GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–VII (NEW) EXAMINATION – WINTER 2022

Subject Code:3171910   **Date:03-01-2023**
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)**	Differentiate impulse and reaction steam turbines. Show the pressure and velocity distribution.	**03**
	(b)	Enlist the various methods used to improve the thermal efficiency and output of a gas turbine? Explain any one with schematic and T-s/h-s diagram shortly.	**04**
	(c)	What do you mean by pulverized coal firing system? List the various types of pulverized coal system. List the advantages and disadvantages of pulverized coal firing system.	**07**
Q.2	**(a)**	Define (i) approach, (ii) range, and (iii) cooling efficiency of a cooling tower.	**03**
	(b)	Differentiate between fusion and fission processes.	**04**
	(c)	In a gas turbine plant, the air at 10°C and 1 bar is compressed to 12 bar with compression efficiency of 80%. The air is heated in the regenerator and the combustion chamber till its temperature is raised to 1400°C, and during the process the pressure falls by 0.2 bar. The air then expanded in the turbine and passes to regenerator which has 75% effectiveness, and causes a pressure drop of 0.2 bar. If the isentropic efficiency of the turbine is 85%. Determine the thermal efficiency of the plant. Specific heat for air and gases = 1.005 kJ/kg K	**07**

OR

	(c)	Steam issues from the nozzles of a de Laval turbine with a velocity of 1200 m/s. The nozzle angle is 20°, the mean blade velocity is 400 m/s., and the inlet and outlet angle of blade are equal. The mass of steam flowing through turbine per hour is 900 kg. Calculate :(a) The blade angles, (b) The relative velocity of steam entering the blades, (c) The tangential force on the blades, (d) The power developed, (e) The blade efficiency. Assume that blade velocity coefficient = 0.8.	**07**
Q.3	**(a)**	Differentiate between forced and induced draft.	**03**
	(b)	What is a supercritical boiler? What are its merits and demerits?	**04**
	(c)	Steam at 30 bar, 350 °C expands through a convergent diver gent nozzle. The exit planepressure is 3 bar. The flow rate is 0.5 kg/s and the nozzle efficiency is 0.8. Assumingthat the velocity at inlet is negligible, determine the throat and exit areas, steam velocityat the exit, and the quality of steam at the exit plane. The critical pressure ratio can betaken as 0.546.	**07**

OR

Q.3 **(a)** What is simple payback period? How it helpful to investor? **03**

(b) What do you understand by breeding? What factors control breeding? **04**

(c) The rated capacity of a power plant is 400 MW. The peak load on the plant is 350 MW. The various consumer groups having maximum demands of 120 MW, 100 MW, 80 MW and 90 MW are connected to the power plant. The annual load factor is 0.8. Calculate (i) the average load (ii) the capacity factor (iii) the energy supplied per year (iv) the reserve factor (v) the demand factor (vi) the diversity factor **07**

Q.4 **(a)** Explain the pollution due to nuclear power plant. **03**

(b) Name the various methods of ash handling. Describe the pneumatic system of ash handling. **04**

(c) With the help of a sketch discuss the construction and working of Boiling Water Reactor (BWR). **07**

OR

Q.4 **(a)** Discuss the advantages of combined cycle power generation. Why is it so important in the present day energy scenario? **03**

(b) What are the principle reasons for operating steam turbines with condenser? Define vaccum efficiency. **04**

(c) What are the basic objectives of feed water treatment? What are the impurities in raw water? Explain reverse osmosisprocess. **07**

Q.5 **(a)** List the essential elements of a hydroelectric power plant. **03**

(b) Explain the effect of load factor on the cost of electricity generated. **04**

(c) List components of wind mill power system, show them with neat sketch. Compare horizontal axis wind turbine with vertical axis wind turbine. **07**

OR

Q.5 **(a)** What is geothermal energy? Give its main application. **03**

(b) Explain how tidal energy is converted to electrical energy. What do you mean by schedule and range of a tidal wave? **04**

(c) What is photovoltaic energy conversion? Explain the operation of a solar cell. What isfill factor? **07**

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