

Course File

Session-2017

Semester: Spring 2020

MT 363: Industrial Thermal Utilities



Department of Mechanical Engineering

**University of Engineering & Technology
Lahore. (KSK Campus)**

Course File Contents

1.	Course Time Table
	Abbreviations
2.	Course Skeleton and Detailed Lecture Plan
	List of PLO's
	List of CLO's mapped with PLO's
3.	Components of Assessment
	CLO's with Relevant Assessment
4.	Semester Calendar
	Date Sheet of Quiz 1, Quiz 2, Mid Term and Final Term Exams
5.	Graded Sample Quizzes (Best, average and worst cases) with Solution Key
6.	Question Paper and Solution with relevant CLO's and Marking Scheme (Mid Term Examination)
	Mid Term Exams Answers Sheets (Graded Best, average and worst cases)
7.	Question Paper and Solution with relevant CLO's and Marking Scheme (Final Term Examination)
	Final Term Exams Answers Sheets (Graded Best, average and worst cases)
8.	Sample Assignments /CEP with Rubrics (Graded Best, average and worst cases)
9.	Results SAR Report(LMS) Course Outline Report(LMS) Course Assessment Report/Faculty Review Report CQI
10.	Lecture Notes (Optional)

List of Abbreviations

CLOS	Course Learning outcomes
PLOS	Program Learning outcomes
CQI	Continuous Quality Improvement
CEP	Complex Engineering Problem
CW	Course Work

BSc. Mechanical Engineering Technology (Session – 2017)

6th Semester

B.SC. Mechanical Engineering Course Skeleton				
Course: Industrial Thermal Utilities	Name of Instructor: Adnan Qamar, M.Sc.	Class 2016	Semester 6 th	Duration Jan-June, 2019
Credit hours:	(Theory) 3	Class Timings: Monday 8:00 am – 11:00 am		
Course Outline: Introduction to different utilities; <u>Boilers</u> : Types, Properties of steam, Assessment of steam distribution losses, Steam leakages, Steam trapping, Condensate and flash steam recovery system, Identifying opportunities for energy savings. Combustion in boilers, Performances evaluation, Analysis of losses, Feed water treatment, Blow down, Energy conservation opportunities, HRSG. <u>Furnaces</u> : Classification, General fuel economy measures in furnaces, Excess air, Heat distribution, Temperature control, Draft control, Waste heat recovery. <u>Insulation and Refractories</u> : Insulation-types and application, Economic thickness of insulation, Heat savings and application criteria, Refractory-types, selection and application of refractories, Heat loss. <u>Compressed air system</u> : Types of air compressors, Compressor efficiency, Efficient compressor operation, Compressed air system components, Capacity assessment, Leakage test, Factors affecting the performance and efficiency. <u>Fans and blowers</u> : Types, Performance evaluation, Efficient system operation, Flow control strategies and energy conservation opportunities. <u>Cooling Tower</u> : Types and performance evaluation, Efficient system operation, Flow control strategies and energy saving opportunities, Assessment of cooling towers. Prerequisite <ol style="list-style-type: none">1. MT 234: Thermodynamics for Technologists2. ET 101: Electrical Technology Recommended Books <ol style="list-style-type: none">1. Audel HVAC Fundamentals, Heating Systems, Furnaces and Boilers2. Service manuals of various Ancillary equipment				

Course Outline (Week and Lecture Wise)

Week No.	Lecture No. 1 hour each	Course Content to be Covered		
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1	1-2	Discussion about general industrial thermal utilities	The students will be able to understand the basics about the thermodynamic systems used in industries	1
2	3-4	Combustion and Performances evaluation in boilers	Able to understand and use the modes of combustion and methods to evaluate the efficiency of industrial boilers	1
3	5-6	Analysis of losses and feed water treatment in industrial boilers	The students would be able to analyze various losses occurring in boilers and methods of feed water treatment	1
4	7-8	Blow down and Energy conservation opportunities in boilers. (Quiz 1)	Understand the concept of blow down and energy conservation. They would be able to know how to conserve the energy in boilers	1
5	9-10	Classification and General fuel economy measures in furnaces	Students will learn about various types of industrial furnaces and fuel economy measures taken for efficient utilization of fuel.	1
6	11-12	Excess air, Heat distribution, Temperature control, Draft control and waste heat recovery in furnaces.	To be able to know about the effect of excess air and temperature control along with the use of heat recovery systems on the efficacy of furnaces	1
7	13-14	Insulation-types and application, Economic thickness of insulation, Heat savings and application criteria for insulations	Understand the concept of insulations and their use to stop the heat losses in various industrial applications	1
8	15-16	Refractory types, selection and application of refractories, Heat loss.	Understand the concept of refractories and their use in various industrial applications	1

9		Mid Term Examination		
10	17-18	Types of air compressors and Compressor efficiency	Able to classify the compressors and to calculate their efficiency	2
11	19-20	Compressed air system components, Capacity assessment, Leakage test, Factors affecting the performance and efficiency	Students will be able to know about different parts of compressed air systems and the factors affecting the performance and efficacy of these systems	2
12	21-22	Types and Performance evaluation of fans (Quiz 2)	Able to classify the fans and blower systems and to calculate their efficiency	2
13	23-24	Efficient system operation and Flow control strategies in fans and blower systems	To know about the operation and flow control strategies for proper functioning and improved performance of the systems	2
14	25-26	Energy conservation opportunities in fans and blower systems	Able to calculate various losses in fans and blowers and know how to overcome these losses to save energy	2
15	27-28	Types and performance evaluation of cooling towers	Able to classify the industrial cooling systems and to calculate their efficiency	3
16	29-30	Efficient system operation and Flow control strategies in cooling towers	To know about the operation and flow control strategies for proper functioning and improved performance of the systems.	3
17	31-32	Energy saving opportunities and Assessment of cooling towers /revision/Queries of the whole course	Able to calculate various losses in cooling towers and know how to overcome these losses to save energy/ Open discussion of the whole syllabus	3
18		End Term Examination		

List of Program Learning Outcomes

PLO-01: Technology Knowledge: An ability to apply knowledge of mathematics, natural science, technology fundamentals and technology specialization to defined and applied technology procedures, processes, systems or methodologies.

PLO-02: Problem Analysis: An ability to Identify, formulate, research literature and analyze broadly-defined technology problems reaching substantiated conclusions using analytical tools appropriate to the discipline or area of specialization.

PLO-03: Design/Development of Solutions: An ability to design solutions for broadly- defined technology problems and contribute to the design of systems, components or processes to meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

PLO-04: Investigation: An ability to conduct investigations of broadly-defined problems; locate, search and select relevant data from codes, data bases and literature, design and conduct experiments to provide valid conclusions.

PLO-05: Modern Tool Usage: An ability to create, Select and apply appropriate techniques, resources, and modern technology and IT tools, including prediction and modelling, to broadly-defined technology problems, with an understanding of the limitations.

PLO-06: The Technologist and Society: An ability to demonstrate understanding of the societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to technology practice and solutions to broadly defined technology problems.

PLO-07: Environment and Sustainability: An ability to understand and evaluate the sustainability and impact of technology work in the solution of broadly defined technology problems in societal and environmental contexts.

PLO-08: Ethics: Understand and commit to professional ethics and responsibilities and norms of technology practice.

PLO-09: Individual and Team Work: An ability to Function effectively as an individual, and as a member or leader in diverse teams.

PLO-10: Communication: An ability to communicate effectively on broadly defined technology activities with the technologist community and with society at large, by being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PLO-11: Project Management: An ability to demonstrate knowledge and understanding of technology management principles and apply these to one's own work, as a member or leader in a team and to manage projects in multidisciplinary environments.

PLO-12: Lifelong Learning: An ability to recognize the need for and have the ability to engage in independent and life-long learning in specialist technologies.

Course learning outcome's

#	Course Learning Outcomes	Programme Learning Objectives (PLOs)												Assessment	
		1	2	3	4	5	6	7	8	9	10	11	12		
1	Discuss combustion mechanism and performance assessment of fired systems.		2												Quiz 1+Mid Term + CW 1
2	Examine operation and performance of industrial air systems.			2											Quiz 2+Final Term
3	Analyze effectiveness and energy conservation opportunities in cooling towers.			2											Final Term + CW 2

1- Low 2- Medium 3- High

Components of Assessment:

Assessment during the semester = 30 marks

Quizzes = 10

Assignments/ Course Work = 10

Class Participation / Attendance / Semester Project / Presentations = 10

Mid Term = 30 marks

End Term Examination = 40 marks

Total = 100 marks

CLO's with Relevant Assessment

#	Course Learning Outcomes	Domain	Level	PLO
1	Discuss combustion mechanism and performance assessment of fired systems.	Cognitive	C-2	PLO-2
2	Examine operation and performance of industrial air systems.	Cognitive	C-3	PLO-3
3	Analyze effectiveness and energy conservation opportunities in cooling towers.	Cognitive	C-4	PLO-3



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Calendar Year-2020

Spring 2020

Commencement of Semester:	20-01-2020
Quiz 1:	24-02-2020 to 28-02-2020
Course work-I Submission	09-03-2020 to 13-03-2020
Mid Term exam:	16-03-2020 to 20-03-2020
Quiz 2:	20-04-2020 to 24-04-2020
Course work-II Submission	27-04-2020 to 01-05-2020
Conclusion of Teaching	08-05-2020
Final Term exam:	11-05-2020 to 22-05-2020
Compilation of Result	25-05-2020 to 05-06-2020
Course Files submission	08-06-2020

Course Works

Sr. No.	Course Work Description	Mapped CLO
1.	Evaluation of energy conservation opportunities in a combined cycle steam turbine power plant.	CLO-1
2.	Evaluation of energy conservation opportunities in industrial cooling towers.	CLO-3