

CBCS Scheme

USN

--	--	--	--	--	--	--	--	--	--

15MN42

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018 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. Define the following terms :
i) Thermodynamic equilibrium ii) Zeroth law of thermodynamics
iii) Thermodynamic system iv) Control surface. (08 Marks)
- b. With a neat diagram, explain quasi – static process. (08 Marks)

OR

- 2 a. Define path function and point function. (04 Marks)
- b. Derive expression for work done for the following process :
i) Constant pressure ii) Isothermal iii) Adiabatic process. (12 Marks)

Module-2

- 3 a. Explain with neat diagram, PMM1 (Perpetual Motion Machine of 1st kind). (04 Marks)
- b. The internal energy of a certain substance is given by the following equation $u = 3.5b PV + 84$. Where $u \rightarrow$ in kJ/kg, P in KPa, V in m^3/kg . A system composed of 3 kg of this substance, expands from the initial pressure of 500 KPa and a volume of $0.22m^3$ to a final pressure of 100KPa in a process in which pressure and volume are related by $Pr^{1.2} = \text{constant}$.
i) If the expansion is quasi – static find Q , ΔU & W .
ii) In another process. The same system expands according to the same pressure – volume relationship as in part (i) and from same initial state to same final state as in part (i), but the heat transfer is 30 kJ. Find work transfer for the process
iii) Explain the difference in work transfers in parts(i) & part(ii). (12 Marks)

OR

- 4 a. With a neat sketch, explain single stage reciprocating air compressor, also derive expression for work done per cycle. (10 Marks)
- b. A single stage reciprocating compressor has two double acting cylinders each having 40cm dia and 50cm stroke. The piston rod diameter is 5cm and speed is 300rpm. The inlet conditions of air is at 1bar $15^\circ C$. The delivery pressures 7.5bar. If the volumetric efficiency is 80%, Mechanical efficiency is 95% and isothermal efficiency is 70%, determine the power required to drive the compressor. (06 Marks)

Module-3

- 5 a. Define the following :
i) Surface tension ii) Capillarity iii) Cavitation iv) Specific gravity. (08 Marks)
- b. Given a shaft in a bush bearing having oil (viscosity is 45 poise) filled in between, it is rotated at a speed of 190 rpm. If the oil film thickness is 0.08m and diameter and lengths of shaft are 12 cm and 25cm, respectively find shear stress shear force, torque and power. (08 Marks)

OR

- 6 a. With a neat sketch, derive an expression to find flow rate using a venturimeter. (08 Marks)
- b. With a neat sketch derive Darcy's equation. (08 Marks)

Module-4

- 7 a. Define the following terms :
i) Pressure ii) Atmospheric pressure iii) Gauge pressure iv) Absolute pressure. (08 Marks)
- b. With a neat diagram, explain inverted u-tube manometer, also derive expression for difference in pressure heads. (08 Marks)

OR

- 8 a. An ice berg in the ocean floats with 1/5th of its volume above the surface. What will be the specific gravity of ice berg relative to ocean water which weights 50N/m²? What portion of its volume would be above? The surface in oil, if the ice berg floats with specific gravity 13.6. (12 Marks)
- b. Define : i) Buoyancy ii) Meta centre. (04 Marks)

Module-5

- 9 a. List out the assumption made in deriving Euler equation. (04 Marks)
- b. Derive Euler's equation of Motion and Bernoulli's equation from the same. (12 Marks)

OR

- 10 With a neat sketch, explain hydraulic gradient line and line of total energy. (16 Marks)

* * * * *