Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME SEMESTER – I EXAMINATION – SUMMER 2017

Subject Code:2712107 Date:11/05/2017

Subject Name: Thermal and Nuclear Power Plants

Time:2:30 pm to 5:00 pm Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Draw general lay of modern steam power plant label major component and state function of each component.	**07**
	(b)	Draw Rankine cycle with T-S diagram. Derive Rankine cycle efficiency with pump work.	**07**
Q.2	**(a)**	Explain methods of maintaining vacuum in condenser. Also give effects of air leakage in condenser.	**07**
	(b)	Explain three stage regeneration of steam with line & T-S diagram.	**07**
		OR	
	(b)	Explain in detail India's three stage nuclear power program.	**07**
Q.3	**(a)**	Explain thermodynamic analysis of combine cycle with supplementary fuel firing using schematic & T-S diagram.	**07**
	(b)	A gas turbine unit has pressure ratio of 6 and maximum cycle temperature is 900^0C. The isentropic efficiencies of the compressor and turbine are 85% and 90% respectively. Air enters the compressor at 15^0C at the rate of 5 kg/s Calorific value of fuel used is 43000 kJ/kg, combustion efficiency is 95% Using Cp_{air} = 1 kJ/kgK Cp_{gas} =1.07 kJ/kgK , and γ= 1.4 for air and gases, find (i) Thermal efficiency (ii) power output (iii) air fuel ratio and (iv) specific fuel consumption.	**07**
		OR	
Q.3	**(a)**	In combine cycle power plant compressor takes 1500 tones air per hour at 26^0C and 1 bar pressure. The maximum temperature of gas turbine is limited to 850^0C. The pressure ratio is 8. The exhaust gases coming from gas turbine is heated further to 700^0C before entering into heat recovery steam generator. The steam is generated at 50 bar and 500^0C. The exhaust gas temperature is limited to 200^0C to avoid the condensation of corrosive gases. Pressure of condenser is 0.7 bar. Compression in compressor and expansion in both turbine are isentropic. Calculate (i) Power generated in each unit of the cycle (ii) Specific fuel consumption Take Cp=1 kJ/kgK , γ= 1.4 for both air and gas, CV fuel used = 41 MJ/kg	**07**
	(b)	Derive an expression for air standard efficiency of ideal Brayton cycle in terms of pressure ratio. State the assumptions made.	**07**
Q.4	**(a)**	Explain methods of finding vacuum efficiency, condenser efficiency mass flow rate of cooling water and air pump capacity in steam condenser.	**07**
	(b)	Enlist different methods of enriching uranium. Explain any one method in detail.	**07**

OR

Q.4 **(a)** Explain binary Hg-steam Vapour cycle with T-S diagram. Also find expression for its efficiency. **07**

(b) Derive an expression for optimum pressure ratio for maximum specific output in actual cycle gas turbine. **07**

Q.5 **(a)** Discuss the performance and operating characteristic of a power plant. **07**

(b) Define the following : **07**

(i) Connected load (ii) Maximum demand (iii)Average demand (iv) Load factor (v) Diversity factor (vi) utilization factor (vii) Plant capacity factor

OR

Q.5 **(a)** An industrial power station has a maximum demand of 70 MW and installed capacity is a single generator of 50 MW. Excess energy if required is brought from the state grid. The load curve of the plant is defined as follows: **07**

Time(Hrs)	0-6	6- 8	8- 12	12- 14	14- 18	18-22	22-24
Load (MW)	30	46	60	46	66	70	36

Determine

(i) Load factor of power station (ii) Load factor of generator station

(iii) Energy purchased from grid/ day (iv) Plant use factor

(b) Explain working of CANDU reactor with neat sketch. **07**

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