2023
TP-153

Course Specification
(Bachelor)

Course Title:	Power Plants
Course Code:	493B-MEC-3
Program:	Bachelor of Science in Engineering
Department:	Mechanical Engineering
College:	College of Engineering
Institution:	Najran University
Version:	1.0
Last Revision Date:	27 February 2024

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3)					
2. Course type					
A.	☐University	☐College	☒ Department	☐Track	☐Others
B.	☐Required		☒ Elective		
3. Level/year at which this course is offered: (Fifth Year \ Level 9)					
4. Course general Description:					
Energy sources for power generation, Principal types of Power Plants, their special features and applications, Selection of site, Power Plant Economics, Cost Consideration, Load Curve, Load Factor, Capacity, Utilization and Diversity Factors. Steam Power Plants and Steam Generators: Types of Boilers, Steam Separators, Economizers, Super Heater, Air Pre-Heaters, Re-Heaters, Feed Water Heaters, Evaporation, Condensation, Cooling Water Systems, Water Treatment Plants. Hydropower Plants: Classification and Layout, Hydroelectric Survey, Pressure Regulation and Surging, Matching of Characteristics, Selection of Turbines, Plant Accessories, Instrumentation and Control. Nuclear Power Plants: Nuclear Fuel, Generation of Nuclear Energy by Fission, Main Components of Nuclear Power Plants, Moderators, Reflectors and Coolant, Nuclear Reactors, Their Types and Applications, Radiation Shielding, Radioactive Waste Disposal and Control. Non-Conventional Power Generation: Solar Energy, Solar Cells, Their Geometry and Construction, Solar Radiators, Solar Ponds, Solar Power Plants, Fuel Cells					
5. Pre-requirements for this course (if any)**:**					
324-MEC-3 (Internal Combustion Engines)					
6. Co-requisites for this course (if any)**:**					
NIL					
7. Course Main Objective(s):					
1.Develop the knowledge of different types of power plants and their classification. 2.Develop the understanding of Steam power plants and steam generators and different means to control them.					

3.The student shall be made aware of the hydroelectric power plants and its operational requirements.
4.The current technology based brief understanding of working and operation of nuclear fuel-based power plants.
5.Understand the use of other resources of energy such as solar power and fuel cells in generating electricity on a large scale.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	45
2.	**Laboratory/Studio**	
3.	**Field**	
4.	**Tutorial**	15
5.	**Others (specify)**	
Total		60

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Develop the knowledge of different types of power plants and their classification.	1	TS:1-Interactive lectures using PowerPoint slides TS:2- Engaging the students in	-Test performance evaluation -Evaluation of participation in

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
			problem-based learning through tutorials TS: 3 – Associating the topics in each chapter with the CLO. TS:4 – Conducting quizzes by the each chapter TS:5 – Giving more example programs in the lecture TS: 6 – Discussion with the students in the class hours	discussion and group assignments
1.2	Student have the knowledge of hydroelectric, nuclear and nonconventional power plant.	7	TS:1-Interactive lectures using PowerPoint slides TS:2- Engaging the students in problem-based learning through tutorials TS: 3 – Associating the topics in each chapter with the CLO. TS:4 – Giving more assignment by the each chapter TS:5 – Giving more example programs in the lecture TS: 6 – Discussion with the students in the class hours	-Test performance evaluation -Evaluation of participation in discussion and group assignments
2.0	**Skills**			
2.1	Knowledge of operational requirement and maintenance of diffuser type of power plant.	6	TS:1-Interactive lectures using PowerPoint slides TS:2- Engaging the students in problem-based	•Locally Developed Exams such as Quiz, Mid & Final Exams with scoring rubrics

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
			learning through tutorials TS: 3 – Associating the topics in each chapter with the CLO. TS:4 – Conducting quizzes for each chapter TS: 5 – Discussion with the students in the class hours	•Assignments involving critical and logical thinking questions •Quizzes
2.2	Understand the use of other resources of energy for power generation.	2	TS:1-Interactive lectures using PowerPoint slides TS:2- Engaging the students in problem-based learning through tutorials TS: 3 – Associating the topics in each chapter with the CLO. TS:4 – Conducting quizzes for each chapter TS: 5 – Discussion with the students in the class hours	•Locally Developed Exams such as Quiz, Mid & Final Exams with scoring rubrics •Assignments involving critical and logical thinking questions •Quizzes
3.0	**Values, autonomy, and responsibility**			
3.1	Knowledge of steam power plant, steam generators and different means to control them.	4	TS:1-Interactive lectures using PowerPoint slides TS:2- Engaging the students in problem-based learning through tutorials TS: 3 – Associating the topics in each chapter with the CLO. TS:4 – Conducting midterm and Final	Locally Developed Exams such as Quiz, Mid & Final Exams with scoring rubrics •Assignments involving critical and logical thinking questions •Quizzes

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
			Exam for each chapter TS:5 – Giving more example programs in the lecture TS: 6 – Discussion with the students in the class hours	
3.2	Knowledge to optimize the resources for power generation.	1	TS:1-Interactive lectures using PowerPoint slides TS:2- Engaging the students in problem-based learning through tutorials TS: 3 – Associating the topics in each chapter with the CLO. TS:4 – Conducting midterm and Final Exam for each chapter TS:5 – Giving more example programs in the lecture TS: 6 – Discussion with the students in the class hours	Locally Developed Exams such as Quiz, Mid & Final Exams with scoring rubrics •Assignments involving critical and logical thinking questions •Quizzes

C. Course Content

No	List of Topics	Contact Hours
1.	Energy sources for power generation, Principal types of Power Plants, their special features and applications, Selection of site, Power Plant Economics, Cost Consideration, Load Curve, Load Factor, Capacity, Utilization and Diversity Factors.	10
2.	Steam Power Plants and Steam Generators: Types of Boilers, Steam Separators, Economizers, Super Heater, Air Pre-Heaters, Re-Heaters, Feed Water Heaters, Evaporation, Condensation, Cooling Water Systems, Water Treatment Plants.	15
3.	Hydropower Plants: Classification and Layout, Hydroelectric Survey, Pressure Regulation and Surging, Matching of Characteristics, Selection of Turbines, Plant Accessories, Instrumentation and Control.	15

4.	Nuclear Power Plants: Nuclear Fuel, Generation of Nuclear Energy by Fission, Main Components of Nuclear Power Plants, Moderators, Reflectors and Coolant, Nuclear Reactors, Their Types and Applications, Radiation Shielding, Radioactive Waste Disposal and Control.	10
5.	Non-Conventional Power Generation: Solar Energy, Solar Cells, Their Geometry and Construction, Solar Radiators, Solar Ponds, Solar Power Plants, Fuel Cells.	10
Total		**60**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Assignments	1-12	10%
2.	Quizzes	1-12	10%
3.	Mid-term	6 & 12	30%
4.	labs	-	-
5.	Final exam	15	50%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	A Course in Power Plant Engineering by S. C. Arora & S. Domkundwar, Dhanpat Rai & Sons Publications
Supportive References	1.Modern Power Plant Engineering by Joel Weismann & Roy Eckart, Prentice Hall of India Pvt. Ltd. 2.Power Plant Technology by M. M. El Wakil, McGraw Hill Publications 3.Power Plant Engineering by Fredrick T. Morse, East West Press
Electronic Materials	Online custom books
Other Learning Materials	NA

2. Required Facilities and equipment

Items	Resources
Facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms and laboratories
Technology equipment (projector, smart board, software)	--
Other equipment (depending on the nature of the specialty)	--

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Program Leaders and Peer Reviewer	Direct, Indirect
Effectiveness of Students assessment	Students & Faculty	Direct and Indirect
Quality of learning resources	Students & Faculty	Direct and Indirect
The extent to which CLOs have been achieved	Students & Faculty	Direct and Indirect
Other		

Assessors (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	DEPARTMENT OF MECHANICAL ENGINEERING
REFERENCE NO.	
DATE	28/02/2024