

2031

B.E. (Mechanical Engineering)  
Third Semester  
MEC-301: Applied Thermodynamics – I

Time allowed: 3 Hours

Max. Marks: 50

**NOTE:** Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Unit. Use of steam table is allowed.

x-x-x

I. Attempt the following:-

- a) Explain, how the Zeroth law of thermodynamics can be used for temperature measurement.
- b) Write short notes on: Heat reservoir. Heat engine
- c) Classify the boilers.
- d) Describe equivalent evaporation.
- e) Depict the theory of steam turbine operation. (5x2)

UNIT - I

II. a) If a gas of volume  $6000\text{cm}^3$  and at pressure of 100 kPa is compressed quasistatically according to  $pV^2 = \text{constant}$  until the volume becomes  $2000\text{cm}^3$ , determine the final pressure and the work transfer.

b) Write short notes on the following:-

Thermodynamic properties, state, path, process

(6,4)

III. a) A blower handles 1 kg/s of air at  $20^\circ\text{C}$  and consumes a power of 15 kW. The inlet and outlet velocities of air are 100 m/s and 150 m/s respectively. Find the exit air temperature, assuming adiabatic conditions. Take  $c_p$  of air is 1.005 kJ/kg-K.

b) Discuss the significance of Clausius inequality.

(7,3)

IV. a) Differentiate between accessories and mountings.

b) Sketch and mark a Lancashire boiler entirely. Explain the operation as well. (4,6)

UNIT - II

V. a) Sketch the velocity diagram of a compounded turbine with two stage velocity.

P.T.O.

(2)

- b) In a single stage impulse turbine, find the requirements for maximum blade efficiency. Confirm even how with blade speed to steam velocity ratios, this efficiency undergoes such a transition. (3,7)
- VI. The mean blade speed of a single impulse turbine is 200 m/s. The nozzles are angled to  $20^\circ$  to the plane of the blades rotation. The nozzles have a steam velocity of 600 m/s. 350000 Kg/hr of steam is used by the turbine. The absolute velocity at the exit is along the turbine's axis Identify the inlet, and the output angles of the blades, (i) the power output of the turbine, (ii) the diagram efficiency, and (iii) the end thrust (per kg steam per second) and its' direction. (10)
- VII. a) What do you know about surface condenser? Explain its helpfulness.
- b) A surface condenser handles condensate at 70.15 cm Hg when barometer reads 76 cm Hg. Steam entering at 2360 kg/hr requires cooling water at 6.81-102 kg/hr,  $10^\circ\text{C}$ . Cooling water leaves condenser at  $27.8^\circ\text{C}$  while condenser has mean temperature of  $37^\circ\text{C}$ . Air leaks into condenser at 0.3 kg/min. Determine, (i) the mass of vapour going out with air per hour (ii) the state of steam entering. (3,7)

x-x-x