

B.E. DEGREE EXAMINATIONS: NOV/DEC 2010

Sixth Semester

MECHATRONICS ENGINEERING

U07MH604: Thermodynamics and Heat Transfer

(Use of Steam tables and charts are permitted)

Time : Three hours

Maximum Marks : 100

Answer all Questions:-

PART A (10 x 1 = 10 Marks)

1. The Zeroth law of thermodynamics defines measure of
a) Pressure b) Temperature c) Enthalpy d) Internal energy
2. Identify the wrong option - Heat and work
a) Both are energy in transit b) are path function c) may or may not occur simultaneously
d) are point function and hence exact differential
3. Compressor capacity is represented by
a) Volume of air delivered b) volume of air sucked c) Both a and b d) None of the above
4. Otto cycle consists of
a) two adiabatic and two constant volume process
b) two adiabatic and two constant pressure process
c) two adiabatic, two constant volume and one constant pressure process
d) none of the above
5. Ammonia is a good refrigerator, but it cannot be used in a domestic refrigerator because of its
a) toxicity b) high vapour pressure c) low COPs d) low heat capacity
6. In the ideal rankine cycle, the steam enters the condenser as a
a) saturated vapour b) saturated liquid
c) saturated liquid – vapour mixture d) superheated steam
7. Temperatures at various points do change with time, the process is called as
a) steady process b) unsteady process
c) combination of steady and unsteady d) none of the above
8. A decrease in heat transfer coefficient over the surface of a pin fin
a) decrease its effectiveness b) increase its effectiveness
c) does not affect its effectiveness d) none of the above

9. Stanton number is the ratio of
- a) Renolds number to Prandtl number b) Prandtl to Nusselt number
 c) Nusselt number to Peclet number d) Peclet number to renolds number
10. The thermal boundary layer thickness is thicker than the momentum boundary layer thickness when prandtl number is
- a) 0 b) less than 1 c) equal to 1 d) greater than 1

PART B (10 x 2 = 20 Marks)

11. What do you mean by entropy?
12. State second law of thermodynamics.
13. Draw the P-V and T-S diagram for Carnot cycle.
14. State any four difference between petrol and diesel engine.
15. Differentiate between refrigeration and air-conditioning.
16. Draw the simple layout of thermal power plant.
17. State Fourier law of heat conduction
18. What do mean by fin efficiency?
19. Write the equation of Newton law of cooling.
20. What do you mean by a black body?

PART C (5 x 14 = 70 Marks)

21. (a) Derive the expression for change in internal energy, Change in enthalpy, Heat transfer and work done for the following process i) Isothermal Process ii) Isentropic process

(OR)

- (b) Derive the Steady flow energy equation for the following

(i) Boiler (ii) Condenser (iii) Nozzle (iv) Turbine

22. (a) An air standard cycle consists of the following process

- (i) Isentropic compression from 15^0 and 1 bar to 5 bar
 (ii) 2500 kJ/kg of heat is added at constant volume
 (iii) Isentropic expansion to initial volume
 (iv) Heat rejection at constant volume

Calculate the ideal efficiency, mean effective pressure, and peak pressure?

(OR)

(b) (i) Derive the expression for efficiency of Carnot cycle (7)

(ii) Differentiate between two stroke and four stroke engine (7)

23. (a) Explain the working of Benson Boiler with neat sketch

(OR)

(b) Dry saturated steam is supplied to a steam turbine at 12 bar and after the expansion its condenser pressure is 1 bar. Find the Rankine cycle efficiency, specific steam consumption. Neglect the pump work.

24. (a) Derive the expression for General Heat conduction Equation

(OR)

(b) In an experiment to determine the thermal conductivity of a long solid 2.5 cm diameter rod, its base is placed in a furnace with a large portion of it projecting in to the room air at 22°C. After steady state conditions prevail, the temperatures at two points, 10 cm apart are found to be 110 °C and 85°C respectively. The convective heat transfer coefficient between the rod surface and the surrounding air is 28.4 W/m² K. Determine thermal conductivity of the rod material.

25. (a) Air at a pressure of 8 kN/m² and a temperature at 250°C flows over a flat plate 0.3 m wide and 1 m long at a velocity of 8 m/s. If the plate is to be maintained at a temperature of 78°C. Estimate the rate of heat to be removed continuously from the plate.

(OR)

(b) A brick wall of emissivity 0.8, 6 m wide x 4 m high is located at a distance of 4 m from opening size 20 cm X 20 cm in a furnace wall. The center line of the opening lies 1 m lowered 1 m left of the wall. If the furnace operates at a temperature of 1523°C and wall temperature is 37°C. Calculate the radiant heat exchange between the opening and wall.
