

Register Number: .....

**B.E.DEGREE EXAMINATIONS: APRIL/MAY 2012**

Fourth Semester

**ELECTRICAL AND ELECTRONICS ENGINEERING**

MEC212: Thermal Engineering & Fluid Mechanics

**Time: Three Hours**

**Maximum Marks: 100**

*Note: Use of Standard thermodynamic tables, Mollier diagram, Psychometric chart and Refrigerant property tables are permitted*

**Answer All Questions:-**

**PART A (10 x 1 = 10 Marks)**

1. An Isolated thermodynamic system
  - (a) Can not exchange only mass with its surroundings
  - (b) Cannot exchange energy in the form of heat only with its surroundings
  - (c) Cannot exchange energy through work only with its surroundings
  - (d) Cannot exchange mass as well as energy with its surroundings
2. A Carnot refrigerator and a Carnot heat pump are operating between the same two reservoirs with fixed temperatures. The COP of these devices can be compared as
  - (a)  $COP_R = COP_{HP}$
  - (b)  $COP_R > COP_{HP}$
  - (c)  $COP_R < COP_{HP}$
  - (d)  $COP_R$  Not equal to  $COP_{HP}$
3. Dryness fraction of steam is
  - (a) Amount of dryness present in the steam
  - (b) Amount of wetness present in the steam
  - (c) Amount of water content in the superheated steam
  - (d) Amount of liquid water present in the wet steam
4. In case of reaction steam turbine
  - (a) There is enthalpy drop only in fixed blades
  - (b) By ordinary thermometer
  - (c) There is enthalpy drop in both Fixed and moving blades
  - (d) There is no enthalpy drop in both fixed moving blades
5. Dry air is Considered to consists of
  - (a) 24% of Oxygen and 76 % of nitrogen by volume
  - (b) 21% of Oxygen and 79 % of Nitrogen by volume
  - (c) 30% of Oxygen and 70 % of Nitrogen by volume
  - (d) 28% of Oxygen and 72 % of Nitrogen by volume

6. Dry Bulb temperature is recorded by
- Pyrometer
  - By thermometer with a dry bulb
  - By thermometer when dry bulb is enveloped by a cotton wick saturated with water.
  - By wet bulb thermometer
7. The property of fluids by which their molecules get attracted to another body is known as
- Capillary action
  - Surface tension
  - Adhesion
  - Cohesion
8. The continuity equation
- requires Newton's law to be satisfied
  - expresses the relation between energy and work
  - relates the mass flow rate
  - relates the constant volume rate
9. Euler's equation is based on the assumption that
- the fluid is non-viscous
  - the fluid is homogeneous and compressible
  - the flow is continuous, steady, and along the streamline
  - The fluid is Newtonian fluid
10. For a laminar flow through a pipe, the loss of head
- is directly proportional to viscosity
  - varies as the square of the pipe diameter
  - varies inversely as the length of the pipe
  - is inversely proportional to the velocity

**PART B (10 x 2 = 20 Marks)**

- State the difference between process and cycle.
- State the Kelvin plank statement with an example.
- Name few mountings and accessories used in the boiler?
- What is meant by compounding in steam turbines?
- What do you mean intercooling in a compressor?
- Name four important properties of a good refrigerant
- State the different methods of measuring pressure.
- Distinguish between rotational flow and irrotational flow. Give one example each.
- Name some practical applications of the of Bernoulli's theorem
- What are the different losses occurs while a fluid flows through a pipeline.

**PART C (5 x 14 = 70 Marks)**

- Show that heat is a path function and not a entropy (4)
  - The piston of an oil engine, of area  $0.0045 \text{ m}^2$ , moves downwards 76 mm, drawing in  $0.00028 \text{ m}^3$  of fresh air from the atmosphere. The pressure in the cylinder is uniform

during the process at 80 kPa, while the atmospheric pressure is 101.325 kPa, the difference being due to the flow resistance in the induction pipe and the inlet valve. Estimate the displacement work done by the air finally in the cylinder. (10)

**(OR)**

b) (i) Two Carnot engines A and B are connected in series between two thermal reservoir maintained at 1000 K and 100 K respectively. Engine A receives 1680 kJ of heat from the high-temperature reservoir and rejects heat to the Carnot engine B. Engine B takes in heat rejected by engine A and rejects heat to the low-temperature reservoir. If engines A and B have equal thermal efficiencies, determine

- (a) the heat rejected by engine B,
- (b) the temperature at which heat is rejected by engine A
- (c) the work done during the process by engines, A and B respectively.
- (d) If engines A and B deliver equal work determine the amount of heat taken in by the engine B and the efficiencies of engines A and B

22. a) (i) Explain with neat sketch the Rankine steam power cycle (7)

(ii) Explain with simple sketch the any two boiler mountings also state their uses. (7)

**(OR)**

b) (i) What is meant by compounding of turbine? Explain the various types of compounding (8)

(ii) Explain with neat sketch the coal and ash handling circuit in a modern steam power plant. (6)

23. a) A single acting two stage air compressor deals with air measured at atmospheric conditions of 1.013 bar and 15°C. At suction, the pressure is 1bar and the temperature is 30°C. The final delivery pressure is 17bar, the inter stage pressure is 4 bar and perfect inter cooling to be assumed. If the LP cylinder bore is 230mm, the common stroke is 150mm and the speed of the compressor is 350 rpm Calculate (1) Volumetric efficiency of compressor (2) Volume of atmospheric air dealt with per minute (3) Power of the driving motor required. Assume Clearance volume of LP cylinder to be 5% and the indices of compression and expansion in the LP & HP cylinder to be 1.25; the mechanical efficiency=85%

**(OR)**

b) (i) Explain the vapour compression cycle Refrigeration with the help of T-s and p-h diagrams. Can this cycle be reversible? If not, why? (7)

(ii) Explain with neat sketch the process of cooling and dehumidification (7)

24. a) (i) A soap bubble 62.5 mm diameter has an internal pressure in excess of the outside pressure of  $20\text{N/m}^2$ . What is the tension in the soap film (4)

(ii) A square metal plate 1.8 m side and 1.8 m thick weighing 60 N is to be lifted through a vertical gap of 30 mm of infinite extent. The oil in the gap has a specific gravity of 0.95 and viscosity of  $3\text{Ns/m}^2$ . If the metal plate is to be lifted at a constant speed of 0.12 m/s. find the force and power required. (10)

**(OR)**

b) (i) Explain in detail with simple sketch the different types of fluid flow. (10)

(ii) What is the flow rate of water in l/m for a 0.2 m diameter pipe, if the average velocity of flow is 1.5 m/s. If the pipe reduces to 0.1 m diameter at another section, what is the velocity of flow at that section? (4)

25. a) (i) Derive the Euler's equation (6)

(ii) The water is flowing through a pipe having diameters 0.3 m and 0.15 m at sections 1 and 2, respectively. The rate of flow through pipe is  $0.04\text{ m}^3/\text{s}$ . The section 1 is 5 m above the datum line and section 2 is 2 m above datum. If the pressure at section 1 is  $300\text{kN/m}^2$ , find the intensity of pressure at section 2. (8)

**(OR)**

b) (i) Derive Darcy-Weisbach equation for the determination of loss of head due to friction in pipe (8)

(ii) Explain with the help of simple sketch the hydraulic gradient and total gradient line. (6)

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