Module (Course Syllabus) Catalogue

2022-2023

College/ Institute	**Erbil Technical Engineering College**	
Department	**Mechanical and Energy Engineering Techniques**	
Module Name	**Power Plants**	
Module Code	**POP702**	
Degree	**Technical Diploma** ☐ **Bachler** ■ **High Diploma** ☐ **Master** ☐ **PhD** ☐	
Semester	**7th**	
Qualification	**Ph.D.**	
Scientific Title	**Lecturer**	
ECTS (Credits)	**5**	
Module type	**Prerequisite** ☐ **Core** ■ **Assist.** ☐	
Weekly hours	**4 hours**	
Weekly hours (Theory)	**(2)hr Class**	**(30)Total hrs Workload**
Weekly hours (Practical)	**(2)hr Class**	**(27)Total hrs Workload**
Number of Weeks	**12**	
Lecturer (Theory)	**Dr. Banipal N. Yaqob**	
E-Mail & Mobile NO.	**banipal.yaqob@epu.edu.iq**	
Lecturer (Practical)	**Mrs. Allaa Abdulqader Omar**	
E-Mail & Mobile NO.	allaaomar11@outlook.com	
Websites	**https://moodle.epu.edu.iq/course/view.php?id=3740**	

Course Book

Course Description	This course deals with application of thermal engineering and fluid mechanics to different thermo-fluid systems. It is concerned with the types, construction, working principles and performance of: boilers, heat exchangers, turbines, power plants, internal combustion engines, overall plant performance, load curves and economics of power plants. This course is supported by tutorials, laboratory experiments and field visits.
Course objectives	To enable the students to: • Describe sources of energy and types of power plants • Analyze different types of steam cycles and estimate efficiencies in a steam power plant • Describe basic working principles of gas turbine and diesel engine power plants. Define the performance characteristics and components of such power plants • Classify different types of coupled vapor cycles and list the advantages of combined cycles power plant • List different types of fuels used in power plants and estimate their heating values • List types, principles of operations, components and applications of steam turbines, steam generators, condensers, feed water and circulating water systems. Estimate different efficiencies associated with such systems • Define terms and factors associated with power plant economics. Calculate present worth depreciation and cost of different types of power plants. Estimate the cost of producing power per kW.
Student's obligation	In this course students are expected to: • Attend all classes. In the event you miss a class, you are responsible for the assignments and announcements made during your absence. • Participate actively in discussions and group exercises. • Prepare for class sessions by reading text assignments. • Attendance at all exams is required. Makeup exams will be given only in emergency cases (proof required). Vacation arrangements are not emergencies. Students who have unexcused absences will receive the grade of zero ("0") for all tests, quizzes, and/or lab experiments missed.

<table>
<tr><td></td><td colspan="5">Feel free to raise questions (even if you suspect you are the only one who does not know the answer) to ensure that you thoroughly understand and are able to apply the theory in real engineering applications.</td></tr>
<tr><td>Required Learning Materials</td><td colspan="5">• Data show, white board and PowerPoint are used throughout the lecture, Testing in department’s Laboratory.
• Publish all lecture notes in college website before the lecture day.</td></tr>
<tr><td rowspan="11">Evaluation</td><td colspan="2">Task</td><td>Weight (Marks)</td><td>Due Week</td><td>Relevant Learning Outcome</td></tr>
<tr><td colspan="2">Paper Review</td><td></td><td></td><td></td></tr>
<tr><td rowspan="6">Assignments</td><td>Homework</td><td>5%</td><td></td><td></td></tr>
<tr><td>Class Activity</td><td>2%</td><td></td><td></td></tr>
<tr><td>Report</td><td rowspan="4">10%</td><td></td><td></td></tr>
<tr><td>Seminar</td><td></td><td></td></tr>
<tr><td>Essay</td><td></td><td></td></tr>
<tr><td>Project</td><td></td><td></td></tr>
<tr><td colspan="2">Quiz</td><td>8%</td><td></td><td></td></tr>
<tr><td colspan="2">Lab.</td><td>10%</td><td></td><td></td></tr>
<tr><td colspan="2">Midterm Exam</td><td>25%</td><td></td><td></td></tr>
<tr><td colspan="2">Final Exam</td><td>40%</td><td></td><td></td></tr>
<tr><td colspan="2">Total</td><td>100%</td><td></td><td></td></tr>
<tr><td>Specific learning outcome:</td><td colspan="5">After completion of this course, the students should be able to:
• Become familiar with power plant systems, terms and definitions and basic power plant engineering design calculations.
• Become familiar with the proper design and application of power plant related equipment.
• Determine the efficiency and output of a modern Rankine cycle steam power plant from given data, including superheat, reheat, regeneration, and irreversibilities.
• Calculate the heat rate, fan power consumption, heating value and combustion air requirements of conventional steam generators (boilers).
• Select the heat transfer tubes needed for condensers and feed water heaters.
• Explain the blade shapes, and calculate work output of typical turbine stages.</td></tr>
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	• Calculate the performance of gas turbines with reheat and regeneration, and discuss the performance of combined cycle power plants. • Discuss the control methods of major pollutants emitted from fossil-fuel power plants. • Interpret experimental and test results and present these in an appropriate engineering report format • Collaborate with others in a team project environment to conduct engineering investigations and produce engineering reports
Course References:	▪ Key references: • "Power Plant Technology", by M.M. EL-Wakil, McGraw Hill, 1st Edition, 1984. • "Power Plant Engineering" by Frederick T. Morse, 3rd Ed. 1953. • "Power Plant Engineering" by G.R. Nagpal, Khanna Publishers, 1998. • "A Course in Power Plant Engineering" by Arora S.C. and Domkundwar S, Dhanpat Rai, 2001. • "Power Plant Engineering", by P.K. Nag Tata, McGraw Hill, 3rd Edition, 2008. • "Applied Thermodynamics for Engineering Technologists" by T.D. EASTOP, A. McCONKY, 5th Ed., Person Education, 2009.

Course topics (Theory)	**Week**	**Learning Outcome**
Steam properties, tables, charts, Steam cycles, Types of boilers, Feed water heater, economizer.	1	
Boiler heat balance.	2	
Fuel and combustion.	3	
Chimney (Stack).	4	
Water circulation.	5	
Condensers, types, thermal efficiency.	6	
Cooling tower, types, water circulating	7	
Steam turbines, types, velocity diagram, design	8-9	
Gas turbines, types, velocity diagram, design	10-11	
Compound steam-gas power plants	12	

Practical Topics	Week	Learning Outcome
Boilers feed water treatment	1-2	
Steam dryness fraction	3-4	
Boiler energy balance	5-6	
Lagging efficiency	7-8	
Condensers	9-10	

Questions Example Design

Q1/ One kg of Octane (C_8H_{18}) is burned with 150% theoretical air. Assuming complete combustion, determine:

(i) Air-fuel ratio
(ii) Dew point of the products at a total pressure 100 kPa.

Q2/ The velocity of steam exiting the nozzle of the impulse stage of a turbine is 400 m/s. The blades operate close to the maximum blade efficiency. The nozzle angle is 20°. Considering symmetrical blades and neglecting blade friction, calculate for a steam flow of 0.6 kg/s, the required power and blade efficiency.

Extra notes: No extra notes

External Evaluator

I confirm that the contents of this syllabus are sufficient and cover all the requirements of Power Plants subject.

Assist. Prof. Dr. Ahmed M. Adham

11/09/2022