CBCS SCHEME

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15MN42

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Thermodynamics and Fluid Mechanics

Time: 3 hrs. Max. Marks: 80

Note: ***Answer FIVE full questions, choosing one full question from each module.***

Module-1

1 a. Define and classify the following with examples:
(i) Thermodynamic system
(ii) Thermodynamic property.
(iii) Energy
(iv) Thermodynamic process. **(08 Marks)**

b. State zeroth law of thermodynamics and explain thermal equilibrium. **(08 Marks)**

OR

2 a. With PV diagram derive an expression for workdone in each case:
(i) Isochoric process. (ii) Isobaric process.
(iii) Isothermal process. (iv) Polytropic process. **(08 Marks)**

b. Differentiate between work transfer and heat transfer. **(04 Marks)**

c. Explain Quasi-static process. **(04 Marks)**

Module-2

3 a. State and explain Kelvin plank and Clausius statement. **(08 Marks)**

b. A fluid system undergoes a non-flow frictionless process following the pressure-volume relation as $P = \frac{5}{V} + 1.5$, where P is in bar and V is in m^3. During the process the volume changes from 0.15 m^2 to 0.05 m^3 and the system rejects 45 KJ of heat. Determine (i) Change in internal energy (ii) Change in enthalpy. **(08 Marks)**

OR

4 a. Derive an expression for workdone during single stage air compression without clearance. **(08 Marks)**

b. A single stage reciprocating air compressor has a swept volume of 2000 cm^3 and runs at 800 rpm. It operates on a pressure ratio of 8, with a clearance of 5% of the swept volume. Assume NTP room conditions and at inlet (P = 101.3 KPa, t = 15°C) and polytropic compression and expansion with n = 1.25. Calculate i) Indicated power (ii) Volumetric efficiency (iii) Mass flow rate (iv) FAD (v) Isothermal efficiency (vi) The actual power needed to drive the compressor, if mechanical efficiency is 0.85. **(08 Marks)**

Module-3

5 a. Define the following:
(i) Density (ii) Specific weight (iii) Specific volume (iv) Specific gravity
(v) Viscosity (vi) Compressibility (vii) Surface tension (viii) Capillarity. **(08 Marks)**

b. Define and explain vapour pressure and cavitation. **(04 Marks)**

c. A plate, 0.025 mm distart from a fixed plate, moves at 60 cm/s and requires a force of 2 N per unit area i.e. 2 N/m^2 to maintain this speed. Determine the fluid viscosity between plates. **(04 Marks)**

OR

6 a. Find the head loss due to friction in a pipe of diameter 300 mm and length 50 m through which water is flowing at a velocity of 3 m/s using (i) Darcy formula (ii) Chezy's formula, for which C = 60. Take V for water = 0.01 stoke. **(08 Marks)**

b. Derive an expression for rate of flow through venturimeter. **(08 Marks)**

Module-4

7 a. Differentiate between,
   (i) Absolute and Gauge pressure.
   (ii) Simple manometer and differential manometer.
   (iii) Piezometer and pressure gauge. **(06 Marks)**

b. A rectangular plane surface is 2 m wide and 3 m deep, it lies in vertical plane in water. Determine the total pressure and position of centre of pressure on the plane surface when its upper edge is horizontal and (i) Coincides with water surface (ii) 2.5 m below the free water surface. **(10 Marks)**

OR

8 a. How will you determine the meta-centric height of a floating body experimentally? Explain with neat sketch. **(08 Marks)**

b. Explain the conditions for stability of floating body. **(04 Marks)**

c. Define : (i) Centre of Buoyancy (ii) Meta-centre (iii) Buoyancy (iv) Meta-centric height **(04 Marks)**

Module-5

9 a. List the assumptions and limitations of Bernoulli's equation. **(06 Marks)**

b. State Bernoulli's theorem. **(02 Marks)**

c. Derive an expression for Bernoulli's equation from first principle. **(08 Marks)**

OR

10 a. Explain HGL and TEL with sketch. **(08 Marks)**

b. A pipe, through which water is flowing, is having diameters 20 cm and 10 cm at the cross sections 1 and 2 respectively. The velocity of water at section 1 is given 4.0 m/s, find the velocity head at sections 1 and 2 and also rate of discharge. **(08 Marks)**

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