Code No.: ME505PC | R20 | H.T.No. | | | 8 | R | | | | | |

**CMR ENGINEERING COLLEGE: : HYDERABAD**
**UGC AUTONOMOUS**
**III–B.TECH–I–Semester End Examinations (Regular) - January- 2024**
**THERMAL ENGINEERING-II**
**(MECH)**

**[Time: 3 Hours]** **[Max. Marks: 70]**

**Note:** This question paper contains two parts A and B.
Part A is compulsory which carries 20 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks.

**PART-A** **(20 Marks)**

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| 1. | a) | State the advantages of Regenerative cycle over simple Rankine cycle. | [2M] |
| | b) | Explain significance of boiler mountings and accessories. | [2M] |
| | c) | Define nozzle efficiency. | [2M] |
| | d) | What is supersaturated flow in steam nozzles. | [2M] |
| | e) | Classify different steam turbines. | [2M] |
| | f) | Distinguish between impulse and reaction turbines. | [2M] |
| | g) | List out the merits of condensers in steam power plant. | [2M] |
| | h) | How regeneration process improves the gas turbine cycle efficiency? | [2M] |
| | i) | Classify jet propulsive engines. | [2M] |
| | j) | Distinguish between jet propulsion and rocket propulsion systems. | [2M] |

**PART-B** **(50 Marks)**

2. In a Rankine cycle, the steam at inlet to turbine is saturated at a pressure of 35 bar and exhaust pressure is 0.2 bar. Determine (i) Network output (ii) Rankine efficiency (iii) Dryness at the end of expansion, assume flow rate is 9.5 kg/s. [10M]

**OR**

3. Explain the construction and working of a "Babcock and Wilcox" boiler. [10M]

4. A steam nozzle is supplied steam at 6 bar and 250°C and it discharges steam at 1 bar. If the divergent portion of the nozzle is 64 mm long and the throat diameter is 5.6 mm, determine the cone angle of the divergent portion. Assume 12% of the total available enthalpy drop lost in friction in the divergent portion. Also determine the velocity and temperature of steam at throat. [10M]

**OR**

5. Derive an expression for maximum discharge through convergent divergent nozzle for steam. [10M]

6. A steam turbine develops 180 kW, with a consumption of 16 kg/kWh. The pressure and the temperature of the steam entering the nozzle are 11 bar and 200°C. The steam leaves the nozzle at 1 bar. The diameter of the nozzle at the throat is 6.5 mm. Find the number of nozzles. If 7% of the total enthalpy drop is lost in friction in diverging part of the nozzle and exit velocity of the leaving steam. [10M]

**OR**

7. The following data related to a stage of reaction turbine: mean rotor diameter 1.5 m, speed ratio 0.72, blade outlet angle $20^0$ and rotor speed 3000 rpm. Determine: (i) the diagram efficiency, (ii) the percentage increase in diagram efficiency and rotor speed if the rotor is designed to run at best theoretical speed, the exit angle being $20^0$ . [10M]

8. Explain the following type of condensers: (i) Regenerative condenser (ii) Evaporative condensers Write their merits, demerits and applications. [10M]

**OR**

9. In a constant pressure open cycle gas turbine, air enters at 1.01325 bar and 24°C. Air leaves the compressor at 6 bar, temperature of gases entering the turbine = 740°C, pressure loss in the combustion chamber = 0.12 bar, Efficiency of compressor = 84%, Efficiency of turbine = 82%, Efficiency of combustion = 85%, $\gamma_{air}$ = 1.4, Cp = 1.024 kJ/kgK for air and gas. Calculate: (i) The quantity of air circulation if the plant develops 1024 kW, (ii) Heat supplied per kg of air circulation, (iii) The thermal efficiency of the cycle. Mass of the fuel may be neglected. [10M]

10. The effective jet exit velocity of a rocket is 3500 m/s, the forward flight velocity is 1250 m/s, and the propellant consumption if 75 kg/s. Calculate: i) The thrust; ii) The thrust power and iii) The propulsive efficiency. [10M]

**OR**

11. Explain the working principle of rocket engine with neat sketch and its applications. [10M]

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