CBCS SCHEME

USN | | | | | | | | | |

17MA33

Third Semester B.E. Degree Examination, June/July 2019
Thermodynamics

Time: 3 hrs. Max. Marks: 100

Note: *1.* **Answer any FIVE full questions, choosing ONE full question from each module.**
2. Use of thermodynamic table and steam table is permitted.

Module-1

1 a. Distinguish between :
i) Open system and isolated system
ii) Intensive property and extensive property
iii) Cyclic process and non-cyclic process. **(06 Marks)**

b. List out similarities and dissimilarities between work and heat. **(04 Marks)**

c. On some temperature scale 0°C is equivalent to 100°B and 100°C is equivalent to 300°B. Determine the temperature in °C corresponding to 200°B. Convert the temperature obtained in °C to Fahrenheit and Kelvin scale. **(10 Marks)**

OR

2 a. What is Quasi static process? Explain its importance in engineering. **(04 Marks)**

b. Derive an expression for the non-flow displacement work done during adiabatic process given by $PV^{\gamma} = C$ where $\gamma = \frac{C_p}{C_v}$. **(06 Marks)**

c. A fluid in a horizontal cylinder fitted with a frictionless leak proof piston is continuously agitated by means of stirrer process of 10 minutes, the piston moves slowly outwards to a distance of 485mm against the atmospheric pressure. The net work done by the fluid during this process is 2000N-m. Given that the speed of electric motor driving the stirrer is 840rpm, estimate the torque required in driving the shaft and shaft output of motor. **(10 Marks)**

Module-2

3 a. State the I law of thermodynamics for a cyclic process. Obtain an expression for the I law of thermodynamics for a closed system undergoing change of state and prove that internal energy is property. **(10 Marks)**

b. A centrifugal pump delivers 50kg of water per second. The inlet and outlet pressures are 1 bar and 4.2bar. The suction is 2.2m below the centre of pump and delivery is 8.5m above the center of pump. The suction and delivery pipe diameter are 20cm and 10cm respectively. Determine the capacity of electric motor to run the pump if pump efficiency is 85%. **(10 Marks)**

OR

4 a. What is PMMKZ? Why is it impossible? **(04 Marks)**

b. State the Kelvin–Planck and Clausius statements of II law of thermodynamics. Show that Kelvin-Planck statement is equivalent to Clausius statement. **(08 Marks)**

c. A heat engine receives half of its heat at a temperature of 1000K and the rest at 500K while rejecting heat to a sink at 300K. What is maximum possible efficiency of this heat engine? **(08 Marks)**

Module-3

5 a. Compare the otto, diesel and dual cycles on P-V diagram and T-S diagrams, when heat is supplied to each cycle is same. **(12 Marks)**

b. An engine working on the otto cycle is supplied with air at 0.1MPa, 35°C. The compression ratio is 8. Heat supplied is 2100 kJ/kg. Calculate the maximum pressure and temperature of cycle, the cycle efficiency and the mean effective pressure. For air take $C_p = 1.005$, $C_V = 0.718$ and $R = 0.287$ kJ/kg K. **(08 Marks)**

OR

6 a. Compare the Rankine and Carnot cycles of steam power plants. List out the factors affecting the efficiency of the Rankine cycle. **(08 Marks)**

b. Steam at 20 bar, 360°C is expanded in a steam turbine to 0.08 bar. It then enters a condenser, where it is condensed to statured liquid water. The pump feeds back the water into boiler. i) Assuming ideal process, find per kg of steam, the net work and the cycle efficiency ii) If the turbine and the pump have each 80% efficiency, find the percentage reduction in net work and cycle efficiency. **(12 Marks)**

Module-4

7 a. What is internal and external irreversibility? Show that entropy is a property of a system. **(10 Marks)**

b. Water is heated from 25°C to 90°C as it flows at a rate of 0.5 kg/s through a tube that is immersed in a hot both at 100°C. Calculate heat transfer, entropy change for water, oil bath and universe. **(10 Marks)**

OR

8 a. Use steam table to determine the unknown properties in the following :

i) P = 1bar, $\gamma = 2.41 m^3/kg$, T = _____

ii) P = 1MPa, T = 150°C, v = _____

iii) T = 100°C, $h_g = 2676$ kJ/kg, P_s = _____

iv) P = 10 bar, T = 250°C, h = _____. **(04 Marks)**

b. With the help of P-T diagram define : i) Triple point ii) Critical point. **(06 Marks)**

c. Steam at 10 bar and dry state is cooled under constant pressure until it becomes 0.85 dry. Using steam tables, find the work done, change in enthalpy, heat transferred and change in entropy. **(10 Marks)**

Module-5

9 a. With a schematic diagram, explain the working of vapour absorption refrigeration system. Show the process on T-S diagram. Write advantages of absorption refrigeration system. **(10 Marks)**

b. In an ideal vapour compression refrigerator of 15KW cooling capacity, the saturated refrigerant vapour leaves the evaporator with an enthalpy of 178kJ/kg. The enthalpies at the exit of the compressor and condenser are respectively 210kJ/kg and 65 kj/kg. Show the cycle on T-S and P-h diagrams and calculate : i) COP ii) Refrigerant flow rate iii) Power required to drive the compressor. **(10 Marks)**

OR

10 a. Define the following terms : i) Dry Bulb Temperature (DBT) ii) Wet Bulb Temperature (WBT) ii) Specific humidity iv) Relative humidity v) Dew point temperature. **(10 Marks)**

b. Atmospheric air at 101.325KPa has 30° DBT and 15°C DT. Without using psychometric chart, using property values form tables, Calculate : i) Partial pressure of air and water vapour ii) Specific humidity iii) Relative humidity iv) Vapour density v) Enthalpy of moist air. **(10 Marks)**