

**R9**

Code: 9A14302

B.Tech II Year I Semester (R09) Supplementary Examinations, May 2013

**ENGINEERING THERMODYNAMICS**

(Mechatronics)

Time: 3 hours

Max Marks: 70

Answer any FIVE questions  
All questions carry equal marks

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- 1 (a) Distinguish between the terms 'closed system', 'open system' and 'isolated system'.  
(b) A fluid at a pressure of 3 bar and with specific volume of  $0.18 \text{ M}^3/\text{kg}$  contained in a cylinder behind a piston expands reversibly to a pressure of 0.6 bar according to a law  $P = C/V^2$ . Calculate the work done by the fluid on the piston.
- 2 (a) State zeroth law of thermodynamic and its significance.  
(b) 10 kg of fluid per minute goes through a reversible steady flow process. The properties of fluid at the inlet are  $P_1 = 1.5 \text{ bar}$  and  $P_2 = 26 \text{ bar}$ ,  $C_1 = 110 \text{ m/c}$  and  $u_1 = 910 \text{ kJ/kg}$ . and at the exit are  $P_1 = 5.5 \text{ bar}$  and  $P_2 = 5.8 \text{ bar}$ ,  $C_2 = 990 \text{ m/s}$ ,  $u_2 = 710 \text{ kJ/kg}$ . During the passage the fluid rejects 55 kJ/s and rises through 55 m. Determine:  
(i) Change in enthalpy. (ii) Work done during the process.
- 3 (a) Compare refrigerator and heat pump.  
(b) A house is to be maintained at a temperature of  $20^\circ \text{C}$  by means of a heat pump pumping heat from the atmosphere. Heat losses through the walls of the house are estimated at 0.65 KW per unit of temperature difference between the inside of the house and the atmosphere. (i) If the atmospheric temperature is  $-10^\circ \text{C}$  what is the minimum power required to drive the pump. (ii) It is proposed to use the same heat pump to cool the house in summer. For the same room temperature the same heat loss rate and the same power input to the pump. Determine the maximum permissible atmospheric temperature.
- 4 (a) Derive an expression for mean effective pressure of an Otto cycle.  
(b) Calculate the thermal efficiency of an Otto cycle working with maximum temperature of  $1400^\circ \text{C}$  and minimum temperature of  $42^\circ \text{C}$ . If the compression ratio is 10 and pressure of air at the beginning of compression is 1.5 bar, then estimate mean effective pressure.
- 5 (a) Explain with a neat sketch the working of a vapour compression cycle.  
(b) What is a superheat Rankine cycle and what are its advantages?
- 6 Explain with neat sketches the construction and working of the following:  
(a) Fuel pump.  
(b) Injector.
- 7 What is meant by ignition delay? What are the causes of knock in CI engines?
- 8 (a) Describe with neat sketches the working of a simple constant pressure open cycle gas turbine.  
(b) Enumerate the various uses of gas turbines.

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