International Islamic University Chittagong

Department of Electrical and Electronic Engineering

B. Sc. Engineering in EEE

Semester End Exam, **Spring 2025**

Course Code: **EEE 4707** Course Title: **Power Plant Engineering**

Time: 2 hours 30 minutes Full Marks: 50

(i) The figures in the right-hand margin indicate full marks

(ii) Course Outcomes and Bloom's Levels are mentioned in additional Columns

Course Outcomes (COs) of the Questions	
CO1	Students will be able to understand the operating principles and economics of different power plants.
CO2	They will learn different possible engineering solutions for power plant in societal and environmental contexts
CO3	They will be able to apply mathematical foundations to solve various power plants and power plant economics related issues.

Bloom's Levels of the Questions						
Letter Symbols	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**
Meaning	Remember	Understand	Apply	Analyze	Evaluate	Create

Part A

[*Answer the questions from the followings*]

1.	a)	i) Draw a labeled schematic of a hydroelectric power plant (HEPP) and critically analyze the function of the penstock in HEPP. ii) Point out technical difficulties those typically encountered in their daily functioning of HEPP?	CO1	**C4**	**05**
1.	b)	A hydro-electric power station has a reservoir of area 2·4 square km and capacity 5×10^6 m^3. The effective head of water is 100m. The penstock, turbine and generation efficiencies are respectively 95%, 90% and 85%. (i) Find the total electrical energy that can be generated from the power station. (ii) If a load of 15,000 kW has been supplied for 3 hours, determine the fall in reservoir level.	**CO3**	**C5**	**05**
2.	a)	Mention the function of 'moderator' in Nuclear Power Plant (NPP)? Explain in brief how water is used as coolant in pressurized water reactor (PWR) and how energy comes from this NPP.	**CO1**	**C4**	**05**
2.	b)	Analyze the environmental and economic advantages of nuclear power plants in comparison to other types of power plants.	**CO2**	**C4**	**05**
		Or,			
2.	a)	Critically analyze the process of nuclear fission and the conditions required for a sustained chain reaction. Elaborate on how these phenomena are harnessed in the core operational framework of a nuclear power plant.	**CO1**	**C4**	**05**
2.	b)	Why waste disposal is important for nuclear power plant? How the liquid and solid waste of NPP is disposed?	**CO2**	**C4**	**05**

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Part B

[Answer the questions from the followings]

3.	a)	Provide a brief overview of a liquid metal MHD generator. Explain the working principle of an MHD generator.	**CO1**	**C6**	**05**
3.	b)	Compare and contrast open-cycle and closed-cycle MHD generators.	**CO1**	**C4**	**05**
4.	a)	A generating station has a maximum demand of 25MW, a load factor of 60%, a plant capacity factor of 50% and a plant use factor of 72%. Find (i) the reserve capacity of the plant (ii) the daily energy produced and (iii) maximum energy that could be produced daily if the plant while running as per schedule, were fully loaded.	**CO3**	**C3**	**05**
4.	b)	(i) Point out the advantages of interconnected grid system? (ii) Analyze the effects of variable loads on power station.	**CO1**	**C4**	**05**
5.	a)	Suppose a total load of 4MW is to be supplied by two units A and B. Derive the condition for the best economic load sharing between the units.	**CO3**	**C5**	**05**
5.	b)	A generating plant has a maximum capacity of 100 kW and costs Tk. 1,60,000. The annual fixed charges are 12% consisting of 5% interest, 5% depreciation and 2% taxes. Determine the fixed charges per kWh if the load factor is (i) 100% and (ii) 50%.	**CO3**	**C5**	**05**

Or,

5.	a)	A generating station has the following data: • Installed capacity = 480 MW • Annual generation = 1.7×10^9 kWh • Load factor = 65% • Capital cost = 3×10^9 Taka • Annual fixed charges (including depreciation and interest) = 10% of capital cost • Fuel cost per kWh = 2.5 Taka Using the given data, determine the overall performance and economic viability of the power station.	**CO3**	**C5**	**05**
5.	b)	A consumer has the following data: Maximum demand = 140 kW Power factor = 0.95 lagging Load factor = 75% The tariff is BDT 120 per kVA of maximum demand plus 60 paise per kWh consumed. Determine: (i) The total annual energy consumption of the consumer. (ii) The total annual bill of the consumer.	**CO3**	**C5**	**05**