**Code: 13A03302** **R13**

B.Tech II Year I Semester (R13) Supplementary Examinations June 2016

**THERMODYNAMICS**

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

**PART – A**

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) What is a pure substance?
(b) What is an irreversible process? Give examples.
(c) What is PPM1?
(d) Write difference between non-flow process and steady flow process.
(e) State Kelvin-Planck statement.
(f) What do you mean by irreversibility of the process?
(g) Write Clausius Clapeyron equation and its significance.
(h) Define p-v-T surface and state its significance.
(i) State Gibb's-Dalton law.
(j) What is an air-standard efficiency and relative efficiency of gas power cycle?

**PART – B**

(Answer all five units, 5 X 10 = 50 Marks)

**UNIT – I**

2 (a) Explain briefly Zeroth law of thermodynamics.

(b) A fluid at a pressure of 3 bar and with specific volume of 0.18 $m^3$/kg, contained in a cylinder behind a piston expands reversibly to a pressure of 0.6 bar according to a law, $p = (C/v^2)$ where C is a constant. Calculate the work done by the fluid on the piston.

**OR**

3 (a) Compare macroscopic and microscopic approaches in thermodynamic studies.

(b) Explain about point function and path function with examples.

**UNIT – II**

4 Write down the general equation for steady flow systems and simplify when applied for the following systems:

(a) Steam turbine.
(b) Steam nozzle.
(c) Centrifugal compressor.
(d) Condenser.

**OR**

5 At the inlet to a certain nozzle the enthalpy of fluid passing is 2800 kJ/kg and velocity is 50 m/s. At the discharge end the enthalpy is 2600 kJ/kg. The nozzle is horizontal and there is negligible heat loss from it.

(i) Find the velocity at exit of the nozzle.
(ii) If the inlet area is 900 $cm^2$ and specific volume at inlet is 0.187 $m^3$/kg, find mass flow rate.
(iii) If the specific volume at the nozzle exit is 0.498 $m^3$/kg, find the exit area of the nozzle.

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**UNIT – III**

6 (a) Explain in detail about Clausius inequality.

(b) 1 kg of air initially at 8 bar pressure and 380 K expands polytropically ($pv^{1.2}$ = constant) until the pressure is reduced to one-fifth value. Calculate: (i) Final specific volume and temperature. (ii) Change of entropy, work done and heat interaction. (iii) Change in entropy.

**OR**

7 (a) Prove that entropy is a property of a system.

(b) 5 kg of air at 550 K and 4 bar is enclosed in a closed system.
(i) Determine the availability of the system if the surrounding pressure and temperature are 1 bar and 290 K respectively.
(ii) If the air is cooled at constant pressure to the atmospheric temperature, determine the availability.

**UNIT – IV**

8 Derive the Maxwell relations.

**OR**

9 (a) Explain about compressibility charts.

(b) A pressure cooker contains 1.5 kg of saturated steam at 5 bar. Find the quantity of heat which must be rejected so as to reduce the quality to 60% dry. Determine the pressure and temperature of the steam at the new state.

**UNIT – V**

10 (a) Explain about adiabatic mixing of perfect gases.

(b) A mixture of hydrogen ($H_2$) and oxygen ($O_2$) is to be made so that ratio of $H_2$ to $O_2$ is 2:1 by volume. If the pressure and temperature are 1 bar and 25℃ respectively, calculate: (i) The mass of $O_2$ required. (ii) The volume of the container.

**OR**

11 (a) Derive expression for air standard efficiency of Otto cycle.

(b) The stroke and cylinder diameter of a compressor ignition engine are 250 mm and 150 mm respectively. If the clearance volume is 0.0004 $m^3$ and fuel injection takes place at constant pressure for 5 percent of the stroke, determine the efficiency of the engine. Assume engine is working on diesel cycle.

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