Seat No. | | | | | | |

AOI-1321

Engineering Thermodynamics
(Old) (1150)

P. Pages: 3

Time: Three Hours **Max.Marks:100**

Instructions to Candidates:

1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. All questions are compulsory. Solve **any two** bits from a, b and c.
5. Use of Non Programmable calculator, steam table, charts are allowed.
6. Assume suitable data, if necessary.
7. Draw neat sketches wherever necessary.

UNIT-I

1. a) Explain the following – **10**

   i) Classical Thermodynamics and Statistical Thermodynamics

   ii) Control volume and Control surface.

   b) Describe the Quasi-state process and explain its significance in detail. **10**

   c) A U-tube mercury manometer has been used to measure the pressure of gas flowing through a pipeline. One arm of the manometer connects with the pipe and the other arm is open to atmosphere . If the difference in level of mercury in the two arms is 40 cm, determine the gas pressure and express it in kPa and bar. The barometer reads 740 mm of mercury. **10**

UNIT-II

2. a) Derive steady flow energy equation for steady flow system using first law of thermodynamics. **10**

   b) The internal energy of a system is given by $U=100+50T+0.04\ T^2$ Joule and heat transfer $Q=4000+16T$ Joule , where T is temperature in K. If the temperature of the system changes from 400 K to 600 K, find the work transfer. **10**

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c) The water stored in a dam is supplied to a water turbine with a rate of 600 kg/sec. The head of water measured from the centre of the turbine is 1500 m. The discharge is 2.5 m below the turbine centre line. The velocity of water at the outlet channel of the turbine is 12 m/sec. Determine the power developed by the turbine. **10**

UNIT-III

3. a) Describe second law of thermodynamics and also define thermal efficiency and coefficient of performance. **10**

b) Write short note on – **10**
i) Principle of Increase of Entropy
ii) Reversible and Irreversible processes.

c) A reversible engine is supplied with heat from two constant temperature sources at 800 K and 500 K and rejects heat to constant temperature sink at 250 K. The engine develops work equivalent to 90 kJ/sec and rejects heat at the rate of 52 kJ/sec. **10**
Find : 1. Heat supplied by each source and
2. Thermal efficiency of the engine.

UNIT-IV

4. a) What is polytropic process ? Derive the equation for work done and Heat supplied. **10**

b) A balloon of spherical shape 6 m in diameter is filled with hydrogen gas at the pressure of 1 bar abs. and 20^0 C. At a later time, the pressure of gas is 94% of its original pressure at the same temperature. **10**
i) What mass of original gas must have escaped if the dimensions of the balloon is not changed.?
ii) Find the amount of heat to be removed to cause the same drop in pressure at constant volume.

c) One kg of air at 14 bar having 0.085 m^3 and 627^0 C is supplied with heat at constant pressure till its volume becomes double. The air is then expanded isentropically till the pressure drops to 1 bar. Calculate the heat supplied and work done. **10**

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UNIT-V

5. a) Write shorts note on - **10**
   i) Latent heat and Sensible heat.
   ii) Quality of steam and throttling process.
   iii) Applications of steam.

   b) What do you understand by the terms Critical state and Triple point. **10**
   Give the pressure and temperature of water at its critical state and Triple point.

   c) Steam initially at 1.5 MPa, 300^0 C expands reversibly and adiabatically **10**
   in a steam turbine to 40^0 C. Determine the ideal work output of the turbine per kg of steam.

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