

International Islamic University Islamabad
Faculty of Engineering and Technology
Department of Electrical Engineering
Spring 2021

Course Information:

Course Title : Power Generation Course Code : EE472 Crédit Hours : 3 Contact Hours : 48	Lab (Yes)
Prerequisites For this Course: Power Distribution and Utilization	
Instructor: Dr. Muhammad Amir	
e-mail : m.amir@iiu.edu.pk	Office: Block II,
Phone:03339277367	Office Hours / Online Availability: 02:00PM to 3:00 PM (Tuesday and Monday) Zoom / Skype / Whatsapp
Text Book: Power Plant Engineering by Dr. P. C. Sharma	
Reference Book(s): Power Plant Engineering by P. K. Nag Elements of Electrical Power Station Design by M.V. Dashpande Power Plant Technology by M. M. El Wakil Principles of Energy Conversion by Arche W. Culp	

Course Description:

This is a basic introductory course in Power System covers the conventional and non-conventional ways of Power Generation. It covers:

- Hydro power plant
- Thermal Power Plant
 - Coal Thermal Power Plant
 - Nuclear Power Plant
 - Gas Turbines
 - Diesel Electric Plant
- MHD Generators
- Introduction to Renewable Energy Generation

Course Objectives:

S.No.	CLO	Domain	Taxonomy Level	PLO
1	To understand basic operation of different types of power plants	cognitive	C1	1
2	Selection of power plants based on the site, cost and performance	cognitive	C3	3

Relevant Program Learning Outcomes (PLOs):

The course is designed so that students will achieve the following PLOs:

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|---|---|
| ☒ 1 Engineering Knowledge | ☐ 2 Problem Analysis |
| ☐ 3 Design/Development of Solutions | ☐ 4 Investigation |
| ☐ 5 Modern Tool Usage | ☐ 6 The Engineer and Society |
| ☐ 7 Environment and Sustainability | ☐ 8 Ethics |
| ☐ 9 Individual and Teamwork | ☐ 10 Communication |
| ☐ 11 Project Management | ☐ 12 Lifelong Learning |

Course Topics:

Power Stations:

- Introduction
- Types of power Station
- Choice of type of Generator
- Cost of Electrical Energy

Hydro Electric Stations

- Introduction
- Types of Hydro Electric Power Stations
- Principle of working of a Hydro Electric Plant
- Power Station Structure and Layout
- Types of Turbine and their characteristics
- Arrangements and location of Hydro Electric Stations
- Types of Hydro Electric Plants and Dam
- Characteristics of Generators
- Costs of Hydro Electric Stations

Coal Thermal Power plant (Steam Power Plants)

- Introduction
- Main Parts and working of a steam Station
- Plant Layout
- Rankin Cycle and its types
- Types of Boiler and their characteristics
- characteristics of steam turbines
- Design of a steam Power Station
- Steam station auxiliaries
- Cost of Steam Station

Gas Turbines

- Introduction, Main Parts of Gas turbine plant
- Plant Layout, Principle of Operation
- Characteristics of Gas Turbine plants
- Gas Turbine Power Plant operation and Control
- Combined Cycles Cost of Gas Turbine Stations

Nuclear Power Stations

- Introduction
- Nuclear Reaction

- Main Parts of Nuclear Power Stations
- Plant Layouts
- Principle of Nuclear Energy
- Nuclear reactor and reactor control
- Types of Power Reactor
- Comparison of various types of reactor
- Economics of Nuclear Power Stations.

MHD Generators:

- Gaseous conductors
- analysis and design of MHD generator
- Problems associated with MHD generation
- possible configuration.

Introduction to renewable energy generation

Renewable energy resources

Course Assessment Criteria

The course will follow the assessment criteria according to HEC/PEC rules, it will have 50/50 division (50% marks will be assigned for Mid Term and 50% marks will be assigned for Final Term Paper).

Mid Term 50% marks are assigned according to the following distribution:

Assignments:	20%
Quizzes:	30%
<u>Mid Term Exam</u>	<u>50%</u>
Total Mid Term	100%

Grading Policy: Students taking the course will be graded, which is based on midterm and final examinations.

NOTES

1. 75% attendance (in physical or online classes) is mandatory for all the students in this course. If any student has less than 75% attendance he/she will not be permitted to sit in the final exam and will be given **“F “grade** in this course.
2. Tutorials will be conducted when ever felt necessary.
3. Homework /assignments will be assigned following some regular pattern.
4. Late homework submission will not be accepted!
5. Since missed homework has a grade of **ZERO** (it is better to submit incomplete homework than no homework at all)
6. Quizzes will be conducted unannounced.

Course Plan:

S.No.	Chapter	No. of lectures	Chapter
Week 1	Introduction to Power plant Engineering	2	Chapter 1
	Hydro Electric Power plants		
Week 2	Runoff, hydrograph, flow duration curve, mass curve, selection of site, calculation of water power plants	2	16.1- 16.6

Week 3	Classification of hydro power plants, types of hydraulic turbines, impulse, reaction propeller	2	16.7-16.19
Week 4	Velocity triangle, pelton , reaction, draft tube, operation characteristics	2	16.10-16.12
Week 5	Surge tank, governing of hydro power plants, selection of turbine, plant layout, combined power plants, underground, automatic and remote control	2	16.13-16.20
	Internal combustion power plants		14
Week 6	Types of IC engine, Four stroke, two stroke engines, Diesel engine and petrol engine, spark ignition, power cycle	2	14.1-10-14.1-10
Week 7	IC engines for power plants, Auxiliary equipment, Air, intake, exhaust, fuel and cooling, lubrication etc	2	14.1-11-14.3-5
Week 8	Super heating, comparison of diesel with steam, waste heat, operation and performance, governing system		14.3-614.9
Mid term			
	Coal Thermal Power Station / steam power plant		Chapter 2
Week 10	Introduction, Main Parts, working of a steam Station and classification of steam power plants, Topping and bottoming Cycles, operation and steam pressure & temperature of steam power plant, Essential Components of thermal coal power plants	2	2.1, 2.1, 2.2, 2.3, 2.3, 2.4
Week 11	Boiler		Chapter 3
	Working of Boiler, classification of boilers and characteristics of boiler,	2	3.1-3.5, 3.8, 3.10, 3.11,
Week 12	Components of Boiler (Steam Generator)		
Week 13	Superheaters and reheaters, Air-preheater, feed water heaters, Economizer, Treatment of feed water, Water hardness and PH values, methods of water treatments,	1	11.2, 11.3, 11.4, 11.5, 3.12
	Steam Nozzles Introduction, Flow of steam through nozzle, mass flow rate of steam through the nozzle, critical pressure ratio, area change I flow through nozzle	1	4.1
	Steam Turbines Introduction, types of turbine, advantages of steam turbines over steam engine, working of steam impulse turbine, working steam reaction turbine, losses in steam turbine, governing of turbines,	1	4.2, 4.4, 5.1-5.5

	description of a 210MW steam turbine, construction of a steam turbine. Steam turbine performance and efficiencies		
Week 14	Heat Cycles Introduction, Rankine cycle, reheat cycle, regenerative cycle,	1	6.1-6.7
	Condensers and cooling tower Function of condenser, types of condensers, condenser efficiency, General introduction of cooling tower, cooling ponds, types of cooling towers, dry cooling towers		7.1, 7.2, 7.8, 8.1, 8.2, 8.3, 8.4
Week 15	Nuclear Power Plant and Internal combustion engine	1	
	General introduction, Nuclear physics, Nuclear reactor, Classification of nuclear reactor, Site selection, Safety Introduction, Basic parts of internal combustion engine, types of internal combustion engine, four stroke diesel engine, two stroke engine, advantages and disadvantages, difference between diesel and petrol engine, internal combustion engine for power plant, Auxiliary equipment	1	13.1, 13.2, 13.3, 13.4, 13.6, 13.7 14.1, 14.2, 14.3
Week 16	Gas Turbines and MHD Generators		
	Introduction of gas turbines, gas turbine cycle, gas turbines fuel, starting of a gas turbine plant, comparison with steam power plant, comparison with diesel engine power plant Gaseous conductors, analysis and design of MHD generator,	1	15.1, 15.2, 15.3, 15.4, 15.5, 15.6
	Introduction to renewable energy generation		
	Renewable energy resources		