CBCS SCHEME

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17MN42

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
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 the following: (i) Open system (ii) Reversible process (iii) Irreversible process (iv) Expensive properties (v) Intensive properties. Give the examples. **(10 Marks)**

b. Explain the zeroth law of thermodynamics. **(04 Marks)**

c. Explain the quasi static process with a neat sketch. **(06 Marks)**

OR

2 a. Differentiate between work and heat. **(04 Marks)**

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

c. Define the following:
(i) Isobaric process (ii) Isothermal process
(iii) Isochoric process (iv) Isentropic process **(08 Marks)**

Module-2

3 a. Explain the first law of thermodynamics. **(06 Marks)**

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

c. 90 kJ of heat is supplied to a system at a constant volume. The system rejects 95 kJ of heat at constant pressure and 18 kJ of work is done on it. The system is brought to its original state by adiabatic process. Determine:
(i) The adiabatic work done
(ii) The values of internal energy at all end states if the initial value is 105 kJ. **(06 Marks)**

OR

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

b. A single stage, double acting air compressor is required to deliver 14 m^3 of air per minute measured at 1.013 bar and 15°C. The delivery pressure is 7 bar and the speed is 300 rpm. 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 the following:
(i) Specific gravity (ii) Viscosity (iii) Specific weight
(iv) Surface tension (v) Capillary **(10 Marks)**

b. A 400 mm diameter shaft is rotating at 200 rpm in a bearing of length 120 mm. If the thickness of oil film is 1.5 mm and the viscosity (dynamic) of the oil is 0.7 NS/m^2. Determine: (i) torque required to overcome friction in bearing (ii) Power utilized in overcoming viscous resistance. **(10 Marks)**

OR

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

b. The following data relate to an orifice meter. Diameter of pipe = 240 mm, reading of differential manometer = 400 mm of mercury, diameter of orifice = 120 mm, coefficient of discharge of orifice meter = 0.65, specific gravity of oil = 0.88. Determine the rate of flow of oil. **(08 Marks)**

c. Define: (i) Compressibility (ii) Vapour pressure and cavitation **(02 Marks)**

Module-4

7 a. List the different manometers. With a neat sketch, explain the working principle of dead weight pressure gauge. **(10 Marks)**

b. Water is flowing through two different pipes to which an inverted differential manometer having an oil of specific gravity 0.8 is connected. The pressure in the pipe A is 19620 N/m^2. Find the pressure in the pipe B for the manometer reading as shown in Fig.Q7(b).

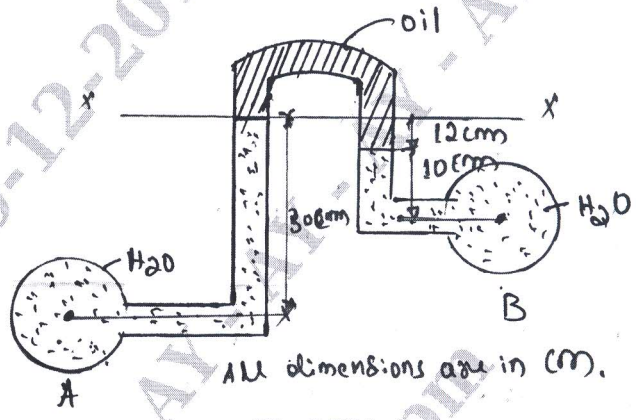

Fig.Q7(b) **(10 Marks)**

OR

8 a. Define the following:
(i) Total pressure (ii) Centre of pressure
(iii) Buoyancy (iv) Meta centre **(04 Marks)**

b. With a neat diagram derive an expression for meta-centric height by analytical method. **(10 Marks)**

c. Explain the conditions of equilibrium of floating and submerged bodies. **(06 Marks)**

Module-5

9 a. Derive the Bernoulli's equation from first principle with a neat sketch and assumptions. **(10 Marks)**

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

OR

10 a. Explain the concept of hydraulic gradient like 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 30 cm and length 400 m. 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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