

Seat No.: \_\_\_\_\_

Enrolment No. \_\_\_\_\_

## GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-VII(NEW) EXAMINATION – SUMMER 2019

Subject Code:2171910

Date:21/05/2019

Subject Name:Power Plant Engineering

Time:02:30 PM TO 05:00 PM

Total Marks: 70

Instructions:

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

|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | MARKS |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| Q.1 | (a) Draw general layout of modern thermal power plant and labelled its components.                                                                                                                                                                                                                                                                                                                                                                                                                                     | 03    |
|     | (b) List the different methods used to control the superheat temperature of steam and explain any one method in details.                                                                                                                                                                                                                                                                                                                                                                                               | 04    |
|     | (c) What is compounding? Explain working principle of pressure compounding with neat sketch.                                                                                                                                                                                                                                                                                                                                                                                                                           | 07    |
| Q.2 | (a) State the advantages and disadvantages of pressurized fluidized bed combustion boiler.                                                                                                                                                                                                                                                                                                                                                                                                                             | 03    |
|     | (b) List down the requirements of good ash handling system.                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 04    |
|     | (c) Explain with neat sketch construction and working Benson boiler and state its advantages.                                                                                                                                                                                                                                                                                                                                                                                                                          | 07    |
|     | OR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |       |
|     | (c) Air enters to compressor of gas turbine plant operating on Brayton cycle at 100 kPa and 300 K with a volumetric flow rate of $5 \text{ m}^3 / \text{sec}$ . the compression pressure ratio is 10. The turbine inlet temperature is 1300 K. The turbine and compressor has an isentropic efficiency of 0.82 and 0.8 respectively. Calculate<br>1) Thermal efficiency of the cycle<br>2) Back work ratio<br>3) Net power developed in kW<br>Assume $C_p = 1.005 \text{ kJ/kg}$ and $\gamma = 1.4$ for air and gases. | 07    |
| Q.3 | (a) State the advantage of mechanical draught over natural draught.                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 03    |
|     | (b) State the requirements of pulverized coal burners.                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 04    |
|     | (c) Explain the working of electrostatic precipitator with neat sketch.                                                                                                                                                                                                                                                                                                                                                                                                                                                | 07    |
|     | OR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |       |
| Q.3 | (a) What is the necessity of cooling tower in a steam power plant?                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 03    |
|     | (b) Differentiate between ramjet engine and pulsejet engine.                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 04    |
|     | (c) A mean blade ring diameter of a single stage impulse turbine is 1.3 meter. It runs at 3200 R.P.M. The nozzle angle is $15^\circ$ and blade speed ratio is 0.45. The blade friction factor is 0.9 and the discharge is axial. calculate blade inlet and outlet angles and power output per kg of steam.                                                                                                                                                                                                             | 07    |
| Q.4 | (a) Explain the role of boiler feed water pH in corrosion of boiler tubes.                                                                                                                                                                                                                                                                                                                                                                                                                                             | 03    |
|     | (b) Differentiate between throttle governing and nozzle control governing.                                                                                                                                                                                                                                                                                                                                                                                                                                             | 04    |
|     | (c) Derive expression for mass flow rate of steam through nozzle.                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 07    |

OR

- Q.4**    **(a)**    Define following term: 1) Vacuum efficiency 2) Condenser efficiency **03**
- (b)**    Draw the P-V and T-S diagram of ideal Brayton cycle. **04**
- (c)**    Write short note on sodium zeolite ion exchange process. **07**
- Q.5**    **(a)**    Write down the function of following components of nuclear reactor :1) Moderator 2) Control rod **03**
- (b)**    Give detailed classification of steam turbines. **04**
- (c)**    Write short note on fast breeder reactor. **07**
- OR**
- Q.5**    **(a)**    Define following terms as applied to jet propulsion: **03**  
                  1) Thrust 2) Propulsive power
- (b)**    Define following terms: 1) Connected Load 2) diversity Factor **04**
- (c)**    Calculate the cost of generation per kWhr for a power station having **07**  
                  following data:
- |                                            |                  |
|--------------------------------------------|------------------|
| Installed capacity of plant                | = 200 MW         |
| Capital cost                               | = Rs. 400 crores |
| Rate of interest and depreciation          | = 12 %           |
| Annual cost of fuel, salaries and taxation | = Rs. 5 crores   |
| Load factor                                | = 50%            |

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