

Code: 9A03302

**R09**

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

**THERMODYNAMICS**

(Common to AE and ME)

Time: 3 hours

Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

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- 1 (a) What is a quasi-static process? What is its characteristic feature?  
(b) An engine cylinder has a piston of area  $0.12 \text{ m}^2$  and contains gas at a pressure of  $1.5 \text{ MPa}$ . The gas expands according to a process which is represented by a straight line on a pressure-volume diagram. The final pressure is  $0.15 \text{ MPa}$ . Calculate the work done by the gas on the piston if the stroke is  $0.3 \text{ m}$ .
- 2 (a) Make a comprehensive energy analysis of the steam turbine.  
(b) The gas leaving the turbine jet engine flows steadily into the jet pipe with enthalpy  $960 \text{ kJ/kg}$  and velocity  $250 \text{ m/s}$ . The exit from the pipe is at enthalpy  $860 \text{ kJ/kg}$  and exhaust is in line with intake. Neglecting heat loss from the system. Determine the velocity of gas leaving the pipe.
- 3 (a) State the limitations of first law of thermodynamics.  
(b) A cyclic heat engine operated between a source temperature of  $900^\circ\text{C}$  and a sink temperature of  $50^\circ\text{C}$ . What is the least rate of heat rejection per KW net output of engine?
- 4 A vessel having a capacity of  $0.05 \text{ m}^3$  contains a mixture of saturated water and saturated steam at a temperature of  $245^\circ\text{C}$ . The mass of liquid present is  $10 \text{ kg}$ . Find the following:  
(i) The pressure. (ii) The mass. (iii) The specific volume.  
(iv) The specific enthalpy. (v) The specific entropy. (vi) The specific internal energy.
- 5 (a) Distinguish between a perfect gas and a real gas. Enumerate the laws formed by perfect gases.  
(b) Write a note on compressibility chart.
- 6 (a) Explain the methodology to convert gravimetric analysis in to volumetric analysis with the help of illustration.  
(b) Explain Dalton law of partial pressures.
- 7 Atmospheric air at  $20^\circ\text{C}$  and  $40\%$  RH enters a heating coil whose temperature is  $38^\circ\text{C}$ . The by-pass factor of heating coil is  $0.25$ . Compute dry bulb temperature, relative humidity and wet bulb temperature of the air leaving the heating coil. The atmospheric air is at  $1 \text{ bar}$ .
- 8 (a) Derive an expression for an air standard efficiency of a Lenoir cycle.  
(b) An engine working on Lenoir cycle with adiabatic index  $1.25$  and compression ratio is  $16$ . Calculate the efficiency.

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