PVP 20

Code: 20ME3403

II B.Tech - II Semester – Regular Examinations – JULY 2022

APPLIED THERMODYNAMICS
(MECHANICAL ENGINEERING)

Duration: 3 hours Max. Marks: 70

Note: 1. This paper contains questions from 5 units of Syllabus. Each unit carries 14 marks and have an internal choice of Questions.
2. All parts of Question must be answered in one place.

UNIT – I

1. a) Write minimum four functional and constructional differences between SI and CI engines. 7 M

b) A four-cylinder engine running at 1200 rpm delivers 20kW. The average torque when one cylinder was cut is 110 Nm. Find the indicated thermal efficiency if the calorific value of the fuel is 43 MJ/kg and the engine uses 360 grams of gasoline per kW h. 7 M

OR

2. a) State the limitations experienced in the evaluation of friction power using Willan's line method. 7 M

b) A twin-cylinder two-stroke engine has a swept volume of 150 cm^3. The maximum power output is 19 kW at 1100 rpm. At this condition the bsfc is 0.11 kg/MJ, and the gravimetric air/fuel ratio is 12:1. If the ambient test conditions were 10°C and 1.03 bar, and the fuel has a calorific value of 44 MJ/kg, calculate: the bmep, the arbitrary overall efficiency and the volumetric efficiency. 7 M

UNIT – II

3. a) Sketch and explain the working of stages of combustion in S.I. Engines with P-θ diagram. 7 M

   b) What is delay period and what are the factors that affect it? 7 M

OR

4. a) What are homogeneous and heterogeneous mixtures? In which engines these mixtures are used? Explain. 7 M

   b) What is meant by Octane and Cetane rating of fuels? Discuss. 7 M

UNIT-III

5. a) What is adiabatic flame temperature? How flame temperature can be calculated? 7 M

   b) A power generating plant uses steam as working fluid and operates at boiler pressure of 50bar, dry saturated and a condenser pressure of 0.1bar. Calculate for these limits: **i)** The cycle efficiency; **ii)** The work ratio and specific steam consumption for Rankine cycle. Take pumping work also into account. 7 M

OR

6. a) Explain Rankine cycle with the help of schematic diagram, Temperature versus Entropy diagram, including Reheating, & Regeneration methods. 7 M

   b) A steam power plant operates on an ideal reheat–regenerative Rankine cycle and has a net power output of 80 MW. Steam enters the high-pressure turbine at 10 MPa and 550°C and leaves at 0.8 MPa. Some steam is extracted at this pressure to heat the feedwater 7 M in an open feedwater heater. The rest of the steam is reheated to 500°C and is expanded in the low-pressure turbine to the condenser pressure of 10 kPa. Show the cycle on a T-s diagram with respect to saturation lines, and determine: i) the mass flow rate of steam through the boiler and ii) the thermal efficiency of the cycle.

UNIT – IV

7. a) Dry saturated steam at a pressure of 10 bar enters a convergent-divergent nozzle and leaves at a pressure of 1 bar. If the flow is adiabatic and frictionless, determine: **(i)** The exit velocity of steam **(ii)** Ratio of cross section at exit and that at throat Assume the index of adiabatic expansion to be 1.135 — 7 M

   b) How air leakage in condenser is damaging to the performance of condenser? Describe the methods to detect and prevent air infiltration in condensers. — 7 M

OR

8. a) How condensers are classified? Explain any one condenser with a neat sketch. — 7 M

   b) How does a condenser employ in steam power plant improves the performance? — 7 M

UNIT – V

9. a) Differentiate between a closed cycle gas turbine and an open cycle gas turbine. — 7 M

   b) What are the various methods which are used to improve the efficiency and output of gas turbine? — 7 M

OR

10. A gas turbine plant works between the temperature limits of 1152 K and 288 K, isentropic efficiencies for compressor and turbine are 0.85 and 0.8 respectively. Determine the optimum ratio for maximum work output and also for maximum cycle thermal efficiency. 14 M