CBCS SCHEME

USN | | | | | | | | | | |

15MT72

Seventh Semester B.E. Degree Examination, June/July 2023
Thermal Engineering

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. State the zeroth law of thermodynamics and explain thermodynamic equilibrium. **(06 Marks)**

b. Explain quasistatic process with a neat sketch. **(06 Marks)**

c. Define the following :
i) Open system.
ii) Closed system.
iii) Intensive property.
iv) Extensive property. **(04 Marks)**

OR

2 a. Derive an expression for displacement work with P.V. diagram for the following process:
i) Isobaric process
ii) Isochoric process.
iii) Isothermal process
iv) Polytropic process. **(08 Marks)**

b. A spherical balloon has a diameter of 25 cm and contains air at a pressure of 1.5 bar. The diameter of the balloon increases to 30 cm due to heating and during this process, the pressure is directly proportional to the diameter. Calculate the work done by air. **(08 Marks)**

Module-2

3 a. Apply the steady flow energy equation to each of the following:
i) Turbine
ii) Centrifugal pump. **(08 Marks)**

b. Derive an expression for Steady Flow Energy Equation (SFEE) with suitable assumptions. **(08 Marks)**

OR

4 a. State Kelvin Plank and Claussius statement and explain equilance of two statements. **(08 Marks)**

b. Derive an expression for COP of refrigerator and heat pump. **(08 Marks)**

Module-3

5 a. Compare Otto, diesel and dual cycles. **(08 Marks)**

b. Derive an expression for air standard efficiency of dual cycle. **(08 Marks)**

OR

6 a. Explain the modes of heat transfer with governing law and equations. **(10 Marks)**

b. Describe boundary conditions of 1st, 2nd and 3rd kind with figures. **(06 Marks)**

Module-4

7 a. Derive an expression for general three dimensional conduction equations in Cartesian coordinate. **(10 Marks)**

b. A slab of 40 mm thick (K = 20 W/m°C) is placed between 2 fluids having temperature 120°C and 25°C respectively. If the corresponding heat transfer coefficient are 250 W/m^2°C and 500 W/m^2°C respectively, find the heat flow rate. **(06 Marks)**

OR

8 a. Using dimensional analysis for free convection heat transfer show that $N_u = C(G_r^N P_r^m)$ with usual notations. **(10 Marks)**

b. Define the following:
i) Natural convection.
ii) Local heat transfer coefficient.
iii) Drag coefficient. **(06 Marks)**

Module-5

9 a. Using Buckingham π theorem for forced convection heat transfer show that $N_u = C(R_e^n P_r^m)$ with usual notations. **(10 Marks)**

b. Explain the physical significance of following:
i) Reynold number.
ii) Prandtl number.
iii) Nusselt number.
iv) Stanton number **(06 Marks)**

OR

10 a. State and explain following law's:
i) Stefan-Boltzman law.
ii) Plank's law.
iii) Kirchoff's law.
iv) Wein displacement law. **(12 Marks)**

b. Define Emissivity. Explain Grey body and black body emissivity. **(04 Marks)**

* * * * *