CBCS SCHEME

USN | | | | | | | | | | 15MN42

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Thermodynamics and Fluid Mechanics

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Explain open, closed and isolated system with example. **(06 Marks)**

b. Distinguish between the following terms:
i) Extensive and Intensive property
ii) Reversible and Irreversible process
iii) Path function and Point function
iv) Temperature and Thermal equilibrium
v) Microscopic and Macroscopic point of view. **(10 Marks)**

OR

2 a. With a neat P-V diagram, derive an expression for work done in each case:
i) Isochoric Process
ii) Isobaric Process
iii) Isothermal Process
iv) Polytropic Process. **(10 Marks)**

b. Define work and heat. Explain the sign convention for work and heat. **(06 Marks)**

Module-2

3 a. State and explain the two statements of 2nd law of thermodynamics. **(08 Marks)**

b. A fluid system undergoes a non-flow frictionless process following the PV relation as $P = 5/v + 1.5$ where P is in bar and v is in m^3. During the process the volume changes from $0.15m^3$ to $0.005m^3$ and the system rejects 45KJ of heat.
Determine:
i) Change in Internal energy
ii) Change in Enthalpy. **(08 Marks)**

OR

4 a. Derive an expression for work done in a single stage compression without clearance volume. **(08 Marks)**

b. A single cylinder reciprocating compressor has a bore of 120mm and a stroke of 150mm, and is driven at a speed of 1200rpm. It is compressing CO_2 gas from a pressure of 120kPa and a temperature of 20°C to a temperature of 215°C. Assume polytropic compression with n = 1.3, no clearance and volumetric efficiency of 100%. Calculate:
i) Pressure ratio
ii) Indicated pressure
iii) Shaft power with mechanical efficiency of 80%
iv) Mass flow rate.
If a second stage of equal pressure ratio were added. Calculate e, the overall pressure ratio f, the bore of the second stage cylinder. If the same stroke was maintained. **(08 Marks)**

Module-3

5 a. Define fluid and classify fluids. **(06 Marks)**

b. The dynamic viscosity of an oil, used for lubrication between a shaft and sleeve is 6 poise. The shaft is of diameter 0.4m and rotates at 190rpm. Calculate the power lost in the bearing for a sleeve length of 90mm. The thickness of the oil film is 1.5mm. **(10 Marks)**

OR

6 a. With a neat sketch, explain the working of orifice meter. **(06 Marks)**

b. An oil of specific gravity 0.7 is flowing through a pipe of diameter 300mm at the rate of 500 litre/s find the head lost due to friction and power required to maintain the flow for a length of 1000m. Take V = 0.29 strokes. **(10 Marks)**

Module-4

7 a. Determine the total pressure on a circular plate of diameter 1.5m which is placed vertically in water in such a way that the centre of plate is 3m below the free surface of water. Find the position of centre of pressure also. **(08 Marks)**

b. With neat sketch explain any two simple manometer and differential monometer. **(08 Marks)**

OR

8 a. Explain with sketch experimental method of determination of the meta-centric height of a floating body. **(08 Marks)**

b. Find the density of a metallic body which floats at the interface of mercury of specific gravity 13.6 and water such that 40% of its volume is sub-merged in mercury and 60% of water. **(08 Marks)**

Module-5

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

b. State Bernoulli's theorem. List the assumption and limitation of Bernoulli's equation. **(08 Marks)**

OR

10 a. Explain HGL and TEL with sketch (Hydraulic Gradient line and Total Energy line). **(08 Marks)**

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

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