Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–VII (NEW) EXAMINATION – WINTER 2024

Subject Code:3171910 Date:04-12-2024

Subject Name: Power Plant Engineering

Time:10:30 AM TO 01:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**
5. **Use of steam tables/Mollier chart is permitted.**

			MARKS
Q.1	**(a)**	What are main circuits in modern thermal power plant? What criteria is considered for site selection of thermal power plant?	**03**
	(b)	Compare the advantages and drawbacks of Gas Turbine power plant with Steam Turbine power plant.	**04**
	(c)	Describe construction of Nuclear reactor. Give the functions and materials used for following components of nuclear reactor: (i) fuel (ii) moderator (iii) reflector.	**07**
Q.2	**(a)**	Explain the principle of fluidized bed combustion with neat sketch.	**03**
	(b)	State the concept of Supercritical Boiler. Describe construction and working of La-Mont boiler.	**04**
	(c)	Give classification of nozzles with application. Derive equation of critical pressure ratio of nozzle and explain its significance in designing nozzle.	**07**
		OR	
	(c)	Superheated steam (n=1.36) is expanded in a set of nozzles from 10 bar and 200 ^{0}C to 5 bar. Find whether the nozzle is convergent or convergent-divergent? Assuming the isentropic expansion of steam, calculate the minimum area of nozzles to flow steam at the rate of 3 kg per second. Neglect the initial velocity and take coefficient of discharge Cd = 0.97.	**07**
Q.3	**(a)**	Define the following terms related to gas turbine. (i) work ratio, (ii) Air rate, (iii) specific fuel consumption	**03**
	(b)	With P-V, T-S and schematic diagram compare open cycle gas turbine plant with closed cycle gas turbine plant.	**04**
	(c)	Explain the effect of following operating variables on the thermal efficiency of gas turbine. (i) Compressor inlet temperature, (ii) Turbine inlet temperature, (iii) Pressure ratio, (iv) Compressor and turbine efficiency.	**07**
		OR	
Q.3	**(a)**	State various applications of gas turbines. State the merits and demerits of gas turbine over steam turbine.	**03**
	(b)	Derive an expression for air standard efficiency of ideal Brayton cycle in terms of pressure ratio. State the assumptions made.	**04**
	(c)	A simple impulse turbine has a mean blade ring diameter of 55 cm and rotates at a speed of 10,000 rpm. The nozzle angle is 20^0 and the steam leaves the nozzle with a velocity of 1000 m/sec. The blades are equiangular and the blade friction factor is 0.85. Determine (i) Inlet angle of the blade (ii) Torque on the turbine rotor for steam flow of 1350 kg/hr (iii) Diagram efficiency.	**07**
Q.4	**(a)**	Explain with neat sketch Natural Draft cooling tower.	**03**
	(b)	Explain working of an electrostatic precipitator for ash handling.	**04**

	(c)	Find the mass flow rate of flue gases through the chimney when the draught produced is equal to 19 mm of water column. The temperature of gases is 300°C and the ambient temperature is 28°C. The mass of air used is 18 kg per kg of fuel burnt. Diameter of chimney is 2.2 m.	**07**

OR

Q.4	**(a)**	Compare Mechanical Draught and Natural Draught.	**03**
	(b)	State importance of vacuum in condenser? Explain any one method to achieve vacuum in condenser.	**04**
	(c)	Why feed water treatment is necessary. List various feed water treatment processes used in power plants. Explain any one in detail with neat sketch.	**07**
Q.5	**(a)**	Explain power production from solar photo-voltaic cells.	**03**
	(b)	Explain principle and working of fuel cells.	**04**
	(c)	Explain importance of waste disposal in nuclear power plant. Describe methods of waste disposal.	**07**

OR

Q.5	**(a)**	Compare horizontal axis wind turbine with vertical axis wind turbine.	**03**
	(b)	Define: (i) connected load, (ii) demand factor (iii) diversity factor (iv) plant capacity factor	**04**
	(c)	Explain PWR Nuclear power plant.	**07**

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