CBCS SCHEME

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17MN42

Fourth Semester B.E. Degree Examination, Jan./Feb. 2021
Thermodynamics and Fluid Mechanics

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define system, classify system. **(08 Marks)**

b. Explain thermodynamic Equilibrium. **(04 Marks)**

c. Explain the Quai-static process with a neat sketch. **(08 Marks)**

OR

2 a. Explain the displacement work of a thermodynamic system with neat sketch. **(08 Marks)**

b. Compare work and heat. **(06 Marks)**

c. Classify Energy. **(06 Marks)**

Module-2

3 a. Explain the second law of thermodynamics according to (i) Clausius (ii) Kelvin plank **(08 Marks)**

b. State first law of thermodynamics. **(02 Marks)**

c. 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 in m^3. During the process the volume changes from $0.15m^3$ to $0.05m^3$ and the system rejects 45 kJ of heat. Determine :

(i) Change in internal energy

(ii) Change in enthalpy. **(10 Marks)**

OR

4 a. Derive an expression for workdone in a single stage compressor without clearance volume. **(10 Marks)**

b. A single state, double acting air compressor is required to deliver $14m^3$ of air per minute measured at 1.013 bar and 15°C. The delivery pressure is 7 bars and the speed is 300rpm. Take the clearance volume as 5% of the swept volume with a compression and expansion index n = 1.3. Calculate the swept volume of the cylinder, the delivery temperature and the indicated power. **(10 Marks)**

Module-3

5 a. Define surface tension. Obtain an Expression for water droplet, liquid jet and Hollow bubble. **(10 Marks)**

b. Derive an expression for Capillary rise and Capillary fall. **(10 Marks)**

OR

6 a. With a neat sketch, derive an expression for discharge through orificemeter. **(10 Marks)**

b. Derive Darcy-Weisbach equation. **(10 Marks)**

Module-4

7 a. Explain the working of Bourdon's pressure gauge. **(10 Marks)**

b. Derive an expression for total pressure and center of pressure for a inclined plane surface submerged in liquid. **(10 Marks)**

OR

8 a. Explain the conditions of Equilibrium for floating and submerged bodies. **(10 Marks)**

b. Define :

(i) Meta-centre and Meta-centric height

(ii) Buoyancy and center of buoyancy. **(04 Marks)**

c. With a neat diagram, derive an expression for meta-centric height by experimental method. **(06 Marks)**

Module-5

9 a. Derive an expression for Bernoulli's equation from Euler's equation of motion. **(10 Marks)**

b. The water is flowing through a tapering pipe having diameters 300mm and 150mm at section 1 and 2 respectively. The discharge through the pipe is 40 liter/sec. The section 1 is 10m above datum and section 2 is 6m above datum. Find the intensity of pressure at section 2 if that at section 1 is $400kN/m^2$. **(10 Marks)**

OR

10 a. Explain the concept of hydraulic gradient line and total energy line with a neat sketch. **(08 Marks)**

b. Determine the difference in the elevation between the water surface in the two tanks which are connected by a horizontal pipe of diameter 30cm and length 400m. The rate of flow of water through the pipe is 300 liters/second. Consider all losses and take the value of friction factor f = 0.032, also draw the TEL and HGL. **(12 Marks)**

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