BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: B. TECH **SEMESTER : V**
BRANCH: MECHANICAL **SESSION : MO/2022**

SUBJECT: ME393 ELEMENTS OF HYDEL AND THERMAL POWER PLANTS
TIME: 3:00 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

				CO	BL
Q1	(a)	State 2 uses of setting up a hydel plant, apart from power generation. Enlist 2 advantages and 2 disadvantages of a hydel power plant in contrast to a thermal power plant.	[3]	1	1
Q1	(b)	Explain the science of hydrology and how it is used to assess the suitability of a site for setting up of a hydel project, briefly mentioning some important plotting tools used in the process.	[2]	1	2
Q1	(c)	Briefly discuss the function and importance of setting up of a pump storage hydel power plant.	[2]	1	2
Q1	(d)	What is the role of governor in a hydel power plant? Briefly discuss the governing mechanism of impulse turbines along with a suitable sketch.	[3]	1	1
Q2	(a)	Define specific speed of a turbine, clearly stating the mathematical form. What is the importance of this parameter in turbine design?	[2]	2	1
Q2	(b)	A turbine develops 10 MW under a head of 2 m at 135 RPM. What is the specific speed of the turbine? What will be its normal speed (in RPM) and output (in kW) under a head of 20 m?	[3]	2	3
Q2	(c)	A Pelton wheel has to be designed for the following specifications. Power to be developed = 6000 kW, net head available = 300 m, speed = 550 RPM, ratio of jet diameter to wheel diameter = 0.1. It is given that the hydraulic efficiency of the turbine = 0.85. Assuming the velocity coefficient, C_v = 0.98 and the speed ratio, C_φ = 0.46, find (a) required flow rate of water, (b) diameter of the turbine wheel, (c) no of jets required and diameter of each jet.	[5]	2	5
Q3	(a)	Outline the characteristics of any one type of conventional boiler OR a high-pressure boiler, along with a sketch showing essential features.	[2]	3	1
Q3	(b)	What are boiler mountings? Name any three boiler mountings, along with a brief description of their functionality.	[3]	3	2
Q3	(c)	What are boiler accessories? Mention any two boiler accessories, and briefly state their functionality in a modern power plant boiler.	[2]	3	2
Q3	(d)	What are the major difficulties associated with impurities in the feed water in a thermal power plant? Mention any two methods of feedwater treatment.	[3]	3	1
Q4	(a)	Mention any one equipment used each for handling of coal in the steam power plant site and for transportation from the site to the furnace. Also state two differences between overfeed and underfeed stokers.	[2]	4	1
Q4	(b)	Mention two advantages of using pulverised coal in steam power plants. State two differences between the Unit system and the Central (Bin) System of pulverised coal firing. Draw the schematic of the Cyclone and Tangential Firing Burners for pulverised coal, clearly labelling the primary and secondary air inlets, and showing the kind of flow that the air-fuel mixture takes inside the furnace.	[3]	4	2
Q4	(c)	What are some of the difficulties associated with handling of coal ash and dust? Mention any two uses of coal ash.	[2]	4	1
Q4	(d)	Describe any two units each for ash and dust disposal, along with their schematic sketch.	[3]	4	2

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Q5	(a)	State the objectives of using steam condensers in a thermal power plant. How are the condensers broadly classified?	[2]	5	1
Q5	(b)	What are cooling towers used for in a thermal power plant? Define approach and range for wet cooling towers. Briefly discuss the heat transfer mechanism for any two types of dry cooling towers, along with their temperature-path length diagrams.	[3]	5	2
Q5	(b)	A boiler uses 2000 kg/hr of coal. The temperature of air supplied is 300 K, and the average temperature of the flue gas leaving the chimney is 650 K. The 33 m high steel chimney produces a draught of 20 mm of water column. Determine (a) the quantity of air supplied per kg of coal, and (b) the draught in terms of column of hot gases.	[5]	5	5

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