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10MT71

Seventh Semester B.E. Degree Examination, June/July 2019
Thermodynamics and Heat Taster

Time: 3 hrs. Max. Marks:100

Note: *1. Answer FIVE full questions, selecting atleast TWO questions from each part.*
2. Use of thermodynamics/ Heat transfer data book is permitted.

PART – A

1 a. Define : i) Control volume ii) closed system iii) isolated system iv) state v) process vi) qusi – static process. **(12 Marks)**

b. Explain use of gas thermometes to measure temperature. **(08 Marks)**

2 a. Distinguish between thermodynamic work and heat. **(10 Marks)**

b. Describe displacement work at a part of a system boundary with P-V diagram. **(10 Marks)**

3 a. Explain first law for a closed system undergoing a cyclic process. And show that energy is a property of the system. **(10 Marks)**

b. In a steam power station, steam flows steadily through a 0.2m diameter pipeline from the boiler to the turbine. at boiler end, the steam conditions are found to be : P = 4MPa, T = 400°C, h = 3213.6 kJ/kg, ad V = 0.073 m^3/kg. At the turbine end, the conditions are found to be : P = 3.5MPa, T = 392°C, h = 3202.6 kJ/kg, and v = 0.084 m^3/kg. There is a heat loss of 8.5 kJ/kg from the pipe line. Calculate the steam flow rate. **(10 Marks)**

4 a. Explain : i) Kelvin - Plank statement ii) classify statement iii) Carnot's theorem. **(12 Marks)**

b. What is reversibility and irreversibility? Write causes of irreversibility. **(08 Marks)**

PART – B

5 a. Describe three distinct modes of heat transfer. **(12Marks)**

b. Derive general one dimensional heat conduction equation. **(08 Marks)**

6 a. Explain briefly i) thermal contact resistance ii) critical thickness of insulation iii) fin efficiency and effectiveness. **(12 Marks)**

b. A steel rod of diameter D = 2cm, length L = 25cm and thermal conductivity K = 50 W/(m°C) is exposed to ambient air at T_∞ = 20°C, with a heat transfer coefficient h = 64 W/(m^2°C). If one end of the rod is maintained at a temperature of 120°C, calculate the heat loss from the rod. **(08 Marks)**

7 a. Define : i) displacement thickness ii) momentum iii) thickness iv) energy thickness v) thermal boundary layer v) critical Raynold's number **(10 Marks)**

b. The heat transfer coefficient(h) of free convection depends upon the buoyancy force per unit mass ($g\beta\theta$), density(ρ), vertical height(L), viscosity (μ), thermal conductivity (K) and specific heat (C_p). Derive $N_u = G_r^a P_r^b$ through dimensional analysis. **(10 Marks)**

8 a. Define following terms used in radiation heat transfer : i) emissivity ii) absorptive iii) gray body iv) black body. **(08 Marks)**

b. Explain concept of view factors. **(04 Marks)**

c. Describe following laws of radiation : i) Wein's displacement law ii) Lambert's law. **(08 Marks)**

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