Total No. of Questions :5] *[Total No. of Printed Pages : 2*

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AE/AU/IP/IEM/ME/PR-304

B.E. III Semester

Examination, December 2016

Thermodynamics

Time : Three Hours

Maximum Marks : 70

Note: i) Answer five questions. In each question part A, B, C is compulsory and D part has internal choice.
ii) All parts of each question are to be attempted at one place.
iii) All questions carry equal marks, out of which part A and B (Max. 50 words) carry 2 marks, part C (Max. 100 words) carry 3 marks, part D (Max. 400 words) carry 7 marks.
iv) Except numericals, Derivation, Design and Drawing etc.

1. a) Explain Thermodynamic Equilibrium.
   b) Give first law of thermodynamics for closed system.
   c) Write down Avogadro's hypothesis.
   d) Enlist limitations of first law of Thermodynamics.

OR

A piston cylinder assembly contains 1 kg of saturated liquid water at 0.1 MPa. Energy is transferred as heat till all the liquid is converted into saturated vapour at the same pressure. Calculate the work done by water and the energy transferred as heat.

2. a) Explain Thermodynamic Heat Pump.
   b) Define Available and Unavailable Energy.
   c) Define Gibb's and Helmholtz functions.
   d) Prove equivalence of Kelvin-Planck and Clausius statement of IInd law of thermodynamics.

OR

An inventor claims to have developed a heat engine which delivers a power output of 1 kW while absorbing energy at the rate of 1.2 kW from a source at 927°C. When the ambient atmosphere is at 27°C. Would you support this claim.

3. a) What is prime difference between real gas and ideal gas?
   b) Define compressibility factor.
   c) What is Maxwell relation? Enlist its applications.
   d) Deduce Van der Waal's equation.

OR

Explain laws of corresponding states, and generalized compressibility chart.

4. a) Define dryness fraction.
   b) Write a short note on steam table's applications.
   c) With the help of a neat sketch explain separating throttling calorimeter, how it measures dryness fraction?
   d) A vessel of volume 1m^3 contains saturated steam of quality 0.85 at 2 bar, calculate the temperature of the steam, the mass of liquid and the mass of vapor.

OR

A throttling calorimeter is used to measure the quality of wet steam at 10 bar flowing through a pipeline. The pressure and temperature at the exit of the calorimeter are measured as 1 bar and 110°C. Determine the quality of steam.

5. a) Draw Dual cycle an P-V and T-S diagram.
   b) Explain mole fraction.
   c) Compare Otto and Diesel cycles on the basis of same heat input and same compression ratio.
   d) In an air standard diesel cycle the minimum and maximum temperatures are 300 k and 2700 k respectively. The minimum and maximum pressure are 1 bar and 40 bar respectively. Calculate the compression ratio, cut off ratio and the thermal efficiency of the cycle.

OR

In an air standard diesel cycle with a compression ratio of 16 and a cut off ratio of 3, the conditions of air at the beginning of the suction stroke are 1 bar and 300 k, calculate the thermal efficiency of the cycle and the energy added per kg of air.

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