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B.Tech II Year I Semester (R09) Supplementary Examinations December 2015 ENGINEERING THERMODYNAMICS

(Mechatronics)

Time: 3 hours

Max. Marks: 70

Answer any FIVE questions All questions carry equal marks

- 1 (a) Define a thermodynamic system. Differentiate between open system, closed system and an isolated system.
 - (b) Determine the work done by the air which enters into an evacuated vessel from atmosphere when the valve is opened. The atmospheric pressure is 1.013 bar and 1.5 m³ of air at atmospheric condition enters into the vessel.
- 2 (a) State the first law of thermodynamics and prove that for a non-flow process, it leads to the energy equation $Q = \Delta U + W$.
 - (b) A gas of mass 1.5 kg undergoes a quasi-static expansion which follows a relationship p = a + bV, where a and b are constants. The initial and final pressures are 1000 kPa and 200 kPa respectively and the corresponding volumes are 0.20 m³ and 1.20 m³. The specific internal energy of the gas is given by the relation u = 1.5 pv 85 kJ/kg. Where p is the kPa and v is in m³/kg. Calculate the net heat transfer and the maximum internal energy of the gas attained during expansion.
- 3 (a) State and explain second law of thermodynamics,
 - (b) 4 kg of air is compressed in a reversible steady flow polytrophic process (PV 1.25 = C) from 1 bar and 30°C to 10 bar. Calculate the work input, heat transferred and the change in the entropy.
- 4 (a) What do you mean by air standard cycles? What are the assumptions for an air standard cycle?(b) Derive an expression for an air standard efficiency of Otto cycle.
- 5 (a) Draw the basic Rankine cycle and derive the expression for its efficiency.
 - (b) Draw the Brayton cycle on the P-V and T-S planes and explain the processes.
- 6 (a) Draw the port timing diagram of a two stroke engine. Explain.
 - (b) Why lubrication is necessary in I.C engine components? Explain different methods of lubrication system.
- 7 (a) Classify fuel injection systems in CI engines.
 - (b) What are the four stages of combustion, explain with a neat sketch?
- 8 (a) What are the advantages of regeneration and reheating the steam in gas turbines?
 - (b) Differentiate between open, closed and semi-closed cycles and draw the schematic layout.

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