering applications of pumps.	**a1-1-1** Understand the relation of hydraulic machines science related to the controls of pumps. **a3-1-1** Understand the dependance of the fluids properties on the natural of the flow parameters inside pumps.
B. Intellectual skills		
B1 [Analyze and evaluate the information in the field of the controls of pumps] & B5 [Assess risks in the professional practice in the field of the controls	**b1-1** Solve engineering problems and design energy systems, components and elements in a creative and innovative attitude related to pumps control.	**b1-1-1** select the suitable solution methods for pumps control problems based on the governing momentum, energy, and mass equations together with the boundary conditions.

of pumps]	**b5-1** apply the appropriate tools from mathematics, science, technology, and the know-how gained from the professional experience to analyze mechanical engineering design problems to meet certain needs.	**b5-1-1** show how, with the aid of a computer, numerically (finite-difference) methods may be used to accurately predict performance of pumps control within the medium.
C. Professional skills		
C1 [Master the basic as well as the latest skills in the field of the controls of pumps] & C2 [Write and evaluate technical and professional reports]	**c1-1** Use a wide range of analytical and technical tools, techniques and equipment including pertinent software. **c2-1** Write and apply numerical modeling methods and/or appropriate computational techniques to engineering problems related to pumps.	**c1-1-1** Apply the knowledge of mathematics (differential equations) and fluid mechanics to derive the differential equation models that describe the flow for different materials inside pumps. **c2-1-1** apply the numerical methods and/or appropriate software package pertaining to pumps control problems.
D. General skills		
D5 [Use different sources to obtain knowledge and information] & D8 [Learn independently and seek continuous learning]	**d5-1** Work effectively in a team and in multi-disciplinary technical and non-technical environments. **d8-2** Share ideas and communicate effectively in written, oral and graphical forms.	**d5-1-1** Work in a team through the preparation of pumps control reports which are required from the students. **d8-2-1** Share ideas and communicate effectively in written, oral and graphical forms.

5- Program Structure and Contents:

5.1 Program Duration: a minimum of 2 years & a maximum of 5 years (including one year of preparatory courses).

5.2 Program Structure:

Week No.	*Topic*	*Total Hours*	*Contact hrs*			*Course ILOs Covered (By No.)*
			Lec.	Tut.	Lab.	
Week-1	Introduction to pumps control flow.	3	3	-	-	a1-1-1, a3-1-1, d5-1-1, d8-2-1
Week-2	Fundamentals of control system types.	3	3	-	-	a1-1-1, b1-1-1, b5-1-1, c1-1-1, c2-1-1
Week-3	Fundamentals of system essentials, and measuring elements.	3	3	-	-	a1-1-1, a3-1-1, b1-1-1, c1-1-1
Week-4	Basics of control speed control.	3	3	-	-	a1-1-1, a3-1-1, b1-1-1, c1-1-1
Week-5	Basics of valves and valves types, control valves and components.	3	3	-	-	d5-1-1, d8-2-1
Week-6	Basics of flow characteristics through valves.	3	3	-	-	a1-1-1, a3-1-1, b1-1-1, b5-1-1, c1-1-1
Week-7	Description of pressure recovery.	3	3	-	-	d5-1-1, d8-2-1
Week-8	Two phase flow regimes (gas-liquid).	3	3	-	-	a1-1-1, a3-1-1, b1-1-1, b5-1-1, c1-1-1, c2-1-1
Week-9	Two phase flow regimes (gas-solid).	3	3	-	-	a1-1-1, a3-1-1, b1-1-1, c1-1-1
Week-10-14	Two phase flow regimes (liquid-solid).	3	3	-	2	a1-1-1, a3-1-1, b1-1-1, c1-1-1
Week-15-19	Description of cavitation.	3	3	-	-	a3-1-1, b1-1-1, c1-1-1, d5-1-1, d8-2-1
Week-20-23	Activators and control systems.	3	3	-	2	a1-1-1, b1-1-1, c1-1-1, c2-1-1, d5-1-1
Week-24-27	Multi orifice and types of pumps control.	3	3	-	2	a1-1-1, a3-1-1, b1-1-1, b5-1-1, c1-1-1 d5-1-1, d8-2-1
Week-28-30	Conclusions obtained from the course.	3	3	-	2	a1-1-1, a3-1-1, b1-1-1, c1-1-1, c2-1-1, d5-1-1

6- Relationship between the course and the programme

Field	Academic Reference Standard (NARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Programme Academic Standards that the course contribute in achieving	**A1(a1-1)** and **A3 (a3-1)**	**B1 (b1-1)** and **B5 (b5-1)**	**C1 (c1-1)** and **C2 (c2-1)**	**D5 (d5-1)** and **D8 (d8-1)**

7- Course Subject Area:

A	**B**	**C**	**D**	**E**	**F**	**G**	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Disccretionry subjects	Total
---	30%		70%				100%

8- Course Topics.

Topic No.	Topic	Weeks
1st	Control and introduction, control system types	1-5
2nd	System essentials, sensing and measuring elements, constant speed control, valves and valves elements, operation and valves types	6-7
3rd	Control valves and components, flow characteristics through valves	8-20
4th	Pressure recovery and cavitations, activators and control systems, multi orifice and types	20-30

8- ILOs Matrix Topics

Course Intended Learning Outcomes (ILOs)	**Course topics**

		1st	2nd	3rd	4th
Knowledge & Understanding	**a1-1-1** Understand the relation of hydraulic machines science related to the controls of pumps.	**X**	**X**	**X**	**X**
	a3-1-1 Understand the dependance of the fluids properties on the natural of the flow parameters inside pumps.	**X**	**X**	**X**	**X**
Intellectual Skills	**b1-1-1** select the suitable solution methods for pumps control problems based on the governing momentum, energy, and mass equations together with the boundary conditions.	**x**	**X**	**X**	**x**
	b5-1-1 show how, with the aid of a computer, numerically (finite-difference) methods may be used to accurately predict performance of pumps control within the medium.	**x**	**X**	**X**	**x**
Professional Skill	**c1-1-1** Apply the knowledge of mathematics (differential equations) and fluid mechanics to derive the differential equation models that describe the flow for different materials inside pumps.	**x**	**X**	**X**	**x**

	c2-1-1 apply the numerical methods and/or appropriate software package pertaining to pumps control problems.	**x**	**X**	**X**	**x**
General Skills	**d5-1-1** Work in a team through the preparation of pumps control reports which are required from the students.	**x**	**X**	**X**	**x**
	d8-2-1 Share ideas and communicate effectively in written, oral and graphical forms.	**x**	**X**	**X**	**x**

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		**8- Teaching and Learning Method:**												
		Lecture	**Presentation and Movies**	**Discussion**	**Tutorial**	**Problem solving**	**Brain storming**	**Projects**	**Site visits**	**Self learning**	**Cooperative**	**Discovering**	**Modelling**	**Playing**
Knowledge & understanding	a1-1-1	X				x								
	a3-1-1	X				x								
Intellectual Skills	b1-1-1	X				x								
	b5-1-1	X				x								
Professional Skills	c1-1-1	X				x							x	
	c2-1-1	X				x							x	
General Skills	d5-1-1		X							X	x			
	d8-2-1									x	x			

			X											

11- Assessment

11.1 Assessment Methods

Course Intended Learning Outcome (ILOs)		Assessment Methods												
		Wirtten Exam	Oral Exam	Tutorial Assessment	Proiect Assessment	Model Assessment	Report Assessment	Quiz assessment	Presentation Assessment	Discussion	Laboratory Test	Home Exm	Monitoring
Knowledge & Understanding	a1-1-1	X											
	a3-1-1	X											
Intellectual Skills	b1-1-1	X											
	b5-1-1	X											
Professional Skills	c1-1-1	X											
	c2-1-1	X											
General Skills	d5-1-1	X											
	d8-2-1	X											

11.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	**100**	**32th**
Final Oral Examination		
Mid term written Examination		
Tutorial discussion, presentation, and report assessment		
Total	**100%**	

12- Facilities required for teaching and learning:

Teaching aids like, lecture room with audio-visual facilities, white board.

13- List of references:

1- "Slurry Transport Using Centrifugal Pumps" by Wilson K C et al. Elsevier Scince Publishers Ltd, England, 1992.
2- "A Design Handbook for Slurry Transfer Systems" by Ed N P Brown et al. Elsevier Scince Publishers Ltd, England, 1990..

Course coordinator: Prof. IMAM AHMED EL_SAWAF
Programme coordinator: : Prof. IMAM AHMED EL_SAWAF
Head of the Department: Prof. KAMAL MORAD

Date: 10/10/2012.

Course Specification

Program on which the course is given	M. Sc. in Mechanical Power Engineering
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering
Department offering the course	Mechanical Power Engineering
Academic year/Level	2nd year
Date of specification approval	***2020***

A- Basic Information

Title: Pump Design (2)	**Code Symbol**: **MEP 514**	
Lecture	3 hours	
Tutorial & Laboratory		
Total	3 hours	Bylaw 2000

B- Professional Information

1- Course Aims:

The aims of this course are to provide the student, upon completing the Mechanical Power Engineering Program, with the basic knowledge and skills of pump design, and classifications of different pump types. Design of axial flow and positive pumps includes shaft, impeller, and casing. Moreover, the course covers topics such as: Pumps classification, theory, design, selection, and performance.

2- Course Objectives

1- **Demonstration of the knowledge and understanding of the importance of pump design.**
2- **Recognizability of diferent types of pumps.**
3- **Evaluation of the performance of diffrent pumps.**
4- **Analysis of different pumps problems and suggesing solution forsuch problems.**

3- Intended Learning Outcomes (ILOs)

NAQAAE Academic Reference Standards (ARS)	Program ILOs	Course ILOs
A. Knowledge and understanding		
A1. Theories, basics and specialized knowledge in the field of learning, as well as the subjects that affect his/her professional practice.	a1-4 Demonstrate sufficient essential knowledge and a deep understanding of the theories, basics and specialized knowledge in the field of **Fluids Engineering and Pumping**.	a-1-4-1 Define the concepts of physical meaning and phenomena are used in pump design. a1-4-2 Classify the types of pumps.
B. Intellectual skills		
B1- Analyze and evaluate the information in the field of specialization, and relate it to solve problems.	b1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to mechanical power engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to pump design based on the flow equations analysis and size.
B2- Solve specialized problems in the field of practice.	b2-1 Apply broad knowledge of modern computational methods and think critically to solve unstructured problems (with incomplete data) related to mechanical power engineering.	b2-1-1 Select the suitable solution methods (Analytical technique and modern computational) for design of pump problems based on the dimension analysis.
C. Professional and practical skills		
C1- Apply professional skills in the field of specialization.	c1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to pump design problems,

	solutions, using latest engineering techniques, skills, and tools.	using latest engineering techniques, skills, and tools.
C2- Write professional reports.	c.2-1 Write and evaluate a professional report on specialized related to mechanical power engineering technical matters.	c2-1-1 Write and evaluate a professional report on Pump Construction and Instrumentation (shaft, impeller, and vanes).
D. General and transferrable skills		
D2- Use information technology to improve his/her professional practice.	d2-1 Use state-of-the-art computer aided design tools for solving mechanical power engineering problems.	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to pump design.
D4- Use different sources to obtain knowledge and information.	d4-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about pump design.
D8- Learn independently and seek continuous learning.	d8-2 Seek continuous learning through continuous education, organizing and participating in seminars, workshops, national and international conferences.	d8-2-1 Exhibit the ability to learn more about pump design.

4- Course Contents

Week No.	*Topic*	*Total Hours*	*Contact hrs*			*Course ILOs Covered (By No.)*
			Lec.	Tut.	Lab.	
Week-1 : 10	Airfoil theory for propeller pump design	18	18	–	–	a1-4-1, a1-4-2, b1-1-1, c1-1-1, c2-1-1, d2-1-1, d4-1-1
Week-11 : 19	Design of axial flow pumps	18	18	–	–	a1-4-1, a1-4-2, b1-1-1, c1-1-1, c2-1-1, d2-1-1, d4-1-1
Week-20 : 30	Design of different types of positive pumps	18	18	–	–	a1-4-1, b1-1-1, b2-1-1, c1-1-1, c2-1-1, d2-1-1, d4-1-1, d8-2-1
Total		**54**	**54**	–	–	

5- Relationship between the course and the programme

Field	National Academic Reference Standard(NARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Programme Academic Standards that the course contribute in achieving	A1 (a1-4)	B1 (b1-1), B2 (b2-1)	C1 (c1-1), C2 (c2-1)	D2 (d2-1), D4 (d4-1), D8 (d8-2)

6- Course Subject Area:

A	**B**	**C**	**D**	**E**	**F**	**G**	
Humanities and Social Science	**Mathematics and Basic Sciences**	**Basic Engineering Science**	**Applied Engineering And Design**	**Computer Applications and ICT**	**Projects and practice**	**Disccretionry subjects**	**Total**
---	**---**	**30%**	**50%**		**20%**		**100 %**

7- Course Topics.

Topic No.	Topic	Weeks
1st	Airfoil theory for propeller pump design	**1-10**
2nd	Design of axial flow pumps	**11-19**
3rd	Design of different types of positive pumps	**20-30**

8- ILOs Matrix Topics

Course Intended Learning Outcomes (ILOs)		Course topics		
		1st	2nd	3rd
Knowledge & Understanding	a-1-4-1 Define the concepts of physical meaning and phenomena are used in pump design.	x	x	x
	a1-4-2 Classify the types of pumps.	x	x	x
Intellectual Skills	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to pump design based on the flow equations analysis and size.	x	x	x
	b2-1-1 Select the suitable solution methods (Analytical technique and modern computational) for design of pump problems based on the dimension analysis.			x
Professional Skill	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to pump design problems, using latest engineering techniques, skills, and tools.	x	x	x
	c2-1-1 Write and evaluate a professional report on Pump Construction and Instrumentation (shaft, impeller, and vanes).	x	x	
General Skills	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to pump design.	x	x	x
	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about pump design.	x	x	x

	d8-2-1 Exhibit the ability to learn more about pump design.			x

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		Teaching and Learning Method												
		Lecture	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Site visits	Self learning	Cooperative	Discovering	Modelling	Playing
Knowledge & understanding	a1-4-1	x		x										
	a1-4-2	x		x		x								
Intellectual Skills	b1-1-1	x		x	x	x								
	b2-1-1	x		x	x	x			x					
Professional Skills	c1-1-1			x	x	x	x		x	x	x			
	c2-1-1	x		x	x	x								
General Skills	d2-1-1	x		x	x	x			x	x	x			
	d4-1-1			x	x				x	x	x			
	d8-2-1			x	x				x	x	x			

10- Teaching and learning method for low capacity and outstanding Student

For low capacity students	Assign a portion of the office hours for those students.
	Give them specific tasks.
	Repeat the explanation of some of the material and tutorials.
	Assign a teaching assistance to follow up the performance of these groups of students.
For outstanding Students	Hand out project assignments to those students.
	Give them some research topics to be searched using the internet and conduct presentation.
	Encourage them to take parts in the running research projects.

11- Assessment

11.1 Assessment Methods

Course Intended Learning Outcome (ILOs)		Assessment Methods											
		Written Exam	Oral Exam	Tutorial Assessment	Project Assessment	Model Assessment	Report Assessment	Quiz assessment	Presentation Assessment	Discussion	Laboratory Test	Home Exm	Monitoring
Knowledge & Understanding	a1-4-1	x											
	a1-4-2	x											
Intellectual Skills	b1-1-1	x											
	b2-1-1	x											
Professional Skills	c1-1-1	x											
	c2-1-1	x											
General Skills	d2-1-1	x											
	d4-1-1	x											
	d8-2-1	x											

11.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	32 th
Mid term written Examination	---	
Quizzes	---	
laboratory examination	---	
Oral examination	---	
Semester work	---	
Total	100%	

12- Facilities required for teaching and learning

Teaching aids like, lecture room with audio-visual facilities, white board.

13- List of references:

13.1- Course Notes & Presentations

13.2- Essential Books (Text Books)

1- A., Esposito, “Fluid Power with Applications”, 7th ed., Pearson Education, 2009.

2- R. S., Khurmi, “A Textbook of Hydraulics, Fluid mechanics and Hydraulic Machines”, S. Chand & Company LTD., 2003.

3- I. J., Karassik, J. P., Messina, P., Cooper, and C. C., Heald,” Pump Handbook”, 3rd ed., MacGraw-Hill, 2001.

Course coordinator. Prof. / Abdoelhady Elabady

Head of the Department: Prof. Kamal Ameen Murad

Date:

Course Specification

Program on which the course is given	M. Sc. in Mechanical Power Engineering
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering
Department offering the course	Mechanical Power Engineering
Academic year/Level	1st year
Date of specification approval	***2020***

A- Basic Information

Title: Aerodynamics(1)	**Code Symbol**: MEP518	
Lecture	3 hours	
Tutorial		
Laboratory		
Total	3 hours	Bylaw 2003

B- Professional Information

1- Course Aims:

Students has been revised to include the main concepts in flow control and boundary layers, and their influence on modern wing design, as well as introducing recent advances in the understanding of fundamental fluid dynamics. Computational methods have been considered to estimate the main forces and momentums to design and research in the aeronautical industry.

2- Course Objectives

1- Is to establish geometrical features of the aircrafts and, wings and airfoils.
2- Is to estimate the required thrust force applied on different aircrafts.
3- Is to understand and to analysis of body pressure distribution for a perfect fluid and in addition to the real one.

3- Intended Learning Outcomes (ILOs)

NAQAAE Academic Reference Standards (ARS)	Program ILOs	Course ILOs
A. Knowledge and understanding		
A1. Theories, basics and specialized knowledge in the field of learning, as well as the subjects that affect his/her professional practice.	a1-2 Understand the theories, basics and specialized knowledge in the field of **Turbo-Machinery and Aero-Dynamics**.	a-1-2-1 Define the concepts of physical meaning and phenomena are used in aerodynamics.
A2- Mutual relation between professional aspects of professional practice and its effects on the Environment.	a2-1 Discuss Social effects of mechanical power engineering technologies.	a2-2-1 Report and recognize the professional aspects of aerodynamics applications and their effects on the Environment.
A4- Basics and principles of quality in professional practice in the field of specialization.	a4-1 Explain Quality Assurance concepts of different mechanical power components and systems development phases.	a4-1-1 Understand the dependence of the thermo-physical properties of the fluids on the natural of the flow and gas dynamics parameters.
B. Intellectual skills		
B1- Analyze and evaluate the information in the field of specialization, and relate it to solve problems.	b1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to mechanical power engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to water power engineering based on the flow equations analysis.

B3- Link and integrate diverse knowledge to solve professional problems.	b3-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems.	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to aerodynamics.
B5- Assess risks in professional practice in the field of specialization.	b5-1 Evaluate pros and cons of given methodologies for mechanical power engineering systems development.	b5-1-1 Evaluate pros and cons of given methodologies for mechanical power engineering systems development.
C. Professional and practical skills		
C1- Master the basic as well as the latest professional skills in the field of specialization.	c1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering techniques, skills, and tools.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to aerodynamics problems, using latest engineering techniques, skills, and tools.
C2- Write and evaluate technical and professional reports.	c.2-1 Write and evaluate a professional report on specialized related to mechanical power engineering technical matters.	c2-1-1 Write and evaluate a professional report on wings and aircrafts.
D. General and transferrable skills		
D2- Use information technology to improve his/her professional practice.	d2-1 Use state-of-the-art computer aided design tools for solving mechanical power engineering problems.	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to aerodynamics.

D5- Use different sources to obtain knowledge and information.	d5-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about aerodynamics.
D8- Learn independently and seek continuous learning.	d8-2 Seek continuous learning through continuous education, organizing and participating in seminars, workshops, national and international conferences.	d8-2-1 Seek continuous learning through continuous education, organizing and participating in seminars, workshops, national and international conferences.

4- Course Contents

Week No.	*Topic*	*Total Hours*	*Contact hrs*			*Course ILOs Covered (By No.)*
			Lec.	Tut.	Lab.	
Week-1 and 3	Fundamental Concepts	9	9	–	–	a1-5-1, a2-1-1, a5-1-1, a5-1-1, b1-1-1, b3-1-1, b5-1-1, c1-1-1, d2-1-1, d5-1-1, d8-2-1
Week-4 and 6	Properties variations	9	9	–	–	a1-5-1, a2-1-1, a5-1-1, a5-1-1, b1-1-1, b3-1-1, b5-1-1, c1-1-1, d2-1-1, d5-1-1, d8-2-1
Week-7 and 9	Body pressure distribution for a perfect fluid	9	9	–	–	a1-5-1, a2-1-1, a5-1-1, a5-1-1, b1-1-1, b3-1-1, b5-1-1, c1-1-1, d2-1-1, d5-1-1, d8-2-1
Week-10 and 12	Body pressure distribution for a real fluid	9	9	–	–	a1-5-1, a5-1-1, a5-1-1, b1-1-1, b5-1-1, c1-1-1, d2-1-1, d5-1-1, d8-2-1
Week-13 and 15	General force equation	9	9	–	–	a1-5-1, a2-1-1, a5-1-1, a5-1-1, b1-1-1, b3-1-1, b5-1-1, c1-1-1, d2-1-1, d5-1-1
Week-16 and 18	General moment equation	9	9	–	–	a1-5-1, a2-1-1, a5-1-1, a5-1-1, b1-1-1, b5-1-1, c1-1-1, d2-1-1, d5-1-1, d8-2-1
Week-19 and 21	Principles aerodynamic forces	9	9	–	–	a1-5-1, a2-1-1, a5-1-1, a5-1-1, b1-1-1, b3-1-1, c1-1-1, d2-1-1, d5-1-1, d8-2-1
Week-22 and 24	Principles aerodynamic moments	9	9	–	–	a1-5-1, a2-1-1, a5-1-1, b1-1-1, b3-1-1, b5-1-1, c1-1-1, d2-1-1, d5-1-1, d8-2-1
Week-25 and 27	Airfoils and Air craft types	9	9	–	–	a1-5-1, a2-1-1, a5-1-1, a5-1-1, b1-1-1, b3-1-1, c1-1-1, d2-1-1, d5-1-1
Week-28 and 30	Wings and Airplane components	9	9	–	–	a1-5-1, a2-1-1, , a5-1-1, b1-1-1, b3-1-1, c1-1-1, d2-1-1, d5-1-1,

						d8-2-1
Total		**90**	**90**	–	–	

5- Relationship between the course and the programme

Field	National Academic Reference Standard(NARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Programme Academic Standards that the course contributes in achieving.	A1 (a1-5), A2 (a2-1), A5 (a5-1)	B1 (b1-1), B3 (b3-1), B5 (b5-1)	C1 (c1-1), C2 (c2-1)	D2 (d2-1), D5 (d5-1), D8(d8-2)

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Disccretionry subjects	Total
---	---	**30%**	**70%**	---	---	---	**100%**

7- Course Topics.

Topic No.	Topic	Weeks
1st	Fundamental Concepts	1-6
2nd	General Force and Moments	7-12
3rd	Air Craft types	13-18
4th	Air craft compnents	19-24
5th	Wings and Airplane components	25-30

8- ILOs Matrix Topics

Course Intended Learning Outcomes (ILOs)		Course topics				
		1st	2nd	3rd	4th	5th
Knowledge & Understanding	a-1-2-1 Define the concepts of physical meaning and phenomena are used in aerodynamics.	x	x	x	x	x

	a2-2-1 Report and recognize the professional aspects of aerodynamics applications and their effects on the Environment.	x		x		
	a5-1-1 Explain Quality Assurance concepts of different mechanical power components and systems development phases.	x		x		x
Intellectual Skills	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to water power engineering based on the flow equations analysis.	x	x	x	x	x
	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to aerodynamics.				x	x
	b5-1-1 Evaluate pros and cons of given methodologies for mechanical power engineering systems development.			x	x	x
Professional Skill	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to water power engineering problems, using latest engineering techniques, skills, and tools.	x	x	x	x	x
	c2-1-1 Write and evaluate a professional report on water hammer.				x	
General Skills	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to aerodynamics.	x	x	x	x	x

	d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about aerodynamics.	x	x	x	x	x
	d8-2-1 Seek continuous learning through continuous education, organizing and participating in seminars, workshops, national and international conferences.	x	x	x	x	x

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		Teaching and Learning Method												
		Lecture	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Site visits	Self learning	Cooperative	Discovering	Modelling	Playing
Knowledge & understanding	a1-5-1	x		x		x								
	a2-2-1	x		x		x								
	a5-1-1	x		x		x								
Intellectual Skills	b1-1-1	x		x	x	x								
	b3-1-1	x		x	x	x			x					
	b5-1-1	x		x	x	x			x	x				
Professional Skills	c1-1-1			x	x	x	x		x	x	x			
	c2-1-1	x		x	x	x								
General Skills	d2-1-1	x		x	x	x			x	x	x			
	d5-1-1			x	x				x	x	x			
	d8-1-1			x	x				x	x	x			

10- Teaching and learning method for low capacity and outstanding Student

For low capacity students	Assign a portion of the office hours for those students.
	Give them specific tasks.
	Repeat the explanation of some of the material and tutorials.
	Assign a teaching assistance to follow up the performance of these groups of students.
For outstanding Students	Hand out project assignments to those students.
	Give them some research topics to be searched using the internet and conduct presentation.
	Encourage them to take parts in the running research projects.

11- Assessment

11.1 Assessment Methods

Course Intended Learning Outcome (ILOs)		Assessment Methods											
		Wirtten Exam	Oral Exam	Tutorial Assessment	Project Assessment	Model Assessment	Report Assessment	Quiz assessment	Presentation Assessment	Discussion	Laboratory Test	Home Exm	Monitoring
Knowledge & Understanding	a1-5-1	x											
	a2-2-1	x											
	a5-1-1	x											
Intellectual Skills	b1-1-1	x											
	b3-1-1	x											
	b5-1-1	x											
Professional Skills	c1-1-1	x											
	c2-1-1	x											
General Skills	d2-1-1	x											
	d5-1-1	x											
	d8-1-1	x											

11.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	32 th

Mid term written Examination	---	
Quizzes	---	
laboratory examination	---	
Oral examination	---	
Semester work	---	
Total	100%	

12- Facilities required for teaching and learning

Teaching aids like, lecture room with audio-visual facilities, white board.

13- List of references:

Essential Books (Text Books)

1- Fundamentals of Aerodynamics (McGraw-Hill International Editions: Mechanical Engineering Series), Tata McGraw-Hill, 1985.
2- Fundamentals of Aerodynamics (Mcgraw Hill Series in Aeronautical and Aerospace Engineering), John Anderson, 2010.

Recommended Books

1- Fundamentals of Astrodynamics (Dover Books on Aeronautical Engineering) by Roger R. Bate, 1971.
2- Jet Engines: Fundamentals of Theory, Design and Operation, Klaus Hunecke, 1997.

Course Coordinator: Prof. Dr.Tharwat Messiha Farag

Head of Department: Prof. Dr. Kamal Ameen Morad

Date :

Course Specification

Program on which the course is given	Mechanical Power Engineering
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering
Department offering the course	Mechanical Power Engineering
Academic year/Level	MSc.
Date of specification approval	***2020***

A- Basic Information

Title: Gas Dynamics (1)	**Code Symbol**: **MEP 519**	
Lecture	3 hours	
Tutorial		
Laboratory		
Total	3 hours	Bylaw 2003
Second term	prerequisite	-

B- Professional Information

1- Course Aims:

The aims of this course are to provide the Student, upon completing the mechanical power engineering programme, with the basic knowledge and skills of how to apply gas dynamics laws in mechanical power engineering.

Course Objectives

On completion of this course, the student should have sufficient broad knowledge in mechanical engineering to:

1- Demonstrate knowledge of gas dynamics;
2- Classify and describe the performance characteristics of theturbomachines;
3- Demonstrate knowledge of the basic construction of urbomachines;
4- Describe the construction of turbomachines.

2- Intended Learning Outcomes (ILOs)

NAQAAE Academic Reference Standards (ARS)	Program ILOs	Course ILOs
A. Knowledge and understanding		
A1. Theories, basics and specialized knowledge in the field of learning, as well as the subjects that affect his/her professional practice.	a1-2 Understand the theories, basics and specialized knowledge in the field of Turbo-Machinery and Aero-Dynamics.	a-1-2-1 Define the concepts of physical meaning and phenomena are used in gas dynamics.
A2- Mutual relation between professional aspects of professional practice and its effects on the Environment.	a2-1 Discuss Social effects of mechanical power engineering technologies.	a2-2-1 Report and recognize the professional aspects of gas dynamics applications and their effects on the Environment.
A5- Basics and principles of quality in professional practice in the field of specialization.	a5-1 Explain Quality Assurance concepts of different mechanical power components and systems development phases.	a5-1-1 Explain Quality Assurance concepts of different mechanical power components and systems development phases.
B. Intellectual skills		
B1- Analyze and evaluate the information in the field of specialization, and relate it to solve problems.	b1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to mechanical power engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to gas power engineering based on the flow equations analysis.
B3- Link and integrate diverse knowledge to solve professional problems.	b3-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems.	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to gas dynamics.

B5- Assess risks in professional practice in the field of specialization.	b5-1 Evaluate pros and cons of given methodologies for mechanical power engineering systems development.	b5-1-1 Evaluate pros and cons of given methodologies for mechanical power engineering systems development.
C. Professional and practical skills		
C1- Master the basic as well as the latest professional skills in the field of specialization.	c1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering techniques, skills, and tools.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to gas dynamics problems, using latest engineering techniques, skills, and tools.
C2- Write and evaluate technical and professional reports.	c.2-1 Write and evaluate a professional report on specialized related to mechanical power engineering technical matters.	c2-1-1 Write and evaluate a professional report on wings and aircrafts.
D. General and transferrable skills		
D2- Use information technology to improve his/her professional practice.	d2-1 Use state-of-the-art computer aided design tools for solving mechanical power engineering problems.	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to gas dynamics.
D5- Use different sources to obtain knowledge and information.	d5-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about gas dynamics.

3-Course Contents

Week No.	*Topic*	*Total Hours*	*Contact hrs*			*Course ILOs Covered (By No.)*
			Lec.	**Tut.**	**Lab.**	
Week,1-4	Introduction compressible flow	3	3	-	-	a1-2-1, a2-2-1, a5-1-1, b1-1-1, b3-1-1, b5-1-1, c1-1-1, d2-1-1, d5-1-1
Week-5-10	Variable area flow	3	3	-	-	a1-2-1, a2-2-1, a5-1-1, b1-1-1, b3-1-1, b5-1-1, c1-1-1, d2-1-1, d5-1-1
Week-11-14	Introduction to shock wave	3	3	-	-	a1-2-1, a2-2-1, a5-1-1, b1-1-1, b3-1-1, b5-1-1, c1-1-1, d2-1-1, d5-1-1
Week-15-19	Normal and oblique shock waves	3	3	-	-	a1-2-1, a2-2-1, a5-1-1, b1-1-1, b3-1-1, b5-1-1, c1-1-1, d2-1-1, d5-1-1
Week-20-22	Diabatic flow	3	3	-	-	a1-2-1, a2-2-1, a5-1-1, b1-1-1, b3-1-1, b5-1-1, c1-1-1, d2-1-1, d5-1-1
Week-23-25	Laminar flow	3	3	-	-	a1-2-1, a2-2-1, a5-1-1, b1-1-1, b3-1-1, b5-1-1, c1-1-1, d2-1-1, d5-1-1
Week-26-30	Two dimensional compressible flow	3	3	-	-	a1-2-1, a2-2-1, a5-1-1, b1-1-1, b3-1-1, b5-1-1, c1-1-1, d2-1-1, d5-1-1

4- Relationship between the course and the programme

Field	National Academic Reference Standard(NARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Program Academic Standards that the course contribute in achieving	A_1, A_2, and A_5	B_1 , B_3 and B_5	C_1 and C_2	D2 and D5

5- Course Subject Area:

A	**B**	**C**	**D**	**E**	**F**	**G**	
Humanities and Social Science	**Mathematics and Basic Sciences**	**Basic Engineering Science**	**Applied Engineering and Design**	**Computer Applications and ICT**	**Projects and practice**	**Disccretionry subjects**	**Total**
---	---	**30%**	**70%**				**100%**

6- Course Topics:

Topic No.	Topic	Weeks
1st	Introduction compressible flow	1-2
2nd	Introduction compressible flow	3-4
3rd	Variable area flow	5-6
4th	Variable area flow	7-8
5th	Variable area flow	9-10
6th	Introduction to shock wave	11
7th	Introduction to shock wave	12-13
9th	Normal and oblique shock waves	14-16
10th	Normal and oblique shock waves	17-18
11th	Diabatic flow	19-20
12th	Laminar flow	21-22
13th	Two dimensional compressible flow	23-25
14th	Two dimensional compressible flow	26-30

8- ILOs Matrix Topics:

Course Intended Learning Outcomes (ILOs)		Course topics												
		1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th
Knowledge & Understanding	a1-5 Understand the theories, basics and specialized knowledge in the field of Turbo-Machinery and Aero-Dynamics.	X												
	a2-1 Discuss Social effects of mechanical power engineering technologies.		X											
	a5-1 Explain Quality Assurance concepts of different mechanical power components and systems development phases.		X											
Intellectual Skills	b1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to mechanical power engineering.		X											

	b3-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems.		X											
	b5-1 Evaluate pros and cons of given methodologies for mechanical power engineering systems development.	X												
Professional Skill	c1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering techniques, skills, and tools.	X	X											
	c.2-1 Write and evaluate a professional report on specialized related to mechanical power engineering technical matters.	X	X											
General Skills	d2-1 Use state-of-the-art computer aided design tools for solving mechanical power engineering problems.	X												
	d5-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	X												

9- Teaching and Learning Method:

Course Intended learning	Teaching and Learning Method

outcomes (ILOs)		Lecture	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Site visits	Self learning	Cooperative	Discovering	Modelling	Playing
Knowledge & understanding	a2-1	x			x	x								
	a2-2	x			x	x								
	a5-1	x			x	x								
Intellectual Skills	b1-1	x			x	x								
	b1-1	x												
	b5-1	x												
Professional Skills	c1-1	x			x	x								
	c2-1	x			x									
General Skills	d2-1									x	x			
	d5-1									x	x			

10- Teaching and learning method for low capacity and outstanding Student:

For low capacity students	**Assign a portion of the office hours for those students.**
	Give them specific tasks.
	Repeat the explanation of some of the material and tutorials.
	Assign a teaching assistance to follow up the performance of this group of students.
For outstanding Students	**Hand out project assignments to those students.**
	Give them some research topics to be searched using the internet and conduct presentation.
	Encourage them to take parts in the running research projects.

11- Assessment

11.1 Assessment Methods:

Course Intended Learning Outcome (ILOs)	Assessment Methods

		Written Exam	Oral Exam	Tutorial Assessment	Project Assessment	Model Assessment	Report Assessment	Quiz assessment	Presentation Assessment	Discussion	Laboratory Test	Home Exam	Monitoring
Knowledge & Understanding	**a2-1**	**x**											
	a2-2	**x**											
	a5-1	**x**		**x**									
Intellectual Skills	**b1-1**	**x**		**x**			**x**				**x**		
	b1-1	**x**											
	b5-1	**x**											
Professional Skills	**c1-1**	**x**		**x**									
	c2-1	**x**									**x**		
General Skills	**d2-1**						**x**			**x**			
	d5-1						**x**			**x**			

11.2 Assessment Schedule and Grades Distribution:

Assessment Method	Percentage	week
Final Examination	**100**	**32th**
Mid term written Examination1	**-**	
Mid term written Examination 2	**-**	**-**
Mid term laboratory assessment	**-**	**-**
End of term laboratory examination	**-**	**-**
Tutorial and report assessment	**-**	
Total	**100%**	

12- Facilities required for teaching and learning

Library Usage:

Students should be encouraged to use library technical resources in the preparation of laboratory reports and oral presentation. At least one oral presentation should involve a significant component of library research to encourage this component of study.

13- List of references:

6.1- Lectures Handout

6.2- Essential Books (Text Books) lecture notes

Recommended Books

- Compressible Fluid Flow, P.H. Oosthuizen and W.E. Carscallen., McGraw-Hill, 1997.
- Modern Compressible Flow, J.D. Anderson, Jr., McGraw-Hill, 1990.

Course Prof./ Dr. Mohamed Reda AbdelKader

Programme coordinator:Dr. Yassen Elsayed

Head of the Department: Prof. Dr. Kamal Ameen Murad

Date:

Course Specification

Program on which the course is given	**Mechanical Engineering**
Major or minor element of program	**Major**
Department offering the program	**Mechanical Engineering**
Department offering the course	**Mechanical Engineering**
Academic year/Level	**MSc.**
Date of specification approval	***2020***

A- Basic Information

Title: **Gas and steam turbines**	**Code Symbol**: **MPE 521**	
Lecture	**3 hours**	
Tutorial		
Laboratory		
Total	**3 hours**	**Bylaw 2003**
First term	**prerequisite**	-

B- Professional Information

1- Course Aims:

The aims of this course are to provide the Student,upon completing the Mechanical Engineering Programme, with the basic knowledge and skills of the principle working of turbomachines (steam turbines, gas turbines), the general classification and analysis. This course will also provide students with the ability to select and design the appropriate stage need to increase the thermal efficiency.

Course Objectives

1- **Demonstration of the knowledge and understanding of the importance of turbomachines**
2- **Defination of the requirements of the turbomachine design**
3- **Recognizability of the different types of turbomachines.**
4- **Evaluation of the suitable protection schemes for turbomachines**
5- **Analysis of different steam turbines, gas turbines**
6- **Understand the main operating characteristics of steam turbines, gas turbines**
7- **Be able to experimentally determine pressure – volume curves for the turbomachines.**

8- Intended Learning Outcomes (ILOs)

NAQAAE Academic Reference Standards (ARS)	Program ILOs	Course ILOs
A. Knowledge and understanding		
A1. Theories, basics and specialized knowledge in the field of learning, as well as the subjects that affect his/her professional practice.	a1-3 Demonstrate sufficient essential knowledge and a deep understanding of the theories, basics and specialized knowledgein the field ofgas turbine and diesel power plants.	a1-3-1 Demonstrate sufficient essential knowledge and a deep understanding of the theories, basics and specialized knowledgein Gas and steam turbines.
B. Intellectual skills		

B1- Define and analyze problems in the field of specialization and sorting them according to priorities	b1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to mechanical power engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems in Gas and steam turbines.
	b1-2 Interpret, analyze, and evaluate a given system specification information and relate it to the design of the required system.	b1-2-1 How to analyze the characteristics and performance of different components of Gas and steam turbines.
B4- Risk assessment in the professional practices.	b4-1 Evaluate pros and cons of given methodologies for mechanical power engineering systems development.	b4-1-1 How to develop the operation of the Gas and steam turbines and increase its efficiencies.
C. Professional and practical skills		
C1- Apply professional skills in the field of specialization.	c1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering techniques, skills, and tools.	c1-1-1 How to solve the operating problems in Gas and steam turbines.
C2- Write professional reports.	c.2-1 Write and evaluate a professional report on specialized related to mechanical power engineering technical matters.	c2-1-1 How to write a technical reports about the operation and performance of Gas and steam turbines.
D. General and transferrable skills		
D2- Use information technology to improve his/her professional practice.	d2-1 Use state-of-the-art computer aided design tools for solving mechanical power engineering problems.	d2-1-1 How to use the advanced computer programs to solve the problems and design of the different components of Gas and steam turbines.
D4- Use different resources to obtain knowledge and information.	d4-1 Use different resources of information like libraries, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d4-1-1 How to upgrade the information about the Gas and steam turbines.

9- Course Contents

Week No.	*Topic*	*Total Hours*	*Contact hrs*			*Course ILOs Covered (By No.)*
			Lec.	Tut.	Lab.	

Week-1,2	**1. Introduction: Dimensional Analysis—BasicThermodynamics and Fluid Mechanics** **1.1 Introduction to Turbomachinery, Types of Turbomachines, Compressible Flow Machines** **1.2 Basic Thermodynamics, Fluid Mechanics,and Definitions of Efficiency**	**3**	**3**	**-**	**-**	**a1-3**
Week-3,4	**1.3 Continuity Equation** **1.4 The First Law of Thermodynamics** **1.5 Newton's Second Law of Motion** **1.6 The Second Law of Thermodynamics: Entropy**	**3**	**3**	**-**	**-**	**a1-3**
Week-5,6	**1.7 Efficiency and Losses of Steam and Gas Turbines.** **1.8 Nozzle and diffuser Efficiency, Energy Transfer in Turbomachinery, The Euler Turbine Equation** **1.9 Examplesand Problems.**	**3**	**3**	**-**	**-**	**a1-3**
Week-7,8	**2. Steam Turbines** **2.1 Introduction, Steam Nozzles, Nozzle Efficiency** **2.2The Reheat Factor** **2.3 Metastable Equilibrium**	**3**	**3**	**-**	**-**	**a1-3**
Week-9,10	**2.4 Stage Design** **2.5 Impulse Stage** **2.6 The Impulse Steam Turbine** **2.7 Reaction Turbine**	**3**	**3**	**-**	**-**	**a1-3**
Week-11,12	**2.8 Pressure Compounding (The Rateau Turbine)** **2.9 Velocity Compounding (The Curtis Turbine),**	**3**	**3**	**-**	**-**	**a1.3, b1-1 & d4-1**
Week-14,13	**2.10 Axial Flow Steam Turbines, Degree of Reaction.** **2.11 Cascade design** **2.12 Illustrative example and solved problems**	**3**	**3**	**-**	**-**	**b1-2, & d2-1**
Week-15-17	**3. Axial Flow and Radial Flow Gas Turbines** **3.1 Introduction to Axial Flow Turbines,** **3.2 Velocity Triangles and Work Output**	**3**	**3**	**-**	**-**	**a1-3 & b2-1**
Week-18,19	**3.3 Degree of Reaction** **3.4 Blade-Loading Coefficient, Stator (Nozzle) and Rotor Losses**	**3**	**3**	**-**	**-**	**b2-1 & c1-1**
Week-20,21	**3.5 Radial Flow Turbine, Velocity Diagrams and Thermodynamic, Analysis** **3.6 Turbine Efficiency, Application of Specific Speed** **3.7 Illustrative example and solved problems.**	**3**	**3**	**-**	**-**	**c2-2**
Week-22,24	**4. Axial Flow turbine** **4.1 Introduction, Velocity Diagram, Degree of Reaction, Stage Loading, Lift-and-Drag Coefficients** **4.2 Cascade Nomenclature and Terminology**	**3**	**3**	**-**	**-**	**a1-3, b1-2& d2-1**
Week-25,28	**4.3 Multi-Stage Performance** **4.5- Illustrative example and solved problems**	**3**	**3**	**-**	**-**	**a1-3, c1-1**
Week-27,30	**Practical examination**					

10- Relationship between the course and the programme

Field	**National Academic Reference Standard(NARS)**			
	Knowledge & Understanding	**Intellectual Skills**	**Professional Skills**	**General Skills**
ProgrammeAcademic Standards that the course contribute in achieving	**A_1**	**B1, B4**	**C_1 ,C2**	**D2, D4**

11- Course Subject Area:

A	**B**	**C**	**D**	**E**	**F**	**G**	
Humanities and Social Science	**Mathematics and Basic Sciences**	**Basic Engineering Science**	**Applied Engineering And Design**	**Computer Applications and ICT**	**Projects and practice**	**Disccretionry subjects**	**Total**
---	---	**30%**	**70%**				**100%**

12- Course Topics.

Topic No.	Topic	Weeks
1st	Definitions, Dimensional Analysis—Basic Thermodynamics and Fluid Mechanics, introduction to turbomachinery, Efficiency	1-4
2nd	Classification of Turbomachines, Compressible Flow Machines Basic Thermodynamics, Fluid Mechanics, and Definitions of Efficiency.	5
3rd	Definitions, application of steam impulse and reaction turbines, single and multi stages, cascade design	6-14
4th	Definition of Axial and Radial flow gas turbines Velocity Diagrams and Thermodynamic, Analysis, Turbine Efficiency, Application of Specific Speed	15-21
5th	Theory of twisted blades, Velocity Diagram, Degree of Reaction, Stage Loading, Lift-and-Drag Coefficients, Cascade Nomenclature and Terminology.	22-30

8- ILOs Matrix Topics

Course Intended Learning Outcomes (ILOs)		Course topics					
		1st	2nd	3rd	4th	5th	6th
Knowledge & Understanding	a1-3-1 Demonstrate sufficient essential knowledge and a deep understanding of the theories, basics and specialized knowledgein Gas and steam turbines.	x					
Intellectual Skills	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems in Gas and steam turbines.			x	x		
	b1-2-1 How to analyze the characteristics and performance of different components of Gas and steam turbines.				x		x
	b4-1-1 How to develop the operation of the Gas and steam turbines and increase its efficiencies.					x	
Professional Skill	c1-1-1 How to solve the operating problems in Gas and steam turbines.		x	x			
	c2-1-1 How to write a technical reports about the operation and performance of Gas and steam turbines.			x	x		x
General Skills	d2-1 Use state-of-the-art computer aided design tools for solving mechanical power engineering problems.		x	x			
	d4-1 Use different resources of information like libraries, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.			x	x		x

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		8- Teaching and Learning Method:												
		Lecture	Presentation and Movies	Discussion	Tutorial	Problemsolving	Brain storming	Projects	Site visits	Self learning	Cooperative	Discovering	Modelling	Playing
Knowledge & understanding	a1-3	x			x	x								
Intellectual Skills	b1-1	x			x	x								
	B1-2	x	x											
	B4-1		x	x		x								
Professional Skills	C1-1	x			x	x								
	C2-1	x			x									
General Skills	D2-1									x	x			
	D4-1									x	x			

10- Teaching and learning method for low capacity and outstanding Student

For low capacity students	Assigna portion of the office hoursfor those students. Contact him by E.mail
	Give them specific tasks.
	Repeat the explanation of some of the material and tutorials.
	Assign a teaching assistance to follow up the performance of these student groups.
For outstanding Students	Hand out project assignments to those students.
	Give them some research topics to be searched using the internet and conduct presentation.
	Encourage them to take parts in the running research projects.

11- Assessment

11.1 Assessment Methods

Course Intended Learning Outcome (ILOs)		Assessment Methods											
		Wirtten Exam	Oral Exam	Tutorial Assessment	Project Assessment	Model Assessment	Report Assessment	Quiz assessment	Presentation Assessment	Disscussion	Laboratory Test	Home Exm	Monitoring
Knowledge &Understanding	A1-3	x											
IntellectualSkills	b1-1	x		x			x				x		
	B1-2	x		x			x				x		
	B4-1	x		x			x				x		
Professional Skills	C1-1	x		x									
	C2-1	x									x		
General Skills	D2-1						x			x			
	D4-1						x			x			

11.2 Assessment Schedule and GradesDistribution

Assessment Method	Percentage	week
Quiz 1		
1st laboratory assessment		
Mid term written Examination		
Quiz 2		
Tutorial and report assessment		
Quiz 3		
2nd laboratory assessment		
Final term laboratory examination		
Final Examination	100	32th
Total	100%	

12- Facilities required for teaching and learning

A. laboratory Usage:

Students are expected to prepare and conduct some laboratory experiments relating to determination of the turbomachine efficiency, reheat factor and specific speedand establishment of different initial conditions,flow characteristics and system arrangements. Also to test different geometries of blade cascade and to prepare lab reports.

B. Library Usage:

Students should be encouraged to use library technical resources in the preparation of laboratory reports and oral presentation. At least one oral presentation should involve a significant component of library research to encourage this component of study.

13- List of references:

1- White, F. M. (2008), Fluid Mechanics, Sixth Edition, McGraw-Hill.

2- Rama S.R. Gorla and Aijaz A. Khan, (2003) "Turbomachinery "Design and Theory", Marcel Dekker, Inc.

3- L. L. FaulknerMECHANICAL ENGINEERING, A Series of Textbooks and Reference Books, Columbus Division, Battelle Memorial Instituteand Department of Mechanical Engineering, The Ohio State University, Columbus, Ohio

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Course Prof. Gamal Hafez

Programme coordinator:Dr. YassenElsayed

Head of the Department: Prof. Kamal Ameen Murad

Date: 10/2019

Course Specification

Program on which the course is given	Post Studies in Mechanical Power Engineering (MSc)
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering
Department offering the course	Preparing courses in Mechanical Power Engineering
Academic year/Level	***2020***
Date of specification approval	

A- Basic Information

Title: **Pumps and Compressors**	**Code Symbol**: **MEP 522**	
Lecture	3 hours	
Tutorial	- hours	
Laboratory	- hours	
Total	3 hours	Bylaw 2012
Second term	prerequisite	-

B- Professional Information

1- Course Aims:

The course of Pneumatic and Hydraulic Systems has been designed in order to give postgraduate students the necessary knowledge and skills for dealing with Pumps and Compressors. The course includes classification, design, and performance testing of pumps and compressors.

2- Course Objectives

1. Introduce the importance and uses of the Pumps and Compressors in engineering.
2. Demonstrate the main components of both Pumps and Compressors.
3. Summarize the maintenance and repairing the Pumps and Compressors.
4. Describe different kinds of performance curves that are necessary for describing the performance of Pumps and Compressors.
5. introduce basic principles of design and operation procedure related to Pumps and Compressors
6. Train the student for Trouble shooting related to Pumps and Compressors.

3- Intended Learning Outcomes (ILOs)

NAQAAE Academic Reference Standards (ARS)	Program ILOs	Course ILOs
A. Knowledge and understanding		
A1. Theories, basics and specialized knowledge in the field of learning, as well as the subjects that affect his/her professional practice.	a1-2 Understand the theories, basics and specialized knowledge in the field of **Fluid Mechanics and Hydraulics**.	a-1-2-1-understanding basic principles of fluid mechanics and thermodynamics as related to Pumps and Compressors a-1-2-2 knowledge of the main components of Pumps and Compressors a-1-2-3 identifying basic principles of design and operation procedure related to Pumps and Compressors
B. Intellectual skills		
B1- Analyze and evaluate the information in the field of specialization, and relate it to solve problems.	b1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to mechanical power engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to pump and compressor selections based on the flow equations analysis.
B2- Solve specialized problems with lack of some data and variables, (incomplete data).	b2-1 Apply broad knowledge of modern computational methods and think critically to solve unstructured problems (with incomplete data) related to mechanical power engineering.	b2-1-1 Select the suitable solution methods (Analytical technique and modern computational) for design of pumps and compressors data sheets problems based on the flow equations analysis.
C. Professional and practical skills		
C1- Master the basic as well as the latest professional skills in the field of specialization.	c1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering techniques, skills, and tools.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to pumps and compressors problems, using latest engineering techniques, skills, and tools.

C2- Write and evaluate technical and professional reports.	c.2-1 Write and evaluate a professional report on specialized related to mechanical power engineering technical matters.	c2-1-1 Write and evaluate a professional report on manufacture philosophy.
D. General and transferrable skills		
D2- Use information technology to improve his/her professional practice.	d2-1 Use state-of-the-art computer aided design tools for solving mechanical power engineering problems.	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to pumps and compressors
D5- Use different sources to obtain knowledge and information.	d5-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about pumps and compressors.
D8- Learn independently and seek continuous learning.	d8-2 Seek continuous learning through continuous education, organizing and participating in seminars, workshops, national and international conferences.	d8-2-1 Exhibit the ability to learn more about pumps and compressors.

4- Course Contents

Week No.	***Topic***	***Total Hours***	***Contact hrs***			***Course ILOs Covered (By No.)***
			Lec.	**Tut.**	**Lab.**	
Week-1 and 5	Introduction & Classification of fluid Machinery	15	15	–	–	a1-2-1, a1-2-2, a1-2-3, b1-1-1, c1-1-1, d2-1-1, d5-1-1, d8-2-1
Week-6 and 10	Governing equations	15	15	–	–	a1-2-1, a1-2-2, a1-2-3, b1-1-1, c1-1-1, d2-1-1, d5-1-1, d8-2-1
Week-1 and 15	2D Cascade	15	15	–	–	a1-2-1, a1-2-2, a1-2-3, b1-1-1, c1-1-1, d2-1-1, d5-1-1, d8-2-1
Week-16 and 20	Pumps	15	15	–	–	a1-2-1, a1-2-2, a1-2-3, b1-1-1, c1-1-1, d2-1-1, d5-1-1, d8-2-1
Week-21 and 25	Compressors	15	15	–	–	a1-2-1, a1-2-2, a1-2-3, b1-1-1, c1-1-1, d2-1-1, d5-1-1, d8-2-1
Week-26 and 30	Maintenances and safety of hydraulic and pneumatic circuits	15	15	–	–	a1-2-1, a1-2-2, a1-2-3, b1-1-1, c1-1-1, d2-1-1, d5-1-1, d8-2-1
Total		**90**	**90**	–	–	

5- Relationship between the course and the programme

Field	National Academic Reference Standard(NARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Programme Academic Standards that the course contribute in achieving	-2)1A1 (a	B1 (b1-1), B2 (b2-1)	C1 (c1-1), C2 (c2-1)	D2 (d2-1), D4 (d5-1), D7 (d8-2)

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Disccretionry subjects	Total
---	---	**30%**	**70%**	---	---	---	**100%**

7- Course Topics.

Topic No.	Topic	Weeks
1st	Introduction & Classification of fluid Machinery	1-6
2nd	Governing equations , 2D Cascade	7-12
3rd	Pumps	13-18
4th	Compressors	19-24
5th	Maintenances and safety of hydraulic and pneumatic circuits	25-30

8- ILOs Matrix Topics

Course Intended Learning Outcomes (ILOs)		Course topics				
		1st	2nd	3rd	4th	5th
Knowledge & Understanding	a-1-2-1-understanding basic principles of fluid mechanics and thermodynamics as related to Pumps and Compressors a-1-2-2 knowledge of the main components of Pumps and Compressors a-1-2-3 identifying basic principles of design and operation procedure related to Pumps and Compressors	x	x	x	x	x
Intellectual Skills	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to operation and maintenance of pumps based on the flow equations analysis.	x	x	x	x	x

	b2-1-1 Select the suitable solution methods (Analytical technique and modern computational) for design of pump data sheets problems based on the flow equations analysis.					x
Professional Skill	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to operation and maintenance of pumps problems, using latest engineering techniques, skills, and tools.	x	x	x	x	x
	c2-1-1 Write and evaluate a professional report on pumps sealing, materials, and accessories.			x		
General Skills	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to operation and maintenance of pumps.	x	x	x	x	x
	d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about operation and maintenance of pumps.	x	x	x	x	x
	d8-2-1 Exhibit the ability to learn more about operation and maintenance of pumps.	x	x		x	

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		Teaching and Learning Method												
		Lecture	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Site visits	Self learning	Cooperative	Discovering	Modelling	Playing
Knowledge & understanding	a1-2-1	x		x										
Intellectual Skills	b1-1-1	x		x	x	x								
	b2-1-1	x		x	x	x			x					

Professional Skills	c1-1-1			x	x	x	x		x	x	x			
	c2-1-1	x		x	x	x								
General Skills	d2-1-1	x		x	x	x			x	x	x			
	d5-1-1			x	x				x	x	x			
	d7-2-1			x	x				x	x	x			

10- Teaching and learning method for low capacity and outstanding Student

For low capacity students	Assign a portion of the office hours for those students.
	Give them specific tasks.
	Repeat the explanation of some of the material and tutorials.
	Assign a teaching assistance to follow up the performance of these groups of students.
For outstanding Students	Hand out project assignments to those students.
	Give them some research topics to be searched using the internet and conduct presentation.
	Encourage them to take parts in the running research projects.

11- Assessment

11.1 Assessment Methods

Course Intended Learning Outcome (ILOs)		Assessment Methods											
		Wirtten Exam	Oral Exam	Tutorial Assessment	Project Assessment	Model Assessment	Report Assessment	Quiz assessment	Presentation Assessment	Discussion	Laboratory Test	Home Exm	Monitoring
Knowledge & Understanding	a1-2-1	x											
Intellectual Skills	b1-1-1	x											
	b2-1-1	x											
Professional Skills	c1-1-1	x											
	c2-1-1	x											
General Skills	d2-1-1	x											
	d5-1-1	x											
	d8-2-1	x											

11.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	32 th
Mid term written Examination	---	
Quizzes	---	

laboratory examination	---	
Oral examination	---	
Semester work	---	
Total	100%	

12- Facilities required for teaching and learning

Teaching aids like lecture room with audio visual facilities, white board, tutorial room and models.

13- List of references:

Essential Books (Text Books)

6.1- Course Notes & CD

6.2-Essential Books (Text Books):

1- Dixon " Fluid Mechanics and Heat transfer of Turbomachinery", 2007.

3- C. P. Kothandaraman , and R. Rudramoorthy "Fluid Mechanics and Machinery ", New Age, 2nd edition, 2009.

4- Frank M. White, "Fluid Mechanics", 4th ed., McGraw-Hill, INC. 1999.

5- I. J. Karassik, J. P., Messina, P., Cooper, and C. C., Heald," Pump Handbook", 3rd ed., MacGraw-Hill, 2001.

6- محمود فوزي هبدالعزيز ، المضخات الهيدروليكية ، الاسس التكنولوجية -

7- 2000 ، محمود ربيع الملط ، هندسة المضخات ، منشأة المعارف ، جلال حزي وشركاه -

Course Coordinator:

Course Prof. Dr. Mohamed El-Ghandour El-Ghandour

Programme coordinator: Dr. Yassen ElSayed Yassen

Head of the Department: Prof. Dr. Kamal Ameen Murad

Date:

Course Specification

Program on which the course is given	M. Sc. in Mechanical Power Engineering
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering
Department offering the course	Mechanical Power Engineering
Academic year/Level	1st year
Date of specification approval	***2020***

A- Basic Information

Title: **Advanced Fluid Mechanics**	**Code Symbol**: **MEP526**	
Lecture	3 hours	
Tutorial		
Laboratory		
Total	3 hours	Bylaw 2003

B- Professional Information

1- Course Aims:

The major aim of this course is to understand the basic concepts of fluid dynamics, thermal fluid and get better understanding of different flow regimes. To help the post graduate students to add more information about laminar and turbulent flows, viscous and non-viscous fluids, Laminar and turbulent flows, Turbulence modeling, fluid measurements, and Multiple-pipe systems. Also, get more knowledge about the Total head losses in pipe systems and its engineering application. Analyze the fluid around immersed bodies. This course will also provide students with the ability to select and design of the experimental model by using dimensional analysis and similarity. Discuss the all phenomena associated with such type of flows and different parameters.

2- Course Objectives

1- Demonstration of the knowledge and understanding of the importance of study of advanced fluid mechanics
2- Definitions of the viscous flows, dimensional analysis and similarity, and fluid around immersed bodies as related to practical applications.
3- Reconcilability of the different equations for fluid flow with different applications.
4- Analysis of different fluid mechanics problems.

3- Intended Learning Outcomes (ILOs)

NAQAAE Academic Reference Standards (ARS)	Program ILOs	Course ILOs
A. Knowledge and understanding		
A1. Theories, basics and specialized knowledge in the field of learning, as well as the subjects that affect his/her professional practice.	a1-4 Demonstrate sufficient essential knowledge and a deep understanding of the theories, basics and specialized knowledge in the field of **Fluids Engineering and Pumping**.	a1-4-1 Understand basics of fluid mechanics and hydraulics
B. Intellectual skills		
B1- Define and analyze problems in the field of specialization and sorting them according to priorities	b1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to mechanical power engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to fluid mechanics and mechanical power engineering.
B3- Analytical reading researches and subjects relevant to the field of specialization**.**	b3-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems.	b3-1-1 Select the suitable measuring scheme for boundary layer thickness based on analysis.
C. Professional and practical skills		
C1- Apply professional skills in the field of specialization.	c1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering techniques,	c1-1-1 Apply the knowledge of mathematics and fluid mechanics to fluid flow in motion.

	skills, and tools.	
C2- Write professional reports.	c.2-1 Write and evaluate a professional report on specialized related to mechanical power engineering technical matters.	c2-1-1 Write and evaluate a professional report on fluid mechanics problems.
D. General and transferable skills		
D2- Use information technology to improve his/her professional practice.	d2-1 Use state-of-the-art computer aided design tools for solving mechanical power engineering problems.	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to fluid mechanics.
D4- Use different sources to obtain knowledge and information.	d4-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about advanced fluid mechanics.

4- Course Contents

Week No.	*Topic*	*Total Hours*	*Contact hrs*			*Course ILOs Covered (By No.)*
			Lec.	Tut.	Lab.	
Week-1:4	**Kinematics of fluid motion**	**12**	**9**	**3**	-	a1-4
Week-5:8	**Flow of incompressible ideal fluids**	**12**	**9**	**3**	-	a1-4,b-1-1,b3-1
Week-9:12	**Flow of compressible ideal fluids**	**12**	**9**	**3**	-	a1-4, b1-1, c1-1
Week-13:16	**Impulse momentum principle**	**12**	**9**	**3**	-	a1-4, b1-1, c1-1
Week-17:19	**Similitude and dimensional analysis**	**9**	**6**	**3**		a1-4, b1-1, c1-1

Week20:22	**Fluid flow in pipes**	**9**	**6**	**3**	-	a1-4, b1-1, c2-1
Week23:27	**Fluid flow around immersed bodes**	**9**	**6**	**3**	-	a1-4, b3-1, c2-1
Week28:30	**Fluid measurements**	**9**	**6**	**3**	-	a1-4,b1-1, c2-1, d2-1
Total		**84**	**60**	**24**		

5- Relationship between the course and the programme

Field	National Academic Reference Standard(NARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Programme Academic Standards that the course contribute in achieving	A1	B1 & B3	C1 & C2	D1 & D4

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Disccretionry subjects	Total
---	---	**30%**	**70%**	---	---	---	**100%**

7- Course Topics.

Topic No.	Topic	Weeks
1st	**Kinematics of fluid motion**	**1-5**
2nd	**Flow of incompressible ideal fluids**	**6-13**
3rd	**Flow of compressible ideal fluids**	**16-21**
4th	**Similitude and dimensional analysis**	**22-24**
5th	**Fluid flow in pipes**	**25,26**
6th	**Fluid flow around immersed bodies**	**27,30**

8- ILOs Matrix Topics

Course Intended Learning Outcomes (ILOs)		**Course topics**					
		1st	**2nd**	**3rd**	**4th**	**5th**	**6th**
Knowledge & Understanding	**a1-4-1 Understand basics of fluid mechanics and hydraulics**	**x**	**x**	**x**	**x**	**x**	**x**
Intellectual Skills	**b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to fluid mechanics. and mechanical power engineering.**			**x**	**x**		

	b3-1-1 Select the suitable measuring scheme for boundary layer thickness based on analysis.			**x**	**x**		
Professional Skill	**c1-1-1 Apply the knowledge of mathematics and fluid mechanics to fluid flow in motion.**				**x**		**x**
	c2-1-1 Write and evaluate a professional report on fluid mechanics problems.					**x**	
General Skills	**d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to fluid mechanics.**		**x**	**x**			
	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about advanced fluid mechanics.			**x**	**x**		**x**

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		Teaching and Learning Method												
		Lecture	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Site visits	Self learning	Cooperative	Discovering	Modelling	Playing
Knowledge & understanding	a1-4-1	x												
Intellectual Skills	b1-1-1	x				x								
	b3-1-1	x				x			x					
Professional Skills	c1-1-1	x				x	x		x	x	x	x		
	c2-1-1	x				x								
General Skills	d2-1-1		x	x		x			x	x	x			
	d4-1-1		x	x					x	x	x			

10- Teaching and learning method for low capacity and outstanding Student

For low capacity students	Assign a portion of the office hours for those students.
	Give them specific tasks.
	Repeat the explanation of some of the material and tutorials.

	Assign a teaching assistance to follow up the performance of these groups of students.
For outstanding Students	Hand out project assignments to those students.
	Give them some research topics to be searched using the internet and conduct presentation.
	Encourage them to take parts in the running research projects.

11- Assessment

11.1 Assessment Methods

Course Intended Learning Outcome (ILOs)		Assessment Methods											
		Written Exam	Oral Exam	Tutorial Assessment	Project Assessment	Model Assessment	Report Assessment	Quiz assessment	Presentation Assessment	Discussion	Laboratory Test	Home Exm	Monitoring
Knowledge & Understanding	a1-4-1	x											
Intellectual Skills	b1-1-1	x											
	b3-1-1	x											
Professional Skills	c1-1-1	x											
	c2-1-1	x											
General Skills	d2-1-1	x											
	d4-1-1	x											

11.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	32 th
Mid term written Examination	---	
Quizzes	---	
laboratory examination	---	
Oral examination	---	
Semester work	---	
Total	100%	

12- Facilities required for teaching and learning

Teaching aids like, lecture room with audio-visual facilities, white board.

13- List of references:

Essential Books (Text Books)

1- White, F. M. (2008), Fluid Mechanics, Sixth Edition, McGraw-Hill.
2- Irving H. Shames, "Mechanics of Fluids", 3rd ed. McGraw-Hill, INC. 1992.
3- Yunus A. Gengel and Robert H. Turner, "Fundamentals of Thermal – Fluid Sciences ", McGraw-Hill, INC. 2001.

Recommended Books

1- Potter, M.C., " Mechanics of Fluids ", 4th ed., Prentice-Hill, INC. 1997.
2- Stephen R. Turns, " Thermal – Fluid Sciences", Cambridge University Press, 2006.

Periodicals, Web sites, etc

- Journal of Fluid and Thermal Engineering.
- http://cms.nelc.edu.eg/course/view.php?id=114

Course Coordinator : Dr / Yassen El-Sayed Yassen
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Head of Department : Prof. Dr. Kamal Ameen Morad

Date :

Course Specification

Program on which the course is given	Ms. C in Mechanical Power Engineering
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering
Department offering the course	Mechanical Power Engineering
Academic year/Level	first year
Date of specification approval	2020

A- Basic Information

Title: Heat Transfer in Industrial Furnaces and Boilers	**Code Symbol**: **MEP528**	
Lecture	3 hours	
Tutorial		
Laboratory		
Total	3 hours	Bylaw 2003

B- Professional Information

1- Course Aims:

In our treatment of heat transfer, we have two major objectives; in addition to obtaining an understanding of the physical mechanisms of the heat transfer in industrial furnaces, we wish to develop the means of control the heat transfer rate and the thermal insulation of boilers. This course is devoted primarily to achieving the former objective. Physical origins are discussed, and relevant dimensionless parameters are developed.

2- Course Objectives:

On completion of this course, the student should have sufficient broad knowledge in mechanical engineering to:
1- Demonstrate knowledge of the fundamentals of heat transfer and heat transfer from gases;
2- Classify and describe the fuels;
3- Demonstrate knowledge of the heat transfer from flames;
4- Classify and describe the industrial furnaces and boilers;
5- Expalin how to control the heat transfer rate in boilers;
6- Domenstrate the thermal insulation of boilers and imdustrial furnaces.

3- Intended Learning Outcomes (ILOs):

NAQAAE Academic Reference Standards (ARS)	Program ILOs	Course ILOs
A. Knowledge and understanding		
A1. Theories, basics and specialized knowledge in the field of learning, as well as the subjects that affect his/her professional practice.	a1-5 Understand the theories, basics and specialized knowledge in the field of Turbo-Machinery and Aero-Dynamics.	a1-5-1 Understand the theories, basics and specialized knowledge in heat transfer, boilers and industrial furnaces.
A2- Mutual relation between professional aspects of professional practice and its effects on the Environment.	a2-2 Recognize the interaction between mechanical power technologies and surrounding environment	a2-2-1 How to control the heat transfer rate and the emissions from flames.
A3- Main scientific advances in the field of specialization.	a3-1 Classify the Potential applications of advanced mechanical power engineering systems.	a3-1-1 Classifications of boilers and industrial furnaces and its applications.
A5- Basics and principles of quality in professional practice in the field of specialization.	a5-1 Explain Quality Assurance concepts of different mechanical power components and systems development phases.	a5-1-1 Select the suitable insulation in boilers and industrial furnaces and increase the heat transfer rate in boilers.
B. Intellectual skills		
B1- Analyze and evaluate the information in the field of specialization, and relate it to solve problems.	b1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to mechanical power engineering.	b1-1-1 How to evaluate the characteristics and performance of components, systems and processes of the boilers.
	b1-2 Interpret, analyze, and evaluate a given system specification information and relate it to the design of the required system.	b1-2-1 How to analyze the characteristics and performance of different types of boilers and industrial furnaces.

B3- Link and integrate diverse knowledge to solve professional problems.	b3-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems.	b3-1-1 How to analyze the performance data of boilers and furnaces and used it to solve problems.
B5- Assess risks in professional practice in the field of specialization.	b5-1 Evaluate pros and cons of given methodologies for mechanical power engineering systems development.	b5-1-1 How to increase the heat transfer rate in boilers and industrial furnaces.
C. Professional and practical skills		
C1- Master the basic as well as the latest professional skills in the field of specialization.	c1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering techniques, skills, and tools.	c1-1-1 How to solve the operating problems in boilers and furnaces.
C2- Write and evaluate technical and professional reports.	c2-1 Write and evaluate a professional report on specialized related to mechanical power engineering technical matters.	c2-1-1 How to write a technical reports about the operation and performance of boilers and industrial furnaces.
D. General and transferrable skills		
D2- Use information technology to improve his/her professional practice.	d2-1 Use state-of-the-art computer aided design tools for solving mechanical power engineering problems.	d2-1-1 How to use the advanced computer programs to solve the problems and design of boilers and industrial furnaces
D5- Use different sources to obtain knowledge and information.	d5-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d5-1-1 How to upgrade the information about the performance of heat transfer, boilers, combustion, and industrial furnaces.
D8- Learn independently and seek continuous learning.	d8-2 Seek continuous learning through continuous education, organizing and participating in seminars, workshops, national and international conferences.	d8-2-1 motivate continuous learning and working in groups as team work

4- Course Contents:

Week No.	*Topic*	*Total Hours*	*Contact hrs*			*Course ILOs Covered (By No.)*
			Lec.	Tut.	Lab.	
Week-1	**Fundamental of heat transfer**	**3**	**3**	**-**	**-**	**a1-5-1, a3-1-1, b1-2-1, c2-1-1, d5-1-1, d8-2-1**
Week-2	**Fundamental of heat transfer (Cont.)**	**3**	**3**	**-**	**-**	**a1-5-1, a3-1-1, b1-2-1, c2-1-1, d5-1-1, d8-2-1**
Week-3	**Fundamental of heat transfer (Cont.)**	**3**	**3**	**-**	**-**	**a1-5-1, a3-1-1, b1-2-1, c2-1-1, d5-1-1, d8-2-1**
Week-4	**Heat transfer from gaseous fuel flame**	**3**	**3**	**-**	**-**	**a1-5-1, a2-2-1, a3-1-1, b1-2-1, c2-1-1, d5-1-1, d8-2-1**
Week-5	**Heat transfer from gaseous fuel flame (Cont.)**	**3**	**3**	**-**	**-**	**a1-5-1, a2-2-1, a3-1-1, b1-2-1, c2-1-1, d5-1-1, d8-2-1**
Week-6	**Heat transfer from gaseous fuel flame (Cont.)**	**3**	**3**	**-**	**-**	**a1-5-1, a2-2-1, a3-1-1, b1-2-1, c2-1-1, d5-1-1, d8-2-1**
Week-7	**Heat transfer from liquid fuel flame**	**3**	**3**	**-**	**-**	**a2-2-1, b1-2-1, c2-1-1, d5-1-1, d8-2-1**
Week-8	**Heat transfer from liquid fuel flame (Cont.)**	**3**	**3**	**-**	**-**	**a2-2-1, b1-2-1, c2-1-1, d5-1-1, d8-2-1**
Week-9	**Heat transfer from liquid fuel flame (Cont.)**	**3**	**3**	**-**	**-**	**a2-2-1, b1-2-1, c2-1-1, d5-1-1, d8-2-1**
Week-10	**Heat transfer from solid fuel flame**	**3**	**3**	**-**	**-**	**a2-2-1, b1-2-1, c2-1-1, d5-1-1, d8-2-1**
Week-11	**Heat transfer from solid fuel flame (Cont.)**	**3**	**3**	**-**	**-**	**a2-2-1, b1-2-1, c2-1-1, d5-1-1, d8-2-1**
Week-12	**Heat transfer from solid fuel flame (Cont.)**	**3**	**3**	**-**	**-**	**a2-2-1, b1-2-1, c2-1-1, d5-1-1, d8-2-1**
Week-13	**Heat transfer from flames in industrial furnaces**	**3**	**3**	**-**	**-**	**a2-2-1, b1-2-1, b5-1-1, c2-1-1, d5-1-1, d8-2-1**
Week-14	**Heat transfer from flames in industrial furnaces (Cont.)**	**3**	**3**	**-**	**-**	**a2-2-1, b1-2-1, b5-1-1, c2-1-1, d5-1-1, d8-2-1**
Week-15	**Heat transfer from flames and combustion products in boilers**	**3**	**3**	**-**	**-**	**a2-2-1, b1-1-1, b3-1-1, c1-1-1, c2-1-1, d5-1-1, d8-2-1**
Week-16	**Heat transfer from flames and combustion products in boilers (Cont.)**	**3**	**3**	**-**	**-**	**a2-2-1, b1-1-1, b3-1-1, c1-1-1, c2-1-1, d5-1-1, d8-2-1**
Week-17	**Heat transfer from flames and combustion products in boilers (Cont.)**	**3**	**3**	**-**	**-**	**a2-2-1, b1-1-1, b3-1-1, c1-1-1, c2-1-1, d5-1-1, d8-2-1**
Week-18	**Methods to control heat transfer rate**	**3**	**3**	**-**	**-**	**a2-2-1, a5-1-1, b1-1-1, b1-2-1, b3-1-1, b5-1-1, c1-1-1, c2-1-1, d2-1-1, d5-1-1, d8-2-1**
Week-19	**Methods to control heat transfer rate (Cont.)**	**3**	**3**	**-**	**-**	**a2-2-1, a5-1-1, b1-1-1, b1-2-1, b3-1-1, b5-1-1, c1-1-1, c2-1-1, d2-1-1, d5-1-1, d8-2-1**
Week-20	**Methods to control heat transfer rate (Cont.)**	**3**	**3**	**-**	**-**	**a2-2-1, a5-1-1, b1-1-1, b1-2-1, b3-1-1, b5-1-1, c1-1-1, c2-1-1, d2-1-1, d5-1-1, d8-2-1**
Week-21-23	**Methods to control heat transfer rate (Cont.)**	**3**	**3**	**-**	**-**	**a2-2-1, a5-1-1, b1-1-1, b1-2-1, b3-1-1, b5-1-1, c1-1-1, c2-1-1, d2-1-1, d5-1-1, d8-2-1**
Week-24-26	**Thermal insulation of boilers and industrial furnaces**	**3**	**3**	**-**	**-**	**a2-2-1, a5-1-1, b3-1-1, b5-1-1, c2-1-1, d2-1-1, d5-1-1, d8-2-1**
Week-27-28	**Thermal insulation of boilers and industrial furnaces (Cont.)**	**3**	**3**	**-**	**-**	**a2-2-1, a5-1-1, b3-1-1, b5-1-1, c2-1-1, d2-1-1, d5-1-1, d8-2-1**
Week-29-30	**Thermal insulation of boilers and industrial furnaces (Cont.)**	**3**	**3**	**-**	**-**	**a2-2-1, a5-1-1, b3-1-1, b5-1-1, c2-1-1, d2-1-1, d5-1-1, d8-2-1**

5- Relationship between the course and the programme:

Field	Academic Reference Standard			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Program Academic Standards that the course contribute in achieving	A1(a1-5), A2(a2-2), A3(a3-1), A5(a5-1)	B1(b1-1 + b1-2), B3(b3-1), B5(b5-1)	C1(c1-1), C2(c2-1)	D2(d2-1), D5(d5-1), D8(d8-2)

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	**Mathematics and Basic Sciences**	**Basic Engineering Science**	**Applied Engineering and Design**	**Computer Applications and ICT**	**Projects and practice**	**Disccretionry subjects**	**Total**
---	---	**30%**	**70%**	---	---	---	**100%**

7- Course Topics:

Topic No.	Topic	Weeks
1st	Fundamental of heat transfer	1, 2 and 3
2nd	Heat transfer from gaseous fuel flame	4, 5 and 6
3rd	Heat transfer from liquid fuel flame	7, 8 and 9
4th	Heat transfer from solid fuel flame	10, 11 and 12
5th	Heat transfer from flames in industrial furnaces	13 and 14
6th	Heat transfer from flames and combustion products in boilers	15, 16 and 17
7th	Methods to control heat transfer rate	18-24
8th	Thermal insulation of boilers and industrial furnaces	25-30

8- ILOs Matrix Topics:

Course Intended Learning Outcomes (ILOs)		Course topics							
		1st	2nd	3rd	4th	5th	6th	7th	8th
Knowledge & Understanding	**a1-5-1 Understand the theories, basics and specialized knowledge in heat transfer, boilers and industrial furnaces.**	**X**	**X**						
	a2-2-1 How to control the heat transfer rate and the emissions from flames.		**X**	**X**	**X**	**X**	**X**	**X**	**X**
	a3-1-1 Classifications of boilers and industrial furnaces and its applications.	**X**	**X**						
	a5-1-1 Select the suitable insulation in boilers and industrial furnaces and increase the heat transfer rate in boilers.							**X**	**X**

Intellectual Skills	**b1-1-1 How to evaluate the characteristics and performance of components, systems and processes of the boilers.**						**X**	**X**	
	b1-2-1 How to analyze the characteristics and performance of different types of boilers and industrial furnaces.	**X**	**X**	**X**	**X**	**X**		**X**	
	b3-1-1 How to analyze the performance data of boilers and furnaces and used it to solve problems.						**X**	**X**	**X**
	b5-1-1 How to increase the heat transfer rate in boilers and industrial furnaces.					**X**		**X**	**X**
Professional Skill	**c1-1-1 How to solve the operating problems in boilers and furnaces.**						**X**	**X**	
	c2-1-1 How to write a technical reports about the operation and performance of boilers and industrial furnaces.	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
General Skills	**d2-1-1 How to use the advanced computer programs to solve the problems and design of boilers and industrial furnaces**							**X**	**X**
	d5-1-1 How to upgrade the information about the performance of heat transfer, boilers, combustion, and industrial furnaces.	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**
	d8-2-1 motivate continuous learning and working in groups as team work	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		Teaching and Learning Method												
		Lecture	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Site visits	Self learning	Cooperative	Discovering	Modelling	Playing
Knowledge & understanding	a1-5-1	x	x	x					x	x	x			
	a2-2-1	x	x	x		x				x	x			
	a3-1-1	x	x	x						x	x			
	a5-1-1	x	x	x						x	x			
Intellectual Skills	b1-1-1	x	x	x		x	x			x	x			
	b1-2-1	x				x				x	x	x		
	b3-1-1	x				x	x			x	x	x		
	b5-1-1	x	x			x				x	x	x		
Professional Skills	c1-1-1	x	x			x				x	x	x		
	c2-1-1	x	x			x				x	x	x		
General Skills	d2-1-1	x	x			x				x	x	x		
	d5-1-1	x	x			x				x	x	x		
	d8-2-1	x	x			x				x	x	x		

10- Assessment

10.1 Assessment Methods:

Course Intended Learning Outcome (ILOs)		Assessment Methods											
		Written Exam	Oral Exam	Tutorial Assessment	Project Assessment	Model Assessment	Report Assessment	Quiz assessment	Presentation	Discussion	Laboratory Test	Home Exam	Monitoring
Knowledge & Understanding	a1-5-1	x											
	a2-2-1	x											
	a3-1-1	x											
	a5-1-1	x											
Intellectual Skills	b1-1-1	x											
	b1-2-1	x											
	b3-1-1	x											
	b5-1-1	x											
Professional Skills	c1-1-1	x											
	c2-1-1	x											
General Skills	d2-1-1	x											
	d5-1-1	x											
	d8-2-1	x											

10.2 Assessment Schedule and Grades Distribution:

Assessment Method	Percentage	week
Final Examination	100	32th
Mid term written Examination1	-	-
Mid term written Examination 2	-	-
Mid term laboratory assessment	-	-
End of term laboratory examination	-	-
Tutorial and report assessment	-	-
Total	100%	

11- Facilities required for teaching and learning:

Teaching aids like, lecture room with audio-visual facilities, white board.

12- List of references:

1- "Fundamentals of Heat and Mass Transfer", by C.P. Kothandaraman, third edition, 2006.
2- "Fundamentals of Heat and Mass Transfer" by Frank P. Incropera and David P. Dewitt, Seventh Edition, 2011
3- "Heat Transfer; A Practical Approach" by Yunus A. Cengel, Second edition, 2009.
4- "Industrial Furnaces" by W.Trinks, M.H.Mawhinney, R.A.Shannon, R.J.Reed, Sixth edition, 2004.

Course coordinator: Dr. Hamada Mohamed Gad

Programme coordinator: Prof. Kamal Morad.

Head of the Department: Prof. Kamal Morad

Date:

Course Specification

Program on which the course is given	M. Sc. in Mechanical Power Engineering
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering
Department offering the course	Mechanical Power Engineering
Academic year/Level	1st year
Date of specification approval	***2020***

A- Basic Information

Title: Solar Energy	**Code Symbol**: MEP557	
Lecture	3 hours	
Tutorial		
Laboratory		
Total	3 hours	Bylaw 2000

B- Professional Information

1- Course Aims:

In our treatment of convection, we have two major objectives. In addition to obtaining an understanding of the physical mechanisms that underline Solar Energy, we wish to develop the means of perform solar energy calculations. This course is devoted primarily to achieving the former objective. Physical origins are discussed, and relevant dimensionless parameters are developed.

With conceptual foundations established, subsequent chapters are used to develop useful effects in solar energy. The course deals with Different models for calculating solar energy intensity. It also describes the behavior of A theory of solar collectors , The thermal losses and thermal efficiency.

1- Course Objectives

1- the first objective is to cover cover the basic principles of convection heat transfer and to present a wealth of real-world engineering applications to give students a feel for engineering practice .
2- Is to develop an understanding of solar collectors, examine the differential equations that govern The thermal losses and thermal efficiency and determine important dimensionless parameters associated with solar energy.
3- is to learn how to estimate the different parameters in order to perform analyses on thermal systems experiencing different types of flow.
4- Is to delineate pertinent trasport phenemena for any process or system involving solar energy.

5- The student should be able to develop representative models for real processes and system and draw conclusions concerning process/system design or performance from the attendant analysis.

2- Intended Learning Outcomes (ILOs)

NAQAAE Academic Reference Standards (ARS)	Program ILOs	Course ILOs
A. Knowledge and understanding		
A1. Theories, basics and specialized knowledge in the field of learning, as well as the subjects that affect his/her professional practice.	a1-5 Understand the theories, basics and specialized knowledge in the field of **Turbo-Machinery and Aero-Dynamics**.	a-1-2-1 Define the concepts of physical meaning and phenomena are used in solar energy .
A2- Mutual relation between professional aspects of professional practice and its effects on the Environment.	a2-1 Discuss Social effects of mechanical power engineering technologies.	a2-2-1 Report and recognize the professional aspects of solar energy applications and their effects on the Environment.
A5- Basics and principles of quality in professional practice in the field of specialization.	a5-1 Explain Quality Assurance concepts of different mechanical power components and systems development phases.	a5-1-1 Explain Quality Assurance concepts of different mechanical power components and systems development phases.
B. Intellectual skills		
B1- Analyze and evaluate the information in the field of specialization, and relate it to solve problems.	b1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to mechanical power engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to solar power engineering based on the flow equations analysis.

B3- Link and integrate diverse knowledge to solve professional problems.	b3-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems.	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to solar energy .
B5- Assess risks in professional practice in the field of specialization.	b5-1 Evaluate pros and cons of given methodologies for mechanical power engineering systems development.	b5-1-1 Evaluate pros and cons of given methodologies for mechanical power engineering systems development.
C. Professional and practical skills		
C1- Master the basic as well as the latest professional skills in the field of specialization.	c1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering techniques, skills, and tools.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to solar energy problems, using latest engineering techniques, skills, and tools.
C2- Write and evaluate technical and professional reports.	c.2-1 Write and evaluate a professional report on specialized related to mechanical power engineering technical matters.	c2-1-1 Write and evaluate a professional report on wings and aircrafts.
D. General and transferrable skills		
D2- Use information technology to improve his/her professional practice.	d2-1 Use state-of-the-art computer aided design tools for solving mechanical power engineering problems.	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to solar energy .

D5- Use different sources to obtain knowledge and information.	d5-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about solar energy .
D8- Learn independently and seek continuous learning.	d8-2 Seek continuous learning through continuous education, organizing and participating in seminars, workshops, national and international conferences.	d8-2-1 Seek continuous learning through continuous education, organizing and participating in seminars, workshops, national and international conferences.

3- Course Contents

Week No.	*Topic*	*Total Hours*	*Contact hrs*			*Course ILOs Covered (By No.)*
			Lec.	Tut.	Lab.	
Week-1 and 3	Fundamental Concepts	9	6	3	–	a1-5-1, a2-1-1, a5-1-1, a5-1-1, b1-1-1, b3-1-1, b5-1-1, c1-1-1, d2-1-1, d5-1-1, d8-2-1
Week-4 and 6	The source of solar energy	9	6	3	–	a1-5-1, a2-1-1, a5-1-1, a5-1-1, b1-1-1, b3-1-1, b5-1-1, c1-1-1, d2-1-1, d5-1-1, d8-2-1
Week-7 and 9	Its intensity in the outer space and the motion of the earth with respect to the sun	9	6	3	–	a1-5-1, a2-1-1, a5-1-1, a5-1-1, b1-1-1, b3-1-1, b5-1-1, c1-1-1, d2-1-1, d5-1-1, d8-2-1
Week-10 and 12	The angles of solar rays on earth	9	6	3	–	a1-5-1, a5-1-1, a5-1-1, b1-1-1, b5-1-1, c1-1-1, d2-1-1, d5-1-1, d8-2-1
Week-13 and 15	Different models for calculating solar energy intensity	9	6	3	–	a1-5-1, a2-1-1, a5-1-1, a5-1-1, b1-1-1, b3-1-1, b5-1-1, c1-1-1, d2-1-1, d5-1-1
Week-16 and 18	A theory of solar collectors	9	6	3	–	a1-5-1, a2-1-1, a5-1-1, a5-1-1, b1-1-1, b5-1-1, c1-1-1, d2-1-1, d5-1-1, d8-2-1
Week-19 and 21	The thermal losses and thermal efficiency	9	6	3	–	a1-5-1, a2-1-1, a5-1-1, a5-1-1, b1-1-1, b3-1-1, c1-1-1, d2-1-1, d5-1-1, d8-2-1
Week-22 and 24	Equation defining the glass cover transmissivity	9	6	3	–	a1-5-1, a2-1-1, a5-1-1, b1-1-1, b3-1-1, b5-1-1, c1-1-1, d2-1-1, d5-1-1, d8-2-1
Week-25 and 27	Solar collector performance	9	6	3	–	a1-5-1, a2-1-1, a5-1-1, a5-1-1, b1-1-1, b3-1-1, c1-1-1, d2-1-1, d5-1-1
Week-28 and 30	Effect on the phase of the fluid	9	6	3	–	a1-5-1, a2-1-1, , a5-1-1, b1-1-1, b3-1-1, c1-1-1, d2-1-1, d5-1-1,

	flowing through the collectors					d8-2-1
Total		**90**	**60**	30	–	

4- Relationship between the course and the programme

Field	National Academic Reference Standard(NARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Programme Academic Standards that the course contributes in achieving.	A1 (a1-5), A2 (a2-1), A5 (a5-1)	B1 (b1-1), B3 (b3-1), B5 (b5-1)	C1 (c1-1), C2 (c2-1)	D2 (d2-1), D5 (d5-1), D8(d8-2)

5- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Disccretionry subjects	Total
---	---	**30%**	**70%**	---	---	---	**100%**

6- Course Topics.

Topic No.	Topic	Weeks
1st	Fundamental Concepts	1-6
2nd	Different models for calculating solar energy intensity	7-12
3rd	A theory of solar collectors	13-18
4th	The thermal losses and thermal efficiency	19-24
5th	Equation defining the glass cover transmissivity	25-30

8- ILOs Matrix Topics

Course Intended Learning Outcomes (ILOs)		Course topics				
		1st	2nd	3rd	4th	5th
Knowledge & Understanding	a-1-2-1 Define the concepts of physical meaning and phenomena are used in solar energy .	x	x	x	x	x

	a2-2-1 Report and recognize the professional aspects of solar energy applications and their effects on the Environment.	x		x		
	a5-1-1 Explain Quality Assurance concepts of different mechanical power components and systems development phases.	x		x		x
Intellectual Skills	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to water power engineering based on the flow equations analysis.	x	x	x	x	x
	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to solar energy .				x	x
	b5-1-1 Evaluate pros and cons of given methodologies for mechanical power engineering systems development.			x	x	x
Professional Skill	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to water power engineering problems, using latest engineering techniques, skills, and tools.	x	x	x	x	x
	c2-1-1 Write and evaluate a professional report on water hammer.				x	
General Skills	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to solar energy .	x	x	x	x	x

	d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about solar energy .	x	x	x	x	x
	d8-2-1 Seek continuous learning through continuous education, organizing and participating in seminars, workshops, national and international conferences.	x	x	x	x	x

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		Teaching and Learning Method												
		Lecture	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Site visits	Self learning	Cooperative	Discovering	Modelling	Playing
Knowledge & understanding	a1-5-1	x		x		x								
	a2-2-1	x		x		x								
	a5-1-1	x		x		x								
Intellectual Skills	b1-1-1	x		x	x	x								
	b3-1-1	x		x	x	x			x					
	b5-1-1	x		x	x	x			x	x				
Professional Skills	c1-1-1			x	x	x	x		x	x	x			
	c2-1-1	x		x	x	x								
General Skills	d2-1-1	x		x	x	x			x	x	x			
	d5-1-1			x	x				x	x	x			
	d8-1-1			x	x				x	x	x			

10- Teaching and learning method for low capacity and outstanding Student

For low capacity students	Assign a portion of the office hours for those students.

	Give them specific tasks.
	Repeat the explanation of some of the material and tutorials.
	Assign a teaching assistance to follow up the performance of these groups of students.
For outstanding Students	Hand out project assignments to those students.
	Give them some research topics to be searched using the internet and conduct presentation.
	Encourage them to take parts in the running research projects.

11- Assessment

11.1 Assessment Methods

Course Intended Learning Outcome (ILOs)		Assessment Methods											
		Written Exam	Oral Exam	Tutorial Assessment	Project Assessment	Model Assessment	Report Assessment	Quiz assessment	Presentation Assessment	Discussion	Laboratory Test	Home Exm	Monitoring
Knowledge & Understanding	a1-5-1	x											
	a2-2-1	x											
	a5-1-1	x											
Intellectual Skills	b1-1-1	x											
	b3-1-1	x											
	b5-1-1	x											
Professional Skills	c1-1-1	x											
	c2-1-1	x											
General Skills	d2-1-1	x											
	d5-1-1	x											
	d8-1-1	x											

11.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	32 th
Mid term written Examination	---	
Quizzes	---	

laboratory examination	---	
Oral examination	---	
Semester work	---	
Total	100%	

12- Facilities required for teaching and learning

Teaching aids like, lecture room with audio-visual facilities, white board.

13- List of references:

Essential Books (Text Books)

1- **John A., William, D. and Beckman, A**., "Solar Engineering of Thermal Processes", New York, USA: John Wiley; 1980.

2- **Moustafa M. Elsayed, Ibrahim S. Taha, and Jaffer A.Sabbagh**. "Design of Solar Thermal Systems". jeddah, saudi arabia: Taha, Jaffer A;1994.

Recommended Books

1- **J.P.Holman** "Heat transfer" Mc Graw-Hill, Ninth Edition, Singapora, 2002.

Course coordinator: Prof. Mohamed Reda AbdElkader

Head of the Department: Prof. Dr. Kamal Ameen Morad

Date:

Course Specification

Program on which the course is given	M. Sc. in Mechanical Power Engineering
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering
Department offering the course	Mechanical Power Engineering
Academic year/Level	1st year
Date of specification approval	***2020***

A- Basic Information

Title: Practical Applications of Renewable Energy	**Code Symbol**: MEP559	
Lecture	3 hours	
Tutorial		
Laboratory		
Total	3 hours	Bylaw 2003

B- Professional Information

1- Course Aims:

In our treatment of convection, we have two major objectives. In addition to obtaining an understanding of the physical mechanisms that underline Renewable Energy, we wish to develop the means of perform renewable energy calculations. This course is devoted primarily to achieving the former objective. Physical origins are discussed, and relevant dimensionless parameters are developed.

With conceptual foundations established, subsequent chapters are used to develop useful effects in renewable energy. The course deals with Different models for calculating renewable energy intensity.

1- Course Objectives

1- the first objective is to cover cover the basic principles of convection heat transfer and to present a wealth of real-world engineering applications to give students a feel for engineering practice .
2- Is to develop an understanding of solar collectors, examine the differential equations that govern The thermal losses and thermal efficiency and determine important dimensionless parameters associated with solar energy.
3- is to learn how to estimate the different parameters in order to perform analyses on thermal systems experiencing different types of flow.
4- Is to delineate pertinent trasport phenemena for any process or system involving renewable energy.

5- The student should be able to develop representative models for real processes and system and draw conclusions concerning process/system design or performance from the attendant analysis.

2- Intended Learning Outcomes (ILOs)

NAQAAE Academic Reference Standards (ARS)	Program ILOs	Course ILOs
A. Knowledge and understanding		
A1. Theories, basics and specialized knowledge in the field of learning, as well as the subjects that affect his/her professional practice.	a1-5 Understand the theories, basics and specialized knowledge in the field of **Turbo-Machinery and Aero-Dynamics**.	a-1-2-1 Define the concepts of physical meaning and phenomena are used in renewable energy .
A2- Mutual relation between professional aspects of professional practice and its effects on the Environment.	a2-1 Discuss Social effects of mechanical power engineering technologies.	a2-2-1 Report and recognize the professional aspects of renewable energy applications and their effects on the Environment.
A5- Basics and principles of quality in professional practice in the field of specialization.	a5-1 Explain Quality Assurance concepts of different mechanical power components and systems development phases.	a5-1-1 Explain Quality Assurance concepts of different mechanical power components and systems development phases.
B. Intellectual skills		
B1- Analyze and evaluate the information in the field of specialization, and relate it to solve problems.	b1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to mechanical power engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to solar power engineering based on the flow equations analysis.

B3- Link and integrate diverse knowledge to solve professional problems.	b3-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems.	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to renewable energy .
B5- Assess risks in professional practice in the field of specialization.	b5-1 Evaluate pros and cons of given methodologies for mechanical power engineering systems development.	b5-1-1 Evaluate pros and cons of given methodologies for mechanical power engineering systems development.
C. Professional and practical skills		
C1- Master the basic as well as the latest professional skills in the field of specialization.	c1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering techniques, skills, and tools.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to renewable energy problems, using latest engineering techniques, skills, and tools.
C2- Write and evaluate technical and professional reports.	c.2-1 Write and evaluate a professional report on specialized related to mechanical power engineering technical matters.	c2-1-1 Write and evaluate a professional report on wings and aircrafts.
D. General and transferrable skills		
D2- Use information technology to improve his/her professional practice.	d2-1 Use state-of-the-art computer aided design tools for solving mechanical power engineering problems.	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to renewable energy .

D5- Use different sources to obtain knowledge and information.	d5-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about renewable energy .
D8- Learn independently and seek continuous learning.	d8-2 Seek continuous learning through continuous education, organizing and participating in seminars, workshops, national and international conferences.	d8-2-1 Seek continuous learning through continuous education, organizing and participating in seminars, workshops, national and international conferences.

3- Course Contents

Week No.	*Topic*	*Total Hours*	*Contact hrs*			*Course ILOs Covered (By No.)*
			Lec.	Tut.	Lab.	
Week-1 and 3	Solar heating, solar dryers	9	6	3	–	a1-5-1, a2-1-1, a5-1-1, a5-1-1, b1-1-1, b3-1-1, b5-1-1, c1-1-1, d2-1-1, d5-1-1, d8-2-1
Week-4 and 6	Solar electricity generation	9	6	3	–	a1-5-1, a2-1-1, a5-1-1, a5-1-1, b1-1-1, b3-1-1, b5-1-1, c1-1-1, d2-1-1, d5-1-1, d8-2-1
Week-7 and 9	Photovoltaic cells	9	6	3	–	a1-5-1, a2-1-1, a5-1-1, a5-1-1, b1-1-1, b3-1-1, b5-1-1, c1-1-1, d2-1-1, d5-1-1, d8-2-1
Week-10 and 12	Solar arbiters	9	6	3	–	a1-5-1, a5-1-1, a5-1-1, b1-1-1, b5-1-1, c1-1-1, d2-1-1, d5-1-1, d8-2-1
Week-13 and 15	Solar desalination	9	6	3	–	a1-5-1, a2-1-1, a5-1-1, a5-1-1, b1-1-1, b3-1-1, b5-1-1, c1-1-1, d2-1-1, d5-1-1
Week-16 and 18	Solar cookers	9	6	3	–	a1-5-1, a2-1-1, a5-1-1, a5-1-1, b1-1-1, b5-1-1, c1-1-1, d2-1-1, d5-1-1, d8-2-1
Week-19 and 21	Solar refrigeration's and air conditioning	9	6	3	–	a1-5-1, a2-1-1, a5-1-1, a5-1-1, b1-1-1, b3-1-1, c1-1-1, d2-1-1, d5-1-1, d8-2-1
Week-22 and 24	Solar pumping	9	6	3	–	a1-5-1, a2-1-1, a5-1-1, b1-1-1, b3-1-1, b5-1-1, c1-1-1, d2-1-1, d5-1-1, d8-2-1
Week-25 and 27	Wind electricity generation	9	6	3	–	a1-5-1, a2-1-1, a5-1-1, a5-1-1, b1-1-1, b3-1-1, c1-1-1, d2-1-1, d5-1-1
Week-28 and 30	Wind pumps	9	6	3	–	a1-5-1, a2-1-1, , a5-1-1, b1-1-1, b3-1-1, c1-1-1, d2-1-1, d5-1-1, d8-2-1
Total		**90**	**60**	30	–	

4- Relationship between the course and the programme

Field	National Academic Reference Standard(NARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Programme Academic Standards that the course contributes in achieving.	A1 (a1-5), A2 (a2-1), A5 (a5-1)	B1 (b1-1), B3 (b3-1), B5 (b5-1)	C1 (c1-1), C2 (c2-1)	D2 (d2-1), D5 (d5-1), D8(d8-2)

5- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Disccretionry subjects	Total
---	---	**30%**	**70%**	---	---	---	**100%**

6- Course Topics.

Topic No.	Topic	Weeks
1st	Solar electricity generation	1-6
2nd	Solar desalination	7-12
3rd	Solar refrigeration's and air conditioning	13-18
4th	Solar pumping	19-24
5th	Wind electricity generation	25-30

8- ILOs Matrix Topics

Course Intended Learning Outcomes (ILOs)		Course topics				
		1st	2nd	3rd	4th	5th
Knowledge & Understanding	a-1-2-1 Define the concepts of physical meaning and phenomena are used in solar energy .	x	x	x	x	x
	a2-2-1 Report and recognize the professional aspects of solar energy applications and their effects on the Environment.	x		x		

	a5-1-1 Explain Quality Assurance concepts of different mechanical power components and systems development phases.	x		x		x
Intellectual Skills	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to water power engineering based on the flow equations analysis.	x	x	x	x	x
	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to solar energy .				x	x
	b5-1-1 Evaluate pros and cons of given methodologies for mechanical power engineering systems development.			x	x	x
Professional Skill	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to water power engineering problems, using latest engineering techniques, skills, and tools.	x	x	x	x	x
	c2-1-1 Write and evaluate a professional report on water hammer.				x	
General Skills	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to solar energy .	x	x	x	x	x
	d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about solar energy .	x	x	x	x	x

	d8-2-1 Seek continuous learning through continuous education, organizing and participating in seminars, workshops, national and international conferences.	x	x	x	x	x

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		Teaching and Learning Method												
		Lecture	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Site visits	Self learning	Cooperative	Discovering	Modelling	Playing
Knowledge & understanding	a1-5-1	x		x		x								
	a2-2-1	x		x		x								
	a5-1-1	x		x		x								
Intellectual Skills	b1-1-1	x		x	x	x								
	b3-1-1	x		x	x	x			x					
	b5-1-1	x		x	x	x			x	x				
Professional Skills	c1-1-1			x	x	x	x		x	x	x			
	c2-1-1	x		x	x	x								
General Skills	d2-1-1	x		x	x	x			x	x	x			
	d5-1-1			x	x				x	x	x			
	d8-1-1			x	x				x	x	x			

10- Teaching and learning method for low capacity and outstanding Student

For low capacity students	Assign a portion of the office hours for those students.
	Give them specific tasks.
	Repeat the explanation of some of the material and tutorials.
	Assign a teaching assistance to follow up the performance of these groups of students.
For outstanding Students	Hand out project assignments to those students.
	Give them some research topics to be searched

	using the internet and conduct presentation.
	Encourage them to take parts in the running research projects.

11- Assessment

11.1 Assessment Methods

Course Intended Learning Outcome (ILOs)		Assessment Methods											
		Wirtten Exam	Oral Exam	Tutorial Assessment	Project Assessment	Model Assessment	Report Assessment	Quiz assessment	Presentation Assessment	Discussion	Laboratory Test	Home Exm	Monitoring
Knowledge & Understanding	a1-5-1	x											
	a2-2-1	x											
	a5-1-1	x											
Intellectual Skills	b1-1-1	x											
	b3-1-1	x											
	b5-1-1	x											
Professional Skills	c1-1-1	x											
	c2-1-1	x											
General Skills	d2-1-1	x											
	d5-1-1	x											
	d8-1-1	x											

11.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	32 th
Mid term written Examination	---	
Quizzes	---	
laboratory examination	---	
Oral examination	---	
Semester work	---	
Total	100%	

12- Facilities required for teaching and learning

Teaching aids like, lecture room with audio-visual facilities, white board.

13- List of references:

Essential Books (Text Books)

1- **John A., William, D. and Beckman, A**., "Solar Engineering of Thermal Processes", New York, USA: John Wiley; 1980.

2- **Moustafa M. Elsayed, Ibrahim S. Taha, and Jaffer A.Sabbagh**. "Design of Solar Thermal Systems". jeddah, saudi arabia: Taha, Jaffer A;1994.

Recommended Books

1- **J.P.Holman** "Heat transfer" Mc Graw-Hill, Ninth Edition, Singapora, 2002.

Course coordinator: Prof. Mohamed Reda AbdElkader

Head of the Department: Prof. Dr. Kamal Ameen Morad

Date:

Course Specification

Program on which the course is given	M. Sc. in Mechanical Power Engineering
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering
Department offering the course	Mechanical Power Engineering
Academic year/Level	1st year
Date of specification approval	***2020***

A- Basic Information

Title: Advanced Thermodynamic	**Code Symbol**: MEP564	
Lecture	3 hours	
Tutorial		
Laboratory		
Total	3 hours	Bylaw 2003

B- Professional Information

1- Course Aims:

The aims of this course are to provide the post graduate student, upon completing the course programme, with the basic knowledge and skills of definitions, principles and applications of advanced thermodynamic and the problems associated with it.

2- Course Objectives

On completion of this course, the post graduate student should have sufficient broad knowledge in mechanical engineering to:

1- The course aims at acquiring the student advanced thermodynamics.
2- Studying the basics of thermo-dynamic
3- Isentropic flow waves.
4- Adiabatic flow.
5- Applications of adiabatic flow.
6- Flow with friction.
7- Thermodynamics of turbo-machines

3- Intended Learning Outcomes (ILOs)

NAQAAE Academic Reference Standards (ARS)	Program ILOs	Course ILOs
A. Knowledge and understanding		
A1. Theories, basics and specialized knowledge in the field of learning, as well as the subjects that affect his/her professional practice.	a1-2 Demonstrate sufficient essential knowledge and a deep understanding of the theories, basics and specialized knowledge in the field of **Air Conditioning and Ventialation**. a1-3 Demonstrate sufficient essential knowledge and a deep understanding of the theories, basics and specialized knowledge in the field of **Thermal Power Plants**.	a1-2-1 Understand basics of thermodynamics. a1-3-1 Understand the isentropic and adiabatic flow to support more knowledge for combustion engines.
B. Intellectual skills		
B1- Define and analyze problems in the field of specialization and sorting them according to priorities	b1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to mechanical power engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to thermodynamics and mechanical power engineering.
B3- Analytical reading researches and subjects relevant to the field of specialization**.**	b3-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems.	b3-1-1 Select the suitable solution methods (Analytical technique and modern computational) for predict adiabatic and isentropic flow.

C. Professional and practical skills		
C1- Apply professional skills in the field of specialization.	c1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering techniques, skills, and tools.	c1-1-1 Apply the knowledge of mathematics and thermodynamics to isentropic and adiabatic flow.
C2- Write professional reports.	c.2-1 Write and evaluate a professional report on specialized related to mechanical power engineering technical matters.	c2-1-1 Write and evaluate a professional report on thermodynamics problems.
D. General and transferable skills		
D2- Use information technology to improve his/her professional practice.	d2-1 Use state-of-the-art computer aided design tools for solving mechanical power engineering problems.	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to thermodynamics.
D4- Use different sources to obtain knowledge and information.	d4-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about advanced thermodynamics.

4- Course Contents

Week No.	*Topic*	*Total Hours*	*Contact hrs*			*Course ILOs Covered (By No.)*
			Lec.	Tut.	Lab.	
Week-1 and 2	Thermodynamics system, properties and processes.	6	6	-	-	a1-2, a1-3
Week-3 and 4	Ideal gases, property relationships, and equations of states.	6	6	-	-	a1-2, a1-3, b-1-1, b3-1
Week-5 and 6	Internal energy, enthalpy, process path, and steady state equation.	6	6	-	-	a1-2, a1-3, b1-1, c1-1
Week-7 and 8	First and second law of thermodynamics.	6	6	-	-	a1-2, a1-3, b1-1, c1-1
Week-9 and 11	Iso-entropic process .	6	6	-	-	a1-2, a1-3, b3-1, c2-1
Week-12 and 14	Thermo-chemical calculation..	6	6	-	-	a1-2, a1-3, b1-1, c2-1
Week-15 and 17	Adiabatic flame temperatures and enthalpy of combustion.	6	6	-	-	a1-2, a1-3, b3-1, c2-1
Week-18 and 19	Combustion efficiencies and air standard and actual engine cycles.	6	6	-	-	a1-2, a1-3, b1-1, c2-1, d2-1
Week-20 and 22	Reversible engine cycles.	9	9	-	-	a1-2, a1-3, b1-1, c2-1, d2-1
Week-23 and 24	Isentropic flow waves.	9	6	-	3	a1-2, a1-3, b1-1, c2-1, d4-1
Week-25 and 26	Thermodynamics of turbo-machines.	6	6	-	-	a1-2, a1-3, b1-1, c2-1, d2-1, d4-1
Week-27 and 28	Calculation for engine cycles.	9	6	-	3	a1-2, a1-3, b1-1, c2-1, d2-1, d4-1
Week-29 and 30	Applications..	9	6	-	3	a1-2, a1-3, b1-1, c2-1, d2-1, d4-1

5- Relationship between the course and the programme

Field	National Academic Reference Standard(NARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Programme Academic Standards that the course contribute in achieving	A1 (a2-a3)	B1 & B3	C1 & C2	D1 & D4

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Disccretionry subjects	Total
---	---	**30%**	**70%**	---	---	---	**100%**

7- Course Topics.

Topic No.	Topic	Weeks
1st	Basic thermodynamics	1-6
2nd	Isentropic flow	7-12
3rd	Adiabatic flow	13-18
4th	Air standard and actual engine cycles	19-24
5th	Thermodynamics of turbo-machines	25-30

8- ILOs Matrix Topics

Course Intended Learning Outcomes (ILOs)		Course topics				
		1st	2nd	3rd	4th	5th
Knowledge & Understanding	a1-2-1 Understand basics of thermodynamics.	x	x	x	x	x
	a1-3-1 Understand the isentropic and adiabatic flow to support more knowledge for combustion engines.	x	x	x	x	x
Intellectual Skills	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to thermodynamics and mechanical power engineering.	x	x	x	x	x

	b3-1-1 Select the suitable solution methods (Analytical technique and modern computational) for predict adiabatic and isentropic flow.	x	x	x	x	x
Professional Skill	c1-1-1 Apply the knowledge of mathematics and thermodynamics to isentropic and adiabatic flow.	x	x	x	x	x
	c2-1-1 Write and evaluate a professional report on thermodynamics problems.	x	x	x	x	x
General Skills	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to thermodynamics.				x	x
	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about advanced thermodynamics.				x	x

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		Teaching and Learning Method												
		Lecture	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Site visits	Self learning	Cooperative	Discovering	Modelling	Playing
Knowledge & understanding	a1-2-1	x												
	a1-3-1	x				x								
Intellectual Skills	b1-1-1	x				x								
	b3-1-1	x				x			x					
Professional Skills	c1-1-1	x				x	x		x	x	x	x		
	c2-1-1	x				x								
General Skills	d2-1-1		x	x		x			x	x	x			
	d4-1-1		x	x					x	x	x			

10- Teaching and learning method for low capacity and outstanding Student

For low capacity students	Assign a portion of the office hours for those students.
	Give them specific tasks.
	Repeat the explanation of some of the material and tutorials.
	Assign a teaching assistance to follow up the performance of these groups of students.
For outstanding Students	Hand out project assignments to those students.
	Give them some research topics to be searched using the internet and conduct presentation.
	Encourage them to take parts in the running research projects.

11- Assessment

11.1 Assessment Methods

Course Intended Learning Outcome (ILOs)		Assessment Methods											
		Written Exam	Oral Exam	Tutorial Assessment	Project Assessment	Model Assessment	Report Assessment	Quiz assessment	Presentation Assessment	Discussion	Laboratory Test	Home Exm	Monitoring
Knowledge & Understanding	a1-2-1	x											
	a1-3-1	x											
Intellectual Skills	b1-1-1	x											
	b3-1-1	x											
Professional Skills	c1-1-1	x											
	c2-1-1	x											
General Skills	d2-1-1	x											
	d4-1-1	x											

11.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	32 th
Mid term written Examination	---	
Quizzes	---	
laboratory examination	---	
Oral examination	---	
Semester work	---	
Total	100%	

12- Facilities required for teaching and learning

Teaching aids like, lecture room with audio-visual facilities, white board.

13- List of references:

"An Introduction to Combustion" By: Stephen Turns, 2nd Edition, 2000
Publisher: McGraw Hill Comp.
"Thermodynamics, An Engineering Approach", Yunus A. Gengel, and Michael A. Boles, McGraw Hill, ISBN: 0072884959 (2006).
"Fundamentals of Thermodynamics", John Wiley, 2003.

"Fundamentals and Technology of Combustion" By: El-Mahallawy and Habik, Elsevier 2002

Course coordinator: Prof. Saad Habik
Programme coordinator: Saad Habik
Head of the Department: Prof. Kamal Morad

Date:

Course Specification

Program on which the course is given	M. Sc.in Mechanical Power Engineering
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering
Department offering the course	Mechanical Power Engineering
Academic year/Level	first year
Date of specification approval	***2020***

A- Basic Information

Title: Automatic control in engines	**Code Symbol**: **MEP568**	
Lecture	3 hours	
Tutorial		
Laboratory		
Total	3 hours	Bylaw 2000

B- Professional Information

1- Course Aims:

The aims of this course are to provide the student, upon completing the diploma in internal combustion engines in mechanical power engineering Programme, Give the students an appreciation of the fundamental principles of Classification of control system, Block diagram, Engine steady state conditions, Engine unsteady state conditions, Engine as a plant controlled in crankshaft rotational speed, Engine as a plant controlled in cooling water (air) temperature, and Dynamic proportion of governors and their components.

2- Course Objectives

1- Demonstration of the knowledge and understanding of the importance of Automatic control in engines
3- Introduce and apply Automatic control in engines theory to describe the behavior and performance of engines.
4- Recognizability of the different types of Automatic control used in internal combustion engines.
5- Evaluation of the suitable schemes for Automatic control elements specially in the combustion engines.

3-Intended Learning Outcomes (ILOs)

NAQAAE Academic Reference Standards (ARS)	Program ILOs	Course ILOs
A. Knowledge and understanding		

A1. Theories, basics and specialized knowledge in the field of learning, as well as the subjects that affect his/her professional practice.	a1-1 Demonstrate sufficient essential knowledge and a deep understanding of the theories, basics and specialized knowledge in the field of **internal combustion engines**	a1-1-1 Understand how the conduction differential equation can be used to obtain the Engine steady and unsteady state conditions.
A2- Mutual relation between professional aspects of professional practice and its effects on the Environment.	a2-1 Discuss Social effects of mechanical power egineering technologies.	a2-1-1 Discuss and recognize the social effects of Automatic control in engines
B. Intellectual skills		
B1- Define and analyze problems in the field of specialization and sorting them according to priorities	b1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to mechanical power engineering.	b1-1-1 select the suitable solution methods for Automatic control in engines problems based the heat conduction equation with the initial and boundary conditions.
B3- Analytical reading researches and subjects relevant to the field of specialization	b3-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems.	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it Automatic control in engines problems.
C. Professional and practical skills		
C1- Apply professional skills in the field of specialization.	c1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering techniques,	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to Automatic control in engines, using latest

	skills, and tools.	engineering techniques, skills, and tools.
C2- Write professional reports.	c.2-1 Write and evaluate a professional report on specialized related to mechanical power egineering tchnical matters.	c2-1-1 Write and evaluate a professional report on Automatic control in engines problems.
D. General and transferrable skills		
D2- Use information technology to improve his/her professional practice.	d2-1 Use state-of-the-art computer aided design tools for solving mechanical power engineering problems.	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to Automatic control in engines problems.
D4- Use different resources to obtain knowledge and information.	d4-1 Use different resources of information like libraries, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about Automatic control in engines.

4-Course Contents

Week No.	*Topic*	*Total Hours*	*Contact hrs*			*Course ILOs Covered (By No.)*
			Lec.	Tut.	Lab.	
Week-2 1	Automatic control systems	6	4	2	-	a1-1-1
Week3-4	Classification of control systems	6	4	2	-	a1-1, b-1-1, b2-1, c1-1, c7-1
Week 5-6	Block diagram	6	4	2	-	a1-1-1, a2-2-1, b1-1-1, c1-1-1
Week 7-8	Engine steady state conditions	6	4	2	-	a1-1-1, a2-2-1, b1-1-1, c1-1-1
Week 9-10	Engine unsteady state conditions	6	4	2	-	b1-1-1, b3-1-1, c1-1-1
Week 11-12	Engine differential equations	6	4	2	-	a1-1-1, a2-1-1, b1-1-1, b3-1-1, c1-1-1,c2-1-1
Week 13-14	Engine as a plant controlled in crankshaft rotational speed	6	4	2	-	a1-1-1, a2-1-1, b1-1-1, b3-1-1, c1-1-1, c2-1-1, d2-1-1, d4-1-1

Week 15-16	Engine as a plant controlled in cooling water (air) temperature	6	4	2	-	A1-1-1, a2-1-1, b1-1-1, b3-1-1, c1-1-1, c2-1-1
Week 17-18	Selection of control method direct acting governors	6	4	2	-	a1-1-1, a2-1-1, b1-1-1, c1-1-1
Week 19-20	Indirect governors	6	4	2	-	a1-1-1, a2-1-1, b1-1-1, c1-1-1
Week 21-23	Electronic governors	6	4	2	-	a1-1-1, a2-1-1, b1-1-1, c1-1-1, c2-1-1, d2-1-1, d4-1-1
Week 24-26	Dynamic proportion of governors and their components	6	4	2	-	a1-1-1, a2-1-1, b1-1-1, c1-1-1, d2-1-1
Week27-30	Stability of automatic control systems	6	4	2	-	a1-1-1, a2-1-1, b1-1-1, b3-1-1, c1-1-1, c2-1-1 d2-1-1, d4-1-1

5- Relationship between the course and the programme

Field	Academic Reference Standard (ARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Programme Academic Standards that the course contribute in achieving	**A1(a1-1)** and **A2(a2-1)**	**B1(b1-1)** and B3(**b3-1)**	**C1(c1-1)** and C2(**c2-1)**	**D2(d2-1)** and D4(**d4-1)**

6- Course Subject Area:

A	**B**	**C**	**D**	**E**	**F**	**G**	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Disccretionry subjects	Total
---	30%		70%				100%

7- Course Topics.

Topic No.	Topic	Weeks
1st	Automatic and Classification control systems	**2**
2nd	Engine steady and unsteady state conditions	**3-10**
3rd	Engine as a plant controlled in crankshaft rotational speed	**11-22**
4th	Selection of control method direct acting governors	**23-30**

8- ILOs Matrix Topics

Course Intended Learning Outcomes (ILOs)		Course topics			
		1st	2nd	3rd	4th
Knowledge & Understanding	**a1-1-1** Understand how the law of energy conservation with the differential equations can be used to obtain the heat equation under transient conditions.	x	x	x	x
	a2-1-1 Discuss and recognize the social effects of transient heat transfer technology.	x	x	x	x
Intellectual Skills	**b1-1-1** select the suitable solution methods for transient problems based the heat conduction equation with the initial and boundary conditions.	x	x	x	x
	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to transient heat transfer.	x	x	x	x
Professional Skill	**c1-1-1** Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to transient heat transfer, using latest engineering techniques, skills, and tools.	x	x	x	x
	c2-1-1 Write and evaluate a professional report on transient heat transfer problems.	x	x	x	x

General Skills	**d2-1-1** Use state-of-the-art computer aided design tools for solving professional problems related to Transient heat transfer problems.		**x**		**x**
	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about transient heat transfer.		**x**		**x**

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		**8- Teaching and Learning Method:**												
		Lecture	**Presentation and Movies**	**Discussion**	**Tutorial**	**Problem solving**	**Brain storming**	**Projects**	**Site visits**	**Self learning**	**Cooperative**	**Discovering**	**Modelling**	**Playing**
Knowledge & understanding	a1-1-1	x				x								
	a2-1-1	x				x								
Intellectual Skills	b1-1-1	x				x								
	b3-1-1	x				x								
Professional Skills	c1-1-1	x				x							x	
	c2-1-1	x				x							x	
General Skills	d2-1-1		x							x	x			
	d4-1-1		x							x	x			

10- Assessment

10.1 Assessment Methods

Course Intended Learning Outcome (ILOs)		Assessment Methods											
		Wirtten Exam	Oral Exam	Tutorial Assessment	Proiect Assessment	Model Assessment	Report Assessment	Quiz assessment	Presentation Assessment	Discussion	Laboratory Test	Home Exm	Monitoring
Knowledge & Understanding	a1-1-1	x											
	a2-1-1	x											
Intellectual Skills	b1-1-1	x											
	b3-1-1	x											
Professional Skills	c1-1-1	x											
	c2-1-1	x											
General Skills	d2-1-1	x											
	d4-1-1	x											

10.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	**100**	**32th**
Final Oral Examination		
Mid term written Examination		
Tutorial discussion, presentation, and report assessment		
Total	**100%**	

11- Facilities required for teaching and learning

Teaching aids like, lecture room with audio-visual facilities, white board.

12- List of references:

- Mechanical Vibrations, Singiresu S. Rao, Addison Wesley publishing Co. 1986

- Elements of vibration analysis, Leonard Meirovitch.Holman, J.P., " Heat Transfer"., McGraw-Hill Book Company, Inc. 1992.

- Foundation Vibration Analysis :A Strength-of-Materials Approach, John P. Wolf, Andrew J. Deeks, Elsevier Linacre House, Jordan Hill, Oxford OX2 8DP 200 Wheeler Road, Burlington, MA 01803 First published 2004 Copyright © 2004, John P. Wolf and Andrew J. Deeks. All rights reserved

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Course Dr. Gamal Zaghloul
Programme coordinator:
Head of the Department: Prof. Kamal Morad

Date:

Course Specification

Program on which the course is given	M. Sc. in Mechanical Power Engineering
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering
Department offering the course	Mechanical Power Engineering
Academic year/Level	first year
Date of specification approval	***2020***

A- Basic Information

Title: Foundations and Vibrations of Engines	**Code Symbol**: **MEP571**	
Lecture	3 hours	
Tutorial		
Laboratory		
Total	3 hours	Bylaw 2000

B- Professional Information

1- Course Aims:

The aims of this course are to provide the student, upon completing the diploma in internal combustion engines in mechanical power engineering Programme, Give the students an appreciation of the fundamental principles of mechanical vibrations and a broad understanding to develop skills in the applications of mechanical vibrations in the internal combustion engines. Give the students an appreciation of the fundamental principles, design , and operation of mechanical vibrations in internal combustion engines. Provide with knowledge of the applications of different famous mechanical foundations in internal combustion engines. To provide students with an understanding of the mechanical vibration systems components utilized in internal combustion engines. Design a vibration system absorber and specify mechanisms commonly used on equipment.

2- Course Objectives

1-Demonstration of the knowledge and understanding of the importance of mechanical vibrations. In internal combustion engines

3- Introduce and apply mechanical vibrations theory to describe the behavior and performance of engines.

4- Recognizability of the different types of mechanical foundations used in internal combustion engines.

5- Evaluation of the suitable schemes for mechanical vibrations elements specially in the combustion engines.

3-Intended Learning Outcomes (ILOs)

NAQAAE Academic Reference Standards (ARS)	Program ILOs	Course ILOs
A. Knowledge and understanding		
A1. Theories, basics and specialized knowledge in the field of learning, as well as the subjects that affect his/her professional practice.	a1-1 Demonstrate sufficient essential knowledge and a deep understanding of the theories, basics and specialized knowledge in the field of **internal combustion engines**	a1-1-1 Understand how the conduction differential equation can be used to obtain the temperatue distribution within different engine elements.
A2- Mutual relation between professional aspects of professional practice and its effects on the Environment.	a2-1 Discuss Social effects of mechanical power egineering technologies.	a2-1-1 Discuss and recognize the social effects of Foundations and Vibrations of Engines
B. Intellectual skills		
B1- Define and analyze problems in the field of specialization and sorting them according to priorities	b1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to mechanical power engineering.	b1-1-1 select the suitable solution methods for Foundations and Vibrations of Engines problems based the heat conduction equation with the initial and boundary conditions.
B3- Analytical reading researches and subjects relevant to the field of specialization	b3-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems.	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it Foundations and Vibrations of Engines problems.
C. Professional and practical skills		

C1- Apply professional skills in the field of specialization.	c1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering techniques, skills, and tools.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to Foundations and Vibrations, using latest engineering techniques, skills, and tools.
C2- Write professional reports.	c.2-1 Write and evaluate a professional report on specialized related to mechanical power egineering tchnical matters.	c2-1-1 Write and evaluate a professional report on Foundations and Vibrations problems.
D. General and transferrable skills		
D2- Use information technology to improve his/her professional practice.	d2-1 Use state-of-the-art computer aided design tools for solving mechanical power engineering problems.	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to Foundations and Vibrations problems.
D4- Use different resources to obtain knowledge and information.	d4-1 Use different resources of information like libraries, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about Foundations and Vibrations.

4-Course Contents

Week No.	*Topic*	*Total Hours*	*Contact hrs*			*Course ILOs Covered (By No.)*
			Lec.	Tut.	Lab.	
Week-2 1	Introduction, definitions, and basic of vibrations. - Vibration and their classifications).	6	4	2	-	a1-1-1
Week3-4	Free vibration - Damping (sources and measurements). Vibrations	6	4	2	-	a1-1, b-1-1, b2-1, c1-1, c7-1

Week 5-6	Forced vibrations (Harmonic and periodic) - Transient vibrations	6	4	2	-	a1-1-1, a2-2-1, b1-1-1, c1-1-1
Week 7-8	Two degree of freedom system – Multi degree of freedom system Multi degree of freedom system	6	4	2	-	a1-1-1, a2-2-1, b1-1-1, c1-1-1
Week 9-10	Linear vibrations measuring instruments - Minimizing of vibrations.	6	4	2	-	b1-1-1, b3-1-1, c1-1-1
Week 11-12	Calculation of The pressure variation during the engine cycle - Force Analysis diagram of dynamic elements	6	4	2	-	a1-1-1, a2-1-1, b1-1-1, b3-1-1, c1-1-1,c2-1-1
Week 13-14	The engine cycle - The pressure diagram analysis of engine cycle	6	4	2	-	a1-1-1, a2-1-1, b1-1-1, b3-1-1, c1-1-1, c2-1-1, d2-1-1, d4-1-1
Week 15-16	Calculation of the pressure variation during the engine cycle - Force analysis for the Piston connecting rod and crank for a single cylinder	6	4	2	-	A1-1-1, a2-1-1, b1-1-1, b3-1-1, c1-1-1, c2-1-1
Week 17-18	Force analysis for multi cylinder engine. - Torsional vibrations	6	4	2	-	a1-1-1, a2-1-1, b1-1-1, c1-1-1
Week 19-20	Torsional vibrations in combustion engines components - Introduction to engine foundation	6	4	2	-	a1-1-1, a2-1-1, b1-1-1, c1-1-1
Week 21-23	Types of engine foundation - Design of engine foundations - Dynamic performance of engine foundations under mechanical vibrations	6	4	2	-	a1-1-1, a2-1-1, b1-1-1, c1-1-1, c2-1-1, d2-1-1, d4-1-1
Week 24-26	Calculation of Deflection of Dampers, - Frequency of Vibration of Dampers - Design dampers by the aid of frequency vibration analysis of dampers,	6	4	2	-	a1-1-1, a2-1-1, b1-1-1, c1-1-1, d2-1-1
Week27-30	Resonance concept - Resonance in internal combustion engines.	6	4	2	-	a1-1-1, a2-1-1, b1-1-1, b3-1-1, c1-1-1, c2-1-1 d2-1-1, d4-1-1

5- Relationship between the course and the programme

Field	Academic Reference Standard (ARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Programme Academic Standards that the course	**A1(a1-1)** and **A2(a2-1)**	**B1(b1-1)** and B3(**b3-1)**	**C1(c1-1)** and C2(**c2-1)**	**D2(d2-1)** and D4(**d4-1)**

contribute in achieving				

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Disccretionry subjects	Total
---	30%		70%				100%

7- Course Topics.

Topic No.	Topic	Weeks
1st	Calculation of The Pressure Variation During The Engine Cycle	**2**
2nd	Force Analysis for The Piston Connecting Rod and Crank for a Single Cylinder .	**3-10**
3rd	Force Analysis for Multi-Cylinder Engine., Torsional Vibrations, Engine Foundation, Damps, Types, Design,	**11-22**
4th	Calculation of Deflection of Dampers, Calculation of Deflection of Dampers, Frequency of Vibration of Dampers, Resonance	**23-30**

8- ILOs Matrix Topics

Course Intended Learning Outcomes (ILOs)		Course topics			
		1st	**2nd**	**3rd**	**4th**
Knowledge & Understanding	**a1-1-1** Understand how the law of energy conservation with the differential equations can be used to obtain the heat equation under transient conditions.	**x**	**x**	**x**	**x**
	a2-1-1 Discuss and recognize the social effects of transient heat transfer technology.	**x**	**x**	**x**	**x**

Intellectual Skills	**b1-1-1** select the suitable solution methods for transient problems based the heat conduction equation with the initial and boundary conditions.	**x**	**x**	**x**	**x**
	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to transient heat transfer.	**x**	**x**	**x**	**x**
Professional Skill	**c1-1-1** Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to transient heat transfer, using latest engineering techniques, skills, and tools.	**x**	**x**	**x**	**x**
	c2-1-1 Write and evaluate a professional report on transient heat transfer problems.	**x**	**x**	**x**	**x**
General Skills	**d2-1-1** Use state-of-the-art computer aided design tools for solving professional problems related to Transient heat transfer problems.		**x**		**x**
	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about transient heat transfer.		**x**		**x**

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)	**8- Teaching and Learning Method:**

		Lecture	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Site visits	Self learning	Cooperative	Discovering	Modelling	Playing
Knowledge & understanding	a1-1-1	x				x								
	a2-1-1	x				x								
Intellectual Skills	b1-1-1	x				x								
	b3-1-1	x				x								
Professional Skills	c1-1-1	x				x							x	
	c2-1-1	x				x							x	
General Skills	d2-1-1		x							x	x			
	d4-1-1		x							x	x			

10- Assessment

10.1 Assessment Methods

Course Intended Learning Outcome (ILOs)		Assessment Methods											
		Wirtten Exam	Oral Exam	Tutorial Assessment	Project Assessment	Model Assessment	Report Assessment	Quiz assessment	Presentation Assessment	Discussion	Laboratory Test	Home Exm	Monitoring
Knowledge & Understanding	a1-1-1	x											
	a2-1-1	x											
Intellectual Skills	b1-1-1	x											
	b3-1-1	x											

Professional Skills	c1-1-1	x											
	c2-1-1	x											
General Skills	d2-1-1	x											
	d4-1-1	x											

10.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	**100**	**32th**
Final Oral Examination		
Mid term written Examination		
Tutorial discussion, presentation, and report assessment		
Total	**100%**	

11- Facilities required for teaching and learning

Teaching aids like, lecture room with audio-visual facilities, white board.

12- List of references:

- Mechanical Vibrations, Singiresu S. Rao, Addison Wesley publishing Co. 1986

- Elements of vibration analysis, Leonard Meirovitch.Holman, J.P., " Heat Transfer"., McGraw-Hill Book Company, Inc. 1992.

- Foundation Vibration Analysis :A Strength-of-Materials Approach, John P. Wolf, Andrew J. Deeks, Elsevier Linacre House, Jordan Hill, Oxford OX2 8DP 200 Wheeler Road, Burlington, MA 01803 First published 2004 Copyright © 2004, John P. Wolf and Andrew J. Deeks. All rights reserved

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Course Dr. Gamal Zaghloul
Programme coordinator:
Head of the Department: Prof. Kamal Morad

Date:

Course Specification

Program on which the course is given	M. Sc. in Mechanical Power Engineering
Major or minor element of program	Major
Department offering the program	Mechanical Engineering
Department offering the course	Mechanical Engineering
Academic year/Level	1st year
Date of specification approval	*2020*

A- Basic Information

Title: steam Power Plants	Code Symbol: MEP 572	
Lecture	3 hours	
Tutorial	-	
Laboratory	-	
Total	3 hours	Bylaw 2000

B- Professional Information

1- Course Aims

The aims of this course are to provide the post graduate student, upon completing the course program, with the basic knowledge and skills of definitions, principles and applications of thermal power plants and the problems associated with it within the following topics:
conventional working cycles, combined cycles, co-generation cycles, power plant setting, fuel and combustion, fuel burning equipment, draught systems, water treatment, and steam piping. Numerous examples based on modern power plants design are included so that students can grasp the methods and acquire an appreciation of different representative physical parameters.
Solved examples enable the post graduate students to interpret the working cycles configurations of the steam power plant and characteristic study of some individual components, along with exergy analysis

2- Course Objectives

1-Demonstration of the knowledge and understanding of exergy method of analysis, based on second law of thermodynamics, for steam power plants (steam turbine plants, combined cycle plants, and co-generation plants).

2- Power plant type, size, number of units, and site selection of the plants according to the load requirement.
3- Analysis, thermal design, and interpretation of the working cycles of the different types of thermal power plants along with control methods.
4- Combustion systems and burning equipment for coal, liquid, and gaseous fuels.
4- Water treatment methodologies, internal and external.
5- Steam piping layout, design, its attachments , and tracing .

3- Intended Learning Outcomes (ILOs)

NAQAAE Academic Reference Standards (ARS)	Program ILOs	Course ILOs
A. Knowledge and understanding		
A1. Theories, basics and specialized knowledge in the field of learning, as well as the subjects that affect his/her professional practice.	a1-3 Demonstrate sufficient essential knowledge and a deep understanding of the theories, basics and specialized knowledge in the field of Thermal Power Plants.	a-1-3-1 Define the concepts of physical meaning and phenomena used in Thermal Power Plants.
B. Intellectual skills		
B1- Define and analyze problems in the field of specialization and sorting them according to priorities	b1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to mechanical power engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to Thermal Power Plants based on the flow equations analysis.
	b1-2 Interpret, analyze, and evaluate a given system specification information and relate it to the design of the required system.	b1-2-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to Thermal Power Plants

B4- Risk assessment in the professional practices.	b4-1 Evaluate pros and cons of given methodologies for mechanical power engineering systems development.	b4-1-1 Evaluate pros and cons of given methodologies for Thermal Power Plants development.
C. Professional and practical skills		
C1- Apply professional skills in the field of specialization.	c1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering techniques, skills, and tools.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to Thermal Power Plants engineering problems, using latest engineering techniques, skills, and tools.
C2- Write professional reports.	c2-1 Write and evaluate a professional report on specialized related to mechanical power engineering technical matters.	c2-1-1 Write and evaluate a professional report on Thermal Power Plants
D. General and transferrable skills		
D2- Use information technology to improve his/her professional practice.	d2-1 Use state-of-the-art computer aided design tools for solving mechanical power engineering problems	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to Thermal Power Plants
D4- Use different sources to obtain knowledge and information.	d4-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about Thermal Power Plants.

4- Course Contents

Week No.	*Topic*	*Total Hours*	*Contact hrs*			*Course ILOs Covered (By No.)*
			Lec.	Tut.	Lab.	
Week-1,2	General review of	6	6	–	–	a1-3-1, b1-1-1, b1-2-1, b4-1-1, c1-1-1, d2-1-1, d4-1-1

	fundamentals					
Week-3,4,5	Conventional cycles	9	9	–	–	a1-3-1, b1-1-1, b1-2-1, b4-1-1, c1-1-1, d2-1-1, d4-1-1
Week-6,7,8	Combined cycles	9	9	–	–	a1-3-1, b1-1-1, b1-2-1, b4-1-1, c1-1-1, d2-1-1, d4-1-1
Week-9,10	Co-generation cycles	6	6	–	–	a1-3-1, b1-1-1, b1-2-1, b4-1-1, c1-1-1, d2-1-1, d4-1-1
Week-11,12	Power plant setting	6	6	–	–	a1-3-1, b1-1-1, b1-2-1, b4-1-1, c1-1-1, d2-1-1, d4-1-1
Week-13,14,15,16	Fuel and combustion	12	12	–	–	a1-3-1, b1-1-1, b1-2-1, b4-1-1, c1-1-1, d2-1-1, d4-1-1
Week-17,18,19,20	Fuel burning equipment	12	12	–	–	a1-3-1, b1-1-1, b1-2-1, b4-1-1, c1-1-1, d2-1-1, d4-1-1
Week-21,22	Draught systems	6	6	–	–	a1-3-1, b1-1-1, b1-2-1, b4-1-1, c1-1-1, d2-1-1, d4-1-1
Week-23,24,25,26	Water treatment	12	12	–	–	a1-3-1, b1-1-1, b1-2-1, b4-1-1, c1-1-1, d2-1-1, d4-1-1
Week-27,28,29,30	Steam piping	12	12	–	–	a1-3-1, b1-1-1, b1-2-1, b4-1-1, c1-1-1, d2-1-1, d4-1-1
	total	90	90			

5- Relationship between the Course and the Programme

Field	National Academic Reference Standard(NARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Programme Academic Standards that the course contributes in achieving.	A1 (a1-3),	B1 (b1-1), (b1-2) B4 (b4-1),	C1 (c1-1), C2 (c2-1)	D2 (d2-1), D4 (d4-1)

6- Course Subject Area

A	B	C	D	E	F	G	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Disccretionry subjects	Total
---	---	30%	70%	---	---	---	100%

7- Course Topics

Topic No.	Topic	Weeks
1st	General review of fundamentals	1,2
2nd	Conventional cycles	3-5

3rd	Combined Cycles	6-8
4th	Co-generation cycles	9,10
5th	Power plant setting	11.12
6th	Fuel and combustion	13-16
7th	Fuel burning equipment	17-20
8th	Draught systems	21,22
9th	Water treatment	23-26
10th	Steam piping	27-30

8- ILOs Matrix Topics

Course Intended Learning Outcomes (ILOs)		Course topics									
		1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
Knowledge & Understanding	a-1-3-1 Define the concepts of physical meaning and phenomena used in Thermal Power Plants	x	x	x	x	x	x	x	x	x	x
Intellectual Skills	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to thermal power plants based on the flow equations analysis.	x	x	x	x	x	x	x	x	x	x
	b1-2-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to Thermal Power Plants	x	x	x	x	x	x	x	x	x	x
	b4-1-1 Evaluate pros and cons of given methodologies for Thermal Power Plants development.	x	x	x	x	x	x	x	x	x	x
Professional Skill	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to thermal power plants problems, using latest engineering techniques, skills, and tools.	x	x	x	x	x	x	x	x	x	x
	c2-1-1 Write and evaluate a professional report on thermal power	x	x	x	x	x	x	x	x	x	x

	plants.										
General Skills	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to thermal power plants	x	x	x	x	x	x	x	x	x	x
	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about thermal power plants.	x	x	x	x	x	x	x	x	x	x

9- Teaching and Learning Method

Course Intended learning outcomes (ILOs)		Teaching and Learning Method												
		Lecture	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Site visits	Self learning	Cooperative	Discovering	Modeling	Playing
Knowledge & understanding	a1-3-1	x		x		x								
Intellectual Skills	b1-1-1	x		x	x	x								
	b2-1-1													
	b4-1-1	x		x	x	x			x					
Professional Skills	c1-1-1			x	x	x	x		x	x	x			
	c2-1-1	x		x	x	x								
General Skills	d2-1-1	x		x	x	x			x	x	x			
	d4-1-1			x	x				x	x	x			

10- Teaching and learning method for low capacity and outstanding Student

For low capacity students	Assign a portion of the office hours for those students.
	Give them specific tasks.
	Repeat the explanation of some of the material and

	tutorials.
	Assign a teaching assistance to follow up the performance of these groups of students.
For outstanding Students	Hand out project assignments to those students.
	Give them some research topics to be searched using the internet and conduct presentation.
	Encourage them to take parts in the running research projects.

11- Assessment

11.1 Assessment Methods

Course Intended Learning Outcome (ILOs)		Assessment Methods											
		Written Exam	Oral Exam	Tutorial Assessment	Project Assessment	Model Assessment	Report Assessment	Quiz assessment	Presentation Assessment	Discussion	Laboratory Test	Home Exam	Monitoring
Knowledge & Understanding	a1-3-1	x											
Intellectual Skills	b1-1-1	x											
	b1-2-1	x											
	b4-1-1	x											
Professional Skills	c1-1-1	x											
	c2-1-1	x											
General Skills	d2-1-1	x											
	d4-1-1	x											

11.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	32 th
Mid term written Examination	---	
Quizzes	---	

laboratory examination	---	
Oral examination	---	
Semester work	---	
Total	100%	

12- Facilities Required for Teaching and Learning

Teaching aids like, lecture room with audio-visual facilities, white board.

13- List of References

[1] EL WAKIL, M.M.,: Powerplant Technology, McGraw-Hill, 1984.
[2] Weston, K.C.,: Energy Conversion, e-book, 2000.
[3] Gosami,D.Y., and F. Kreith: Energy Conversion, e-book, 2008.
[4] Ganapathy, V.,: Industrial Boilers Design, Applications, and Calculations, e-book, 2003.
[5] Kehlhofer, R.,: Combined-Cycle Gas Steam Turbine Power Plants, e-book, 1997.
[6] Singer, J.G.,: Combustion Fossil Power, e-book, 1991.
[7] Thumann, A., and D. B. Mehta,: Handbook of Energy Engineering, e-book, 2000.
[8] Ganapathy, V.,: Industrial Boilers and Heat Recovery Steam Generators, e-book, 2003.
[9] Snthony, E.J.,: Fluidized Bed Combustion, e-book, 2004.
[10] Raja, A. K., et. al.,: Power Plant Engineering, e-book,2006.
[11] Petchers, N.,: Combined Heating Cooling and Power Handbook Technologies & Applications, e-book, 2003.

Programme coordinator:

Prof. Dr. Nady Naguib Mikhael
Professor of Thermal Power and Heat Engines
Mechanical Power Engineering Department

Date:

Prof. Dr. Kamal Ameen Morad
Head of Mechanical Power Engineering Department

Course Specification

Program on which the course is given	M. Sc. in Mechanical Power Engineering
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering
Department offering the course	Mechanical Power Engineering
Academic year/Level	Second year
Date of specification approval	2020

A- Basic Information

Title: Gas Turbine and Diesel Engine Power Plants	**Code Symbol**: **MEP573**	
Lecture	3 hours	
Tutorial		
Laboratory		
Total	3 hours	Bylaw 2000

B- Professional Information

1- Course Aims:

In our treatment of this course, we have two major objectives; in addition to obtaining an understanding of the operation and classification of the gas turbine power plants, we wish to understand the performance of the diesel power plants. This course is devoted primarily to help the post graduate students to add more information about the gas turbine power plants operation and classification, thermal efficiency improvement, combustion chambers, performance of the diesel engine power plants, engine supercharging, dual fuel engine and fuel injection system.

2- Course Objectives:

On completion of this course, the student should have sufficient broad knowledge in mechanical engineering to:
1- Demonstrate knowledge of the gas turbine performance;
2- Classify and describe the gas turbine power plants;
3- Demonstrate knowledge of the diesel engine power plants;
4- Classify and describe the combustion chambers;
5- Expalin the performance of the diesel engine;
6- Classify the fuel injection systems of the diesel engine;
7- Expalin the performance of dual fuel plants.

3- Intended Learning Outcomes (ILOs):

NAQAAE Academic Reference Standards (ARS)	Program ILOs	Course ILOs
A. Knowledge and understanding		
A1. Theories, basics and specialized knowledge in the field of learning, as well as the subjects that affect his/her professional practice.	a1-3 Demonstrate sufficient essential knowledge and a deep understanding of the theories, basics and specialized knowledgein the field ofgas turbine and diesel power plants.	a1-3-1 Demonstrate sufficient essential knowledge and a deep understanding of the theories, basics and specialized knowledgein gas turbine and diesel power plants operation.
B. Intellectual skills		
B1- Define and analyze problems in the field of specialization and sorting them according to priorities	b1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to mechanical power engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems in gas turbine and diesel engine power plants.
	b1-2 Interpret, analyze, and evaluate a given system specification information and relate it to the design of the required system.	b1-2-1 How to analyze the characteristics and performance of different components of gas turbine and diesel engine power plants.
B4- Risk assessment in the professional practices.	b4-1 Evaluate pros and cons of given methodologies for mechanical power engineering systems development.	b4-1-1 How to develop the operation of the gas turbine and diesel engine power plants and increase its efficiencies.
C. Professional and practical skills		
C1- Apply professional skills in the field of specialization.	c1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering techniques, skills, and tools.	c1-1-1 How to solve the operating problems in gas turbine and diesel engine power plants.
C2- Write professional reports.	c.2-1 Write and evaluate a professional report on specialized related to mechanical power engineering technical matters.	c2-1-1 How to write a technical reports about the operation and performance of gas turbine and diesel engine power plants.
D. General and transferrable skills		
D2- Use information technology to improve his/her professional	d2-1 Use state-of-the-art computer aided design tools for solving	d2-1-1 How to use the advanced computer programs to solve the

practice.	mechanical power engineering problems.	problems and design of the different components of gas turbine power plant.
D4- Use different resources to obtain knowledge and information.	d4-1 Use different resources of information like libraries, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d4-1-1 How to upgrade the information about the gas turbine and diesel engine power plants.

4- Course Contents:

Week No.	*Topic*	*Total Hours*	*Contact hrs*			*Course ILOs Covered (By No.)*
			Lec.	Tut.	Lab.	
Week-1	**Gas turbine power plants classifications**	**3**	**2**	**1**	**-**	**a1-3-1, c2-1-1**
Week-2	**Gas turbine power plants classifications (Cont.)**	**3**	**2**	**1**	**-**	**a1-3-1, c2-1-1**
Week-3	**Gas turbine power plants classifications (Cont.)**	**3**	**2**	**1**	**-**	**a1-3-1, c2-1-1**
Week-4	**Thermal efficiency improvement**	**3**	**2**	**1**	**-**	**b1-1-1, b1-2-1, b4-1-1, c1-1-1, d2-1-1, d4-1-1**
Week-5	**Thermal efficiency improvement (Cont.)**	**3**	**2**	**1**	**-**	**b1-1-1, b1-2-1, b4-1-1, c1-1-1, d2-1-1, d4-1-1**
Week-6	**Thermal efficiency improvement (Cont.)**	**3**	**2**	**1**	**-**	**b1-1-1, b1-2-1, b4-1-1, c1-1-1, d2-1-1, d4-1-1**
Week-7	**Combustion chambers performance**	**3**	**2**	**1**	**-**	**a1-3-1, c2-1-1, d4-1-1**
Week-8	**Combustion chambers performance (Cont.)**	**3**	**2**	**1**	**-**	**a1-3-1, c2-1-1, d4-1-1**
Week-9	**Combustion chambers performance (Cont.)**	**3**	**2**	**1**	**-**	**a1-3-1, c2-1-1, d4-1-1**
Week-10	**The main systems of the diesel engine power plants**	**3**	**2**	**1**	**-**	**a1-3-1, c2-1-1**
Week-11	**The main systems of the diesel engine power plants (Cont.)**	**3**	**2**	**1**	**-**	**a1-3-1, c2-1-1**
Week-12	**The main systems of the diesel engine power plants (Cont.)**	**3**	**2**	**1**	**-**	**a1-3-1, c2-1-1**
Week-13	**Combustion chambers performance of the diesel engine power plants**	**3**	**2**	**1**	**-**	**a1-3-1, c2-1-1, d4-1-1**
Week-14	**Combustion chambers performance of the diesel engine power plants (Cont.)**	**3**	**2**	**1**	**-**	**a1-3-1, c2-1-1, d4-1-1**
Week-15	**Combustion chambers performance of the diesel engine power plants (Cont.)**	**3**	**2**	**1**	**-**	**a1-3-1, c2-1-1, d4-1-1**
Week-16	**Engine supercharging**	**3**	**2**	**1**	**-**	**a1-3-1, b1-1-1, b1-2-1, b4-1-1, c1-1-1, c2-1-1, d2-1-1, d4-1-1**
Week-17	**Engine supercharging (Cont.)**	**3**	**2**	**1**	**-**	**a1-3-1, b1-1-1, b1-2-1, b4-1-1, c1-1-1, c2-1-1, d2-1-1, d4-1-1**
Week-18	**Engine supercharging (Cont.)**	**3**	**2**	**1**	**-**	**a1-3-1, b1-1-1, b1-2-1, b4-1-1, c1-1-1, c2-1-1, d2-1-1, d4-1-1**
Week-19-20	**Dual fuel engines**	**3**	**2**	**1**	**-**	**a1-3-1, b1-1-1, b1-2-1, b4-1-1, c1-1-1, c2-1-1, d2-1-1, d4-1-1**

Week-21-22	**Dual fuel engines (Cont.)**	**3**	**2**	**1**	**-**	**a1-3-1, b1-1-1, b1-2-1, b4-1-1, c1-1-1, c2-1-1, d2-1-1, d4-1-1**
Week-23-24	**Dual fuel engines (Cont.)**	**3**	**2**	**1**	**-**	**a1-3-1, b1-1-1, b1-2-1, b4-1-1, c1-1-1, c2-1-1, d2-1-1, d4-1-1**
Week-25-26	**Fuel injection systems**	**3**	**2**	**1**	**-**	**a1-3-1, b1-1-1, b1-2-1, b4-1-1, c1-1-1, c2-1-1, d2-1-1, d4-1-1**
Week-27-28	**Fuel injection systems (Cont.)**	**3**	**2**	**1**	**-**	**a1-3-1, b1-1-1, b1-2-1, b4-1-1, c1-1-1, c2-1-1, d2-1-1, d4-1-1**
Week-29-30	**Fuel injection systems (Cont.)**	**3**	**2**	**1**	**-**	**a1-3-1, b1-1-1, b1-2-1, b4-1-1, c1-1-1, c2-1-1, d2-1-1, d4-1-1**

5- Relationship between the course and the programme:

Field	Academic Reference Standard			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Program Academic Standards that the course contribute in achieving	A1(a1-3)	B1(b1-1, b1-2), B4(b4-1)	C1(c1-1), C2(c2-1)	D2(d2-1), D4(d4-1)

6- Course Subject Area:

A	**B**	**C**	**D**	**E**	**F**	**G**	
Humanities and Social Science	**Mathematics and Basic Sciences**	**Basic Engineering Science**	**Applied Engineering and Design**	**Computer Applications and ICT**	**Projects and practice**	**Disccretionry subjects**	**Total**
---	**---**	**30%**	**70%**	**---**	**---**	**---**	**100%**

7- Course Topics:

Topic No.	Topic	Weeks
1st	**Gas turbine power plants classifications**	1, 2 and 3
2nd	**Thermal efficiency improvement**	4, 5 and 6
3rd	**Combustion chambers performance**	7, 8 and 9
4th	**The main systems of the diesel engine power plants**	10, 11 and 12
5th	**Combustion chambers performance of the diesel engine power plants**	13, 14 and 15
6th	**Engine supercharging**	16, 17 and 18
7th	**Dual fuel engines**	19, 20 and 21
8th	**Fuel injection systems**	22, 23 and 24

8- ILOs Matrix Topics:

Course Intended Learning Outcomes (ILOs)		Course topics							
		1st	2nd	3rd	4th	5th	6th	7th	8th
Knowledge & Understanding	a1-3-1 Demonstrate sufficient essential knowledge and a deep understanding of the theories, basics and specialized knowledgein gas turbine and diesel power plants operation.	X		X	X	X	X	X	X
Intellectual Skills	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems in gas turbine and diesel engine power plants.		X				X	X	X
	b1-2-1 How to analyze the characteristics and performance of different components of gas turbine and diesel engine power plants.		X				X	X	X
	b4-1-1 How to develop the operation of the gas turbine and diesel engine power plants and increase its efficiencies.		X				X	X	X
Professional Skill	c1-1-1 How to solve the operating problems in gas turbine and diesel engine power plants.		X				X	X	X
	c2-1-1 How to write a technical reports about the operation and performance of gas turbine and diesel engine power plants.	X		X	X	X	X	X	X
General Skills	d2-1-1 How to use the advanced computer programs to solve the problems and design of the different components of gas turbine power plant.		X				X	X	X
	d4-1-1 How to upgrade the information about the gas turbine and diesel engine power plants.		X	X		X	X	X	X

9- Teaching and Learning Method:

Course Intended learning outcomes(ILOs)		Teaching and Learning Method												
		Lecture	Presentation and Movies	Discussion	Tutorial	Problemsolving	Brain storming	Projects	Site visits	Self learning	Cooperative	Discovering	Modelling	Playing
Knowledge & understanding	a1-3-1	x	x	x			x		x	x	x			
Intellectual Skills	b1-1-1	x	x	x		x	x			x	x			
	b1-2-1	x	x	x		x	x			x	x			
	b4-1-1	x	x			x				x	x	x		
Professional Skills	c1-1-1	x	x			x				x	x	x		
	c2-1-1	x	x			x	x			x	x	x		
General Skills	d2-1-1	x	x			x	x			x	x	x		
	d4-1-1	x	x			x				x	x	x		

10- Assessment

10.1 Assessment Methods:

Course Intended Learning Outcome (ILOs)		Assessment Methods											
		Written Exam	Oral Exam	Tutorial	Project Assessment	Model Assessment	Report Assessment	Quiz assessment	Presentation	Discussion	Laboratory Test	Home Exam	Monitoring
Knowledge& Understanding	a1-3-1	x											
IntellectualSkills	b1-1-1	x											
	b1-2-1	x											
	b4-1-1	x											
Professional Skills	c1-1-1	x											
	c2-1-1	x											
General Skills	d2-1-1	x											
	d4-1-1	x											

10.2 Assessment Schedule and GradesDistribution:

Assessment Method	Percentage	week
Final Examination	**100**	**32th**
Mid term written Examination1	**-**	**-**
Mid term written Examination 2	**-**	**-**
Mid term laboratory assessment	**-**	**-**
End of term laboratory examination	**-**	**-**
Tutorial and report assessment	**-**	**-**
Total	**100%**	

11- Facilities required for teaching and learning:

Teaching aids like, lecture room with audio-visual facilities, white board.

12- List of references:

1- "Industrial and ProcessFurnacesPrinciples, Design and Operation", by Peter Mullinger and Barrie Jenkins, 2008.
2- "Industrial Furnaces" by W.Trinks, M.H.Mawhinney, R.A.Shannon, R.J.Reed, Sixth edition, 2004.
3- "Power Plant Engineering" by A. K. Raja, Amit Prakash Srivastava and Manish Dwivedi, 2006.
4- "Fundamentals of Internal Combustion Engines" by H. N. Gupta, 2006
5- "Internal Combustion Engines" by Shyam K. Agrawal, 2008.
6- "Internal Combustion Engine Theory and Practice" by S. P. Sen, 1977.

Course coordinator: Dr. Hamada Mohamed Gad

Programme coordinator: Dr. Yassen ElSayed Yassen

Head of the Department: Prof. Dr. Kamal Morad

Date:

Course Specification

Program on which the course is given	Post Studies in Mechanical Power Engineering (MSc)
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering
Department offering the course	Preparing courses in Mechanical Power Engineering
Academic year/Level	***2020***
Date of specification approval	

A- Basic Information

Title: **Pneumatic and Hydraulic Systems**	**Code Symbol**: **MEP 578**	
Lecture	3 hours	
Tutorial	- hours	
Laboratory	- hours	
Total	3 hours	Bylaw 2000
Second term	prerequisite	-

B- Professional Information

1- Course Aims:

The course of Pneumatic and Hydraulic Systems has been designed in order to give postgraduate students the necessary knowledge and skills for the use of pneumatic and hydraulic circuits to transmission the power or the force – raising the load from lower level to the upper level – control and generation the power.

2- Course Objectives

1. introduce the importance and uses of the pneumatic and hydraulic circuits for transmission, generation and control the force or the power.
2. demonstrate the main components of both pneumatic circuits and hydraulic circuits.
3. summarize the maintenance and repairing the hydraulic and pneumatic circuits.
4. describe the kinds of conductors and pipe fitting.
5. design a simple hydraulic and pneumatic circuits.

3- Intended Learning Outcomes (ILOs)

NAQAAE Academic Reference Standards (ARS)	Program ILOs	Course ILOs
A. Knowledge and understanding		
A1. Theories, basics and specialized knowledge in the field of learning, as well as the subjects that affect his/her professional practice.	a1-4 Demonstrate sufficient essential knowledge and a deep understanding of the theories, basics and specialized knowledge in the field of **Fluids Engineering and Pumping**.	a-1-4-1 Define the concepts of physical meaning and phenomena are used in Pneumatic and Hydraulic Systems.
B. Intellectual skills		
B1- Analyze and evaluate the information in the field of specialization, and relate it to solve problems.	b1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to mechanical power engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to Pneumatic and Hydraulic Systems based on the flow equations analysis.
B2- Solve specialized problems in the field of practice.	b2-1 Apply broad knowledge of modern computational methods and think critically to solve unstructured problems (with incomplete data) related to mechanical power engineering.	b2-1-1 Select the suitable solution methods (Analytical technique and modern computational) for design of pump data sheets problems based on the flow equations analysis.
C. Professional and practical skills		
C1- Apply professional skills in the field of specialization.	c1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering techniques, skills, and tools.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to Pneumatic and Hydraulic Systems problems, using latest engineering techniques, skills, and tools.
C2- Write professional reports.	c.2-1 Write and evaluate a professional report on specialized related to mechanical power engineering technical matters.	c2-1-1 Write and evaluate a professional report on pumps sealing, materials, and accessories.

D. General and transferrable skills		
D2- Use information technology to improve his/her professional practice.	d2-1 Use state-of-the-art computer aided design tools for solving mechanical power engineering problems.	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to Pneumatic and Hydraulic Systems.
D4- Use different sources to obtain knowledge and information.	d4-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about Pneumatic and Hydraulic Systems.
D8- Learn independently and seek continuous learning.	d8-2 Seek continuous learning through continuous education, organizing and participating in seminars, workshops, national and international conferences.	d8-2-1 Exhibit the ability to learn more about Pneumatic and Hydraulic Systems.

4- Course Contents

Week No.	***Topic***	***Total Hours***	***Contact hrs***			***Course ILOs Covered (By No.)***
			Lec.	**Tut.**	**Lab.**	
Week-1 and 2	Introduction & Classification of fluid power systems.	6	6	–	–	a1-4-1, b1-1-1, c1-1-1, c2-1-1, d2-1-1, d4-1-1
Week-3 and 4	Governing equations	6	6	–	–	a1-4-1, b1-1-1, c1-1-1, c2-1-1, d2-1-1, d4-1-1
Week-5 and 6	Main component of pneumatic and hydraulic systems	6	6	–	–	a1-4-1, b1-1-1, c1-1-1, c2-1-1, d2-1-1, d4-1-1
Week-7 and 8	Types of conductors (steel tube and pipes, plastic tubes and flexible hoses)	6	6	–	–	a1-4-1, b1-1-1, c1-1-1, c2-1-1, d2-1-1, d4-1-1
Week-9 and 10	Introduction of positive and non–positive pumps	6	6	–	–	a1-4-1, b1-1-1, c1-1-1, c2-1-1, d2-1-1, d4-1-1
Week-11 and 12	Gear pumps (Internal, External, lobe, Gerotor and Screw pumps)	6	6	–	–	a1-4-1, b1-1-1, c1-1-1, c2-1-1, d2-1-1, d4-1-1
Week-13 and 14	Vane and piston pumps	6	6	–	–	a1-4-1, b1-1-1, c1-1-1, c2-1-1, d2-1-1, d4-1-1
Week-15 and 16	Introduction and classifications of compressors	6	6	–	–	a1-4-1, b1-1-1, c1-1-1, d2-1-1, d4-1-1, d8-2-1
Week-17 and 19	Gear Actuators	9	9	–	–	a1-4-1, b1-1-1, b2-1-1, c1-1-1, d2-1-1, d4-1-1, d8-2-1
Week-20 and 21	Piston and vane actuators and Valves	6	6	–	–	a1-4-1, b1-1-1, c1-1-1, d2-1-1, d4-1-1, d8-2-1

Week-22 and 23	Additional components to increase the performance of fluid power circuits (e.g. Intensifiers and accumulators)	6	6	–	–	a1-4-1, b1-1-1, c1-1-1, d2-1-1, d4-1-1, d8-2-1
Week-24 and 26	Design of hydraulic circuits	9	9	–	–	a1-4-1, b1-1-1, c1-1-1, d2-1-1, d4-1-1, d7-2-1
Week-27 and 28	Design of pneumatic circuits	6	6	–	–	a1-4-1, b1-1-1, b2-1-1, c1-1-1, d2-1-1, d4-1-1
Week-29 and 30	Maintenances and safety of hydraulic and pneumatic circuits	6	6	–	–	a1-4-1, b1-1-1, b2-1-1, c1-1-1, d2-1-1, d4-1-1
Total		**90**	**90**	–	–	

5- Relationship between the course and the programme

Field	National Academic Reference Standard(NARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Programme Academic Standards that the course contribute in achieving	-4)1A1 (a	B1 (b1-1), B2 (b2-1)	C1 (c1-1), C2 (c2-1)	D2 (d2-1), D4 (d4-1), D8 (d8-2)

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Disccretionry subjects	Total
---	---	**30%**	**70%**	---	---	---	**100%**

7- Course Topics.

Topic No.	Topic	Weeks
1st	Introduction & Classification of fluid power systems.	1-6
2nd	Introduction of positive and non–positive pumps	7-12
3rd	Design of hydraulic circuits	13-18
4th	Design of pneumatic circuits	19-24
5th	Maintenances and safety of hydraulic and pneumatic circuits	25-30

8- ILOs Matrix Topics

Course Intended Learning Outcomes (ILOs)	Course topics				
	1st	2nd	3rd	4th	5th

Knowledge & Understanding	a-1-4-1 Define the concepts of physical meaning and phenomena are used in Pneumatic and Hydraulic Systems.	x	x	x	x	x
Intellectual Skills	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to Pneumatic and Hydraulic Systems based on the flow equations analysis.	x	x	x	x	x
	b2-1-1 Select the suitable solution methods (Analytical technique and modern computational) for design of pump data sheets problems based on the flow equations analysis.					x
Professional Skill	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to Pneumatic and Hydraulic Systems problems, using latest engineering techniques, skills, and tools.	x	x	x	x	x
	c2-1-1 Write and evaluate a professional report on pumps sealing, materials, and accessories.	x	x	x		
General Skills	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to Pneumatic and Hydraulic Systems.	x	x	x	x	x
	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about Pneumatic and Hydraulic Systems.	x	x	x	x	x
	d8-2-1 Exhibit the ability to learn more about Pneumatic and Hydraulic Systems.				x	

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		Teaching and Learning Method												
		Lecture	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Site visits	Self learning	Cooperative	Discovering	Modelling	Playing
Knowledge & understanding	a1-4-1	x		x										
Intellectual Skills	b1-1-1	x		x	x	x								
	b2-1-1	x		x	x	x			x					
Professional Skills	c1-1-1			x	x	x	x		x	x	x			
	c2-1-1	x		x	x	x								
General Skills	d2-1-1	x		x	x	x			x	x	x			
	d4-1-1			x	x				x	x	x			
	d8-2-1			x	x				x	x	x			

10- Teaching and learning method for low capacity and outstanding Student

For low capacity students	Assign a portion of the office hours for those students.
	Give them specific tasks.
	Repeat the explanation of some of the material and tutorials.
	Assign a teaching assistance to follow up the performance of these groups of students.
For outstanding Students	Hand out project assignments to those students.
	Give them some research topics to be searched using the internet and conduct presentation.
	Encourage them to take parts in the running research projects.

11- Assessment

11.1 Assessment Methods

Course Intended Learning Outcome (ILOs)		Assessment Methods											
		Wirtten Exam	Oral Exam	Tutorial Assessment	Project Assessment	Model Assessment	Report Assessment	Quiz assessment	Presentation Assessment	Discussion	Laboratory Test	Home Exm	Monitoring
Knowledge & Understanding	a1-4-1	x											
Intellectual	b1-1-1	x											

Skills	b2-1-1	x											
Professional Skills	c1-1-1	x											
	c2-1-1	x											
General Skills	d2-1-1	x											
	d4-1-1	x											
	d8-2-1	x											

11.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	32 th
Mid term written Examination	---	
Quizzes	---	
laboratory examination	---	
Oral examination	---	
Semester work	---	
Total	100%	

12- Facilities required for teaching and learning

Teaching aids like lecture room with audio visual facilities, white board, tutorial room and models.

13- List of references:

6.1- Course Notes & CD

6.2-Essential Books (Text Books):

- Crowe ,CT., Flger,D.F, & Robertson, J.A, "Engineering Fluid Mechanics" , John Wiley &sons INC.,8th edition,2005.
- Esposito,A.,"'Fluid Power with Applications" prentice-Hall INT.(UK) 4th edition,1997.
- Mendel O., "Practical Piping Handbook" Penwell Books, 1981.
- Sahu,G.K "Handbook of Piping Design" Newage International, 1998.

Course Coordinator:

Course Prof. Dr. Imam Ahmad El-Sawaf

Programme coordinator:

Head of the Department: Ass. Prof. Hamada Mohamed Gad

Date: 10/9/2019

Course Specification

Program on which the course is given	Mechanical Power Engineering
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering
Department offering the course	Mechanical Power Engineering
Academic year/Level	MSc.
Date of specification approval	***2020***

A- Basic Information

Title: Water Desalination	**Code Symbol: MEP585**	
Lecture	3 hours	
Tutorial	-	
Laboratory	-	
Total	3 hours	Bylaw 2003
Secondterm	prerequisite	-

B- Professional Information

1- Course Aims:

The aims of this course are to provide the Student, upon completing the mechanical power engineering programme, with the basic knowledge and skills of definitions, principles and applications of water desalination, design and performance of desalination plants, study of the problems common to distillation.

Course Objectives

On completion of this course, the student should have sufficient broad knowledge in mechanical engineering to:

1- Demonstrate knowledge of the different types of water desalination;
2- Classify and describe the the desalination processe;
3- Demonstrate knowledge of the future desalinatino methods;
4- Domenstrate knowledge about the desalniation plant selection
5- Domenstrate the water treatment chemicals;
6- Domenstrate the desalination using combined power cycles.
7- Domenstrate knowledge about the distillation by ion exchange

2- Intended Learning Outcomes (ILOs)

NAQAAE Academic Reference Standards (ARS)	Program ILOs	Course ILOs
A. Knowledge and understanding		
A1. Theories, basics and specialized knowledge in the field of learning, as well as the subjects that affect his/her professional practice.	a1-2 Understand the theories, basics and specialized knowledge in the field of **Turbo-Machinery and Aero-Dynamics**.	a-1-2-1 Define the concepts of physical meaning and phenomena are used in Water Desalination.
A2- Mutual relation between professional aspects of professional practice and its effects on the Environment.	a2-1 Discuss Social effects of mechanical power engineering technologies.	a2-2-1 Report and recognize the professional aspects of Water Desalination applications and their effects on the Environment.
A5- Basics and principles of quality in professional practice in the field of specialization.	a5-1 Explain Quality Assurance concepts of different mechanical power components and systems development phases.	a5-1-1 Explain Quality Assurance concepts of different mechanical power components and systems development phases.
B. Intellectual skills		
B1- Analyze and evaluate the information in the field of specialization, and relate it to solve problems.	b1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to mechanical power engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to solar power engineering based on the flow equations analysis.

B3- Link and integrate diverse knowledge to solve professional problems.	b3-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems.	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to Water Desalination.
B5- Assess risks in professional practice in the field of specialization.	b5-1 Evaluate pros and cons of given methodologies for mechanical power engineering systems development.	b5-1-1 Evaluate pros and cons of given methodologies for mechanical power engineering systems development.
C. Professional and practical skills		
C1- Master the basic as well as the latest professional skills in the field of specialization.	c1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering techniques, skills, and tools.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to Water Desalination problems, using latest engineering techniques, skills, and tools.
C2- Write and evaluate technical and professional reports.	c.2-1 Write and evaluate a professional report on specialized related to mechanical power engineering technical matters.	c2-1-1 Write and evaluate a professional report on Water Desalination
D. General and transferrable skills		
D2- Use information technology to improve his/her professional practice.	d2-1 Use state-of-the-art computer aided design tools for solving mechanical power engineering problems.	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to Water Desalination .

D5- Use different sources to obtain knowledge and information.	d5-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about Water Desalination.
D8- Learn independently and seek continuous learning.	d8-2 Seek continuous learning through continuous education, organizing and participating in seminars, workshops, national and international conferences.	d8-2-1 Seek continuous learning through continuous education, organizing and participating in seminars, workshops, national and international conferences.

3-Course Contents

Week No.	*Topic*	*Total Hours*	*Contact hrs*			*Course ILOs Covered (By No.)*
			Lec.	**Tut.**	**Lab.**	
Week-1,2	Introduction and basic concepts	3	3		-	a1-2, a2-1, a5-1, b1-1, b3-1, b5-1, c1-1 , c2-1, d2-1 , d5-1 , d8-1
Week-3,4	Sea water desalination methods	3	3		-	a1-2, a2-1, a5-1, b1-1, b3-1, b5-1, c1-1 , c2-1, d2-1 , d5-1 , d8-1
Week-5,6	Sea water desalination methods	3	3		-	a1-2, a2-1, a5-1, b1-1, b3-1, b5-1, c1-1 , c2-1, d2-1 , d5-1 , d8-1
Week-7,8	Distillation by ion exchange	3	3		-	a1-2, a2-1, a5-1, b1-1, b3-1, b5-1, c1-1 , c2-1, d2-1 , d5-1 , d8-1
Week-9,10	Reverse osmosis	3	3		-	a1-2, a2-1, a5-1, b1-1, b3-1, b5-1, c1-1 , c2-1, d2-1 , d5-1 , d8-1
Week-11,12	Combination distillation processes	3	3		-	a1-2, a2-1, a5-1, b1-1, b3-1, b5-1, c1-1 , c2-1, d2-1 , d5-1 , d8-1
Week-13,14	Combination distillation processes	3	3		-	a1-2, a2-1, a5-1, b1-1, b3-1, b5-1, c1-1 , c2-1, d2-1 , d5-1 , d8-1
Week-15-17	Desalination using combined power cycles	3	3		-	a1-2, a2-1, a5-1, b1-1, b3-1, b5-1, c1-1 , c2-1, d2-1 , d5-1 , d8-1
Week-18,19	Introduction to water treatment	3	3		-	a1-2, a2-1, a5-1, b1-1, b3-1, b5-1, c1-1 , c2-1, d2-1 , d5-1 , d8-1
Week-20-24	Water treatment Methods	3	3		-	a1-2, a2-1, a5-1, b1-1, b3-1, b5-1, c1-1 , c2-1, d2-1 , d5-1 , d8-1

Week-25-27	Water treatment Methods	3	3		-	a1-2, a2-1, a5-1, b1-1, b3-1, b5-1, c1-1 , c2-1, d2-1 , d5-1 , d8-1
Week-28-30	Water treatmentchemicals	3	3		-	a1-2, a2-1, a5-1, b1-1, b3-1, b5-1, c1-1 , c2-1, d2-1 , d5-1 , d8-1

4- Relationship between the course and the programme

Field	National Academic Reference Standard(NARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Program Academic Standards that the course contribute in achieving	A_1, A_2, and A5	B_1, B_3, and B_5	C_1, and C_2	D_2, D_5, and D_8

5- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	**Mathematics and Basic Sciences**	**Basic Engineering Science**	**Applied Engineering and Design**	**Computer Applications and ICT**	**Projects and practice**	**Disccretionry subjects**	**Total**
---	---	**20%**	**80%**				**100%**

6- Course Topics:

Topic No.	Topic	Weeks
1st	Introductionand basic concepts	2
2nd	Sea water desalination methods	4
3rd	Distillation by ion exchange	6
4th	Reverse osmosis	8
5th	Combination distillation processes	10
6th	Desalination using combined power cycles	17
7th	Introduction to water treatment	20-24
8th	Water treatment Methods	25-27
9th	Water treatmentchemicals	28-30

8- ILOs Matrix Topics:

Course Intended Learning Outcomes (ILOs)		Course topics								
		1st	2nd	3rd	4th	5th	6th	7th	8th	9th
Knowledge & Understanding	a-1-2-1 Define the concepts of physical meaning and phenomena are used in Water Desalination.	**X**	**X**							

	a2-2-1 Report and recognize the professional aspects of Water Desalination applications and their effects on the Environment.				X					
	a5-1-1 Explain Quality Assurance concepts of different mechanical power components and systems development phases.				X					
Intellectual Skills	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to solar power engineering based on the flow equations analysis.				X					
	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to Water Desalination.			X	X	X		X		X
	b5-1-1 Evaluate pros and cons of given methodologies for mechanical power engineering systems development.			X				X	X	
Professional Skill	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to Water Desalination problems, using latest engineering techniques, skills, and tools.	X		X						
	c2-1-1 Write and evaluate a professional report on Water Desalination				X				X	
General Skills	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to Water	X					X			

	Desalination .									
	d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about Water Desalination.						X			X
	d8-2-1 Seek continuous learning through continuous education, organizing and participating in seminars, workshops, national and international conferences.	X					X			

9- Teaching and Learning Method:

Course Intended learning outcomes(ILOs)		Teaching and Learning Method												
		Lecture	Presentation and Movies	Discussion	Tutorial	Problemsolving	Brain storming	Projects	Site visits	Self learning	Cooperative	Discovering	Modelling	Playing
Knowledge & understanding	a1-2	x			x	x	x		x					
	a2-1	x			x	x	x		x					
	a5-1	x			x	x								
Intellectual Skills	b2-1	x			x	x								
	b3-1	x			x	x								
	b5-1	x			x	x								
Professional Skills	c1-1	x			x	x			x					
	c2-1	x			x	x								
General Skills	d2-1	x	x		x	x			x					
	d5-1	x	x		x	x			x					
	d8-2	x	x		x	x			x					

10- Teaching and learning method for low capacity and outstanding Student:

For low capacity students	**Assigna portion of the office hoursfor thosestudents.**
	Give them specific tasks.
	Repeat the explanation of some of the material and tutorials.
	Assign a teaching assistance to follow up the performance of this group of students.
For outstanding Students	**Hand out project assignments to those students.**
	Give them some research topics to be searched using the internet and conduct presentation.
	Encourage them to take parts in the running research projects.

11- Assessment

11.1 Assessment Methods:

Course Intended Learning Outcome (ILOs)		**Assessment Methods**											
		Written Exam	**Oral Exam**	**Tutorial Assessment**	**Project Assessment**	**Model Assessment**	**Report Assessment**	**Quiz assessment**	**Presentation Assessment**	**Discussion**	**Laboratory Test**	**Home Exam**	**Monitoring**
Knowledge& Understanding	**a1-2**	x											
	a2-1	x											
	a5-1	x		x									
IntellectualSkills	**b2-1**	x		x			x				x		
	b3-1	x											
	b5-1	x											
Professional Skills	**c1-1**	x		x									
	c2-1	x									x		
General Skills	**d2-1**		x				x			x			
	d5-1		x				x			x			
	d8-2		x										

11.2 Assessment Schedule and GradesDistribution:

Assessment Method	Percentage	week
Final Examination	**10**	**32th**
Mid term written Examination1		
Mid term written Examination 2	**-**	**-**
Mid term laboratory assessment	**-**	**-**
End of term laboratory examination		
Tutorial and report assessment		
Total	**100%**	

12- Facilities required for teaching and learning

A. laboratory Usage:
Students are expected to prepare and conduct some laboratory experiments relating to mechanical power systems. Also to test some mechanical systems function and to prepare lab reports.

B. Library Usage:
Students should be encouraged to use library technical resources in the preparation of laboratory reports and oral presentation. At least one oral presentation should involve a significant component of library research to encourage this component of study.

13- List of references:

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- Moustafa M. Elsayed, Ibrahim S. Taha, and Jaffer A.Sabbagh. "Design of Solar Thermal Systems". jeddah, saudi arabia: Taha, Jaffer A;1994.

4- John A., William, D. and Beckman, A., "Solar Engineering of Thermal Processes", New York, USA: John Wiley; 1980.

5- J.P.Holman "Heat transfer" Mc Graw-Hill, Ninth Edition, Singapora, 2002.

Course coordinator : Dr. Yasser Elhenawy
Programme coordinator:Dr. Yassen Elsayed
Head of the Department: Prof. Dr. Kamal Ameen Murad

Date:

Course Specification

Program on which the course is given	M. Sc. in Mechanical Power Engineering
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering
Department offering the course	Mechanical Power Engineering
Academic year/Level	1st year
Date of specification approval	***2020***

A- Basic Information

Title: Combustion Engineering	**Code Symbol**: MEP600	
Lecture	3 hours	
Tutorial		
Laboratory		
Total	3 hours	Bylaw 2000

B- Professional Information

1- Course Aims:

The aims of the course to understand analyses of basic combustion concepts and its introduction of a wide variety of practical applications that motivate or relate to the various theoretical concepts.

2- Course Objectives

1- Is to understand the main concepts of chemical reaction and ccombustion.
2- Is to recognize the flame classification and its application.
3- Is to determine the methods for flame stabilization.

3- Intended Learning Outcomes (ILOs)

NAQAAE Academic Reference Standards (ARS)	Program ILOs	Course ILOs
A. Knowledge and understanding		

A1. Theories, basics and specialized knowledge in the field of learning, as well as the subjects that affect his/her professional practice.	a1-3 Understand the theories, basics and specialized knowledge in the field of **Thermodynamics, and Internal Combustion engine.**	a-1-3-1 Define the concepts of physical meaning and phenomena are used in combustion systems.
B. Intellectual skills		
B1- Analyze and evaluate the information in the field of specialization, and relate it to solve problems.	b1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to mechanical power engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to combustion based on the flow equations analysis.
B2- Solve specialized problems with available givens and parameters.	b2-1 Apply broad knowledge of modern computational methods and think critically to solve unstructured problems (with incomplete data) related to mechanical power engineering.	b2-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to combustion systems.
C. Professional and practical skills		
C1- Master the basic as well as the latest professional skills in the field of specialization.	c1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering techniques, skills, and tools.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to water power engineering problems, using latest engineering techniques, skills, and tools.

C2- Write and evaluate technical and professional reports.	c.2-1 Write and evaluate a professional report on specialized related to mechanical power engineering technical matters.	c2-1-1 Write and evaluate a professional report on combustion systems.
D. General and transferrable skills		
D2- Use information technology to improve his/her professional practice.	d2-1 Use state-of-the-art computer aided design tools for solving mechanical power engineering problems.	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to combustion systems.
D4- Use different sources to obtain knowledge and information.	d4-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about combustion systems.

4- Course Contents

Week No.	*Topic*	*Total Hours*	*Contact hrs*			*Course ILOs Covered (By No.)*
			Lec.	Tut.	Lab.	
Week-1 and 3	Introduction to Combustion	9	9	–	–	a1-3-1, b1-1-1, b2-1-1, c1-2-1, c1-1-1, d2-1-1, d4-1-1
Week-4 and 6	Mass and Heat Transfer	9	9	–	–	a1-3-1, b1-1-1, b2-1-1, c1-2-1, c1-1-1, d2-1-1, d4-1-1
Week-7 and 9	Diffusion Combustion	9	9	–	–	a1-3-1, b1-1-1, b2-1-1, c1-2-1, c1-1-1, d2-1-1, d4-1-1
Week-10 and 12	Vaporization of Liquid Droplet	9	9	–	–	a1-3-1, b1-1-1, b2-1-1, c1-2-1, c1-1-1, d4-1-1
Week-13 and 15	Laminar diffusion Flame	9	9	–	–	a1-3-1, b1-1-1, b2-1-1, c1-2-1, c1-1-1, d2-1-1
Week-16 and 18	Turbulent Diffusion Flames	9	9	–	–	a1-3-1, b1-1-1, b2-1-1, c1-2-1, c1-1-1, d2-1-1, d4-1-1
Week-19 and 21	Kinetic in Combustion Phenomenon Chemical Kinetics	9	9	–	–	a1-3-1, b1-1-1, b2-1-1, c1-2-1, c1-1-1, d2-1-1, d4-1-1
Week-22 and 24	Spontaneous Combustion and Well Stirred Reactor	9	9	–	–	a1-3-1, b2-1-1, c1-2-1, c1-1-1, d2-1-1, d4-1-1
Week-25 and 27	Flame Stabilization by Bluff-Bodies and by Air Swirler	9	9	–	–	a1-3-1, b1-1-1, b2-1-1, d2-1-1, d4-1-1

Week-28 and 30	Flame Propagation	9	9	–	–	a1-3-1, b1-1-1, b2-1-1, c1-2-1, c1-1-1, d2-1-1, d4-1-1
Total		**90**	**90**	–	–	

5- Relationship between the course and the programme

Field	National Academic Reference Standard(NARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Programme Academic Standards that the course contributes in achieving.	A1 (a1-2),	B1 (b1-1), B2 (b2-1),	C1 (c1-1), C2 (c2-1)	D2 (d2-1), D4 (d4-1)

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Disccretionry subjects	Total
---	---	**30%**	**70%**	---	---	---	**100%**

7- Course Topics.

Topic No.	Topic	Weeks
1st	Fundamental Concepts	1-6
2nd	Premixed and Diffusion Flames	7-12
3rd	Flame Stabilization	13-18
4th	Atomization and Atomizers	19-24
5th	Droplet Evaporation &Combustion	25-30

8- ILOs Matrix Topics

Course Intended Learning Outcomes (ILOs)		Course topics				
		1st	2nd	3rd	4th	5th
Knowledge & Understanding	a-1-2-1 Define the concepts of physical meaning and phenomena are used in water power engineering.	x	x	x	x	x

	a2-2-1 Report and recognize the professional aspects of water power engineering applications and their effects on the Environment.	x		x		
Intellectual Skills	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to water power engineering based on the flow equations analysis.	x	x	x	x	x
	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to water power engineering.					x
Professional Skill	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to water power engineering problems, using latest engineering techniques, skills, and tools.	x	x	x	x	x
	c2-1-1 Write and evaluate a professional report on water hammer.				x	
General Skills	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to water power engineering.	x	x	x	x	x
	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about water power engineering.	x	x	x	x	x

9- Teaching and Learning Method:

Course Intended learning	Teaching and Learning Method

outcomes (ILOs)		Lecture	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Site visits	Self learning	Cooperative	Discovering	Modelling	Playing
Knowledge & understanding	a1-2-1	x		x		x								
Intellectual Skills	b1-1-1	x		x	x	x								
	b2-1-1	x		x	x	x			x					
Professional Skills	c1-1-1			x	x	x	x		x	x	x			
	c2-1-1	x		x	x	x								
General Skills	d2-1-1	x		x	x	x			x	x	x			
	d4-1-1			x	x				x	x	x			

10- Teaching and learning method for low capacity and outstanding Student

For low capacity students	Assign a portion of the office hours for those students.
	Give them specific tasks.
	Repeat the explanation of some of the material and tutorials.
	Assign a teaching assistance to follow up the performance of these groups of students.
For outstanding Students	Hand out project assignments to those students.
	Give them some research topics to be searched using the internet and conduct presentation.
	Encourage them to take parts in the running research projects.

11- Assessment

11.1 Assessment Methods

Course Intended Learning Outcome (ILOs)		Assessment Methods											
		Written Exam	Oral Exam	Tutorial Assessment	Project Assessment	Model Assessment	Report Assessment	Quiz assessment	Presentation Assessment	Discussion	Laboratory Test	Home Exm	Monitoring
Knowledge & Understanding	a1-2-1	x											
Intellectual Skills	b1-1-1	x											
	b2-1-1	x											
Professional Skills	c1-1-1	x											
	c2-1-1	x											
General Skills	d2-1-1	x											
	d5-1-1	x											

11.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	32 th
Mid term written Examination	---	
Quizzes	---	
laboratory examination	---	
Oral examination	---	
Semester work	---	
Total	100%	

12- Facilities required for teaching and learning

Teaching aids like, lecture room with audio-visual facilities, white board.

13- List of references:

Essential Books (Text Books)

1. An Introduction to Combustion: Concepts and Applications by Stephen R. Turns (Jan 24, 2011).
2. Combustion, Fourth Edition by Irvin Glassman and Richard Yetter (Sep 8, 2008).
3. Principles of Combustion by Kenneth K. Kuo (Jan 14, 2005).

Recommended Books

1. Fundamentals of Combustion Processes (Mechanical Engineering Series) by Sara McAllister, Jyh-Yuan Chen and A. Carlos Fernandez-Pello (Apr 19, 2011).
2. Combustion Engineering, Second Edition by Kenneth W. Ragland and Kenneth M. Bryden(May 6, 2011).

Course Coordinator: Prof. Dr. Tharwat Messiha Farag

Head of Department: Prof. Dr. Kamal Ameen Morad

Date :

Course Specification

Program on which the course is given	M. Sc. in Mechanical Power Engineering
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering
Department offering the course	Mechanical Power Engineering
Academic year/Level	1st year
Date of specification approval	***2020***

A- Basic Information

Title: Advanced Fluid Dynamics	**Code Symbol**: MEP601	
Lecture	3 hours	
Tutorial		
Laboratory		
Total	3 hours	Bylaw 2000

B- Professional Information

1- Course Aims:

The major aim of this course is to understand the basic concepts of advanced fluid dynamics and get better understanding of different flow regimes. To help the post graduate students to add more information about fluid dynamics, dimensional analysis and similarity, boundary layer, potential flow, and viscous flow. Also, get more knowledge about the kinematics of flow – control volume approach, continuity, momentum and energy equations, compressible flow and sonic speed – flow through nozzles, mass, energy and momentum conservations, and its engineering application. Analyze the graphical solution methods of unsteadily laminar flow. This course will also provide students with the ability to select and design of the experimental model by using dimensional analysis and similarity. Discuss the all phenomena associated with such type of flows and different parameters.

2- Course Objectives

1- Demonstration of the knowledge and understanding of the importance of study of advanced fluid dynamics
2- Definitions of the viscous flows, dimensional analysis and similarity, and compressible flow as related to practical applications.
3- Reconcilability of the different equations for fluid flow with different applications.
4- Analysis of different fluid dynamics problems.

3- Intended Learning Outcomes (ILOs)

NAQAAE Academic Reference Standards (ARS)	Program ILOs	Course ILOs
A. Knowledge and understanding		
A1. Theories, basics and specialized knowledge in the field of learning, as well as the subjects that affect his/her professional practice.	a1-2 Understand the theories, basics and specialized knowledge in the field of **Fluid Mechanics and Hydraulics**.	a-1-2-1 Define the concepts of physical meaning and phenomena are used in advanced fluid dynamics.
A5- The knowledge related to the impact of professional practice on the Environment, and the work carried out for conservation and preservation.	a5-2 Recognize the interaction between mechanical power technologies and surrounding environment	a5-2-1 Report and recognize the professional aspects of advanced fluid dynamics applications and their effects on the Environment.
B. Intellectual skills		
B1- Analyze and evaluate the information in the field of specialization, and relate it to solve problems.	b1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to mechanical power engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to advanced fluid dynamics based on the flow equations analysis.
B3- Link and integrate diverse knowledge to solve professional problems.	b3-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems.	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to advanced fluid dynamics.

C. Professional and practical skills		
C1- Master the basic as well as the latest professional skills in the field of specialization.	c1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering techniques, skills, and tools.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to advanced fluid dynamics problems, using latest engineering techniques, skills, and tools.
C2- Write and evaluate technical and professional reports.	c.2-1 Write and evaluate a professional report on specialized related to mechanical power engineering technical matters.	c2-1-1 Write and evaluate a professional report on Potential and viscous Flows.
D. General and transferrable skills		
D2- Use information technology to improve his/her professional practice.	d2-1 Use state-of-the-art computer aided design tools for solving mechanical power engineering problems.	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to advanced fluid dynamics.
D4- Use different sources to obtain knowledge and information.	d4-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about advanced fluid dynamics.

4- Course Contents

Week No.	*Topic*	*Total Hours*	*Contact hrs*			*Course ILOs Covered (By No.)*
			Lec.	Tut.	Lab.	
Week-1 and 2	Euler's equation of motion	6	6	–	–	a1-2-1, a2-2-1, b1-1-1, b3-1-1, c1-1-1, d2-1-1
Week-3 and 4	Equation of containing irrotational flow	6	6	–	–	a1-2-1, a2-2-1, b1-1-1, b3-1-1, c1-1-1, d2-1-1

Week-5 and 6	Velocity potential, Stream function in two dimensional flow	6	6	–	–	a1-2-1, b1-1-1, b3-1-1, c1-1-1, c2-1-1, d2-1-1, d5-1-1
Week-7 and 8	Two dimensional sources and sinks	6	6	–	–	a1-2-1, b1-1-1, b3-1-1, c1-1-1, c2-1-1, d2-1-1, d5-1-1
Week-9 and 10	Two dimensional doubles	6	6	–	–	a1-2-1, b1-1-1, b3-1-1, c1-1-1, c2-1-1, d2-1-1, d5-1-1
Week-11 and 12	Circulation	6	6	–	–	a1-2-1, b1-1-1, b3-1-1, c1-1-1, c2-1-1, d2-1-1, d5-1-1
Week-13 and 14	Combined flows	6	6	–	–	a1-2-1, b1-1-1, b3-1-1, c1-1-1, c2-1-1, d2-1-1, d5-1-1
Week-15 and 16	Complex variables	6	6	–	–	a1-2-1, b1-1-1, b3-1-1, c1-1-1, c2-1-1, d2-1-1, d5-1-1
Week-17 and 18	Conferral mapping	6	6	–	–	a1-2-1, b1-1-1, b3-1-1, c1-1-1, c2-1-1, d2-1-1, d5-1-1
Week-19 and 20	Steady flow around circular cylinders and circular	6	6	–	–	a1-2-1, b1-1-1, b3-1-1, c1-1-1, c2-1-1, d2-1-1, d5-1-1
Week-21 and 22	Dimensional analysis and similarity	6	6	–	–	a1-2-1, a2-2-1, b1-1-1, b3-1-1, c1-1-1, d2-1-1
Week-23 and 24	Equations for viscous flow	6	6	–	–	a1-2-1, b1-1-1, b3-1-1, c1-1-1, c2-1-1, d2-1-1
Week-25 and 26	Flow between parallel boundaries	6	6	–	–	a1-2-1, a2-2-1, b1-1-1, b3-1-1, c1-1-1, d2-1-1
Week-27 and 28	Flow between concentric cylinders	6	6	–	–	a1-2-1, a2-2-1, b1-1-1, b3-1-1, c1-1-1, d2-1-1
Week-29 and 30	Theory of lubrication	6	6	–	–	a1-2-1, a2-2-1, b1-1-1, b3-1-1, c1-1-1, d2-1-1
Total		**90**	**90**	–	–	

5- Relationship between the course and the programme

Field	National Academic Reference Standard(NARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Programme Academic Standards that the course contributes in achieving.	A1 (a1-2), A2 (a2-2)	B1 (b1-1), B3 (b3-1)	C1 (c1-1), C2 (c2-1)	D2 (d2-1), D5 (d5-1)

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Disccretionry subjects	Total
---	---	**30%**	**70%**	---	---	---	**100%**

7- Course Topics.

Topic No.	Topic	Weeks
1st	Fluid motion	1-6
2nd	Dimensional Analysis and Similarity	7-12
3rd	Boundary Layer	13-18
4th	Potential Flow	19-24
5th	Viscous Flow	25-30

8- ILOs Matrix Topics

Course Intended Learning Outcomes (ILOs)		Course topics				
		1st	2nd	3rd	4th	5th
Knowledge & Understanding	a-1-2-1 Define the concepts of physical meaning and phenomena are used in water power engineering.	x	x	x	x	x
	a5-2-1 Report and recognize the professional aspects of water power engineering applications and their effects on the Environment.	x	x	x		
Intellectual Skills	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to water power engineering based on the flow equations analysis.	x	x	x	x	x
	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to water power engineering.	x	x	x	x	x
Professional Skill	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to water power engineering problems, using latest engineering techniques, skills, and tools.	x	x	x	x	x

	c2-1-1 Write and evaluate a professional report on water hammer.				x	
General Skills	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to water power engineering.	x	x	x	x	x
	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about water power engineering.			x		

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		Teaching and Learning Method												
		Lecture	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Site visits	Self learning	Cooperative	Discovering	Modelling	Playing
Knowledge & understanding	a1-2-1	x		x		x								
	a5-2-1	x		x		x								
Intellectual Skills	b1-1-1	x		x	x	x								
	b3-1-1	x		x	x	x			x					
Professional Skills	c1-1-1			x	x	x	x		x	x	x			
	c2-1-1	x		x	x	x								
General Skills	d2-1-1	x		x	x	x			x	x	x			
	d4-1-1			x	x				x	x	x			

10- Teaching and learning method for low capacity and outstanding Student

For low capacity students	Assign a portion of the office hours for those students.
	Give them specific tasks.
	Repeat the explanation of some of the material and tutorials.

	Assign a teaching assistance to follow up the performance of these groups of students.
For outstanding Students	Hand out project assignments to those students.
	Give them some research topics to be searched using the internet and conduct presentation.
	Encourage them to take parts in the running research projects.

11- Assessment

11.1 Assessment Methods

Course Intended Learning Outcome (ILOs)		Assessment Methods											
		Written Exam	Oral Exam	Tutorial Assessment	Project Assessment	Model Assessment	Report Assessment	Quiz assessment	Presentation Assessment	Discussion	Laboratory Test	Home Exm	Monitoring
Knowledge & Understanding	a1-2-1	x											
	a5-2-1	x											
Intellectual Skills	b1-1-1	x											
	b3-1-1	x											
Professional Skills	c1-1-1	x											
	c2-1-1	x											
General Skills	d2-1-1	x											
	d4-1-1	x											

11.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	32 th
Mid term written Examination	---	
Quizzes	---	
laboratory examination	---	
Oral examination	---	
Semester work	---	
Total	100%	

12- Facilities required for teaching and learning

Teaching aids like, lecture room with audio-visual facilities, white board.

13- List of references:

Essential Books (Text Books)

1 - Frank M. White, "Fluid Mechanics" Third Edition, McGraw Hill Inc.,1994
2 -Irving H. Shames, Mechanics of Fluids

Recommended Books

1-Munson & Young, Fundamentals of Fluid Mechanics,2006
2- REA, The Fluid Mech. and Dynamics Problem Solver
3- Schaum's, Outline series Fluid Mech. and Hydraulics

Course Coordinator : Prof. Dr. Gamal Hafiz Ahmed Mostafa

Head of Department : Prof. Dr. Kamal Ameen Morad

Date :

Course Specification

Program on which the course is given	M. Sc. in Mechanical Power Engineering
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering
Department offering the course	Mechanical Power Engineering
Academic year/Level	first year
Date of specification approval	***2020***

A- Basic Information

Title: Multi-Phase Flow	**Code Symbol**: **MEP 602**	
Lecture	3 hours	
Tutorial		
Laboratory		
Total	3 hours	Bylaw 2003

B- Professional Information

1- Programme Aims:

In our treatment of multi-phase flow behavior, we have two major objectives. In addition to obtaining an understanding of the physical mechanisms that underline multi-phase flow, we wish to develop the means of how to do calculations to describe it. This course is devoted primarily to achieving the former objective. Physical origin are discussed, and relevant dimensionless parameters are viewed and discussed.

With conceptual foundations, established, subsequent chapters are used to develop useful tools for quantifying multi-phase flow effects. Chapter 1 and 2 present methods for computing the multi-phase flow models and its coefficients associated with external and internal flow configurations, respectively. Chapter 3 describes methods for determining these coefficients, and Chapter 4 considers the problem with phase change (gas-liquid).

2- Graduate Attributes:

1- the first objective is to cover the basic principles of multi-phase flow and to present a wealth of real-world engineering applications to give students a feel for engineering practice .
2- Is to develop an understanding of multi-phase flow phenemena, examine the descrbing experimental models that govern the velocity, solid concentration and pressure changes that are applicable to multi-phase flow and determine important dimensionless parameters associated with these models.

3- Is to learn how to estimate multi-phase flow models in order to perform analyses on practical systems experiencing different types of flow under different concentration of materials.
4- Is to use requisite practical inputs for computing multi-phase flow rates and/or material concentration.
5- Is to delineate pertinent trasport phenemena for any process or system involving multi-phase flow.
6- The student should be able to develop representative models for real processes and system and draw from the conclusions diagrams and figures concerning process system according to their design or performance from the attendant analysis.

3- Intended Learning Outcomes (ILOs) for the whole program:

NAQAAE Academic Reference Standards (ARS)	Programme ILOs that the course contribute in achieving	Course ILOs
A. Knowledge & Understanding		
A1 [Theories, basics and specialized knowledge in the field of multi-phase flow, aswell as the subjects that affect his/her professional practice] & A5- The knowledge related to the impact of professional practice on the Environment, and the work carried out for conservation and preservation.	**a1-1** The basic theories and principles of some other engineering and mechanical engineering disciplines providing support to mechanical power disciplines. **a5-1** Characteristics and properties of materials relevant to mechanical engineering applications.	**a1-1-1** Understand the relation of fluid mechanics science related to the science of multi-phase flow. **a5-1-1** Understand the dependance of the multi-phase flow properties on the natural of the flow parameters.
B. Intellectual skills		

B1 [Analyze and evaluate the information in the field of multi-phase flow, and relate it to solve problems] & B2 [Solve specialized problems with lack of some data and variables based on analytical thinking]	**b1-1** Solve engineering problems and design mechanical power and energy systems, components and elements in a creative and innovative attitude. **b2-1** apply the appropriate tools from mathematics, science, technology, and the know-how gained from the professional experience to analyze mechanical engineering design problems to meet certain needs.	**b1-1-1** select the suitable solution methods for multi-phase flow problems based on the governing momentum, energy, and mass equations together with the boundary conditions. **b2-1-1** show how, with the aid of a computer, numerically (finite-difference) methods may be used to accurately predict multi-phase flow rates within the medium.
C. Professional skills		
C1 [Master the basic as well as the latest professional skills in the field of multi-phase flow problems] & C3 [Evaluate means and tools available in the field of practice]	**c1-1** Use a wide range of analytical and technical tools, techniques and equipment including pertinent software. **c3-1** Apply numerical modeling methods and/or appropriate computational techniques to engineering problems.	**c1-1-1** Apply the knowledge of mathematics (differential equations) and fluid mechanics to derive the differential equation models that describe the flow for different materials. **c3-1-1** apply the numerical methods and/or appropriate software package pertaining to multi-phase flow problems.
D. General skills		
D4 [Use different sources to obtain knowledge and information] & D7 [Learn independently and seek continuous learning]	**d4-1** Work effectively in a team and in multi-disciplinary technical and non-technical environments. **d7-1** Share ideas and communicate effectively in written, oral and graphical	**d4-1-1** Work in a team through the preparation of multi-phase flow reports which are required from the students. **d7-1-1** Share ideas and communicate effectively in written,

	forms.	oral and graphical forms.

4- Course Contents

Week No.	*Topic*	*Total Hours*	*Contact hrs*			*Course ILOs Covered (By No.)*
			Lec.	**Tut.**	**Lab.**	
Week-1	Introduction to multi-phase flow.	3	3	-	-	a1-1-1, a5-1-1, d4-1-1, d7-1-1
Week-2	Fundamentals of phase equilibrium of single materials.	3	3	-	-	a5-1-1, b-1-1-1, b2-1-1, c1-1-1, c3-1-1
Week-3	Fundamentals of phase equilibrium of mixture materials.	3	3	-	-	a1-1-1, a5-1-1, b1-1-1, c1-1-1
Week-4	Basics of dynamic equilibrium and equations for bubble growth dynamics effects.	3	3	-	-	a1-1-1, a5-1-1, b1-1-1, c1-1-1
Week-5	Basics of dynamic equilibrium and equations for bubble growth momentum effects.	3	3	-	-	d4-1-1, d7-1-1
Week-6	Basics of dynamic equilibrium and equations for bubble growth viscosity effects.	3	3	-	-	a1-1-1, a5-1-1, b1-1-1, b2-1-1, c1-1-1
Week-7	Description of two-phase flow regimes.	3	3	-	-	d4-1-1, d7-1-1
Week-8	Two phase flow regimes (gas-liquid).	3	3	-	-	a1-1-1, a2-1-1, b1-1-1, b2-1-1, c1-1-1, c3-1-1
Week-9	Two phase flow regimes (gas-solid).	3	3	-	-	a1-1-1, a5-1-1, b1-1-1, c1-1-1
Week-10-13	Two phase flow regimes (liquid-solid).	3	3	-	2	a1-1-1, a5-1-1, b1-1-1, c1-1-1
Week-14-20	Description of two-phase flow regimes models.	3	3	-	-	a5-1-1, b1-1-1, c1-1-1, d4-1-1, d7-1-1
Week-21-24	Two phase flow regimes models for void fraction.	3	3	-	2	a1-1-1, b1-1-1, c1-1-1, c3-1-1, d4-1-1
Week-25-27	Two-phase flow regimes models for pressure drop.	3	3	-	2	a1-1-1, a5-1-1, b1-1-1, b2-1-1, c1-1-1, d4-1-1, d7-1-1

Week-28-30	Boiling modes.	3	3	-	2	a1-1-1, a5-1-1, b1-1-1, c1-1-1, c3-1-1, d4-1-1

5- Relationship between the course and the programme

Field	Academic Reference Standard (NARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Programme Academic Standards that the course contribute in achieving	**A1 (a1-1)** and **A5 (a5-1)**	**B1 (b1-1)** and **B2 (b2-1)**	**C1 (c1-1)** and **C3 (c3-1)**	**D4 (d4-1)** and **D7 (d7-1)**

6- Course Subject Area:

A	**B**	**C**	**D**	**E**	**F**	**G**	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Disccretionry subjects	Total
---	30%		70%				100%

7- Course Topics.

Topic No.	Topic	Weeks
1st	Phase Equilibrium of single materials and mixtues	1-5
2nd	Basics of dynamic equilibrium and equations for bubble growth dynamics, momentum and viscosity effects	6-7
3rd	Two=phase flow regimes, models for void fraction and pressure drop calculations	8-20
4th	Boiling modes	21-30

8- ILOs Matrix Topics

Course Intended Learning Outcomes (ILOs)		Course topics			
		1st	2nd	3rd	4th
Knowledge & Understanding	**a1-1-1** Understand the relation of fluid mechanics science related to the science of multi-phase flow.	**x**	**X**	**X**	**X**
	a5-1-1 Understand the dependance of the multi-phase flow properties on the natural of the flow parameters.	**X**	**x**	**X**	**X**
Intellectual Skills	**b1-1-1** select the suitable solution methods for multi-phase flow problems based on the governing momentum, energy, and mass equations together with the boundary conditions.	**x**	**x**	**X**	**x**
	b2-1-1 show how, with the aid of a computer, numerically (finite-difference) methods may be used to accurately predict multi-phase flow rates within the medium.	**x**	**X**	**x**	**x**
Professional Skill	**c1-1-1** Apply the knowledge of mathematics (differential equations) and fluid mechanics to derive the differential equation models that describe the flow for different materials.	**x**	**x**	**X**	**x**

	c3-1-1 apply the numerical methods and/or appropriate software package pertaining to multi-phase flow problems.	**x**	**x**	**X**	**x**
General Skills	**d4-1-1** Work in a team through the preparation of multi-phase flow reports which are required from the students.	**x**	**x**	**X**	**x**
	d7-1-1 Share ideas and communicate effectively in written, oral and graphical forms.	**x**	**x**	**X**	**x**

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		**Teaching and Learning Method:**												
		Lecture	**Presentation and Movies**	**Discussion**	**Tutorial**	**Problem solving**	**Brain storming**	**Projects**	**Site visits**	**Self learning**	**Cooperative**	**Discovering**	**Modelling**	**Playing**
Knowledge & understanding	a1-1-1	X				x								
	a5-1-1	X				x								
Intellectual Skills	b1-1-1	X				x								
	b2-1-1	X				x								
Professional Skills	c1-1-1	X				x							x	
	c3-1-1	X				x							x	
General Skills	d4-1-1		X							X	x			

	d7-1-1		X							x	x			

11- Assessment

11.1 Assessment Methods

Course Intended Learning Outcome (ILOs)		Assessment Methods											
		Wirtten Exam	Oral Exam	Tutorial Assessment	Proiect Assessment	Model Assessment	Report Assessment	Quiz assessment	Presentation Assessment	Discussion	Laboratory Test	Home Exm	Monitoring
Knowledge & Understanding	a1-1-1	x											
	a5-1-1	x											
Intellectual Skills	b1-1-1	x											
	b2-1-1	x											
Professional Skills	c1-1-1	x											
	c3-1-1	x											
General Skills	d4-1-1	x											
	d7-1-1	x											

11.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	**100**	**32th**
Final Oral Examination		
Mid term written Examination		
Tutorial discussion, presentation, and report assessment		

Total	**100%**	

12- Facilities required for teaching and learning:

Teaching aids like, lecture room with audio-visual facilities, white board.

13- List of references:

1- "Slurry Transport Using Centrifugal Pumps" by Wilson K C et al. Elsevier Scince Publishers Ltd, England, 1992.
2- "A Design Handbook for Slurry Transfer Systems" by Ed N P Brown et al. Elsevier Scince Publishers Ltd, England, 1990..

Course coordinator: Prof. IMAM AHMED EL_SAWAF
Programme coordinator: : Prof. IMAM AHMED EL_SAWAF
Head of the Department: Prof. KAMAL MORAD

Date:.

Course Specification

Program on which the course is given	M. Sc. in Mechanical Power Engineering
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering
Department offering the course	Mechanical Power Engineering
Academic year/Level	1st year
Date of specification approval	***2020***

A- Basic Information

Title: Water Power Engineering	**Code Symbol**: MEP603	
Lecture	3 hours	
Tutorial		
Laboratory		
Total	3 hours	Bylaw 2003

B- Professional Information

1- Course Aims:

The major aim of this course is to understand the basic concepts of water power engineering, with the basic knowledge and skills of the concepts and principles of fluid dynamics and hydraulics. To help the post graduate students to add more information about water power engineering, hydraulic turbines, power plant construction, water hammer, and cost water power. Also, get more knowledge about the flow data and water power estimates and its engineering application. Analyze the speed and pressure regulation with engineering applications. This course will also provide students with the ability to select and design of the gausses effects and protection on the water power systems.

2- Course Objectives

1- Demonstration of the knowledge and understanding of the importance of study of water power engineering.
2- Definitions of the Waterways and penstocks, Power house equipment, and Plant accessories as related to practical applications.
3- Reconcilability of the different equations for fluid flow with different applications.
4- Analysis of different Speed and pressure regulations.

3- Intended Learning Outcomes (ILOs)

NAQAAE Academic Reference Standards (ARS)	Program ILOs	Course ILOs
A. Knowledge and understanding		
A1. Theories, basics and specialized knowledge in the field of learning, as well as the subjects that affect his/her professional practice.	a1-2 Understand the theories, basics and specialized knowledge in the field of **Fluid Mechanics and Hydraulics**.	a-1-2-1 Define the concepts of physical meaning and phenomena are used in water power engineering.
A5- The knowledge related to the impact of professional practice on the Environment, and the work carried out for conservation and preservation.	a5-2 Recognize the interaction between mechanical power technologies and surrounding environment	a5-2-1 Report and recognize the professional aspects of water power engineering applications and their effects on the Environment.
B. Intellectual skills		
B1- Analyze and evaluate the information in the field of specialization, and relate it to solve problems.	b1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to mechanical power engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to water power engineering based on the flow equations analysis.
B3- Link and integrate diverse knowledge to solve professional problems.	b3-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems.	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to water power engineering.

C. Professional and practical skills		
C1- Master the basic as well as the latest professional skills in the field of specialization.	c1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering techniques, skills, and tools.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to water power engineering problems, using latest engineering techniques, skills, and tools.
C2- Write and evaluate technical and professional reports.	c.2-1 Write and evaluate a professional report on specialized related to mechanical power engineering technical matters.	c2-1-1 Write and evaluate a professional report on water hammer.
D. General and transferrable skills		
D2- Use information technology to improve his/her professional practice.	d2-1 Use state-of-the-art computer aided design tools for solving mechanical power engineering problems.	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to water power engineering.
D4- Use different sources to obtain knowledge and information.	d4-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about water power engineering.

4- Course Contents

Week No.	*Topic*	*Total Hours*	*Contact hrs*			*Course ILOs Covered (By No.)*
			Lec.	Tut.	Lab.	
Week-1 and 3	Study of flow data and water power estimates.	9	9	–	–	a1-2-1, a5-2-1, b1-1-1, c1-1-1, d2-1-1, d4-1-1
Week-4 and 6	Hydraulic turbines	9	9	–	–	a1-2-1, b1-1-1, c1-1-1, d2-1-1, d4-1-1
Week-7 and 9	Power plant construction.	9	9	–	–	a1-2-1, a5-2-1, b1-1-1, c1-1-1, d2-1-1, d4-1-1

Week-10 and 12	Waterways and penstocks	9	9	–	–	a1-2-1, a5-2-1, b1-1-1, c1-1-1, d2-1-1, d4-1-1
Week-13 and 15	Power house equipment	9	9	–	–	a1-2-1, a5-2-1, b1-1-1, c1-1-1, d2-1-1, d4-1-1
Week-16 and 18	Plant accessories	9	9	–	–	a1-2-1, a5-2-1, b1-1-1, c1-1-1, d2-1-1, d4-1-1
Week-19 and 21	Speed and pressure regulation	9	9	–	–	a1-2-1, a5-2-1, b1-1-1, c1-1-1, d2-1-1, d4-1-1
Week-22 and 24	Water hammer	9	9	–	–	a1-2-1, b1-1-1, c1-1-1, c2-1-1, d2-1-1, d4-1-1
Week-25 and 27	Gausses effects and protection	9	9	–	–	a1-2-1, b1-1-1, b3-1-1, c1-1-1, d2-1-1, d4-1-1
Week-28 and 30	Cost and value water power	9	9	–	–	a1-2-1, b1-1-1, b3-1-1, c1-1-1, d2-1-1, d4-1-1
Total		**90**	**90**	–	–	

5- Relationship between the course and the programme

Field	National Academic Reference Standard(NARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Programme Academic Standards that the course contributes in achieving.	A1 (a1-2), A2 (a5-2)	B1 (b1-1), B3 (b3-1)	C1 (c1-1), C2 (c2-1)	D2 (d2-1), D5 (d4-1)

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Disccretionry subjects	Total
---	---	**30%**	**70%**	---	---	---	**100%**

7- Course Topics.

Topic No.	Topic	Weeks
1st	Water power engineering	1-6
2nd	Hydraulic turbines	7-12
3rd	Power plant construction	13-18
4th	Water hammer	19-24
5th	Cost and value water power	25-30

8- ILOs Matrix Topics

Course Intended Learning Outcomes (ILOs)		Course topics				
		1st	2nd	3rd	4th	5th
Knowledge & Understanding	a-1-2-1 Define the concepts of physical meaning and phenomena are used in water power engineering.	x	x	x	x	x
	a5-2-1 Report and recognize the professional aspects of water power engineering applications and their effects on the Environment.	x		x		
Intellectual Skills	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to water power engineering based on the flow equations analysis.	x	x	x	x	x
	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to water power engineering.					x
Professional Skill	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to water power engineering problems, using latest engineering techniques, skills, and tools.	x	x	x	x	x
	c2-1-1 Write and evaluate a professional report on water hammer.				x	
General Skills	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to water power engineering.	x	x	x	x	x
	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about water power engineering.	x	x	x	x	x

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		Teaching and Learning Method												
		Lecture	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Site visits	Self learning	Cooperative	Discovering	Modelling	Playing
Knowledge & understanding	a1-2-1	x		x		x								
	a5-2-1	x		x		x								
Intellectual Skills	b1-1-1	x		x	x	x								
	b3-1-1	x		x	x	x			x					
Professional Skills	c1-1-1			x	x	x	x		x	x	x			
	c2-1-1	x		x	x	x								
General Skills	d2-1-1	x		x	x	x			x	x	x			
	d4-1-1			x	x				x	x	x			

10- Teaching and learning method for low capacity and outstanding Student

For low capacity students	Assign a portion of the office hours for those students.
	Give them specific tasks.
	Repeat the explanation of some of the material and tutorials.
	Assign a teaching assistance to follow up the performance of these groups of students.
For outstanding Students	Hand out project assignments to those students.
	Give them some research topics to be searched using the internet and conduct presentation.
	Encourage them to take parts in the running research projects.

11- Assessment

11.1 Assessment Methods

Course Intended Learning Outcome (ILOs)		Assessment Methods											
		Written Exam	Oral Exam	Tutorial Assessment	Project Assessment	Model Assessment	Report Assessment	Quiz assessment	Presentation Assessment	Discussion	Laboratory Test	Home Exm	Monitoring
Knowledge & Understanding	a1-2-1	x											
	a5-2-1	x											
Intellectual Skills	b1-1-1	x											
	b3-1-1	x											
Professional Skills	c1-1-1	x											
	c2-1-1	x											
General Skills	d2-1-1	x											
	d4-1-1	x											

11.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	32 th
Mid term written Examination	---	
Quizzes	---	
laboratory examination	---	
Oral examination	---	
Semester work	---	
Total	100%	

12- Facilities required for teaching and learning

Teaching aids like, lecture room with audio-visual facilities, white board.

13- List of references:

Essential Books (Text Books)

1- Frank M. White, "Fluid Mechanics", 4th ed., McGraw-Hill, INC. 1999.

1- Peter K. Bridn, "Hydraulic Fluids", John Wiley & Sons, Inc. New York, 1996.

Recommended Books

2- Larry W. Mays, “Hydraulic Design Handbook”, McGraw-Hill, 2004.
2- Irving H. Shames, "Mechanics of Fluids", 3rd ed. McGraw-Hill, INC. 1992.

Course Coordinator : Prof. Dr. Fawzy Mohamed El-Otla

Head of Department : Prof. Dr. Kamal Ameen Morad

Date :

Course Specification

Program on which the course is given	M. Sc. in Mechanical Power Engineering
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering
Department offering the course	Mechanical Power Engineering
Academic year/Level	1st year
Date of specification approval	***2020***

A- Basic Information

Title: Unsteady Fluid Flow	**Code Symbol**: MEP604	
Lecture	3 hours	
Tutorial		
Laboratory		
Total	3 hours	Bylaw 2003

B- Professional Information

1- Course Aims:

This course aims to provide the student with Origins of unsteady flow; unsteady flow in pipes and ducts; simplified method of analysis, method of characteristics; boundary conditions for method characteristics analyses; graphical and numerical procedures for solving the characteristics equations; application of solution techniques for practical problems; pressure exchangers and other devices with unsteady flow.

2- Course Objectives

1- The student should be able to coverthe basic princibles of unstaedy fluid flows.
2- The student should be able to develop an understanding of methods of controlling transients.
3- The student should be able to delineate pertinent trasport phenemena for any process or system involving unstaedy fluid flow.
4- The student should be able to develop representative models for real processes and system and draw conclusions concerning process/system design or performance from the attendant analysis.

3- Intended Learning Outcomes (ILOs)

NAQAAE Academic Reference Standards (ARS)	Program ILOs	Course ILOs
A. Knowledge and understanding		
A1- Theories, basics and specialized knowledge in the field of learning, as well as other related subjects.	a1-2 Understand the theories, basics and specialized knowledge in the field of Fluid Mechanics and Hydraulics.	a1-2-1 Understand the concepts of unsteady flow. a1-2-2 Understand the different factor that affect the flow and affect the transient conditions
A5- The knowledge related to the impact of professional practice on the Environment, and the work carried out for conservation and preservation.	a5-2 Recognize the interaction between mechanical power technologies and surrounding environment.	a5-2-1 Understand the application of solution techniques for practical problems; pressure exchangers and other devices utilizing unsteady flow.
B. Intellectual skills		
B1- Analyze and evaluate information in the field of specialization, and relate it to solve problems and formulate theories.	b1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to mechanical power engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to analyse problems related to unsteady fluid flow applications.
B3- Perform research and studies to add to the accumulated knowledge.	b3-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems.	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to unsteady fluid flow.

C. Professional and practical skills		
C1- Master the basic as well as the latest professional skills in the field of specialization.	c1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering techniques, skills, and tools.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to unsteady fluid flow problems, using latest engineering techniques, skills, and tools.
C2- Write and evaluate technical and professional reports.	c.2-1 Write and evaluate a professional report on specialized related to mechanical power engineering technical matters.	c2-1-1 Write and evaluate a professional report on unsteady fluid flow measurements and similarity.
D. General and transferrable skills		
D2- Use information technology to improve his/her professional practice.	d2-1 Use state-of-the-art computer aided design tools for solving mechanical power engineering problems.	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to unsteady fluid flow and its applications.
D4- Use different sources to obtain knowledge and information.	d4-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about unsteady fluid flow and its applications.
D7- Self evaluation and continuous learning.	d7-1 Express a strong foundation of continuous learning so they can maintain their technical competency.	d-7-1-1 Use different sources of information journals, internet access facilities, etc. to upgrade and enhance their knowledge.

4- Course Contents

Week No.	*Topic*	*Total Hours*	*Contact hrs*			*Course ILOs Covered (By No.)*
			Lec.	Tut.	Lab.	
Week-1	Fluid flows classifications	3	3	-	-	a1-2-1,a1-2-2,
Week-2	Unstaedy flow- inertia of pressure.	3	3	-	-	a1-2-1,a1-2-2,a2-2-1
Week-3	Pressure transients	3	3	-	-	a1-2-2,a2-2-2, b1-1-1, b3-1-1
Week-4	Pipe networks.	3	3	-	-	a2-2-1, b3-1-1
Week-5	Water Hummer	3	3	-	-	a2-2-1, b3-1-1, b1-1-1
Week-6	water Hummer in Turbines	3	3	-	-	a2-2-1, b3-1-1
Week-7	Surge Tanks- design	3	3	-	-	a2-2-1, b3-1-1
Week-8	Method of characteristics	3	3	-	-	c2-1-1, d2-1-1, d4-1-1, d7-1-1
Week-9-14	Oil Pipeline transients	3	3	-	-	a1-2-2, b3-1-1
Week-15-17	Methods of controlling transients	3	3	-	-	a1-2-2, c1-1-1, c2-1-1
Week-18-22	Reciprocating Pumps	3	3	-	-	a2-2-1, b3-1-1
Week-23-25	Turbines	3	3	-	-	a2-2-1,b3-1-1,d2-1-1
Week-26-27	Applications for Compressible fluids	3	3	-	-	a2-2-1, c2-1-1
Week-28-30	Computer programming aids	3	3	-	2	c1-1-1, d2-1-1, d4-1-1, d7-1-1

5- Relationship between the course and the programme

Field	National Academic Reference Standard(NARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Programme Academic Standards that the course contributes in achieving.	A1 (a1-2-1, a1-2-2), A2 (a2-2-1)	B1 (b1-1-1), B3 (b3-1-1)	C1 (c1-1-1), C2 (c2-1-1)	D2 (d2-1-1), D4 (d4-1-1), D7 (d7-1-1)

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Disccretionry subjects	Total
---	---	**20%**	**70%**	**-10--**	---	---	**100%**

7- Course Topics.

Topic No.	Topic	Weeks
1st	unsteady flow basics, applications	1-3
2nd	pipeline network , transient design constains	4-10
3rd	hydraulic machines	11-17
4th	applications for compressible fluids	18-24
5th	Computer programming aids	25-30

8- ILOs Matrix Topics

Course Intended Learning Outcomes (ILOs)	Course topics				
	1st	2nd	3rd	4th	5th

Knowledge & Understanding	a1-2-1 Understand the concepts of unsteady flow.	x				
	a1-2-2 Understand the different factor that affect the flow and affect the transient conditions	x	x			
	a2-2-1 Understand the application of solution techniques for practical problems; pressure exchangers and other devices utilizing unsteady flow.	x	x	x	x	
Intellectual Skills	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to analyse problems related to unsteady fluid flow applications.	x	x			
	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to unsteady fluid flow.	x	x	x		
Professional Skill	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to unsteady fluid flow problems, using latest engineering techniques, skills, and tools.					x
	c2-1-1 Write and evaluate a professional report on unsteady fluid flow measurements and similarity.				x	
General Skills	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to unsteady fluid flow and its applications.		x	x		x

	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about unsteady fluid flow and its applications.		x			x
	d-7-1-1 Use different sources of information journals, internet access facilities, etc. to upgrade and enhance their knowledge.		x			x

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		Teaching and Learning Method												
		Lecture	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Site visits	Self learning	Cooperative	Discovering	Modelling	Playing
Knowledge & understanding	a1-2-1	x		x										
	a1-2-2	x		x		x								
	a2-2-1	x		x		x								
Intellectual Skills	b1-1-1	x		x	x	x								
	b3-1-1	x		x	x	x			x					
Professional Skills	c1-1-1			x	x	x	x		x	x	x			
	c2-1-1	x		x	x	x								
General Skills	d2-1-1	x		x	x	x			x	x	x			
	d4-1-1			x	x				x	x	x			
	d7-1-1			x						x				

10- Teaching and learning method for low capacity and outstanding Student

For low capacity students	Assign a portion of the office hours for those students.
	Give them specific tasks.
	Repeat the explanation of some of the material and

	tutorials.
	Assign a teaching assistance to follow up the performance of these groups of students.
For outstanding Students	Hand out project assignments to those students.
	Give them some research topics to be searched using the internet and conduct presentation.
	Encourage them to take parts in the running research projects.

11- Assessment

11.1 Assessment Methods

Course Intended Learning Outcome (ILOs)		Assessment Methods											
		Wirtten Exam	Oral Exam	Tutorial Assessment	Project Assessment	Model Assessment	Report Assessment	Quiz assessment	Presentation Assessment	Discussion	Laboratory Test	Home Exm	Monitoring
Knowledge & Understanding	a1-2-1	x											
	a1-2-2	x											
	a2-2-1	x											
Intellectual Skills	b1-1-1	x	x										
	b3-1-1	x		x									
Professional Skills	c1-1-1	x								x			
	c2-1-1	x					x						
General Skills	d2-1-1			x									
	d4-1-1						x						
	d7-1-1						x						

11.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	32 th
Mid term written Examination	---	
Quizzes	---	

laboratory examination	---	
Oral examination	---	
Semester work	---	
Total	100%	

12- Facilities required for teaching and learning

Teaching aids like, lecture room with audio-visual facilities, white board.

13- List of references:

1- "Mechanics of Fluids" , (AlfredJohn), Eighth Edition, 2006
2- "Mechanics of Fluids", by Irving Shames, Third edition, 1993.
3- „Fluid Mechanics“, Joseph Franzini, E. Finnemore, Ninth edition, 1997

Periodicals, Web sites, etc

- *Journal of Fluids Engineering*
- *International Journal for Numerical Methods in Fluids*

Course coordinator: Dr. Amany Saif.
Programme coordinator: Prof. Kamal Morad.
Head of the Department: Prof. Kamal Morad

Date:

Course Specification

Program on which the course is given	M. Sc.in Mechanical Power Engineering
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering
Department offering the course	Mechanical Power Engineering
Academic year/Level	1st year
Date of specification approval	***2020***

A- Basic Information

Title: **Jet Propulsion**	**Code Symbol**: MEP605	
Lecture	3 hours	
Tutorial		
Laboratory		
Total	3 hours	Bylaw 2000

B- Professional Information

1- Course Aims:

* This course covers the operating principles of jet engines such as turbojet, turboprop , turbofan, and rocket engines. Both the fundamental mathematics and hardware are addressed. Numerous examples based on modern engines are included so that students can grasp the methods and acquire an appreciation of different representative physical parameters. A student is expected to understand the individual steps of analyzing an entire engine or an individual component and to develop an appreciation of trend analysis of engine performance.

* Solved examples enable the students to interpret the working cycles configurations of the different jet propulsion engines, characteristics study of the engine components and for the whole engine, and matching of the engine component at different flight conditions using computational approach.

2- Course Objectives

1- Cycle Analysis for different engines are defined, the fundamental thermodynamic and gas dynamic behavior of the various components are covered, and ideal and non-ideal analyses are performed on each type of engine considered as a whole. Fundamental applicable thermodynamic principles are reviewed in details. The performance of each individual component is studied, including trend studies and quantitative analysis, along with methodologies for presentation. The effects of non-ideal characteristics.

2- Jet propulsion engines classifications, working principles, perormance study at different flight conditions.
3- System matching and analysis are considered, so that engine performance can be predicted for both on-and off-design conditions.
4- Flight performance of the aerovehicle including range and endurance, lift and drag effects, and all other performance parameters are studied.

3- Intended Learning Outcomes (ILOs)

NAQAAE Academic Reference Standards (ARS)	Program ILOs	Course ILOs
A. Knowledge and understanding		
A1. Theories, basics and specialized knowledge in the field of learning, as well as the subjects that affect his/her professional practice.	a1-3 Understand the theories, basics and specialized knowledge in the field of **Thermodynamics, and Internal Combustion engine.**	a-1-3-1 Define the concepts of physical meaning and phenomena are used in jet propulsion systems.
B. Intellectual skills		
B1- Analyze and evaluate the information in the field of specialization, and relate it to solve problems.	b1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to mechanical power engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to jet propulsion based on the flow equations analysis.
B2- Solve specialized problems with lack of some data and variables, (incomplete data).	b2-1 Apply broad knowledge of modern computational methods and think critically to solve unstructured problems (with incomplete data) related to mechanical power engineering.	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to jet propulsion systems.

C. Professional and practical skills		
C1- Master the basic as well as the latest professional skills in the field of specialization.	c1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering techniques, skills, and tools.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to jet propulsion engineering problems, using latest engineering techniques, skills, and tools.
C2- Write and evaluate technical and professional reports.	c.2-1 Write and evaluate a professional report on specialized related to mechanical power engineering technical matters.	c2-1-1 Write and evaluate a professional report on jet propulsion systems.
D. General and transferrable skills		
D2- Use information technology to improve his/her professional practice.	d2-1 Use state-of-the-art computer aided design tools for solving mechanical power engineering problems.	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to jet propulsion systems.
D4- Use different sources to obtain knowledge and information.	d4-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about jet propulsion systems.

4- Course Contents

Week No.	*Topic*	*Total Hours*	*Contact hrs*			*Course ILOs Covered (By No.)*
			Lec.	Tut.	Lab.	
Week-1 and 3	Introduction to jet propulsion systems: historical review, classification	9	9	–	–	a1-3-1, b1-1-1, b2-1-1, c1-2-1, c1-1-1, d2-1-1, d4-1-1
Week-4 and 6	General review of fundamentals: thermodynamics, gas dynamics, and combustion process.	9	9	–	–	a1-3-1, b1-1-1, b2-1-1, c1-2-1, c1-1-1, d2-1-1, d4-1-1

Week-7 and 9	Rocket Propulsion: requirements and capabilities, rocket propulsion engines - types of rocket nozzles, parameters for chemical rockets.	9	9	–	–	a1-3-1, b1-1-1, b2-1-1, c1-2-1, c1-1-1, d2-1-1, d4-1-1
Week-10 and 12	Aircraft Gas Turbine Engine: thrust equation, propulsive efficiency and other definition equations, gas turbine engine components.	9	9	–	–	a1-3-1, b1-1-1, b2-1-1, c1-2-1, c1-1-1, d4-1-1
Week-13 and 15	Aircraft Gas Turbine Engine: working cycles, aircraft engine design.	9	9	–	–	a1-3-1, b1-1-1, b2-1-1, c1-2-1, c1-1-1, d2-1-1
Week-16 and 18	Parametric Cycle Analysis of Ideal Engines: steps and assumptions , ramjet, turbojet, turbofan, turboprop.	9	9	–	–	a1-3-1, b1-1-1, b2-1-1, c1-2-1, c1-1-1, d2-1-1, d4-1-1
Week-19 and 21	Component Performance: inlet and diffuser ,compressor and turbine, combustor and after burn, exhaust nozzle.	9	9	–	–	a1-3-1, b1-1-1, b2-1-1, c1-2-1, c1-1-1, d2-1-1, d4-1-1
Week-22 and 24	Parametric Cycle Analysis of Real Engines - Engine Performance Analysis- Turbo-machinery: axial-flow compressor, centrifugal-flow compressor, axial-flow turbine, centrifugal-flow turbine.	9	9	–	–	a1-3-1, b2-1-1, c1-2-1, c1-1-1, d2-1-1, d4-1-1
Week-25 and 27	Inlets, Nozzles, and Combustion Systems- Matching of Aircraft Gas Turbine Components.	9	9	–	–	a1-3-1, b1-1-1, b2-1-1, d2-1-1, d4-1-1
Week-28 and 30	Tutorials and Solved Problems - Tutorials and Solved Problems	9	9	–	–	a1-3-1, b1-1-1, b2-1-1, c1-2-1, c1-1-1, d2-1-1, d4-1-1
	total	90	90			

5- Relationship between the course and the programme

Field	National Academic Reference Standard(NARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Programme Academic Standards that the course	A1 (a1-2),	B1 (b1-1),	C1 (c1-1),	D2 (d2-1),

contributes in achieving.		B2 (b2-1),	C2 (c2-1)	D4 (d5-1)

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Disccretionry subjects	Total
---	---	**30%**	**70%**	---	---	---	**100%**

7- Course Topics.

Topic No.	Topic	Weeks
1st	Introduction to jet propulsion systems - General review of fundamentals - Rocket Propulsion	1-6
2nd	Aircraft Gas Turbine Engine - Parametric Cycle Analysis of Ideal Engines - Component Performance	7-12
3rd	Parametric Cycle Analysis of Real Engines - Engine Performance Analysis	13-18
4th	Turbo-machinery - Inlets, Nozzles, and Combustion Systems	19-24
5th	Matching of Aircraft Gas Turbine Components - Tutorials and Solved Problems	25-30

8- ILOs Matrix Topics

Course Intended Learning Outcomes (ILOs)		Course topics				
		1st	2nd	3rd	4th	5th
Knowledge & Understanding	a-1-2-1 Define the concepts of physical meaning and phenomena are used in jet propulsion systems.	x	x	x	x	x
	a2-2-1 Report and recognize the professional aspects of jet propulsion systems applications and their effects on the Environment.	x		x		
Intellectual Skills	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to jet propulsion systems based on the flow equations analysis.	x	x	x	x	x
	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to jet propulsion systems.					x

Professional Skill	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to jet propulsion systems problems, using latest engineering techniques, skills, and tools.	x	x	x	x	x
	c2-1-1 Write and evaluate a professional report on water hammer.				x	
General Skills	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related jet propulsion systems.	x	x	x	x	x
	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about jet propulsion systems.	x	x	x	x	x

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		Teaching and Learning Method												
		Lecture	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Site visits	Self learning	Cooperative	Discovering	Modeling	Playing
Knowledge & understanding	a1-2-1	x		x		x								
Intellectual Skills	b1-1-1	x		x	x	x								
	b2-1-1	x		x	x	x			x					
Professional Skills	c1-1-1			x	x	x	x		x	x	x			
	c2-1-1	x		x	x	x								
General Skills	d2-1-1	x		x	x	x			x	x	x			
	d4-1-1			x	x				x	x	x			

10- Teaching and learning method for low capacity and outstanding Student

For low capacity students	Assign a portion of the office hours for those students.
	Give them specific tasks.
	Repeat the explanation of some of the material and tutorials.
	Assign a teaching assistance to follow up the performance of these groups of students.
For outstanding Students	Hand out project assignments to those students.
	Give them some research topics to be searched using the internet and conduct presentation.
	Encourage them to take parts in the running research projects.

11- Assessment

11.1 Assessment Methods

Course Intended Learning Outcome (ILOs)		Assessment Methods											
		Written Exam	Oral Exam	Tutorial Assessment	Project Assessment	Model Assessment	Report Assessment	Quiz assessment	Presentation Assessment	Discussion	Laboratory Test	Home Exm	Monitoring
Knowledge & Understanding	a1-2-1	x											
Intellectual Skills	b1-1-1	x											
	b2-1-1	x											
Professional Skills	c1-1-1	x											
	c2-1-1	x											
General Skills	d2-1-1	x											
	d5-1-1	x											

11.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	32 th
Mid term written Examination	---	

Quizzes	---	
laboratory examination	---	
Oral examination	---	
Semester work	---	
Total	100%	

12- Facilities required for teaching and learning

Teaching aids like, lecture room with audio-visual facilities, white board.

13- List of references:

[1] "Elements of Propulsion Gasturbines and Rockets", by Mattingly, Jack D., Copyright © 2006 by The American Institute of Aeronautics and Astronautics, USA.

[2] "Fundamental of Jet Propulsions and Application", by Flack, Ronald D., Copyright © 2005 by Cambridge University,

Programme coordinator:
Prof. Dr. Nady Naguib Mikhael

Professor of Thermal Power and Heat Engines
Mechanical Power Engineering Department

Prof. Dr. Kamal Ameen Morad

Head of Mechanical Power Engineering Department

Date:

Course Specification

Program on which the course is given	M. Sc. in Mechanical Power Engineering
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering
Department offering the course	Mechanical Power Engineering
Academic year/Level	1st year
Date of specification approval	***2020***

A- Basic Information

Title: Turbulent Flow	**Code Symbol**: **MEP606**	
Lecture	3 hours	
Tutorial		
Laboratory		
Total	3 hours	Bylaw 2000

B- Professional Information

1- Course Aims:

2- The main objective of the course is to understand the phenomena of turbulent flow and its applications. One the main task of the course is to treat the different solutions of the turbulent flow mechanism and solution. Starting the course with the fundamentals of the turbulent flow in different cases, types and problems used in typical engineering systems such as those found in domestic use manufacturing, machinery, and power production. The course is divided into successive modules that cover basics of turbulent flow, different cases of turbulent flow, and the fluid behavior and analysis of the different systems. As well as, the detailed description of the solution of the fluid flow equations and different models used for the solution. The topic of the mathematical formulation of the fluid flow turbulent models solution will be introduced at the end of the course to cover a very important subject in engineering turbulent fluid flow field and applications.

3- Course Objectives

1- Introduce the turbulent flow phenomena and its application in mehcnaical power engineering.
2- Analyze the basic equations of turbulent flow in different cases of open and closed flow.
3- Understand the measurements techniques of turbulent flow.
4- Demonstrate the different turbulent flow models and its mathematical solutions.

5- Describe the availabilty of each turbulent model for solution of certain application, and its error analysis.

4- Intended Learning Outcomes (ILOs)

NAQAAE Academic Reference Standards (ARS)	Program ILOs	Course ILOs
A. Knowledge and understanding		
A1. Theories, basics and specialized knowledge in the field of learning, as well as the subjects that affect his/her professional practice.	a1-2 Understand the theories, basics and specialized knowledge in the field of Fluid Mechanics and Hydraulics.	a1-2-1 Understand the concepts of turbulent flow. a1-2-2 Understand the different factor that affect the flow and affect the turbulent conditions
A5- The knowledge related to the impact of professional practice on the Environment, and the work carried out for conservation and preservation.	a5-2 Recognize the interaction between mechanical power technologies and surrounding environment.	a5-2-1 Understand the application of solution techniques for practical problems; pressure exchangers and other devices utilizing turbulent flow.
B. Intellectual skills		
B1- Analyze and evaluate the information in the field of specialization, and relate it to solve problems.	b1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to mechanical power engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to analyse problems related to turbulent flow applications.

B3- Link and integrate diverse knowledge to solve professional problems.	b3-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems.	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to turbulent flow.
C. Professional and practical skills		
C1- Master the basic as well as the latest professional skills in the field of specialization.	c1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering techniques, skills, and tools.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to turbulent flow problems, using latest engineering techniques, skills, and tools.
C2- Write and evaluate technical and professional reports.	c.2-1 Write and evaluate a professional report on specialized related to mechanical power engineering technical matters.	c2-1-1 Write and evaluate a professional report on turbulent flow measurements and similarity.
D. General and transferrable skills		
D2- Use information technology to improve his/her professional practice.	d2-1 Use state-of-the-art computer aided design tools for solving mechanical power engineering problems.	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to turbulent flow and its applications.
D4- Use different sources to obtain knowledge and information.	d4-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about turbulent flow and its applications.

D7- Self evaluation and continuous learning.	d7-1 Express a strong foundation of continuous learning so they can maintain their technical competency.	d-7-1-1 Use different sources of information journals, internet access facilities, etc. to upgrade and enhance their knowledge.

5- Course Contents

Week No.	*Topic*	*Total Hours*	*Contact hrs*			*Course ILOs Covered (By No.)*
			Lec.	Tut.	Lab.	
Week-1	Introduction and general revision of fluid flow concept and types	3	3	-	-	a1-2-1,a1-2-2,
Week2-5	Definition of turbulent fluid flow and nature of turbulence, applications and case study	12	12	-	-	a1-2-1,a1-2-2,a5-2-1
Week6-11	General equation of turbulent fluid flow and applications, and solution for flat plate and tubes	18	18	-	-	a1-2-2,a5-2-2, b1-1-1, b3-1-1
Week12-15	Measurement devices of turbulent flow and case study	12	12	-	-	a5-2-1, b3-1-1
Week16-18	General differential equation of fluid flow (Naveir Stock's)	6	6	-	-	a5-2-1, b3-1-1, b1-1-1
Week19-24	Turbulent models and solution of turbulent equations and case studies	12	12	-	-	a5-2-1, b3-1-1
Week25-27	Group seminars in turbulent flow applications	9	9	-	-	a5-2-1, b3-1-1
Week28-30	General Revision on the course	6	6	-	-	c2-1-1, d2-1-1, d4-1-1, d7-1-1

6- Relationship between the course and the programme

Field	National Academic Reference Standard(NARS)

	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Programme Academic Standards that the course contributes in achieving.	A1 (a1-2-1, a1-2-2), A2 (a2-2-1)	B1 (b1-1-1), B3 (b3-1-1)	C1 (c1-1-1), C2 (c2-1-1)	D2 (d2-1-1), D4 (d4-1-1), D7 (d7-1-1)

7- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Disccretionry subjects	Total
---	---	**30%**	**70%**	---	---	---	**100%**

8- Course Topics.

Topic No.	Topic	Weeks
1st	Introduction and general revision of fluid flow concept and types	1-3
2nd	Definition of turbulent fluid flow and nature of turbulence, applications and case study	2-5
3rd	General equation of turbulent fluid flow and applications, and solution for flat plate and tubes - Measurement devices of turbulent flow and case study	6-15
4th	General differential equation of fluid flow (Naveir Stock's) - Turbulent models and solution of turbulent equations and case studies	16-25
5th	Group seminars in turbulent flow applications - General Revision on the course	26-30

8- ILOs Matrix Topics

Course Intended Learning Outcomes (ILOs)	Course topics				
	1st	2nd	3rd	4th	5th

Knowledge & Understanding	a1-2-1 Understand the concepts of unsteady flow.	x				
	a1-2-2 Understand the different factor that affect the flow and affect the transient conditions	x	x			
	a2-2-1 Understand the application of solution techniques for practical problems; pressure exchangers and other devices utilizing unsteady flow.	x	x	x	x	
Intellectual Skills	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to analyse problems related to unsteady fluid flow applications.	x	x			
	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to unsteady fluid flow.	x	x	x		
Professional Skill	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to unsteady fluid flow problems, using latest engineering techniques, skills, and tools.					x
	c2-1-1 Write and evaluate a professional report on unsteady fluid flow measurements and similarity.				x	
General Skills	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to unsteady fluid flow and its applications.		x	x		x

	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about unsteady fluid flow and its applications.		x			x
	d-7-1-1 Use different sources of information journals, internet access facilities, etc. to upgrade and enhance their knowledge.		x			x

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		Teaching and Learning Method												
		Lecture	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Site visits	Self learning	Cooperative	Discovering	Modelling	Playing
Knowledge & understanding	a1-2-1	x		x										
	a1-2-2	x		x		x								
	a2-2-1	x		x		x								
Intellectual Skills	b1-1-1	x		x	x	x								
	b3-1-1	x		x	x	x			x					
Professional Skills	c1-1-1			x	x	x	x		x	x	x			
	c2-1-1	x		x	x	x								
General Skills	d2-1-1	x		x	x	x			x	x	x			
	d4-1-1			x	x				x	x	x			
	d7-1-1			x						x				

10- Teaching and learning method for low capacity and outstanding Student

For low capacity students	Assign a portion of the office hours for those students.
	Give them specific tasks.

	Repeat the explanation of some of the material and tutorials.
	Assign a teaching assistance to follow up the performance of these groups of students.
For outstanding Students	Hand out project assignments to those students.
	Give them some research topics to be searched using the internet and conduct presentation.
	Encourage them to take parts in the running research projects.

11- Assessment

11.1 Assessment Methods

Course Intended Learning Outcome (ILOs)		Assessment Methods											
		Wirtten Exam	Oral Exam	Tutorial Assessment	Project Assessment	Model Assessment	Report Assessment	Quiz assessment	Presentation Assessment	Discussion	Laboratory Test	Home Exm	Monitoring
Knowledge & Understanding	a1-2-1	x											
	a1-2-2	x											
	a2-2-1	x											
Intellectual Skills	b1-1-1	x	x										
	b3-1-1	x		x									
Professional Skills	c1-1-1	x								x			
	c2-1-1	x					x						
General Skills	d2-1-1			x									
	d4-1-1						x						
	d7-1-1						x						

11.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	32 th
Mid term written Examination	---	

Quizzes	---	
laboratory examination	---	
Oral examination	---	
Semester work	---	
Total	100%	

12- Facilities required for teaching and learning

Teaching aids like, lecture room with audio-visual facilities, white board.

13- List of references:

1- Frank M. White, " Fluid mechanics ", 4th edition, 2001, Mc Graw Hill.
2- Tuncere Cebici, "Analysis of turbulent flow", 2004, Elsevir LTD.
3- D. Drikakis and B.J. Geurts, " Turbulent Flow Compiutation", 2004, KLUWER ACADEMIC PUBLISHERS, NEW YORK.

Periodicals, Web sites, etc

- *Journal of Fluids Engineering*
- *International Journal for Numerical Methods in Fluids*

Course coordinator: Prof. Dr Eng Ayman Mohamed

Programme coordinator: Prof. Dr Eng Kamal Morad

Head of the Department: Prof. Dr Eng Kamal Morad

Course Specification

Program on which the course is given	M. Sc. in Mechanical Power Engineering
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering
Department offering the course	Mechanical Power Engineering
Academic year/Level	1st year
Date of specification approval	***2020***

A- Basic Information

Title: Advanced Fluid Mechanics and Thermodynamics	**Code Symbol**: MEP607	
Lecture	3 hours	
Tutorial		
Laboratory		
Total	3 hours	Bylaw 2000

B- Professional Information

1- Course Aims:

The major aim of this course is to understand the basic concepts of fluid dynamics, thermal fluid and get better understanding of different flow regimes. To help the post graduate students to add more information about laminar and turbulent flows, viscous and non-viscous fluids, Laminar and turbulent flows, Turbulence modeling, and Multiple-pipe systems. Also, get more knowledge about the Total head losses in pipe systems and its engineering application. Analyze the compressible flow within nozzles in one and two dimensional directions. This course will also provide students with the ability to select and design of the experimental model by using dimensional analysis and similarity. Discuss the all phenomena associated with such type of flows and different parameters.

2- Course Objectives

1- Demonstration of the knowledge and understanding of the importance of study of advanced fluid mechanics and thermodynamics
2- Definitions of the viscous flows, dimensional analysis and similarity, and compressible flow as related to practical applications.
3- Reconcilability of the different equations for fluid flow with different applications.
4- Analysis of different fluid mechanics and thermodynamics problems.

3- Intended Learning Outcomes (ILOs)

NAQAAE Academic Reference Standards (ARS)	Program ILOs	Course ILOs
A. Knowledge and understanding		
A1. Theories, basics and specialized knowledge in the field of learning, as well as the subjects that affect his/her professional practice.	a1-1 Demonstrate sufficient essential knowledge and a deep understanding of the concepts and theories of **Mathematics and Computational Techniques** appropriate to their areas of specialization in mechanical power engineering.	a1-1-1 Analyze the theories of mathematics and sciences are used in advanced fluid mechanics and thermodynamics.
	a1-2 Understand the theories, basics and specialized knowledge in the field of **Fluid Mechanics and Hydraulics**.	a-1-2-1 Define the concepts of physical meaning and phenomena are used in advanced fluid mechanics and thermodynamics. a1-2-2 Classify the fluid flows according to their internal and external viscous flows, compressible and incompressible flows, and heat transfer and frictional flows. a1-2-3 Discuss the basics differences between the most common turbulence modeling according to their complex flow and complex geometry.
A2- Mutual relation between professional aspects of professional practice and its effects on the Environment.	a2-2 Recognize the interaction between mechanical power technologies and surrounding environment.	a2-2-1 Report and recognize the professional aspects of advanced fluid mechanics and thermodynamics applications and their effects on the Environment.

A3- Main scientific advances in the field of specialization.	a3-2 Report new advances in analysis and design methodologies in mechanical power engineering and its application paradigms.	a3-2-1 Report new advances in analysis and design methodologies in fluid-thermal and its application paradigms.
B. Intellectual skills		
B1- Analyze and evaluate the information in the field of specialization, and relate it to solve problems.	b1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to mechanical power engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to advanced fluid mechanics and thermodynamics based on the flow equations analysis.
B3- Link and integrate diverse knowledge to solve professional problems.	b3-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems.	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to advanced fluid mechanics and thermodynamics.
C. Professional and practical skills		
C1- Master the basic as well as the latest professional skills in the field of specialization.	c1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering techniques, skills, and tools.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to advanced fluid mechanics and thermodynamics problems, using latest engineering techniques, skills, and tools.
C2- Write and evaluate technical and professional reports.	c.2-1 Write and evaluate a professional report on specialized related to mechanical power engineering technical matters.	c2-1-1 Write and evaluate a professional report on fluid flow measurements and similarity.
D. General and transferrable skills		

D2- Use information technology to improve his/her professional practice.	d2-1 Use state-of-the-art computer aided design tools for solving mechanical power engineering problems.	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to advanced fluid mechanics and thermodynamics.
D5- Use different sources to obtain knowledge and information.	d5-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about advanced fluid mechanics and thermodynamics.

4- Course Contents

Week No.	*Topic*	*Total Hours*	*Contact hrs*			*Course ILOs Covered (By No.)*
			Lec.	Tut.	Lab.	
Week-1 and 2	Kinematics of fluid motion	6	6	–	–	a1-2-1, a1-2-2, b1-1-1, b3-1-1, c1-1-1, d2-1-1, d5-1-1
Week-3 and 4	Flow of incompressible ideal fluids	6	6	–	–	a1-2-1, a1-2-2, b1-1-1, b3-1-1, c1-1-1, d2-1-1, d5-1-1
Week-5 and 6	Flow of compressible ideal fluids	6	6	–	–	a1-1-1, a1-2-1, a1-2-3, b1-1-1, b3-1-1, c1-1-1, d2-1-1, d5-1-1
Week-7 and 8	Impulse momentum principle	6	6	–	–	a1-1-1, a1-2-1, a2-2-1, b1-1-1, b3-1-1, c1-1-1, d2-1-1, d5-1-1
Week-9 and 11	Similitude and dimensional analysis	9	9	–	–	a1-2-1, a1-2-1, b1-1-1, b3-1-1, c1-1-1, d2-1-1, d5-1-1
Week-12 and 14	Fluid flow in pipes	9	9	–	–	a1-2-1, a2-2-1, b1-1-1, b3-1-1, c1-1-1, c2-1-1, d2-1-1, d5-1-1
Week-15 and 17	Fluid flow around immersed bodies	9	9	–	–	a1-1-1, a1-2-1, a3-2-1, b1-1-1, b3-1-1, c1-1-1, d2-1-1, d5-1-1
Week-18 and 19	Fluid measurements	6	6	–	–	a1-2-1, a1-2-2, a2-2-1, b1-1-1, b3-1-1, c1-1-1, d2-1-1, d5-1-1
Week-20 and 22	Basic of thermodynamics	9	9	–	–	a1-2-1, a2-2-1, b1-1-1, b3-1-1, c1-1-1, c2-1-1, d2-1-1, d5-1-1
Week-23 and 24	Isentropic flow	6	6	–	–	a1-2-1, a3-2-1, b1-1-1, b3-1-1, c1-1-1, d2-1-1, d5-1-1
Week-25 and 26	Wave adiabatic flow	6	6	–	–	a1-2-1, a3-2-1, b1-1-1, b3-1-1, c1-1-1, d2-1-1, d5-1-1
Week-27 and 28	Flow with friction	6	6	–	–	a1-2-1, a3-2-1, b1-1-1, b3-1-1, c1-1-1, d2-1-1, d5-1-1
Week-29 and 30	Thermodynamics of turbo-machines	6	6	–	–	a1-2-1, a2-2-1, b1-1-1, b3-1-1, c1-1-1, d2-1-1, d5-1-1
Total		**90**	**90**	–	–	

5- Relationship between the course and the programme

Field	National Academic Reference Standard(NARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Programme Academic Standards that the course contributes in achieving.	A1 (a1-1, a1-2), A2 (a2-2), A3 (a3-2)	B1 (b1-1), B3 (b3-1)	C1 (c1-1), C2 (c2-1)	D2 (d2-1), D5 (d5-1)

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Disccretionry subjects	Total
---	---	**30%**	**70%**	---	---	---	**100%**

7- Course Topics.

Topic No.	Topic	Weeks
1st	Incompressible Viscous Flow	1-6
2nd	Turbulence modeling	7-12
3rd	Dimensional Analysis and Similarity	13-18
4th	Compressible Flow	19-24
5th	Flow with friction and heat transfer	25-30

8- ILOs Matrix Topics

Course Intended Learning Outcomes (ILOs)		Course topics				
		1st	2nd	3rd	4th	5th
Knowledge & Understanding	a1-1-1 Analyze the theories of mathematics and sciences are used in advanced fluid mechanics and thermodynamics.	x	x		x	
	a1-2-1 Define the concepts of physical meaning and phenomena are used in advanced fluid mechanics and thermodynamics.	x	x	x	x	x
	a1-2-2 Classify the fluid flows according to their internal and external viscous flows, compressible and incompressible flows, and heat transfer and frictional flows.	x		x	x	x

	a1-2-3 Discuss the basics differences between the most common turbulence modeling according to their complex flow and complex geometry.		x			
	a2-2-1 Report and recognize the professional aspects of advanced fluid mechanics and thermodynamics applications and their effects on the Environment.	x		x	x	
	a3-2-1 Report new advances in analysis and design methodologies in fluid-thermal and its application paradigms.			x	x	
Intellectual Skills	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to advanced fluid mechanics and thermodynamics based on the flow equations analysis.	x	x	x	x	x
	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to advanced fluid mechanics and thermodynamics.	x	x	x	x	x
Professional Skill	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to advanced fluid mechanics and thermodynamics problems, using latest engineering techniques, skills, and tools.	x	x	x	x	x
	c2-1-1 Write and evaluate a professional report on fluid flow measurements and similarity.	x		x		
General Skills	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to advanced fluid mechanics and thermodynamics.	x	x	x	x	x
	d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about advanced fluid mechanics and thermodynamics.	x	x	x	x	x

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		Teaching and Learning Method												
		Lecture	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Site visits	Self learning	Cooperative	Discovering	Modelling	Playing
Knowledge & understanding	a1-1-1	x		x										
	a1-2-1	x		x		x								
	a1-2-2	x		x		x								
	a1-2-3	x		x		x								
	a2-2-1	x		x		x								
	a3-2-1	x		x		x								
Intellectual Skills	b1-1-1	x		x	x	x								
	b3-1-1	x		x	x	x			x					
Professional Skills	c1-1-1			x	x	x	x		x	x	x			
	c2-1-1	x		x	x	x								
General Skills	d2-1-1	x		x	x	x			x	x	x			
	d5-1-1			x	x				x	x	x			

10- Teaching and learning method for low capacity and outstanding Student

For low capacity students	Assign a portion of the office hours for those students.
	Give them specific tasks.
	Repeat the explanation of some of the material and tutorials.
	Assign a teaching assistance to follow up the performance of these groups of students.
For outstanding Students	Hand out project assignments to those students.
	Give them some research topics to be searched using the internet and conduct presentation.
	Encourage them to take parts in the running research projects.

11- Assessment

11.1 Assessment Methods

Course Intended Learning Outcome (ILOs)		Assessment Methods											
		Written Exam	Oral Exam	Tutorial Assessment	Project Assessment	Model Assessment	Report Assessment	Quiz assessment	Presentation Assessment	Discussion	Laboratory Test	Home Exm	Monitoring
Knowledge & Understanding	a1-1-1	x											
	a1-2-1	x											
	a1-2-2	x											
	a1-2-3	x											
	a2-2-1	x											
	a3-2-1	x											
Intellectual Skills	b1-1-1	x											
	b3-1-1	x											
Professional Skills	c1-1-1	x											
	c2-1-1	x											
General Skills	d2-1-1	x											
	d5-1-1	x											

11.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	32 th
Mid term written Examination	---	
Quizzes	---	
laboratory examination	---	
Oral examination	---	
Semester work	---	
Total	100%	

12- Facilities required for teaching and learning

Teaching aids like, lecture room with audio-visual facilities, white board.

13- List of references:

Essential Books (Text Books)

1- Stephen R. Turns, " Thermal – Fluid Sciences", Cambridge University Press, 2006.
2- Yunus A. Gengel and Robert H. Turner, “Fundamentals of Thermal – Fluid Sciences ”, McGraw-Hill, INC. 2001.

Recommended Books

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.

Periodicals, Web sites, etc

- Journal of Fluid and Thermal Engineering.
- http://cms.nelc.edu.eg/course/view.php?id=114

Course Coordinator : Dr / Yassen El-Sayed Yassen

E-mail: y_yassen70@yahoo.com

Head of Department : Prof. Dr. Kamal Ameen Morad

Date :

Course Specification

Program on which the course is given	M. Sc. in Mechanical Power Engineering
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering
Department offering the course	Mechanical Power Engineering
Academic year/Level	1st year
Date of specification approval	***2020***

A- Basic Information

Title: Aerodynamics (2)	**Code Symbol**: MEP608	
Lecture	3 hours	
Tutorial		
Laboratory		
Total	3 hours	Bylaw 2003

B- Professional Information

1- Course Aims:

Students has been revised to include the main concepts in flow control and boundary layers, and their influence on modern wing design, as well as introducing recent advances in the understanding of fundamental fluid dynamics. Computational methods have been considered to estimate the main forces and momentums to design and research in the aeronautical industry.

2- Course Objectives

1- Is to establish geometrical features of the aircrafts and, wings and airfoils.
2- Is to estimate the required thrust force applied on different aircrafts.
3- Is to understand and to analysis of body pressure distribution for a perfect fluid and in addition to the real one.

3- Intended Learning Outcomes (ILOs)

NAQAAE Academic Reference Standards (ARS)	Program ILOs	Course ILOs
A. Knowledge and understanding		
A1. Theories, basics and specialized knowledge in the field of learning, as well as the subjects that affect his/her professional practice.	a1-5 Understand the theories, basics and specialized knowledge in the field of **Turbo-Machinery and Aero-Dynamics**.	a-1-5-1 Define the concepts of physical meaning and phenomena are used in aerodynamics.
A4- Basics and principles of quality in professional practice in the field of specialization.	a4-1 Explain Quality Assurance concepts of different mechanical power components and systems development phases.	a4-1-1 Explain Quality Assurance concepts of different mechanical power components and systems development phases.
B. Intellectual skills		
B1- Analyze and evaluate the information in the field of specialization, and relate it to solve problems.	b1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to mechanical power engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to water power engineering based on the flow equations analysis.
B3- Link and integrate diverse knowledge to solve professional problems.	b3-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems.	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to aerodynamics.
C. Professional and practical skills		
C1- Master the basic as	c1-1 Express competence	c1-1-1 Express competence skills, such

well as the latest professional skills in the field of specialization.	skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering techniques, skills, and tools.	as identifying, formulating, analyzing, and creating engineering solutions related to aerodynamics problems, using latest engineering techniques, skills, and tools.
C2- Write and evaluate technical and professional reports.	c.2-1 Write and evaluate a professional report on specialized related to mechanical power engineering technical matters.	c2-1-1 Write and evaluate a professional report on wings and aircrafts.
D. General and transferrable skills		
D2- Use information technology to improve his/her professional practice.	d2-1 Use state-of-the-art computer aided design tools for solving mechanical power engineering problems.	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to aerodynamics.
D4- Use different sources to obtain knowledge and information.	d4-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about aerodynamics.

4- Course Contents

Week No.	*Topic*	*Total Hours*	*Contact hrs*			*Course ILOs Covered (By No.)*
			Lec.	Tut.	Lab.	
Week-1 and 3	Airfoils & Wings	9	9	–	–	a1-5-1, a4-1-1, b1-1-1, b3-1-1, c1-1-1, c2-1-1,d2-1-1, d4-1-1
Week-4 and 6	Other Different Airplane components	9	9	–	–	a1-5-1, a4-1-1, b1-1-1, b3-1-1, c1-1-1, c2-1-1,d2-1-1, d4-1-1
Week-7 and 9	Airfoil Characteristics	9	9	–	–	a1-5-1, a4-1-1, b1-1-1, b3-1-1, c1-1-1, c2-1-1, d4-1-1
Week-10 and 12	Force Representation	9	9	–	–	a1-5-1, a4-1-1, b1-1-1, b3-1-1, c1-1-1, c2-1-1, d4-1-1
Week-13 and 15	Lift and Drag and Lift/Drag Ratio	9	9	–	–	a1-5-1, a4-1-1, b1-1-1, b3-1-1, c1-1-1, c2-1-1,d2-1-1, d4-1-1

Week-16 and 18	Pitching Momentum	9	9	–	–	a1-5-1, b3-1-1, c1-1-1, c2-1-1,d2-1-1, d4-1-1
Week-19 and 21	Airfoil Balance	9	9	–	–	a1-5-1, b3-1-1, c1-1-1, c2-1-1,d2-1-1, d4-1-1
Week-22 and 24	Airfoil Stability	9	9	–	–	a1-5-1, c1-1-1, c2-1-1,d2-1-1, d4-1-1
Week-25 and 27	Aspect Ratio	9	9	–	–	a1-5-1, c1-1-1, c2-1-1,d2-1-1, d4-1-11
Week-28 and 30	Plan Form Influences	9	9	–	–	a1-5-1, c1-1-1, c2-1-1,d2-1-1, d4-1-1
Total		**90**	**90**	–	–	

5- Relationship between the course and the programme

Field	National Academic Reference Standard(NARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Programme Academic Standards that the course contributes in achieving.	A1 (a1-5), A4 (a4-1)	B1 (b1-1), B3 (b3-1),	C1 (c1-1), C2 (c2-1)	D2 (d2-1), D4 (d4-1),

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Disccretionry subjects	Total
---	---	**30%**	**70%**	---	---	---	**100%**

7- Course Topics.

Topic No.	Topic	Weeks
1st	Airfoils & Wings	1-6
2nd	Other Different Airplane components	7-12
3rd	Airfoil Characteristics	13-18
4th	Lift and Drag and Lift/Drag Ratio	19-24
5th	Airfoil Balance and Stability	25-30

8- ILOs Matrix Topics

Course Intended Learning Outcomes (ILOs)		Course topics				
		1st	2nd	3rd	4th	5th
Knowledge & Understanding	a-1-2-1 Define the concepts of physical meaning and phenomena are used in aerodynamics.	x	x	x	x	x
	a4-1-1 Explain Quality Assurance concepts of different mechanical power components and systems development phases.	x		x		x
Intellectual Skills	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to water power engineering based on the flow equations analysis.	x	x	x	x	x
	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to aerodynamics.				x	x
Professional Skill	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to water power engineering problems, using latest engineering techniques, skills, and tools.	x	x	x	x	x
	c2-1-1 Write and evaluate a professional report on water hammer.			x	x	x
General Skills	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to aerodynamics.	x	x	x	x	x
	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and	x	x	x	x	x

	enhance their conceptual knowledge about aerodynamics.					

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		Teaching and Learning Method												
		Lecture	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Site visits	Self learning	Cooperative	Discovering	Modelling	Playing
Knowledge & understanding	a1-5-1	x		x		x								
	a4-1-1	x		x		x								
Intellectual Skills	b1-1-1	x		x	x	x								
	b3-1-1	x		x	x	x			x					
Professional Skills	c1-1-1			x	x	x	x		x	x	x			
	c2-1-1	x		x	x	x								
General Skills	d2-1-1	x		x	x	x			x	x	x			
	d4-1-1			x	x				x	x	x			

10- Teaching and learning method for low capacity and outstanding Student

For low capacity students	Assign a portion of the office hours for those students.
	Give them specific tasks.
	Repeat the explanation of some of the material and tutorials.
	Assign a teaching assistance to follow up the performance of these groups of students.
For outstanding Students	Hand out project assignments to those students.
	Give them some research topics to be searched using the internet and conduct presentation.
	Encourage them to take parts in the running research projects.

11- Assessment

11.1 Assessment Methods

Course Intended Learning Outcome (ILOs)		Assessment Methods											
		Wirtten Exam	Oral Exam	Tutorial Assessment	Project Assessment	Model Assessment	Report Assessment	Quiz assessment	Presentation Assessment	Discussion	Laboratory Test	Home Exm	Monitoring
Knowledge & Understanding	a1-5-1	x											
	a4-1-1	x											
Intellectual Skills	b1-1-1	x											
	b3-1-1	x											
Professional Skills	c1-1-1	x											
	c2-1-1	x											
General Skills	d2-1-1	x											
	d4-1-1	x											

11.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	32 th
Mid term written Examination	---	
Quizzes	---	
laboratory examination	---	
Oral examination	---	
Semester work	---	
Total	100%	

12- Facilities required for teaching and learning

Teaching aids like, lecture room with audio-visual facilities, white board.

13- List of references:

Essential Books (Text Books)

1- Fundamentals of Aerodynamics (McGraw-Hill International Editions: Mechanical Engineering Series), Tata McGraw-Hill, 1985.

2- Fundamentals of Aerodynamics (Mcgraw Hill Series in Aeronautical and Aerospace Engineering), John Anderson, 2010.

Recommended Books

1- Fundamentals of Astrodynamics (Dover Books on Aeronautical Engineering) by Roger R. Bate, 1971.
2- Jet Engines: Fundamentals of Theory, Design and Operation, Klaus Hunecke, 1997.

Course Coordinator: Prof. Dr. Tharwat Messiha Farag

Head of Department: Prof. Dr. Kamal Ameen Morad

Date :

Course Specification

Program on which the course is given	M. Sc. in Mechanical Power Engineering
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering
Department offering the course	Mechanical Power Engineering
Academic year/Level	1st year
Date of specification approval	***2020***

A- Basic Information

Title: **Advanced Turbo Mechanics**	**Code Symbol**: MEP609	
Lecture	3 hours	
Tutorial		
Laboratory		
Total	3 hours	Bylaw 2003

B- Professional Information

1- Course Aims:

The study of Turbo mechanics is of great importance in many engineering fields. The aims of this course are to provide the Post graduate Student, in Mechanical Engineering Programme, with the basic knowledge of Advanced Turbo Mechanics. The first chapter deals in great detail with thermodynamics, properties of gases and steam and their influence on the operation of various equipments in the power plant stations. The next chapter discusses the dynamic of compressible flow through nozzles and blades. Flow through axial single and multistage turbines are discussed in chapters three. The analysis in two dimensional cascades is discussed in chapter four. Chapter five discusses the basic characteristics flow through axial and radial fans and compressors. Many of illustrative numerical examples are discussed. SI system of units is adopted throughout of this course.

2- Course Objectives

1- Demonstration of the knowledge and understanding of the importance of turbomachines
2- Defination of the requirements of the turbomachine design
3- Recognizability of the different types of turbomachines.
4- Evaluation of the suitable protection schemes for turbomachines
5- Analysis of different steam turbines, gas turbines, fans, and air compressors.
6- Understand the main operating characteristics of steam turbines, gas turbines, fans, and air compressors.

7- Be able to experimentally determine pressure – volume curves for the turbomachines.
8- Preparing students to communicate and work effectively in team and multi-disciplinary technical environments

3- Intended Learning Outcomes (ILOs)

NAQAAE Academic Reference Standards (ARS)	Program ILOs	Course ILOs
A. Knowledge and understanding		
A1. Theories, basics and specialized knowledge in the field of learning, as well as the subjects that affect his/her professional practice.	a1-5 Understand the theories, basics and specialized knowledge in the field of **Turbo-Machinery and Aero-Dynamics**.	a-1-5-1 Define the concepts of physical meaning and phenomena are used in advanced turbo mechanics.
A4- Basics and principles of quality in professional practice in the field of specialization.	a4-1 Explain Quality Assurance concepts of different mechanical power components and systems development phases.	a4-1-1 Explain Quality Assurance concepts of different mechanical power components and systems development phases.
B. Intellectual skills		
B1- Analyze and evaluate the information in the field of specialization, and relate it to solve problems.	b1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to mechanical power engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to advanced turbo mechanics based on the flow equations analysis.

B3- Link and integrate diverse knowledge to solve professional problems.	b3-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems.	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to advanced turbo mechanics.
C. Professional and practical skills		
C1- Master the basic as well as the latest professional skills in the field of specialization.	c1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering techniques, skills, and tools.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to advanced turbo mechanics problems, using latest engineering techniques, skills, and tools.
C2- Write and evaluate technical and professional reports.	c.2-1 Write and evaluate a professional report on specialized related to mechanical power engineering technical matters.	c2-1-1 Write and evaluate a professional report on compressors and turbines.
D. General and transferrable skills		
D2- Use information technology to improve his/her professional practice.	d2-1 Use state-of-the-art computer aided design tools for solving mechanical power engineering problems.	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to advanced turbo mechanics.
D4- Use different sources to obtain knowledge and information.	d4-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about advanced turbo mechanics.

4- Course Contents

Week	*Topic*	*Total*	*Contact hrs*	*Course ILOs*

No.		*Hours*	Lec.	Tut.	Lab.	*Covered (By No.)*
Week-1 and 3	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 - Continuity Equation - The First Law of Thermodynamics - Newton's Second Law of Motion - The Second Law of Thermodynamics: Entropy	9	9	–	–	a1-5-1, a4-1-1, b1-1-1, b3-1-1, c1-1-1, c2-1-1,d2-1-1, d4-1-1
Week-4 and 6	Efficiency and Losses of Steam and Gas Turbines, Fans, and air Compressors - Nozzle and diffuser Efficiency, Energy Transfer in Turbomachinery, The Euler Turbine Equation - Examples and Problems.- Illustrative example and solved problems	9	9	–	–	a1-5-1, a4-1-1, b1-1-1, b3-1-1, c1-1-1, c2-1-1,d2-1-1, d4-1-1
Week-7 and 10	Steam Turbines - Introduction, Steam Nozzles, Nozzle Efficiency - The Reheat Factor - Metastable Equilibrium - Illustrative example and solved problems - Stage Design - Impulse Stage - The Impulse Steam Turbine - Reaction Turbine - Pressure Compounding (The Rateau Turbine) - Velocity Compounding (The Curtis Turbine)- Illustrative example and solved problems	12	12	–	–	a1-5-1, a4-1-1, b1-1-1, b3-1-1, c1-1-1, c2-1-1, d4-1-11
Week-11 and 14	Axial Flow Steam Turbines, Degree of Reaction - Cascade design - Illustrative example and solved problems - Axial Flow and Radial Flow Steam Turbines - Introduction to Axial Flow Turbines - Velocity Triangles and Work Output - Degree of Reaction - Blade-Loading Coefficient, Stator (Nozzle) and Rotor Losses	12	12	–	–	a1-5-1, a4-1-1, b1-1-1, b3-1-1, c1-1-1, c2-1-1, d4-1-1
Week-15 and 17	Radial Flow Turbine, Velocity Diagrams and Thermodynamic, Analysis - Turbine Efficiency, Application of Specific Speed - Illustrative example and solved problems.	9	9	–	–	a1-5-1, a4-1-1, b1-1-1, b3-1-1, c1-1-1, c2-1-1,d2-1-1, d4-1-1
Week-18 and 20	Two dimensional cascades - Types of turbine cascades - Losses in the turbine cascades, profile, secondary and total losses - Analysis of total losses - Illustrative example and solved problems	9	9	–	–	a1-5-1, b3-1-1, c1-1-1, c2-1-1,d2-1-1, d4-1-11
Week-21 and 24	Axial Flow and Radial Flow Fans air Compressors - Introduction to Axial air Compressors - Velocity Triangles and Work Output - Degree of Reaction - Blade-Loading Coefficient, Stator (Nozzle) and Rotor Losses - Still in Compressors	12	12	–	–	a1-5-1, b3-1-1, c1-1-1, c2-1-1,d2-1-1, d4-1-1

Week-25 and 30	Design of Axial flow Turbines and Compressors - Blade Design - Cascade Design - Computer Programs	12	12	–	–	a1-5-1, c1-1-1, c2-1-1,d2-1-1, d4-1-1

5- Relationship between the course and the programme

Field	National Academic Reference Standard(NARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Programme Academic Standards that the course contributes in achieving.	A1 (a1-5), A4 (a4-1)	B1 (b1-1), B3 (b3-1),	C1 (c1-1), C2 (c2-1)	D2 (d2-1), D4 (d4-1),

6- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Disccretionry subjects	Total
---	---	**30%**	**70%**	---	---	---	**100%**

7- Course Topics.

Topic No.	Topic	Weeks
1st	**Definitions, Dimensional Analysis—Basic Thermodynamics and Fluid Mechanics, introduction to turbomachinery, Efficiency**	1-6
2nd	**Classification of Turbomachines, Compressible Flow Machines Basic Thermodynamics, Fluid Mechanics, and Definitions of Efficiency.**	7-12
3rd	**Definitions, application of steam impulse and reaction turbines, single and multi stages, cascade design**	13-18
4th	**Definition of Axial and Radial flow gas turbines Velocity Diagrams and Thermodynamic, Analysis, Turbine Efficiency, Application of Specific Speed**	19-24
5th	**Definition of Axial Flow Compressors and Fans, Introduction, Velocity Diagram, Degree of Reaction, Stage Loading, Lift-and-Drag Coefficients, Cascade Nomenclature and Terminology, two dimensional cascades, Design of axial flow turbines and compressors, and two dimensional cascades.**	25-30

8- ILOs Matrix Topics

Course Intended Learning Outcomes (ILOs)	Course topics				
	1st	2nd	3rd	4th	5th

Knowledge & Understanding	a-1-2-1 Define the concepts of physical meaning and phenomena are used in aerodynamics.	x	x	x	x	x
	a4-1-1 Explain Quality Assurance concepts of different mechanical power components and systems development phases.	x		x		x
Intellectual Skills	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to water power engineering based on the flow equations analysis.	x	x	x	x	x
	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to aerodynamics.				x	x
Professional Skill	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to water power engineering problems, using latest engineering techniques, skills, and tools.	x	x	x	x	x
	c2-1-1 Write and evaluate a professional report on water hammer.			x	x	x
General Skills	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to aerodynamics.	x	x	x	x	x
	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about aerodynamics.	x	x	x	x	x

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		Teaching and Learning Method												
		Lecture	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Site visits	Self learning	Cooperative	Discovering	Modelling	Playing
Knowledge & understanding	a1-5-1	x		x		x								
	a4-1-1	x		x		x								
Intellectual Skills	b1-1-1	x		x	x	x								
	b3-1-1	x		x	x	x			x					
Professional Skills	c1-1-1			x	x	x	x		x	x	x			
	c2-1-1	x		x	x	x								
General Skills	d2-1-1	x		x	x	x			x	x	x			
	d4-1-1			x	x				x	x	x			

10- Teaching and learning method for low capacity and outstanding Student

For low capacity students	Assign a portion of the office hours for those students.
	Give them specific tasks.
	Repeat the explanation of some of the material and tutorials.
	Assign a teaching assistance to follow up the performance of these groups of students.
For outstanding Students	Hand out project assignments to those students.
	Give them some research topics to be searched using the internet and conduct presentation.
	Encourage them to take parts in the running research projects.

11- Assessment

11.1 Assessment Methods

Course Intended Learning	Assessment Methods

Outcome (ILOs)		Wirtten Exam	Oral Exam	Tutorial Assessment	Project Assessment	Model Assessment	Report Assessment	Quiz assessment	Presentation Assessment	Discussion	Laboratory Test	Home Exm	Monitoring
Knowledge & Understanding	a1-5-1	x											
	a4-1-1	x											
Intellectual Skills	b1-1-1	x											
	b3-1-1	x											
Professional Skills	c1-1-1	x											
	c2-1-1	x											
General Skills	d2-1-1	x											
	d4-1-1	x											

11.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	32 th
Mid term written Examination	---	
Quizzes	---	
laboratory examination	---	
Oral examination	---	
Semester work	---	
Total	100%	

12- Facilities required for teaching and learning

Teaching aids like, lecture room with audio-visual facilities, white board.

13- List of references:

1- **White, F. M. (2008), Fluid Mechanics, Sixth Edition, McGraw-Hill.**
2- **Rama S.R. Gorla and Aijaz A. Khan, (2003) "Turbomachinery "Design and Theory", Marcel Dekker, Inc.**
3- **L. L. Faulkner MECHANICAL ENGINEERING, A Series of Textbooks and Reference Books, Columbus Division, Battelle Memorial Institute and Department of Mechanical Engineering, The Ohio State University, Columbus, Ohio**

Course Prof. Atef M. Alm-Edin
Programme coordinator:
Head of the Department: Prof. Dr. Kamal Ameen Morad

Date:.

Course Specification

Program on which the course is given	M. Sc. in Mechanical Power Engineering
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering
Department offering the course	Mechanical Power Engineering
Academic year/Level	first year
Date of specification approval	***2020***

A- Basic Information

Title: Gas dynamics (2)	**Code Symbol**: **MEP610**	
Lecture	3 hours	
Tutorial		
Laboratory		
Total	3 hours	By law 2000

B- Professional Information

1- Course Aims:

In our treatment of convection, we have two major objectives. In addition to obtaining an understanding of the physical mechanisms that underline gas dynamics, we wish to develop the means of perform gas dynamics calculations. This course is devoted primarily to achieving the former objective. Physical origins are discussed, and relevant dimensionless parameters are developed.

With conceptual foundations established, subsequent chapters are used to develop useful effects in gas dynamics. The course deals with the subsonic and supersonic flow. It also describes the behavior of the flow in adiabatic and diabatic form.

2- Course Objectives

1- the first objective is to cover cover the basic principles of convection heat transfer and to present a wealth of real-world engineering applications to give students a feel for engineering practice .
2- Is to develop an understanding of boundary gas dynamics, examine the differential equations that govern the velocity and temperature fields taht are aplicable to boundary layer equation and determine important dimensionless parameters associated withgas dynamics.
3- is to learn how to estimate the different parameters in order to perform analyses on thermal systems experiencing different types of flow.
4- Is to use requisite inputs for computing gas dynamics parameters.
5- Is to delineate pertinent trasport phenemena for any process or system involving gasdynamics.

6- The student should be able to develop representative models for real processes and system and draw conclusions concerning process/system design or performance from the attendant analysis.

3- Intended Learning Outcomes (ILOs)

NAQAAE Academic Reference Standards (ARS)	Program ILOs	Course ILOs
A. Knowledge and understanding		
A1. Theories, basics and specialized knowledge in the field of learning, as well as the subjects that affect his/her professional practice.	a1-5 Understand the theories, basics and specialized knowledge in the field of **Turbo-Machinery and Aero-Dynamics**.	a-1-5-1 Understand the relation of thermodynamic and fluid mechanics sciences the the science of gas dynamics.
A4- Basics and principles of quality in professional practice in the field of specialization.	a4-1 Explain Quality Assurance concepts of different mechanical power components and systems development phases.	a4-1-1 Understand the dependence of the thermo-physical properties of the fluids on the natural of the flow and gas dynamics parameters.
B. Intellectual skills		
B1- Analyze and evaluate the information in the field of specialization, and relate it to solve problems.	**b1** Solve engineering problems and design mechanical power and energy systems, components and elements in a creative and innovative attitude	**b1-1** select the suitable solution methods for gas dynamics problems based on the governing momentum, energy, and species conservation equations together with the boundary conditions

B2- Link and integrate diverse knowledge to solve professional problems.	**b2** apply the appropriate tools from mathematics, science, technology, and the know-how gained from the professional experience to analyze mechanical engineering design problems to meet certain needs.	**b2-1** show how, with the aid of a computer, numerically (finite-difference) methods may be used to accurately predict temperatures and heat transfer rates within the medium and its boundary.
C. Professional and practical skills		
C1- Master the basic as well as the latest professional skills in the field of specialization.	**c1** Use a wide range of analytical and technical tools, techniques and equipment including pertinent software	**c1-1** Apply the knowledge of mathematics (differential equations) and thermodynamics (conservation of energy) to derive the differential equation that govern gas dynamics for different geometries.
C5- Write and evaluate technical and professional reports.	**c5-1** Apply numerical modeling methods and/or appropriate computational techniques to engineering problems.	**c5-1-1** apply the numerical methods and/or appropriate software package.
D. General and transferrable skills		
D1- Use information technology to improve his/her professional practice.	**d1** Work effectively in a team and in multi-disciplinary technical and non-technical environments..	**d1-1** Work in a team through the preparation of gas dynamics reports which are required from the students.
D4- Use different sources to obtain knowledge and information.	**d4** Share ideas and communicate effectively in written, oral and graphical forms.	**d4-1** Share ideas and communicate effectively in written, oral and graphical forms.

4-Course Contents

Week No.	*Topic*	*Total Hours*	*Contact hrs*			*Course ILOs Covered (By No.)*
			Lec.	Tut.	Lab.	
Week-1 and 2	Introduction to gas dynamics	6	4	2	-	A-1-2-1 , a4-1-1 , d1-1, d4-1
Week-3 and 4	Energy equation for adiabatic flow with friction.	6	4	2	-	a4-1-1 , b-1-1, b2-1, c1-1, c5-1
Week-5 and 8	Fanno and Rleigh line	12	8	4	-	a-1-2-1 , a4-1-1 , b1-1, c1-1
Week-9	Normal Shock Wave	3	2	1	-	a-1-2-1 , a4-1-1 , b1-1, c1-1
Week-10 and 11	Thermal flow with friction in a parallel duct	6	4	2	-	d1-1, d4-1
Week-12 and 14	Heat transfer for internal flow.	9	6	3	-	a-1-2-1 , a4-1-1 , b1-1, b2-1, c1-1
Week-15 and 16	One dimensional wave motion	6	4	2	-	d1-1, d4-1
Week-17 and 19	The weak shock , very strong shock	9	6	3	-	a-1-2-1 , a4-1-1 , b1-1, b2-1, c1-1, c5-1
Week-20 and 21	Two dimensional flow	6	4	2	-	a-1-2-1 , a4-1-1 , b1-1, c1-1
Week-22	Steady supersonic flow.	3	2	1	-	a-1-2-1 , a4-1-1 , b1-1, c1-1
Week-23 and 25	Oblique wave, supersonic flow over a wedge.	9	6	3	-	a4-1-1 , b1-1, c1-1, d1-1, d4-1
Week-26 and 27	Weak oblique shock	6	4	2	-	a-1-2-1 , b1-1, c1-1, c5-1, d1-1
Week-28	Supersonic compression.	3	2	1	-	a-1-2-1 , a4-1-1 , b1-1, b2-1, c1-1 d1-1, d4-1
Week-29 and 30	Supersonic compression by turning , Mayer function.	6	4	2	-	a-1-2-1 , a4-1-1 , b1-1, c1-1, c7-1 d1-1
Total		90	60	30	–	

5- Relationship between the course and the programme

Field	National Academic Reference Standard(NARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Programme Academic Standards that the course contributes in achieving.	**A1**and **A5**	**B1** and **B2**	**C1** and **C5**	**D1** and **D4**

6- Course Subject Area:

A	**B**	**C**	**D**	**E**	**F**	**G**	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Disccretionry subjects	Total
---	---	30%	70%	---	---	---	100%

7- Course Topics.

Topic No.	Topic	Weeks
1st	Adiabatic flow with friction	1-7
2nd	Sonic flow	7-15
3rd	Oblique waves	15-22
4th	Supersonic flow	22-30

8- ILOs Matrix Topics

Course Intended Learning Outcomes (ILOs)		**Course topics**			
		1st	**2nd**	**3rd**	**4th**
Knowledge & Understanding	**a-1-5-1** Understand the relation of thermodynamic and fluid mechanics sciences the the science of gas dynamics.	**x**	**x**	**x**	**x**

	a4-1-1 Understand the dependance of the thermo-physical properties of the fluids on the natural of the flow and gas dynamics parameters.	**x**	**x**	**x**	**x**
Intellectual Skills	**b1-1** select the suitable solution methods for convection problems based on the governing momentum, energy, and species conservation equations together with gas dynamics.	**x**	**x**	**x**	**x**
	b2-1 show how, with the aid of a computer, numerically (finite-difference) methods may be used to accurately predict gas dynamics characteristics.	**x**	**x**	**x**	**x**
Professional Skill	**c1-1** the knowledge of mathematics (differential equations) and thermodynamics (conservation of energy) to derive the differential equation that govern gas dynamics equations for different geometries.	**x**	**x**	**x**	**x**
	c5-1 apply the numerical methods and/or appropriate software package such gas dynamics problems.	**x**	**x**	**x**	**x**
General Skills	**d1-1** Work in a team through the preparation of gas dynamics reports which are required from the students.	**x**	**x**	**x**	**x**
	d4-1 Share ideas and communicate effectively in written, oral and graphical forms.	**x**	**x**	**x**	**x**

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		8- Teaching and Learning Method:												
		Lecture	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Site visits	Self learning	Cooperative	Discovering	Modelling	Playing
Knowledge & understanding	a-1-2-1	x				x								
	a4-1-1	x				x								
Intellectual Skills	b1-1	x				x								
	b2-1	x				x								
Professional Skills	c1-1	x				x							x	
	c5-1	x				x							x	
General Skills	d1-1		x							X	x			
	d4-1		x							x	x			

10- Teaching and learning method for low capacity and outstanding Student

For low capacity students	Assign a portion of the office hours for those students.
	Give them specific tasks.
	Repeat the explanation of some of the material and tutorials.
	Assign a teaching assistance to follow up the performance of these groups of students.
For outstanding Students	Hand out project assignments to those students.
	Give them some research topics to be searched using the internet and conduct presentation.

	Encourage them to take parts in the running research projects.

11- Assessment

11.1 Assessment Methods

Course Intended Learning Outcome (ILOs)		Assessment Methods											
		Wirtten Exam	Oral Exam	Tutorial Assessment	Proiect Assessment	Model Assessment	Report Assessment	Quiz assessment	Presentation Assessment	Discussion	Laboratory Test	Home Exm	Monitoring
Knowledge & Understanding	a-1-5-1	x											
	a4-1-1	x											
Intellectual Skills	b1-1	x											
	b2-1	x											
Professional Skills	c1-1	x											
	c5-1	x											
General Skills	d1-1	x											
	d4-1	x											

11.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	**100**	**32th**
Final Oral Examination		
Mid term written Examination		
Tutorial discussion, presentation, and report assessment		
Total	**100%**	

12- Facilities required for teaching and learning

Teaching aids like, lecture room with audio-visual facilities, white board.

13- List of references:

1- "Compressible Fluid Flow" A.Shapiro,John Wiley&Sons,1976.
2- "Gas dynamics", Purohit, Scietific Publisher, 2008.
3- "Fundamintaks of Gas Dynamics", Yadoo, Khanne Publisher, 2008.

Course coordinator: Prof. Mohamed Reda AbdElkader

Head of the Department: Prof. Dr. Kamal Ameen Morad

Date:

Course Specification

Program on which the course is given	M. Sc.in Mechanical Power Engineering
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering
Department offering the course	Mechanical Power Engineering
Academic year/Level	first year
Date of specification approval	***2020***

A- Basic Information

Title: Conduction Heat Transfer	**Code Symbol**: **MEP611**	
Lecture	3 hours	
Tutorial		
Laboratory		
Total	3 hours	Bylaw 2000

B- Professional Information

1- Course Aims:

The aim of this course is to acquire the student with the essential knowledge to be able to:

2- Identify various kinds of conduction heat transfer that are taking place in a particular system.
3- Design and analyze simple and complex problems of advanced heat conduction working at steady and un-steady situations using analytical, numerical and graphical methods.
4- Modify existing study to consider another mode of heat transfer.

5- Course Objectives

1- Be familiar with the various kinds of conduction heat transfer problems.
2- Know which is likely to be the best procedure to solve problems for particular applications.
3- Understand the key factors in conduction heat transfer problems.
4- Be able to estimate the rate of heat transfer and the temperature distribution analytically, numerically and graphically.

6- Intended Learning Outcomes (ILOs)

NAQAAE Academic Reference Standards (ARS)	Program ILOs	Course ILOs
A. Knowledge and understanding		
A1. Theories, basics and specialized knowledge in the field of learning, as well as the subjects that affect his/her professional practice.	a1-4 Understand the theories, basics and specialized knowledge in the field of **Heat and Mass Transfer**.	a1-4-1 Analyze the theories of mathematics and sciences are used in conduction hat transfer and its applications.
B. Intellectual skills		
B1- Analyze and evaluate the information in the field of specialization, and relate it to solve problems.	b1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to mechanical power engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to conduction hat transfer based on the momentum equation and energy and mass balances.
B2- Solve specialized problems with lack of some data and variables, (incomplete data).	b2-1 Apply broad knowledge of modern computational methods and think critically to solve unstructured problems (with incomplete data) related to mechanical power engineering.	b2-1-1 Apply numerical analysis method to write the computer program to solve problems (with incomplete data) related to heat transfer equipment.
C. Professional and practical skills		
C1- Master the basic as well as the latest professional skills in the field of	c1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to conduction hat transfer problems, using latest engineering

specialization.	techniques, skills, and tools.	techniques, skills, and tools.
C2- Write and evaluate technical and professional reports.	c2-1 Write and evaluate a professional report on specialized related to mechanical power engineering technical matters.	c2-1-1 Write and evaluate a professional report on conduction hat transfer measurements and similarity.
D. General and transferrable skills		
D2- Use information technology to improve his/her professional practice.	d2-1 Use state-of-the-art computer aided design tools for solving mechanical power engineering problems.	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to conduction hat transfer.
D4- Use different sources to obtain knowledge and information.	d4-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about conduction hat transfer.

7- Course Contents

Week No.	***Topic***	***Total Hours***	***Contact hrs***			***Course ILOs Covered (By No.)***
			Lec.	**Tut.**	**Lab.**	
Week- 1, 2	The general equation of conduction heat transfer.	6	4	2	-	a1-4-1, d1-1, d4-1
Week-3, 4	The thermal conductivity	6	4	2	-	a1-4-1, b-11--1, b2-1-1, c1-1-1, c2-1-1
Week- 5, 6	Steady state conduction heat transfer in one dimension	6	4	2	-	a1-4-1, b1-1-1, c1-1-1
Week- 7, 8	Concept of thermal resistance	6	4	2	-	a1-4-1, b1-1-1, c1-1-1
Week- 9, 10	Extended surfaces	6	4	2	-	d1-1, d4-1

Week 11, 12	Steady state conduction heat transfer in two dimensions	6	4	2	-	a1-4-1, b1-1-1, b2-1-1, c1-1-1
Week-13, 14	Steady state conduction heat transfer in three dimensions	6	4	2	-	d1-1, d4-1
Week-15, 16	Unsteady state conduction heat transfer in one dimension	6	4	2	-	a1-4-1, b1-1-1, b2-1-1, c1-1-1, c2-1-1
Week-17, 18	Unsteady state conduction heat transfer having mixed boundary conditions	6	4	2	-	a1-4-1, b1-1-1, c1-1-1
Week-19, 22	Numerical solution of one-dimensional unsteady-state heat transfer by conduction	6	4	2	-	a1-4-1, b1-1-1, c1-1-1
Week-23, 25	Graphical solution of unsteady state conduction heat transfer in one-dimension	6	4	2	-	a1-4-1, b1-1-1, c1-1-1, d1-1, d4-1
Week-26, 28	Unsteady state conduction heat transfer in multi – dimensions.	6	4	2	-	a4-1-1, b1-1-1, c1-1-1, c2-1-1, d1-1
Week-29, 30	Time varying boundary conditions, phase change with moving boundaries.	6	4	2	-	a1-4-1, b1-1-1, b2-1-1, c1-1-1 d1-1, d4-1

8- Relationship between the course and the programme

Field	Academic Reference Standard (ARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Programme Academic Standards that the course contribute in achieving	**A1(a1-4)** and	**B1(b1-1)** and B2(**b2-1)**	**C1(c1-1)** and C2(**c2-1)**	**D2(d2-1)** and D4(d4-1)

9- Course Subject Area:

A	**B**	**C**	**D**	**E**	**F**	**G**	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Disccretionry subjects	Total
---	20%		60%	20%			100%

10- Course Topics.

Topic No.	Topic	Weeks
1st	Genenral Equation of Conduction Heat Transfer	1-8
2nd	Extended Surfaces	9-10
3rd	Steady State Conduction Heat Transfer	11-15
4th	Un-steady State Conduction Heat Transfer	16-30

8- ILOs Matrix Topics

Course Intended Learning Outcomes (ILOs)		**Course topics**			
		1st	**2nd**	**3rd**	**4th**
Knowledge & Understanding	a1-4-1 Analyze the theories of mathematics and sciences are used in convection heat transfer and its applications.	**x**	**x**	**x**	**x**
Intellectual Skills	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to convection heat transfer based on the momentum equation and energy and mass balances.	**x**	**x**	**x**	**x**
	b2-1-1 Apply numerical analysis method to write the computer program to solve problems (with incomplete data) related to heat transfer equipment.	**x**	**x**	**x**	**x**
Professional Skill	c1-1-1 Express competence skills, such as identifying, formulating, analyzing,				**x**

	and creating engineering solutions related to convection heat transfer problems, using latest engineering techniques, skills, and tools.	x	x	x	
	c2-1-1 Write and evaluate a professional report on convection heat transfer measurements and similarity.	x	x	x	x
General Skills	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to convection heat transfer.	x	x	x	x
	d4-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	x	x	x	x

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)	**8- Teaching and Learning Method:**												
	Lecture	**Presentation and Movies**	**Discussion**	**Tutorial**	**Problem solving**	**Brain storming**	**Projects**	**Site visits**	**Self learning**	**Cooperative**	**Discovering**	**Modelling**	**Playing**

Knowledge & understanding	a1-4-1	X				x								
Intellectual Skills	b1-1-1	X				x								
	b2-1-1	X				x								
Professional Skills	c1-1-1	X				x							x	
	c2-1-1	X				x							x	
General Skills	d2-1-1		x							X	x			
	d4-1-1		x							x	x			

11- Assessment

11.1 Assessment Methods

Course Intended Learning Outcome (ILOs)		**Assessment Methods**											
		Wirtten Exam	**Oral Exam**	**Tutorial Assessment**	**Proiect Assessment**	**Model Assessment**	**Report Assessment**	**Quiz assessment**	**Presentation Assessment**	**Discussion**	**Laboratory Test**	**Home Exm**	**Monitoring**
Knowledge & Understanding	a1-4-1	x											
Intellectual Skills	b1-1-1	x											
	b2-1-1	x											
Professional Skills	c1-1-1	x											
	c2-1-1	x											
General Skills	d2-1-1	x											
	d4-1-1	x											

11.2 Assessment Schedule and Grades Distribution

Assessment Method	**Percentage**	**week**

Final Examination	**100**	**32th**
Final Oral Examination		
Mid term written Examination		
Tutorial discussion, presentation, and report assessment		
Total	**100%**	

12- Facilities required for teaching and learning

Teaching aids like, lecture room with audio-visual facilities, white board.

13- List of references:

1- **Heat Transfer, Abasic approach, M. N. Ozisik, 1985.**
2- **Heat Transfer, J. P. Holman, 1997.**
3- **An Introduction to Mass & Heat Transfer, Priciples of Analysis and Design, Stanley Middleman, 1983.**
4- **Engineering Thermodynamics, Work and Heat Transfer, G. F. C. Rogers And Y. R . Mayhew, Longman Group Ltd., 3rd /e, 1981.**
5- **Engineering Heat Transfer, James R. Welty, SI version, 1978.**

Course co-ordinator: Dr. Ahmed Abd Allah. Elkady.

Programme co-ordinator:

Head of the Department: Prof. Kamal Morad

Date:

Course Specification

Program on which the course is given	M. Sc. in Mechanical Power Engineering
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering
Department offering the course	Mechanical Power Engineering
Academic year/Level	
Date of specification approval	***2020***

A- Basic Information

Title: Heat Transfer by Convection	**Code Symbol**: **MEP612**	
Lecture	3 hours	
Tutorial		
Laboratory		
Total	3 hours	Bylaw 2000

B- Professional Information

1- Course Aims:

In our treatment of convection, we have two major objectives. In addition to obtaining an understanding of the physical mechanisms that underline convection transfer, we wish to develop the means of perform convection calculations. This course is devoted primarily to achieving the former objective. Physical origins are discussed, and relevant dimensionless parameters are developed.

With conceptual foundations established, subsequent chapters are used to develop useful tools for quantifying convection effects. Chapter 1 and 2 present methods for computing the convection coefficients associated with forced convection in external and internal flow configurations, respectively. Chapter 3 describes methods for determining these coefficients in free convection, and Chapter 4 considers the problem of convection with phase change (boiling and condensing).

2- Course Objectives

1- the first objective is to cover cover the basic principles of convection heat transfer and to present a wealth of real-world engineering applications to give students a feel for engineering practice .

2- Is to develop an understanding of boundary layer phenemena, examine the differential equations that govern the velocity and temperature fields taht are aplicable to boundary layer equation and determine important dimensionless parameters associated with convection heat transfer.

3- is to learn how to *estimate convection coefficients* in order to perform analyses on thermal systems experiencing different types of flow and heat transfer situations.

4- Is to use requisite inputs for computing heat transfer rates and/or material temperatures.
5- Is to delineate pertinent trasport phenemena for any process or system involving heat transfer.
6- The student should be able to develop representative models for real processes and system and draw conclusions concerning process/system design or performance from the attendant analysis.

3- Intended Learning Outcomes (ILOs)

NAQAAE Academic Reference Standards (ARS)	Program ILOs	Course ILOs
A. Knowledge and understanding		
A1. Theories, basics and specialized knowledge in the field of learning, as well as the subjects that affect his/her professional practice.	a1-4 Understand the theories, basics and specialized knowledge in the field of **Heat and Mass Transfer**.	a1-4-1 Analyze the theories of mathematics and sciences are used in convection heat transfer and its applications.
A3- Main scientific advances in the field of specialization.	a3-1 Classify the Potential applications of advanced mechanical power engineering systems.	a3-1-1 Report new advances in analysis and solving methodologies in convection heat transfer.
	a3-3 Discuss the recent and update developments in the most important themes related to mechanical power engineering	a3-3-1 discuss the recent methods and researches to solve the convection heat transfer problems numerically.
B. Intellectual skills		

B1- Analyze and evaluate the information in the field of specialization, and relate it to solve problems.	b1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to mechanical power engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to convection heat transfer based on the momentum equation and energy and mass balances.
B2- Solve specialized problems with lack of some data and variables, (incomplete data).	b2-1 Apply broad knowledge of modern computational methods and think critically to solve unstructured problems (with incomplete data) related to mechanical power engineering.	b2-1-1 Apply numerical analysis method to write the computer program to solve problems (with incomplete data) related to heat transfer equipment.
C. Professional and practical skills		
C1- Master the basic as well as the latest professional skills in the field of specialization.	c1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering techniques, skills, and tools.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to convection heat transfer problems, using latest engineering techniques, skills, and tools.
C2- Write and evaluate technical and professional reports.	c2-1 Write and evaluate a professional report on specialized related to mechanical power engineering technical matters.	c2-1-1 Write and evaluate a professional report on convection heat transfer measurements and similarity.
D. General and transferrable skills		
D2- Use information technology to improve his/her professional practice.	d2-1 Use state-of-the-art computer aided design tools for solving mechanical power engineering problems.	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to convection heat transfer.

D5- Use different sources to obtain knowledge and information.	d5-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d5-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about convection heat transfer.

4- Course Contents

Week No.	***Topic***	***Total Hours***	***Contact hrs***			***Course ILOs Covered (By No.)***
			Lec.	**Tut.**	**Lab.**	
Week-1 and 2	Introduction to convection heat transfer.	6	4	2	-	a1-4-1, a3-1-1, d1-1, d4-1
Week-3 and 4	Energy equation for laminar boundary layer.	6	4	2	-	a1-4-1, a3-3-1, b-11--1, b2-1-1, c1-1-1, c2-1-1
Week-5 and 6	Heat transfer for external flow, The relation between fluid friction and heat transfer	6	4	2	-	a1-4-1, a3-1-1, a3-3-1, b1-1-1, c1-1-1
Week-7 and 8	Flow across cylinder and sphere and across tube banks.	6	4	2	-	a1-4-1, a3-1-1, a3-3-1, b1-1-1, c1-1-1
Week-9 and 10	Empirical relations for external flow	6	4	2	-	d1-1, d4-1
Week-11 and 12	Heat transfer for internal flow.	6	4	2	-	a1-4-1, a3-1-1, a3-3-1, b1-1-1, b2-1-1, c1-1-1
Week-13 and 14	Empirical relations for pipe and tubes	6	4	2	-	d1-1, d4-1
Week-15 and 16	Free convection heat transfer from vertical and horizontal walls and cylinders.	6	4	2	-	a1-4-1, a3-1-1, a3-3-1, b1-1-1, b2-1-1, c1-1-1, c2-1-1
Week-17 and 18	Free convection from inclined surfaces, cylinders and sphere	6	4	2	-	a1-4-1, a3-1-1, a3-3-1, b1-1-1, c1-1-1
Week-19 and 20	Free convection in enclosed spaces.	6	4	2	-	a1-4-1, a3-1-1, 3-3-1, b1-1-1, c1-1-1
Week-21 and 22	Combined free and forced convection.	6	4	2	-	a1-4-1, a3-3-1, b1-1-1, c1-1-1, d1-1, d4-1
Week-23 and 24	Dimensionless parameters in boiling and condensation, boiling	6	4	2	-	a4-1-1, a3-3-1, b1-1-1, c1-1-1, c2-1-1, d1-1

	modes					
Week-25 and 26	Modes of pool boiling, pool boiling correlations, forced convection boiling.	6	4	2	-	a1-4-1, a3-1-1, a3-3-1, b1-1-1, b2-1-1, c1-1-1 d1-1, d4-1
Week-27 - 30	Laminar and turbulent film condensations, condensation in horizontal tube.	6	4	2	-	a1-4-1, a3-1-1, a3-3-1, b1-1-1, c1-1-1, c2-1-1, d1-1

5- Relationship between the course and the programme

Field	Academic Reference Standard (ARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Programme Academic Standards that the course contribute in achieving	**A1(a1-4)** and **A3(a3-1 and a3-3)**	**B1(b1-1)** and B2(**b2-1)**	**C1(c1-1)** and C2(**c2-1)**	**D2(d2-1)** and D5(d5-1)

6- Course Subject Area:

A	**B**	**C**	**D**	**E**	**F**	**G**	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Disccretionry subjects	Total
---	20%		60%	20%			100%

7- Course Topics.

Topic No.	Topic	Weeks
1st	**Forced Convection: External Flow**	**1-10**
2nd	**Forced Convection: Internal Flow**	**11-14**
3rd	**Free Convection**	**15-22**
4th	**Condensation and Boiling**	**23-30**

8- ILOs Matrix Topics

Course Intended Learning Outcomes (ILOs)	**Course topics**

		1st	2nd	3rd	4th
Knowledge & Understanding	a1-4-1 Analyze the theories of mathematics and sciences are used in convection heat transfer and its applications.	x	x	x	x
	a3-1-1 Report new advances in analysis and solving methodologies in convection heat transfer.	x	x	x	x
	a3-3-1 discuss the recent methods and researches to solve the convection heat transfer problems numerically.	x	x	x	x
Intellectual Skills	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to convection heat transfer based on the momentum equation and energy and mass balances.	x	x	x	x
	b2-1-1 Apply numerical analysis method to write the computer program to solve problems (with incomplete data) related to heat transfer equipment.	x	x	x	x
Professional Skill	c1-1-1 Express competence skills, such as identifying,				

	formulating, analyzing, and creating engineering solutions related to convection heat transfer problems, using latest engineering techniques, skills, and tools.	x	x	x	x
	c2-1-1 Write and evaluate a professional report on convection heat transfer measurements and similarity.	x	x	x	x
General Skills	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to convection heat transfer.	x	x	x	x
	d5-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	x	x	x	x

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)	8- Teaching and Learning Method:

		Lecture	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Site visits	Self learning	Cooperative	Discovering	Modelling	Playing
Knowledge & understanding	a1-4-1	X				x								
	a3-1	X				x								
	a3-3-1	X				x								
Intellectual Skills	b1-1-1	X				x								
	b2-1-1	X				x								
Professional Skills	c1-1-1	X				x							x	
	c2-1-1	X				x							x	
General Skills	d2-1-1		x							X	x			
	d5-1-1		x							x	x			

11- Assessment

11.1 Assessment Methods

Course Intended Learning Outcome (ILOs)		Assessment Methods											
		Wirtten Exam	Oral Exam	Tutorial Assessment	Project Assessment	Model Assessment	Report Assessment	Quiz assessment	Presentation Assessment	Discussion	Laboratory Test	Home Exm	Monitoring
Knowledge & Understanding	a1-4-1	x											
	a3-1-1	x											
	a3-3-1	x											
Intellectual Skills	b1-1-1	x											
	b2-1-1	x											

Professional Skills	c1-1-1	x											
	c2-1-1	x											
General Skills	d2-1-1	x											
	d5-1-1	x											

11.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	**100**	**32 th**
Final Oral Examination		
Mid term written Examination		
Tutorial discussion, presentation, and report assessment		
Total	**100%**	

12- Facilities required for teaching and learning

Teaching aids like, lecture room with audio-visual facilities, white board.

13- List of references:

1- "Fundamentals of Heat and Mass Transfer" by Frank P. Incropera and David P. Dewitt, Seventh Edition, 2011

2- "Heat Transfer; A Practical Approach" by Yunus A. Cengel, Second edition, 2009.

Course Prof. Mohamed Mohamed Shabaan.

Programme coordinator:

Head of the Department: Prof. Kamal Morad

Date:

Course Specification

Program on which the course is given	M. Sc. in Mechanical Power Engineering
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering
Department offering the course	Mechanical Power Engineering
Academic year/Level	1st year
Date of specification approval	***2020***

A- Basic Information

Title :Boundary layer theory	**Code Symbol**: MEP614	
Lecture	3 hours	
Tutorial		
Laboratory		
Total	3 hours	Bylaw 2000

B- Professional Information

1- Course Aims:

The study of fluid mechanics is of great importance in many engineering fields. The aims of this course are to provide the Post graduate Student, in Mechanical Engineering Programme, with the basic knowledge of Advanced Fluid Mechanics, especially the Boundary layer theory. The first chapter deals in great detail with properties of fluids and the kinematics of fluid flow. Continuity, momentum, energy and Navier stokes equations and applications are discussed in chapters two. The Laminar viscous flows are discussed in chapter three. In chapter Four, the turbulence and turbulent flow through pipes are given. Boundary layer theory and forces due to flow of fluids over bodies are discussed in chapter Four. Chapter five discusses the characteristics of Laminar and Turbulent boundary layer flow, the basic mechanisms of flow separation. SI system of units is adopted throughout of this course. Many of illustrative numerical examples are discussed. The objective questions included number 100. A total number of 150 exercise problems, mostly with answers are available.

2-Course Objectives

1- **Demonstration the knowledge and understanding the importance of Fluid Mechanics.**
2- **Definition the fluid in motion and requirements of the fluid flow applications.**
3- **Reconcilability the kinematics of fluid flow and different types of fluid flow regimes, Laminar viscous flow, turbulent flow, laminar and turbulent boundary layer flows.**
4- **Evaluation of the suitable analysis schemes for fluid flow in motion, continuity, momentum, energy, Navier-Stoles , Prandtl's boundary layer and van-Karaman Momentum Integral equations.**
5- **Analysis of different fluid flow problems and conducting laboratory experimental verifications.**
6- **Understand the main operating characteristics of boundary layer and flow separation.**

7- **Be able to determine and find out the boundary layer thickness over different body configurations**
8- **Preparing students to communicate and work effectively in team and multi-disciplinary technical environments**

3-Intended Learning Outcomes (ILOs)

NAQAAE Academic Reference Standards (ARS)	Program ILOs	Course ILOs
A. Knowledge and understanding		
A1. Theories, basics and specialized knowledge in the field of learning, as well as the subjects that affect his/her professional practice.	a1-2 Understand the theories, basics and specialized knowledge in the field of Fluid Mechanics and Hydraulics.	a1-2-1 Understand the concepts of Boundary layer theory. a1-2-2 Understand the different factor that affect the flow and affect the transient conditions.
A2- Mutual relation between professional aspects of professional practice and its effects on the Environment.	a2-2 Recognize the interaction between mechanical power technologies and surrounding environment.	a2-2-1 Understand the application of solution techniques for practical problems; pressure exchangers and other devices utilizing Boundary layer theory.
B. Intellectual skills		
B1- Analyze and evaluate the information in the field of specialization, and relate it to solve problems.	b1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to mechanical power engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to analyses problems related to Boundary layer theory applications.

B3- Link and integrate diverse knowledge to solve professional problems.	b3-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems.	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to Boundary layer theory.
C. Professional and practical skills		
C1- Master the basic as well as the latest professional skills in the field of specialization.	c1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering techniques, skills, and tools.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to Boundary layer theory problems, using latest engineering techniques, skills, and tools.
C2- Write and evaluate technical and professional reports.	c.2-1 Write and evaluate a professional report on specialized related to mechanical power engineering technical matters.	c2-1-1 Write and evaluate a professional report on Boundary layer theory measurements and similarity.
D. General and transferrable skills		
D2- Use information technology to improve his/her professional practice.	d2-1 Use state-of-the-art computer aided design tools for solving mechanical power engineering problems.	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to Boundary layer theory and its applications.
D4- Use different sources to obtain knowledge and information.	d4-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about Boundary layer theory and its applications.

D7- Learn independently and seek continuous learning.	d7-1 Express a strong foundation of continuous learning so they can maintain their technical competency.	d-7-1-1 Use different sources of information journals, internet access facilities, etc. to upgrade and enhance their knowledge.

4-Course Contents

Week No.	*Topic*	*Total Hours*	*Contact hrs*			*Course ILOs Covered (By No.)*
			Lec.	Tut.	Lab.	
Week-1,2,3	**-Review of basic concepts of fluid in motion. -Description of fluid flow, classification of fluid flows, streamlines, Pathlines, and Streaklines, static, dynamic, total (stagnation) pressures acceleration of a fluid particle**	**9**	**6**	**3**	-	a1-2-1,a1-2-2
Week,4,5,6	**- Fluid flow characteristics, measuring of fluid velocity and pressure head, flow rate and continuity equation. - Definition of control volume, control surface, flow energy, Euler's equation, Bernoulli's theorem and Bernoulli's equation**	**9**	**6**	**3**	-	a1-2-1,a1-2-2,a2-2-1
Week-7,8,9,10	**- Basic information about laminar viscous flows, flow regimes and Reynolds number, critical Reynolds number, Navier Stokes equation, relation between shear stress and pressure gradient, laminar flow in circular pipes- Hagen Poiseuille law. - Illustrative example and solved problems**	**9**	**6**	**3**	-	a1-2-2,a2-2-2, b1-1-1, b3-1-1
Week-11,12,13,15,16	**- Desirable attribute of hydrodynamic lubrication, Dashport mechanism: Movement of piston in a Dashpot., viscous resistance in a Bush Bearing., and viscous resistance in Collar Bearing and Foot Step Bearing. - Illustrative example and solved problems.**	**9**	**6**	**3**	-	a2-2-1, b3-1-1
Week-17,18,19	**- Basic information turbulence and turbulent flow through pipes, growth of instability and transition from laminar to turbulent flow, effect of turbulence, classification of turbulence, Reynolds equations of turbulence, turbulence modeling, flow loss in pipes, Darcy equation for head loss due to frication, Minor head losses, pipe in series and in parallel. - Illustrative example and solved problems**	**9**	**6**	**3**	-	a2-2-1, b3-1-1
Week-20,21,22	**- Application of Navier Stokes and Darcy equations and concept of equivalent pipe, hydraulic gradient and total energy lines, hydraulic transmission of power. - Application examples of Navier Stokes equation and determination of velocity components fluid flows.**	**9**	**6**	**3**	-	a2-2-1, b3-1-1
Week-23,24,25	**Coordination of flow through nozzles, water hammer, hydraulically smooth and rough pipes, Prandtl universal velocity distribution, velocity distribution in smooth and rough pipes. Determination of average velocity distribution for smooth and rough pipes, frication factor for smooth and rough pipes, friction factor charts, - Illustrative example and solved problems**	**9**	**6**	**3**	-	c2-1-1, d2-1-1, d4-1-1, d7-1-1
Week-26,27-30	**- Definition of laminar and turbulent boundary layer flows, Description of boundary layer, boundary layer parameters,**	**9**	**6**	**3**	-	a1-2-2, b3-1-1

	Prandtl's boundary layer equation, Blasius solution for laminar boundary layer flows, van-Karman momentum integral equation. Discusstion of laminar boundary layer and turbulent boundary layer flows and boundary layer flow separation. **- Illustrative examples.**					

5-Relationship between the course and the programme

Field	National Academic Reference Standard(NARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Programme Academic Standards that the course contributes in achieving.	A1 (a1-2-1, a1-2-2), A2 (a2-2-1), A3 (a3-1-1, a3-2-1, a3-3-1)	B1 (b1-1-1), B3 (b3-1-1)	C1 (c1-1-1), C2 (c2-1-1)	D2 (d2-1-1), D5 (d5-1-1), D8 (d8-1-1)

6-Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Disccretionry subjects	Total
---	---	**30%**	**70%**	---	---	---	**100%**

7-Course Topics.

Topic No.	Topic	Weeks
1st	**Definitions, Fluid flow characteristics, stream lines, pathlines, streaklines, continuity equation**	**1-6**
2nd	**Basic information about laminar viscous flows, flow regimes and Reynolds number, critical Reynolds number, Navier Stokes equation, relation between shear stress and pressure gradient, laminar flow in circular pipes- Hagen Poiseuille law.**	**7-13**
3rd	**Basic information turbulence and turbulent flow through pipes, growth of instability and transition from laminar to turbulent flow, effect of turbulence, classification of turbulence, Reynolds equations of turbulence, turbulence modeling, flow loss in pipes, Darcy equation for head loss due to frication, Minor head losses, pipe in series and in parallel.**	**16-21**
4th	**Coordination of flow through nozzles, water hammer, hydraulically smooth and rough pipes, Prandtl universal velocity distribution, velocity distribution in smooth and rough pipes.** **Determination of average velocity distribution for smooth and rough pipes, frication factor for smooth and rough pipes, friction factor charts.**	**22-24**
5th	**- Definition of laminar and turbulent boundary layer flows,** **Description of boundary layer, boundary layer parameters, Prandtl's**	**25-30**

	boundary layer equation, Blasius solution for laminar boundary layer flows, van-Karman momentum integral equation. Discusstion of laminar boundary layer and turbulent boundary layer flows and boundary layer flow separation.	

8- ILOs Matrix Topics

Course Intended Learning Outcomes (ILOs)		Course topics				
		1st	2nd	3rd	4th	5th
Knowledge & Understanding	a1-2-1 Understand the concepts of unsteady flow.	x				
	a1-2-2 Understand the different factor that affect the flow and affect the transient conditions	x	x			
	a2-2-1 Understand the application of solution techniques for practical problems; pressure exchangers and other devices utilizing unsteady flow.	x	x	x	x	
Intellectual Skills	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to analyse problems related to unsteady fluid flow applications.	x	x			

	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to unsteady fluid flow.	x	x	x		
Professional Skill	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to unsteady fluid flow problems, using latest engineering techniques, skills, and tools.					x
	c2-1-1 Write and evaluate a professional report on unsteady fluid flow measurements and similarity.				x	
General Skills	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to unsteady fluid flow and its applications.		x	x		x
	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about unsteady fluid flow and its applications.		x			x
	d-7-1-1 Use different sources of information journals, internet access facilities, etc. to upgrade and enhance their knowledge.		x			x

9- Teaching and Learning Method:

Course Intended learning	Teaching and Learning Method

outcomes (ILOs)		Lecture	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Site visits	Self learning	Cooperative	Discovering	Modelling	Playing
Knowledge & understanding	a1-2-1	x		x										
	a1-2-2	x		x		x								
	a2-2-1	x		x		x								
Intellectual Skills	b1-1-1	x		x	x	x								
	b3-1-1	x		x	x	x			x					
Professional Skills	c1-1-1			x	x	x	x		x	x	x			
	c2-1-1	x		x	x	x								
General Skills	d2-1-1	x		x	x	x			x	x	x			
	d4-1-1			x	x				x	x	x			
	d7-1-1			x						x				

10- Teaching and learning method for low capacity and outstanding Student

For low capacity students	Assign a portion of the office hours for those students.
	Give them specific tasks.
	Repeat the explanation of some of the material and tutorials.
	Assign a teaching assistance to follow up the performance of these groups of students.
For outstanding Students	Hand out project assignments to those students.
	Give them some research topics to be searched using the internet and conduct presentation.
	Encourage them to take parts in the running research projects.

11- Assessment

11.1 Assessment Methods

Course Intended Learning	Assessment Methods

Outcome (ILOs)		Written Exam	Oral Exam	Tutorial Assessment	Project Assessment	Model Assessment	Report Assessment	Quiz assessment	Presentation Assessment	Discussion	Laboratory Test	Home Exam	Monitoring
Knowledge & Understanding	a1-2-1	x											
	a1-2-2	x											
	a2-2-1	x											
Intellectual Skills	b1-1-1	x	x										
	b3-1-1	x		x									
Professional Skills	c1-1-1	x								x			
	c2-1-1	x					x						
General Skills	d2-1-1			x									
	d4-1-1						x						
	d7-1-1						x						

11.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	32 th
Mid term written Examination	---	
Quizzes	---	
laboratory examination	---	
Oral examination	---	
Semester work	---	
Total	100%	

12- Facilities required for teaching and learning

Teaching aids like, lecture room with audio-visual facilities, white board.

13- List of references:

1- **White, F. M. (2008), Fluid Mechanics, Sixth Edition, McGraw-Hill.**
2- **Baker, Bonnie, (1998) "Thermistors in Single Supply Temperature Sensing Circuits", AN685, Microchip Technology Inc.**
3- **Kumar, D.S., (2006), "Fluid mechanics and fluid power engineering", S.K. Kataria & Sons, Delhi-110006**

Course coordinator: Gamal H. Moustafa

Head of the Department: Prof. Dr. Kamal Ameen Morad

Date:

Course Specification

Program on which the course is given	Ms. Sc. in Mechanical Power Engineering
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering
Department offering the course	Mechanical Power Engineering
Academic year/Level	first year
Date of specification approval	***2020***

A- Basic Information

Title: Heat Transfer by Radiation	**Code Symbol**: **MEP615**	
Lecture	3 hours	
Tutorial		
Laboratory		
Total	3 hours	Bylaw 2000

B- Professional Information

1- Course Aims:

Thermal radiation is an extremely important process, and in the physical sense it is perhaps the most interesting of the heat transfer modes. It is relevant to many industrial heating, cooling, and drying processes, as well as to energy conversion methods that involve fossil fuel combustion and solar radiation.

This course considers the means by which radiation is generated, the specific nature of the radiation, and the manner in which it interacts with matter. We give particular attention to radiative interactions at the surface and to the properties that must be introduced to describe these interactions. We focus on means for computing radiative exchange between two or more surfaces, between gases and enclosure, combined convection and radiation, applications and numerical solutions for radiation problems.

2- Course Objectives

1- Is to establish geometrical features of the radiation exchange problem by developing the notation of a *view factor*.
2- Is to develop procedure for predicting radiative exchange between surfaces that form an *enclosure*.
3- Is to consider the effects of a *participating medium*, namely, an intervening gas that emits and absorbs radiation.

3- Intended Learning Outcomes (ILOs)

NAQAAE Academic Reference Standards (ARS)	Program ILOs	Course ILOs
A. Knowledge and understanding		
A1- Theories, basics and specialized knowledge in the field of learning, as well as other related subjects.	a1-4 Understand the theories, basics and specialized knowledge in the field of **Fluid Mechanics and Hydraulics**.	a1-4-1 Analyze the theories of mathematics and sciences are used in radiation heat transfer and its applications.
B. Intellectual skills		
B1- Analyze and evaluate information in the field of specialization, and relate it to solve problems and formulate theories.	b1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to mechanical power engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to radiation heat transfer based on the equation of energy conservation.
B2- Solve specialized problems with available givens and parameters.	b2-1 Apply broad knowledge of modern computational methods and think critically to solve unstructured problems (with incomplete data) related to mechanical power engineering.	b-2-1-1 Apply numerical analysis method to write the computer program to solve problems (with incomplete data) related to radiation heat transfer equipment.
B3- Perform research and studies to add to the accumulated knowledge.	b3-1 Compare and evaluate published articles and research concerning specified problem related to mechanical power engineering.	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to radiation heat transfer.
C. Professional and practical skills		

C1- Master the basic as well as the latest professional skills in the field of specialization.	c1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering techniques, skills, and tools.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to radiation heat transfer problems, using latest engineering techniques, skills, and tools.
C2- Write and evaluate technical and professional reports.	c.2-1 Write and evaluate a professional report on specialized related to mechanical power engineering technical matters.	c2-1-1 Write and evaluate a professional report on radiation heat transfer.
D. General and transferrable skills		
D2- Use information technology to improve his/her professional practice.	d2-1 Use state-of-the-art computer aided design tools for solving mechanical power engineering problems.	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to water power engineering.
D4- Use different sources to obtain knowledge and information.	d4-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge.	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about water power engineering.

4- Course Contents

Week No.	***Topic***	***Total Hours***	***Contact hrs***			***Course ILOs Covered (By No.)***
			Lec.	**Tut.**	**Lab.**	
Week-1 and 2	Fundamental Concepts	3	3	-	-	a4-1-1
Week-3 and 4	Radiation heat flux	3	3	-	-	a4-1-1,, b-1-1-1, b2-1-1, b3-1-1
Week-5 and 6	Radiation intensity	3	3	-	-	a4-1-1, b1-1-1, b2-1-1,b3-1-1
Week-7 and 8	Black body radiation	3	3	-	-	a4-1-1, b1-1-1, b2-1-1,b3-1-1

Week-9 and 10	Emission from real surfaces	3	3	-	-	b1-1, b2-1-1, b3-1-1
Week-11 and 12	Absorption, reflection, and transmission by real surfaces	3	3	-	-	a4-1-1, b1-1-1, b2-1-1, b3-1-1
Week-13 and 14	The view factor	3	3	-	-	a4-1-1, b1-1-1, b2-1,1, b3-1-1, c1-1-1, d2-1-1, d4-1-1
Week-15 and 16	Black body radiation Exchange	3	3	-	-	a4-1-1, b1-1-1, b2-1-1, b3-1-1-, c1-1-1, c2-1-1
Week17 and 18	Radiation exchange between opaque, diffuse, gray surfaces in an enclosure	3	3	-	-	a4-1-1, b1-1-1,, b2-1-1-, b3-1-1, c1-1-1
Week-19 and 20	Multimode heat transfer	3	3	-	2	a4-1-1, b1-1-1, b2-1,1, b3-1-1, c1-1-1, c2-1-1
Week-21 and 22	Implications of the simplifying assumptions	3	3	-	-	a4-1-1, b1-1-1, b2-1-1, b3-1-1, c1-1-1, c2-1-1
Week-23 - 27	Radiation exchange with participating media	3	3	-	2	a4-1-1, b1-1-1, b2-1-1 b3-1-1, c1-1-1, c2-1-1, d2-1-1,d4-1-1
Week-28 - 30	Volumetric absorption, gaseous emission and absorption	3	3	-	2	a4-1-1, b1-1-1, b2-1-1, b3-1-1, c1-1-1, c2-1-1 d2-1-1, d4-1-1

5- Relationship between the course and the programme

Field	Academic Reference Standard (ARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Programme Academic Standards that the course contribute in achieving	**A4(a4-1)**	**B1(b1-1), B2(b2-1)** and B3(**b3,1)**	**C1(c1-1)** and C2(**c2-1)**	**D2(d2-1)** and D4(**d4-1)**

6- Course Subject Area:

A	**B**	**C**	**D**	**E**	**F**	**G**	
Humanities	Mathematics	Basic	Applied	Computer	Projects	Disccretionry	Total

and Social Science	and Basic Sciences	Engineering Science	Engineering And Design	Applications and ICT	and practice	subjects	
---	20%		60%	20%			100%

7- Course Topics.

Topic No.	Topic	Weeks
1st	Fundamental Concepts	1-6
2nd	Radiation properties	7-14
3rd	Black and real bodies radiation	15-25
4th	Radiation exchange with participating media	26-30

8- ILOs Matrix Topics

Course Intended Learning Outcomes (ILOs)		Course topics			
		1st	2nd	3rd	4th
Knowledge & Understanding	a1-4-1 Analyze the theories of mathematics and sciences are used in radiation heat transfer and its applications.	x	x	x	x
Intellectual Skills	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to radiation heat transfer based on the equation of energy conservation.	x	x	x	x
	b-2-1-1 Apply numerical analysis method to write the computer program to solve problems (with incomplete data)	x	x	x	x

	related to radiation heat transfer equipment.				
	b3-1-1 Analyze, interpret and manipulate data from a variety of sources and relate it to solve professional problems related to radiation heat transfer.	x	x	x	x
Professional Skill	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions related to radiation heat transfer problems, using latest engineering techniques, skills, and tools.	x	x	x	x
	c2-1-1 Write and evaluate a professional report on radiation heat transfer.			x	x
General Skills	d2-1-1 Use state-of-the-art computer aided design tools for solving professional problems related to water power engineering.		x		x
	d4-1-1 Use different sources of information like library, internet access facilities, etc. to upgrade and enhance their conceptual knowledge about water power engineering.		x		x

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		8- Teaching and Learning Method:												
		Lecture	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Site visits	Self learning	Cooperative	Discovering	Modelling	Playing
Knowledge & understanding	a4-1-1	x				x								
Intellectual Skills	b1-1-1	x				x								
	b2-1-1	x				x								
	b3-1-1	x				x								
Professional Skills	c1-1-1	x				x							x	
	c2-1-1	x				x							x	
General Skills	d2-1-1		x							x	x			
	d4-1-1		x							x	x			

11- Assessment

11.1 Assessment Methods

Course Intended Learning Outcome (ILOs)	Assessment Methods											
	Wirtten Exam	Oral Exam	Tutorial Assesment	Project Assessment	Model Assessment	Report Assessment	Quiz assessment	Presentation Assessment	Discussion	Laboratory Test	Home Exm	Monitoring

Knowledge & Understanding	a4-1-1	x											
Intellectual Skills	b1-1-1	x											
	b2-1-1	x											
	b3-1-1	X											
Professional Skills	c1-1-1	X											
	c2-1-1	X											
General Skills	d2-1-1	x											
	d4-1-1	x											

11.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	**100**	**32th**
Final Oral Examination		
Mid term written Examination		
Tutorial discussion, presentation, and report assessment		
Total	**100%**	

12- Facilities required for teaching and learning

Teaching aids like, lecture room with audio-visual facilities, white board.

13- List of references:

1- "Fundamentals of Heat and Mass Transfer" by Frank P. Incropera and David P. Dewitt, Seventh Edition, 2011

2- "Heat Transfer; A Practical Approach" by Yunus A. Cengel, Second edition, 2009.

Course coordinator: Prof. Kamal Morad.
Programme coordinator: Prof. Kamal Morad.
Head of the Department: Prof. Kamal Morad

Date:

Course Specification

Program on which the course is given	Ms.Sc.in Mechanical Power Engineering
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering
Department offering the course	Mechanical Power Engineering
Academic year/Level	first year
Date of specification approval	***2020***

A- Basic Information

Title: Advanced Measurements	**Code Symbol**: **MEP616**	
Lecture	3 hours	
Tutorial		
Laboratory		
Total	3 hours	Bylaw 2000

B- Professional Information

1- Course Aims:

In our treatment of mechanical measurements, we have many major objectives; explaining how to use the laser applications for measurements of fluid flow velocity, concentration of combustion products, temperature and soot concentration, chromatographic chemical analysis of gaseous mixture and flow velocity measurement with hot wire anemometer.

2- Course Objectives

On completion of this course, the student should have sufficient broad knowledge in mechanical engineering to:

1- Demonstrate knowledge of the fundamentals of mechanical measurements;
2- Classify the measurement instruments and measurements types;
3- Demonstrate knowledge of laser applications for measurements;
4- Classify and describe the instruments used to measure the velocity and flow rate;
5- Expalin how to measure the combustion exhaust products concentration;
6- Expalin how to use the high speed camera and its applications.

3-Intended Learning Outcomes (ILOs)

NAQAAE Academic Reference Standards (ARS)	Program ILOs	Course ILOs
A. Knowledge and understanding		
A1.Essential facts, fundamentals, concepts, principles and theories relevant to Mechanical Engineering.	a1-1 Ability to apply knowledge of mathematics, science and engineering	a1-1-1 a1-2 How to classify the measurement types. a1-1-2 How to classify the measurement types.
A2- The constraints which mechanical power engineers have to judge to reach at an optimum solution.	a2-1 The constrains which mechanical power engineers have to judge to reach at an optimum solution.	a2-1-1 How to control combustion emissions. a2-1-2 How to select the measurement instrument according to its properties.
B. Intellectual skills		
B1-Solve engineering problems and design mechanical power and energy systems, components and elements in a creative and innovative attitude.	b1-1 Solve engineering problems and design mechanical power and energy systems, components and elements in a creative and innovative attitude.	b1-1-1 Solve many engineering problems in flow measurements. b1-1-2 How to increase accuracy of measurements.
B3-Analyze and interpret data, and design experiments to obtain new data.	b3-1 Analyze and interpret data, and design experiments to obtain new data.	b3-1-1 How to think in a creative and innovative way in problem solving and design.
C. Professional and practical skills		
C2- Analyze experimental results and determine their accuracy and validity.	C2-1 Analyze experimental results and determine their accuracy and validity.	C2-1-1 Calculate the accuracy of the instruments.

C4- Refer to scientific literature effectively.	c.4-1 Refer to scientific literature effectively.	C4-1-1 Knowledge of science and information technology about the measurements, high speed camera, and chromatograph.
D. General and transferrable skills		
D2- Share ideas and communicate effectively in written, oral and graphical forms.	d2-1 Share ideas and communicate effectively in written, oral and graphical forms.	d2-1-1 How to collaborate effectively within multidisciplinary team. d2-1-2 Motivate the students.
D4-Recognize the importance of considering the environmental, social and economical issues in engineering practice.	d4-1 Recognize the importance of considering the environmental, social and economical issues in engineering practice.	d4-1-1 How to increase the performance of the measurement instruments. d4-1-2 How to control the exhaust emissions from combustion.

4-Course Contents

Week No.	*Topic*	*Total Hours*	*Contact hrs*			*Course ILOs Covered (By No.)*
			Lec.	Tut.	Lab.	
Week-2 1	General Introduction	6	4	2	-	a1-1-1,
Week3-4	Laser Applications for Measurements of Fluid Flow Velocity	6	4	2	-	a1-1, a12-1, b-1-1, b2-1, c1-1, c7-1
Week 5-6	Laser Applications for Measurements of Fluid Flow Velocity	6	4	2	-	a1-1-1, a2-2-1, b1-1-1, c1-1-1
Week 7-8	Concentration Analysis of Combustion Products	6	4	2	-	a1-1-1, a2-2-1, b1-1-1, c1-1-1
Week 9-10	Concentration Analysis of Combustion Products	6	4	2	-	b1-1-1, b3-1-1, c1-1-1
Week 11-12	Temperature and Soot Measurements	6	4	2	-	a1-1-1, a2-1-1, b1-1-1, b3-1-1, c1-1-1,c2-1-1

Week 13-14	Temperature and Soot Measurements	6	4	2	-	a1-1-1, a2-1-1, b1-1-1, b3-1-1, c1-1-1, c2-1-1, d2-1-1, d4-1-1
Week 15-16	Chromatographic Chemical Analysis of Gaseous Mixture	6	4	2	-	A1-1-1, a2-1-1, b1-1-1, b3-1-1, c1-1-1, c2-1-1
Week 17-18	Chromatographic Chemical Analysis of Gaseous Mixture	6	4	2	-	a1-1-1, a2-1-1, b1-1-1, c1-1-1
Week 19-20	Flow Velocity Measurements	6	4	2	-	a1-1-1, a2-1-1, b1-1-1, c1-1-1
Week 21-22	Flow Velocity Measurements	6	4	2	-	a1-1-1, a2-1-1, b1-1-1, c1-1-1, c2-1-1, d2-1-1, d4-1-1
Week 23-26	Data Acquisition Systems	6	4	2	-	a1-1-1, a2-1-1, b1-1-1, c1-1-1, d2-1-1
Week27-30	High Speed Cameras	6	4	2	-	a1-1-1, a2-1-1, b1-1-1, b3-1-1, c1-1-1, c2-1-1 d2-1-1, d4-1-1

5- Relationship between the course and the programme

Field	Academic Reference Standard (ARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Programme Academic Standards that the course contribute in achieving	**A1** and **A2**	**B1** and B3	**C2**and C4	**D2** and D4

6- Course Subject Area:

A	**B**	**C**	**D**	**E**	**F**	**G**	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Disccretionry subjects	Total
---	30%		70%				100%

7- Course Topics.

Topic No.	Topic	Weeks
1st	General Introduction	1 and 2
2nd	Laser Applications for Measurements of Fluid Flow Velocity	3- 6
3rd	Concentration Analysis of Combustion Products	7- 10
4th	Temperature and Soot Measurements	11- 14
5th	Chromatographic Chemical Analysis of Gaseous Mixture	15-18
6th	Flow Velocity Measurements	19-22
7th	Data Acquisition Systems	23- 27
8th	High Speed Cameras	28 - 30

8- ILOs Matrix Topics

Course Intended Learning Outcomes (ILOs)		Course topics							
		1st	2nd	3rd	4th	5th	6th	7th	8th
Knowledge & Understanding	a1-1-1 a1-2 How to classify the measurement types. a1-1-2 How to classify the measurement types.	x	x	x	x	x	x	x	x
	a2-1-1 How to control combustion emissions. a2-1-2 How to select the measurement instrument according to its properties.	x	x	x	x	x	x	x	x
Intellectual Skills	b1-1-1 Solve many engineering problems in flow measurements. b1-1-2 How to increase accuracy of measurements.	x	x	x	x	x	x	x	x
	b3-1-1 How to think in a creative and innovative way in	x	x	x	x	x	x	x	x

	problem solving and design.								
Professional Skill	C2-1-1 Calculate the accuracy of the instruments.	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**
	C4-1-1 Knowledge of science and information technology about the measurements, high speed camera, and chromatograph.	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**
General Skills	d2-1-1 How to collaborate effectively within multidisciplinary team. d2-1-2 Motivate the students.		**x**		**x**		**x**		**x**
	d4-1-1 How to increase the performance of the measurement instruments. d4-1-2 How to control the exhaust emissions from combustion.		**x**		**x**		**x**		**x**

9- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		8- Teaching and Learning Method:												
		Lecture	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Site visits	Self learning	Cooperative	Discovering	Modelling	Playing
Knowledge & understanding	a1-1-1 a1-1-2	x				x								
	a2-1-1 a2-1-2	x				x								
Intellectual Skills	b1-1-1 b1-1-2	x				x								
	b3-1-1	x				x								
Professional Skills	c2-1-1	x				x							x	
	c4-1-1	x				x							x	
General Skills	d2-1-1 d2-1-2		x							x	x			
	d4-1-1 d4-1-2		x							x	x			

10- Assessment

10.1 Assessment Methods

Course Intended Learning Outcome (ILOs)		Assessment Methods											
		Wirtten Exam	Oral Exam	Tutorial Assessment	Proiect Assessment	Model Assessment	Report Assessment	Quiz assessment	Presentation Assessment	Discussion	Laboratory Test	Home Exm	Monitoring
Knowledge & Understanding	a1-1-1 a1-1-2	x											
	a2-1-1 a2-1-2	x											
Intellectual Skills	b1-1-1 b1-1-2	x											
	b3-1-1	x											
Professional Skills	c2-1-1	x											
	c4-1-1	x											
General Skills	d2-1-1 d2-1-2	x											
	d4-1-1 d4-1-2	x											

10.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	**100**	**32th**
Final Oral Examination		
Mid term written Examination		
Tutorial discussion, presentation, and report assessment		
Total	**100%**	

11- Facilities required for teaching and learning

Teaching aids like, lecture room with audio-visual facilities, white board.

12- List of references:

1- "Principles of Measurement Systems" by John P. Bentley, Fourth Edition, 2005.
2- "Theory and Design for Mechanical Measurements" by Richard S. Figliola Donald E. Beasley, Fifth Edition, 2011.
3- "Sensitivity and Uncertainty Analysis Theory" by Dan G. Cacuci, Volume 1, 2003.

Course Prof. Dr. Mohamed A. Okeily
Programme coordinator:
Head of the Department: **Prof. Dr. Kamal Ameen Morad**

Date:

Course Specification

Program on which the course is given	M.sc. in Mechanical Power Engineering
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering.
Department offering the course	Physics and Mathematical Engineering
Academic year/Level	M.SC.
Date of specification approval	2020

A- Basic Information

Course Title: Advanced Engineering Mathematics 1	**Lecture:** 3 hours
Course Code : SCI 600	**Tutorial/ Laboratory:**
Bylaw 2000	Total: 3 hours

B- Professional Information

1- Course Aims:

This course aims to acquire the student with the essential knowledge to understand of the, special functions, Laplace transform, solution of differential equations in power series. The course provides the students with the necessary practical and professional skills concerning the dealing with special functions (Bessel, Legendre, Beta and Gamma, and Chebtchev Polynomials) and their practical in different branches and the principles of solving the differential equations in the neighborhood of the singular point in series solution are among the main aims of the course.

By the end of the course the students will be able to:

1- deal with Laplace transform functions of several variables in various fields.

2- Solve the ordinary differential equations using Frobenius method.

3- deal with the special function in different fields.

2- Intended Learning Outcomes (ILOs):

NAQAAE Academic Reference Standards (ARS)	Programme ILOs	Course ILOs
A. Knowledge and understanding		
A1- Theories, basics and specialized knowledge in the field of learning, as well as the subjects that affect his/her professional practice.	a1-1 Demonstrate sufficient essential knowledge and a deep understanding of the concepts and theories of **mathematics and computer science** appropriate to their areas of specialization in Mechanical Power Engineering	a1-1-1 Understanding the basic concepts for the elementary and special function. a1-1-2- Recognize the Laplace transform and easily applicable to the boundary value problems of differential equations a1-1-3- Understanding the generalizations of the special functions and practical. a1-1-4 Be able to find the solution of the homogeneous linear d. e. in the neighborhood of regular singular point(Frobenius method). a1-1-5 Providing student in a compact form most of the properties of special functions.(legendere polynomial,Bessel functions,Hermite function)

3- Course Contents:

No.	*Topic*	*Total hours*	*Lec. hours*	*Tut. Hours*
1	Solution in series of the differential equations	30	20	10
2	Special functions	30	20	10
3	Laplace transform	30	20	10
Total		90	60	30

4- Relationship between the course and the program

Fields	Knowledge & Understanding
Program Academic Standards that the course contribute in achieving	A1 (a1-1)

5- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Disccretionry subjects	Total
	100%						100%

6- Course Topics.

Topic No.	***Topic***	***weeks***
1	Solution in series of the differential equations	1-10
2	Special functions	11-20
3	Laplace transform	21-30

7- ILOs Matrix Topics

Course (ILOs)	**1st**	**2nd**	**3rd**
a1-1-1 Understanding the basic concepts for the elementary and special function.		**X**	
a1-1-2- Recognize the Laplace transform and			**X**

easily applicable to the boundary value problems of differential equations			
a1-1-3- Understanding the generalizations of the special functions and practical.		**X**	
a1-1-4 Be able to find the solution of the homogeneous linear d. e. in the neighborhood of regular singular point(Frobenius method).	**X**		
a1-1-5 Providing student in a compact form most of the properties of special functions.(legendere polynomial,Bessel functions,Hermite function)		**X**	

8- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		Teaching and Learning Method												
		Lecture	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Report	Self learning	Cooperative	Discovering	Computer Simulation	Practical Experiments
Knowledge & understanding	a1-1-1 a1-1-2 a1-1-3 a1-1-4 a1-1-5	X X X X X		X X X X X	X X X X X	X X X X X								

9- Assessment

9.1 Assessment Methods

Final Written Examination : to assess students' knowledge, understanding, analysis, creativity, problem solving, and problem identification.

9.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	Week
Final Examination	100	32nd
Total	100%	

10- Facilities required for teaching and learning

Whiteboard – Class Room Equipped with Computer and Video Projector - Library.

A. Library Usage:

Students are encouraged to use library technical resources in the studying of the course.

11- List of references:

1- Mathematical physics by B D Gupta .

2-Special functions of mathematics by N. Sneddon.

3- Calculus , by Swokowski.

4 -Advanced mathematics for engineering.

Course coordinator : Dr .Mohamed Khlil ELGayyar

Head of Department: Ass. Prof. Dr/ Walid Fathalla Mohamed

Date: 2012/2013

Course Specification

Program on which the course is given	M.sc. in Mechanical Power Engineering
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering.
Department offering the course	Physics and Mathematical Engineering
Academic year/Level	M.SC.
Date of specification approval	2020

A- Basic Information

Course Title: Advanced Engineering Mathematics 2	**Lecture: 3** hours
Course Code : SCI 601	**Tutorial/ Laboratory:**
Bylaw 2000	Total: 3 hours

B- Professional Information

1- Course Aims:

This course aims to acquire the student with the essential knowledge to understand of the, systems of linear differential equations, vector analysis, Fourir integration and applications. The course provides the students with the necessary practical and professional skills concerning the dealing with ordinary differential equations and partial and marginal problems and Green functions.

By the end of the course the students will be able to:

1- Deal with Fourir integration and applications.

2- Solve the ordinary differential equations and partial.

3- Deal with the special function in different fields.

2- Intended Learning Outcomes (ILOs):

NAQAAE Academic Reference Standards (ARS)	Programme ILOs	Course ILOs
A. Knowledge and understanding		
A1- Theories, basics and specialized knowledge in the field of learning, as well as the subjects that affect his/her professional practice.	a1-1 Demonstrate sufficient essential knowledge and a deep understanding of the concepts and theories of **mathematics and computer science** appropriate to their areas of specialization in Mechanical Power Engineering	a1-1-1 Understanding the basic concepts for the elementary and special function. a1-1-2- Recognize the Fourir integration and applications to the boundary value problems of differential equations a1-1-3- Understanding the generalizations of the marginal problems and Green functions. a1-1-4 Be able to find the solution of the systems of linear differential equations. a1-1-5 Providing student in a compact form most of the properties of vector analysis.

3- Course Contents:

No.	*Topic*	*Total hours*	*Lec. hours*	*Tut. Hours*
1	Systems of linear differential equations – vector analysis – Fourir integration and applications	30	20	10
2	Ordinary differential equations and partial	30	20	10
3	Marginal problems and Green functions	30	20	10
Total		90	60	30

4- Relationship between the course and the program

Fields	Knowledge & Understanding
Program Academic Standards that the course contribute in achieving	A1 (a1-1)

5- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Disccretionry subjects	Total
	100%						100%

6- Course Topics.

Topic No.	***Topic***	***weeks***
1	Systems of linear differential equations – vector analysis – Fourir integration and applications	1-10
2	Ordinary differential equations and partial	11-20
3	Marginal problems and Green functions	21-30

7- ILOs Matrix Topics

Course (ILOs)	**1st**	**2nd**	**3rd**
a1-1-1 Understanding the basic concepts for the elementary and special function.		**X**	
a1-1-2- Recognize the Laplace transform and easily applicable to the boundary value problems of differential equations			**X**
a1-1-3- Understanding the generalizations of the special functions and practical.		**X**	

a1-1-4 Be able to find the solution of the homogeneous linear d. e. in the neighborhood of regular singular point(Frobenius method). a1-1-5 Providing student in a compact form most of the properties of special functions.(legendere polynomial,Bessel functions,Hermite function)	**X**	**X**	

8- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		Teaching and Learning Method											
		Lecture	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Report	Self learning	Cooperative	Discovering	Computer Simulation	Practical Experiments
Knowledge & understanding	a1-1-1 a1-1-2 a1-1-3 a1-1-4 a1-1-5	X X X X X		X X X X X	X X X X X	X X X X X								

9- Assessment

9.1 Assessment Methods

Final Written Examination : to assess students' knowledge, understanding, analysis, creativity, problem solving, and problem identification.

9.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	Week
Final Examination	100	32nd
Total	100%	

10- Facilities required for teaching and learning

Whiteboard – Class Room Equipped with Computer and Video Projector - Library.

A. Library Usage:

Students are encouraged to use library technical resources in the studying of the course.

11- List of references:

1- Mathematical physics by B D Gupta .

2-Special functions of mathematics by N. Sneddon.

3- Calculus , by Swokowski.

4 -Advanced mathematics for engineering.

Course coordinator : Dr .Mohamed Khlil ELGayyar

Head of Department: Ass. Prof. Dr/ Walid Fathalla Mohamed

Date:

Quality Assurance & Accreditation Unit

Course Specification

Program on which the course is given	Pre-masters in Mechanical Power Engineering.
Major or minor element of program	Major
Department offering the program	Mechanical Power Engineering
Department offering the course	Physics and Mathematical Engineering
Academic year/Level	Pre-masters
Date of specification approval	2020

A- Basic Information

Course Title: Engineering Numerical Analysis	**Lecture:** 2 hours
Course Code : SCI 603	**Tutorial/ Laboratory:** 1 hour
Bylaw 2000	Total: 3 hours

B- Professional Information

1- Course Aims:

This course aims to equip the student with the essential knowledge and stimulate intuitive understanding of some basic concepts and methods of Numerical analysis and by the end of this course the student should be able to:

1- Solve ordinary differential equations using numerical methods.

2- Compute the numerical interpolation function.

4- Evaluate the numerical integral.

5- Deal with systems of linear equations.

6- Find where two functions intersect.

2- Intended Learning Outcomes (ILOs):

NAQAAE Academic Reference Standards (ARS)	Programme ILOs	Course ILOs
A. Knowledge and understanding		
A1- Theories, basics and specialized knowledge in the field of learning, as well as the subjects that affect his/her professional practice.	a1-1 Demonstrate sufficient essential knowledge and a deep understanding of the theories, basics and specialized knowledge in Numerical Analysis.	a1-1-1- Identify the solution of ordinary differential equations numerically. a1-1-2- Review the theories and concepts used to solve systems of linear equations. a1-1-3- Recognize the contribution and impacts on Special functions in different areas of science. a1-1-4- Describe numerical integrals. a1-1-5- Define the numerical derivatives. a1-1-6- Compute a numerical interpolation for a set of data.

3- Course Contents:

No.	*Topic*	*Total hours*	*Lec. hours*	*Tut. Hours*
1	The divided differences	12	12	6
2	Numerical Interpolation	12	12	6
3	Numerical integration	12	12	6
4	Numerical Solutions of ordinary differential equations	12	12	6
5	Solving systems of linear equations.	12	12	6
Total		60	60	30

4- Relationship between the course and the programme

Fields	Knowledge & Understanding
Program Academic Standards that the course contribute in achieving	A1 (a1-1)

5- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Computer Applications and ICT	Projects and practice	Disccretionry subjects	Total
	100%						100%

6- Course Topics.

Topic No.	***Topic***	***weeks***
1	The divided differences	1-6
2	Numerical Interpolation	7-12
3	Numerical integration	13-18
4	Numerical Solutions of ordinary differential equations	19-24
5	Solving systems of linear equations.	25-30

7- ILOs Matrix Topics

Course (ILOs)	1st	2nd	3rd	4th	5th
a1-1-1- Identify the solution of ordinary differential equations numerically.				X	
a1-1-2- Review the theories and concepts used to solve systems of linear equations.					X
a1-1-3- Recognize the contribution and impacts on Special functions in different areas of science.	X			X	
a1-1-4- Describe numerical integrals.			X		X
a1-1-5- Define the numerical derivatives.					
a1-1-6- Compute a numerical interpolation for a set of data.		X			

8- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		Teaching and Learning Method												
		Lecture	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Report	Self learning	Cooperative	Discovering	Computer Simulation	Practical Experiments
Knowledge & understanding	a1-1-1	X		X	X	X								
	a1-1-2	X		X	X	X								
	a1-1-3	X		X	X	X								
	a1-1-4	X	X	X	X	X								
	a1-1-5	X		X	X	X								
	a1-1-6	X	X	X	X	X								

9- Assessment

9.1 Assessment Methods

Final Written Examination : to assess students' knowledge, understanding, analysis, creativity, problem solving, and problem identification.

9.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	Week
Final Examination	100	32nd
Total	100%	

10- Facilities required for teaching and learning

Whiteboard – Class Room Equipped with Computer and Video Projector - Library.

A. Library Usage:

Students are encouraged to use library technical resources in the studying of the course.

11- List of references:

George W. Collins, " **Fundamental Numerical Methods and Data Analysis", 2003**.

Course coordinator : Dr/ Moanis Moaz

Head of Department: Ass. Prof. Dr/ Walid Fathalla Mohamed

Date:

Course Specification

Program on which the course is given	M.SC. Mechanical Power Engineering.
Major or minor element of program	
Department offering the program	Mechanical Power Engineering
Department offering the course	Physics and Mathematical Engineering
Academic year/Level	M.SC. Programs
Date of specification approval	2020

A- Basic Information

Title: Engineering Probabilities and Statistics	**Code Symbol**: **SCI 604**	
Lecture	3 hours	
Tutorial / Laboratory		
Total	3 hours	Bylaw 2000

B- Professional Information

1- Course Aims:

This course is designed to provide basic concepts probability and statistical methods and their relevance in the engineering. Topics include the calculus of events, probability, random variables, distributions, Independence, moments, moment-generating functions, Conditional probability, Estimation Theory, Testing of hypotheses, Regression and Correlation.

2- Intended Learning Outcomes (ILOs) for the whole program

This course is designed to achieve the above objectives through the following Intended **Learning Outcomes (ILOs)**:

NAQAAE Academic Reference Standards (ARS)	Program ILOs	Course ILOs
A. Knowledge and understanding		
A1- Basic facts & theories in the field of mechanical design, and production.	a1-1 Demonstrate sufficient essential knowledge and a deep understanding of the concepts and theories of mathematics and engineering science appropriate to their areas of specialization in marine engineering, so as to apply acquired knowledge in analysis, developing new engineering research. a1-2 Identify different equation, their properties and applications. a1-4 a Knowledge of engineering techniques, and Concept of solutions for any mathematical systems.	a1-1-1 Demonstrate sufficient essential knowledge and a deep understanding of the concepts and theories of reinforcements of the finite element and finite difference methods. a1-2-1 Identify different types of the finite element and finite difference methods, their properties and applications. a1-4-1 a Knowledge of engineering the finite element and finite difference methods techniques.
A4- Basics and principles of quality in professional practice in the field of specialization.	a4-1 an understanding of variational formulation and approximation techniques for the engineering marine.	a4-1-1 an understanding of variational formulation and approximation techniques for the engineering techniques.
A5- The knowledge related to the impact of professional practice on the variational formulation of boundary-value problems.	a5-2 Recognize the Motivation and variational [or weak] formulation.	a5-2-1 Recognize the Motivation and variational [or weak] formulation.
B. Intellectual skills		
B1- Analyze and evaluate information in the field of	b1-1 Demonstrate an investigatory and analytic thinking approach (Problem	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems

specialization, and relate it to solve problems and formulate theories.	solving) to solve problems related to marine engineering.	related to any branch.
B3- Perform research and studies to add to the accumulated knowledge.	b3-1 Write an research plain to conduct applied research.	b3-1-1 Write an research plain to conduct applied research by use finite element and finite difference methods.
B4- Write research papers.	b4-1 Compare and evaluate published articles and research concerning specified problem related to marine engineering.	b4-1-1 Compare and evaluate published articles and research concerning specified problem related to any branch.
B9-Performing conversations and discussions built on the basis of evidence and proofs.	b9-1 Manage discussions on basis of evidence and proofs	b9-1-1 Manage discussions on basis of evidence and proofs related to the finite element and finite difference methods.
C. Professional and practical skills		
C1- Master the basic as well as the latest professional skills in the field of specialization.	c1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering techniques, skills, and tools.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering techniques, skills, and tools related to the finite element and finite difference methods.
C2- Write and evaluate technical and professional reports.	c.2-1 Write and evaluate a professional report on specialized related to the finite element and finite difference methods.	c.2-1-1 Write and evaluate a professional report on specialized related to the finite element and finite difference methods.
D. General and transferrable skills		
D1-Communicate effectively using all different methods	d1-1 Express professional and communication skills to innovate and to interact with the scientific community, research team and technocrats involved in multinational companies at global level in the related fields to marine	d1-1-1 Express professional and communication skills to innovate and to interact with the scientific community, research team and technocrats involved in multinational companies at global level in the related to the finite element and finite

	engineering.	difference methods.
D4- Use different sources to obtain knowledge and information.	d4-1 Apply self evaluation and specify his/her educational needs related marine engineering.	d4-1-1 Apply self evaluation and specify his/her educational needs related to the finite element and finite difference methods.
D7- Self evaluation and continuous learning.	d7-1 Apply self evaluation and specify his educational needs related marine engineering.	d7-1-1 Apply self evaluation and specify his educational needs related to the finite element and finite difference methods.

3- Course Contents

Lecture Topics	Total Hours	Lecture Hours	Practical /Tutorial Hours
1- An introduction to the finite element and finite difference methods.	**3**	**3**	--
2- Variational formulation and approximation (Notation – boundary and initial value problems – gradient and divergence theorems – functional).	**9**	**9**	--
3- Variational formulation of boundary- value problems (Motivation - variational [or weak] formulation).	**9**	**9**	--
4- Variational methods of approximation (the Ritz method – the method of Weighted Residuals- the Galerkin method - the Least squares method - the Collocation method- the Courant method – Time dependent problems).	**12**	**12**	--
5- Finite element analysis of one dimensional problems.	**6**	**6**	--
6- Finite element analysis of two dimensional problems.	**6**	**6**	--
7- Two dimensional Finite elements and interpolation functions.	**9**	**9**	--
8- Second order, multivariable equations.	**9**	**9**	--
9- Iso-parametric elements and numerical integration.	**6**	**6**	--
10- Computer implementation (general outline – input data –	**15**	**15**	--

calculation of element matrices – assembly in a banded matrix form – imposition of boundary conditions – solution of equations and postprocessing – applications of the computer program).			
Total	**84**	**84**	**--**

4- Relationship between the course and the programme

Field	National Academic Reference Standard(NARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Academic Program Standards that the course contributes in achieving.	A1 (a1-1, a1-2, a1-4), A4 (a4-1), A5 (a5-2)	B1 (b1-1), B3 (b3-1), B4 (b4-1), B9 (b9-1)	C1 (c1-1), C2 (c2-1)	D1 (d1-1), D4 (d4-1), D7 (d7-1)

5- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Applications	Projects and practice	Discretionary subjects	Total
5%	50%	20%		15%	10%		100%

6- Course Topics.

Topic No.	Topic	Weeks
1st	An introduction to the finite element and finite difference methods.	1
2nd	Variational formulation and approximation (Notation – boundary and initial value problems – gradient and divergence theorems – functional).	2-4
3rd	Variational formulation of boundary- value problems (Motivation - variational [or weak] formulation).	5-7
4th	Variational methods of approximation (the Ritz method – the method of Weighted Residuals- the Galerkin method - the Least squares method - the Collocation method- the Courant method – Time dependent problems).	8-11

5th	Finite element analysis of one dimensional problems.	12-13
6th	Finite element analysis of two dimensional problems.	14-15
7th	Two dimensional Finite elements and interpolation functions.	16 - 18
8th	Second order, multivariable equations.	19 - 21
9th	Iso-parametric elements and numerical integration.	22-23
10th	Computer implementation (general outline – input data – calculation of element matrices – assembly in a banded matrix form – imposition of boundary conditions – solution of equations and postprocessing – applications of the computer program).	24-30

7- ILOs Matrix Topics

Course topics	**1st**	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**	**8th**	**9th**	**10th**
Course ILOs	**Knowledge & Understanding**									
a1-1-1 Demonstrate sufficient essential knowledge and a deep understanding of the concepts and theories of reinforcements of the finite element and finite difference methods.		x	x	x						
a1-2-1 Identify different types of the finite element and finite difference methods, their properties and applications.		x								
a1-4-1 a Knowledge of engineering the finite element and finite difference methods techniques.	x									
a4-1-1 an understanding of variational formulation and approximation techniques for the engineering techniques.			x							
a5-2-1 Recognize the Motivation and variational [or weak] formulation.				x	x					
Course ILOs	**Intellectual Skills**									

b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to any branch.	x	x	x		x	x	x	x	x	x
b3-1-1 Write an research plain to conduct applied research by use finite element and finite difference methods.		x		x						
b4-1-1 Compare and evaluate published articles and research concerning specified problem related to any branch.		x						x		
b9-1-1 Manage discussions on basis of evidence and proofs related to the finite element and finite difference methods.	x				x					
Course ILOs	**Professional Skill**									
c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering techniques, skills, and tools related to the finite element and finite difference methods.	x	x	x	x	x	x	x	x	x	x
c.2-1-1 Write and evaluate a professional report on specialized related to the finite element and finite difference methods.		x		x						
Course ILOs	**General Skills**									
d1-1-1 Express professional and communication skills to innovate and to interact with the scientific community, research team and technocrats involved in multinational companies at global level in the related to the finite element and finite difference methods.				x						
d4-1-1 Apply self evaluation and specify his/her educational needs related to the finite element and finite difference methods.		x		x		x	x			
d7-1-1 1 Apply self evaluation and specify his educational needs related to the finite element and finite difference methods.			x	x		x	x			

8- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		Teaching and Learning Method												
		Lecture	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Report	Self learning	Cooperative	Discovering	Computer Simulation	Practical Experiments
Knowledge & understanding	a1-1-1	x			x	x								
	a1-2-2	x												
	a1-4-1	x												
	a4-1-1	x												
	a5-2-1	x												
Intellectual Skills	b1-1-1				x	x								
	b3-1-1		x	x					x	x				
	b4-1-1		x	x					x	x				
	b9-1-1		x	x					x	x				
Professional Skills	c1-1-1				x	x								
	c2-1-1		x	x					x	x				
General Skills	d1-1-1													
	d4-1-1		x							x				
	d7-1-1		x							x				

9- Assessment

9.1 Assessment Methods

Final Written Examination : to assess students' knowledge, understanding, analysis, creativity, problem solving, and problem identification.

9.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	32
Total	100%	

10- Facilities required for teaching and learning

Blackboard – Class Room Equipped with Computer and Video Projector.

A. laboratory Usage:

Students are expected to use computer lab in faculty workshops or others.

B. Library Usage:

Students should be encouraged to use library technical resources in the preparation of oral presentation. At least one oral presentation should involve a significant component of library research to encourage this component of study.

11- List of References:

Course book.

Essential Books (Text Books):

***Applied Statistics and Probability for Engineers*, 4th Ed. by Douglas C. Montgomery and George C. Runger. 2006. ISBN: 0-471-74589-8.**

12- Program Coordination Committee:

Course Coordinator:	**Dr. Youssef Aly Mohamed Baghdadi**
Program coordinator:	**Dr. Youssef Aly Mohamed Baghdadi**
Head of the Department:	Ass. Prof. Dr. Walid Fathalla Mohamed

Date: 2012/2013

SCI 605
Finite Element and Finite Difference Methods

Course Specification

Course Specification

Program on which the course is given	M.SC. Mechanical Power Engineering
Major or minor element of program	Mechanical Power Engineering
Department offering the program	Physics and Mathematical Engineering
Department offering the course	
Academic year/Level	MS.C Programs
Date of specification approval	2020

A- Basic Information

Title: Finite Element Methods	**Code Symbol**: **SCI 605**	
Lecture	3 hours	
Tutorial / Laboratory		
Total	3 hours	Bylaw 2000

B- Professional Information

1- Course Aims:

The main Objectives of this course are to know the finite element and finite difference methods are introduced as a variationally based technique of solving differential equations. A continuous problem described by a differential equation is put into equivalent variational form, and the approximate solution is assumed to be a linear combination. The finite element method provides a systematic technique for deriving the approximation functions for simple subregions by which a geometrically complex region can be represented. In the finite element method, the approximation functions are piecewise polynomials (i.e., polynomials that are defined only on a subregion, called an element).

The approach taken in this course falls somewhere in the middle of the approaches taken in this course that are completely mathematical and those approaches that are more structural-mechanics-oriented. In the study of variational an finite element method, advanced mathematics are intentionally avoided in the interest of simplicity. However, a minimum of mathematical machinery that seemed necessary. The computer programs are very easy to understand because they are study along the same lines as the theory.

Numerous examples, most of which are applications of the concepts to specific problems in various fields of engineering and applied science, are provided throughout the course.

2- Intended Learning Outcomes (ILOs) for the whole program

This course is designed to achieve the above objectives through the following Intended **Learning Outcomes (ILOs)**:

NAQAAE Academic Reference Standards (ARS)	Program ILOs	Course ILOs
A. Knowledge and understanding		
A1- Basic facts & theories in the field of mechanical design, and production.	a1-1 Demonstrate sufficient essential knowledge and a deep understanding of the concepts and theories of mathematics and engineering science appropriate to their areas of specialization in marine engineering, so as to apply acquired knowledge in analysis, developing new engineering research. a1-2 Identify different equation, their properties and applications. a1-4 a Knowledge of engineering techniques, and Concept of solutions for any mathematical systems.	a1-1-1 Demonstrate sufficient essential knowledge and a deep understanding of the concepts and theories of reinforcements of the finite element and finite difference methods. a1-2-1 Identify different types of the finite element and finite difference methods, their properties and applications. a1-4-1 a Knowledge of engineering the finite element and finite difference methods techniques.
A4- Basics and principles of quality in professional practice in the field of specialization.	a4-1 an understanding of variational formulation and approximation techniques for the engineering marine.	a4-1-1 an understanding of variational formulation and approximation techniques for the engineering techniques.
A5- The knowledge related to the impact of professional practice on the variational formulation of boundary-value problems.	a5-2 Recognize the Motivation and variational [or weak] formulation.	a5-2-1 Recognize the Motivation and variational [or weak] formulation.
B. Intellectual skills		

B1- Analyze and evaluate information in the field of specialization, and relate it to solve problems and formulate theories.	b1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to marine engineering.	b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to any branch.
B3- Perform research and studies to add to the accumulated knowledge.	b3-1 Write an research plain to conduct applied research.	b3-1-1 Write an research plain to conduct applied research by use finite element and finite difference methods.
B4- Write research papers.	b4-1 Compare and evaluate published articles and research concerning specified problem related to marine engineering.	b4-1-1 Compare and evaluate published articles and research concerning specified problem related to any branch.
B9-Performing conversations and discussions built on the basis of evidence and proofs.	b9-1 Manage discussions on basis of evidence and proofs	b9-1-1 Manage discussions on basis of evidence and proofs related to the finite element and finite difference methods.
C. Professional and practical skills		
C1- Master the basic as well as the latest professional skills in the field of specialization.	c1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering techniques, skills, and tools.	c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering techniques, skills, and tools related to the finite element and finite difference methods.
C2- Write and evaluate technical and professional reports.	c.2-1 Write and evaluate a professional report on specialized related to the finite element and finite difference methods.	c.2-1-1 Write and evaluate a professional report on specialized related to the finite element and finite difference methods.
D. General and transferrable skills		
D1-Communicate effectively using all different methods	d1-1 Express professional and communication skills to innovate and to interact with the scientific community, research team and technocrats	d1-1-1 Express professional and communication skills to innovate and to interact with the scientific community, research team and technocrats involved in multinational

	involved in multinational companies at global level in the related fields to marine engineering.	companies at global level in the related to the finite element and finite difference methods.
D4- Use different sources to obtain knowledge and information.	d4-1 Apply self evaluation and specify his/her educational needs related marine engineering.	d4-1-1 Apply self evaluation and specify his/her educational needs related to the finite element and finite difference methods.
D7- Self evaluation and continuous learning.	d7-1 Apply self evaluation and specify his educational needs related marine engineering.	d7-1-1 Apply self evaluation and specify his educational needs related to the finite element and finite difference methods.

3- Course Contents

Lecture Topics	Total Hours	Lecture Hours	Practical /Tutorial Hours
1- An introduction to the finite element and finite difference methods.	**3**	**3**	--
2- Variational formulation and approximation (Notation – boundary and initial value problems – gradient and divergence theorems – functional).	**9**	**9**	--
3- Variational formulation of boundary- value problems (Motivation - variational [or weak] formulation).	**9**	**9**	--
4- Variational methods of approximation (the Ritz method – the method of Weighted Residuals- the Galerkin method - the Least squares method - the Collocation method- the Courant method – Time dependent problems).	**12**	**12**	--
5- Finite element analysis of one dimensional problems.	**6**	**6**	--
6- Finite element analysis of two dimensional problems.	**6**	**6**	--
7- Two dimensional Finite elements and interpolation functions.	**9**	**9**	--
8- Second order, multivariable equations.	**9**	**9**	--

9- Iso-parametric elements and numerical integration.	**6**	**6**	--
10- Computer implementation (general outline – input data – calculation of element matrices – assembly in a banded matrix form – imposition of boundary conditions – solution of equations and postprocessing – applications of the computer program).	**15**	**15**	--
Total	**84**	**84**	--

4- Relationship between the course and the programme

Field	National Academic Reference Standard(NARS)			
	Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
Academic Program Standards that the course contributes in achieving.	A1 (a1-1, a1-2, a1-4), A4 (a4-1), A5 (a5-2)	B1 (b1-1), B3 (b3-1), B4 (b4-1), B9 (b9-1)	C1 (c1-1), C2 (c2-1)	D1 (d1-1), D4 (d4-1), D7 (d7-1)

5- Course Subject Area:

A	B	C	D	E	F	G	
Humanities and Social Science	Mathematics and Basic Sciences	Basic Engineering Science	Applied Engineering And Design	Applications	Projects and practice	Discretionary subjects	Total
5%	50%	20%		15%	10%		100%

6- Course Topics.

Topic No.	Topic	Weeks
1st	An introduction to the finite element and finite difference methods.	1
2nd	Variational formulation and approximation (Notation – boundary and initial value problems – gradient and divergence theorems – functional).	2-4
3rd	Variational formulation of boundary- value problems (Motivation - variational [or weak] formulation).	5-7

4th	Variational methods of approximation (the Ritz method – the method of Weighted Residuals- the Galerkin method - the Least squares method - the Collocation method- the Courant method – Time dependent problems).	8-11
5th	Finite element analysis of one dimensional problems.	12-13
6th	Finite element analysis of two dimensional problems.	14-15
7th	Two dimensional Finite elements and interpolation functions.	16 - 18
8th	Second order, multivariable equations.	19 - 21
9th	Iso-parametric elements and numerical integration.	22-23
10th	Computer implementation (general outline – input data – calculation of element matrices – assembly in a banded matrix form – imposition of boundary conditions – solution of equations and postprocessing – applications of the computer program).	24-30

7- ILOs Matrix Topics

Course topics	**1st**	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**	**8th**	**9th**	**10th**
Course ILOs	**Knowledge & Understanding**									
a1-1-1 Demonstrate sufficient essential knowledge and a deep understanding of the concepts and theories of reinforcements of the finite element and finite difference methods.		x	x	x						
a1-2-1 Identify different types of the finite element and finite difference methods, their properties and applications.		x								
a1-4-1 a Knowledge of engineering the finite element and finite difference methods techniques.	x									
a4-1-1 an understanding of variational formulation and approximation techniques for the engineering techniques.			x							
a5-2-1 Recognize the Motivation and variational [or weak] formulation.				x	x					

Course ILOs	Intellectual Skills									
b1-1-1 Demonstrate an investigatory and analytic thinking approach (Problem solving) to solve problems related to any branch.	x	x	x		x	x	x	x	x	x
b3-1-1 Write an research plain to conduct applied research by use finite element and finite difference methods.		x		x						
b4-1-1 Compare and evaluate published articles and research concerning specified problem related to any branch.		x						x		
b9-1-1 Manage discussions on basis of evidence and proofs related to the finite element and finite difference methods.	x				x					
Course ILOs	**Professional Skill**									
c1-1-1 Express competence skills, such as identifying, formulating, analyzing, and creating engineering solutions, using latest engineering techniques, skills, and tools related to the finite element and finite difference methods.	x	x	x	x	x	x	x	x	x	x
c.2-1-1 Write and evaluate a professional report on specialized related to the finite element and finite difference methods.		x		x						
Course ILOs	**General Skills**									
d1-1-1 Express professional and communication skills to innovate and to interact with the scientific community, research team and technocrats involved in multinational companies at global level in the related to the finite element and finite difference methods.				x						
d4-1-1 Apply self evaluation and specify his/her educational needs related to the finite element and finite difference methods.		x		x		x	x			

d7-1-1 1 Apply self evaluation and specify his educational needs related to the finite element and finite difference methods.			x	x		x	x			

8- Teaching and Learning Method:

Course Intended learning outcomes (ILOs)		Teaching and Learning Method												
		Lecture	Presentation and Movies	Discussion	Tutorial	Problem solving	Brain storming	Projects	Report	Self learning	Cooperative	Discovering	Computer Simulation	Practical Experiments
Knowledge & understanding	a1-1-1	x			x	x								
	a1-2-2	x												
	a1-4-1	x												
	a4-1-1	x												
	a5-2-1	x												
Intellectual Skills	b1-1-1				x	x								
	b3-1-1		x	x					x	x				
	b4-1-1		x	x					x	x				
	b9-1-1		x	x					x	x				
Professional Skills	c1-1-1				x	x								
	c2-1-1		x	x					x	x				
General Skills	d1-1-1													
	d4-1-1		x							x				
	d7-1-1		x							x				

9- Assessment

9.1 Assessment Methods

Final Written Examination : to assess students' knowledge, understanding, analysis, creativity, problem solving, and problem identification.

9.2 Assessment Schedule and Grades Distribution

Assessment Method	Percentage	week
Final Examination	100	32
Total	100%	

10- Facilities required for teaching and learning

Blackboard – Class Room Equipped with Computer and Video Projector.

A. laboratory Usage:

Students are expected to use computer lab in faculty workshops or others.

B. Library Usage:

Students should be encouraged to use library technical resources in the preparation of oral presentation. At least one oral presentation should involve a significant component of library research to encourage this component of study.

11- List of References:

- ***Course book.***

Essential Books (Text Books):

- **An Introduction to the Finite Element Method by J. N. Reddy.**
- **Variational Calculus in Science and Engineering by M. J. Forray.**

12- Program Coordination Committee:

Course Coordinator: **Prof. Dr. A. S. Abdalla Wassf**

Associate Professor

Program coordinator: **Prof. A. S. Abdalla Wassf**

Head of the Department: **Ass. Prof. Dr. Walid Fathalla Mohamed**

Date: