c) Explain how enthalpy and specific heat of gas mixtures change from that of an ideal gas?

d) The following data are available for an engine working on Otto cycle:

Intake air pressure = 90 kPa

Intake air temperature = 300 k

Compression ratio = 8

Heat supplied = 2000 kJ/kg

Determine:

i) Maximum pressure developed.

ii) Maximum temperature developed during the cycle.

iii) Cycle efficiency

iv) m.e.p of cycle

OR

A hypothetical mixture of gases has the following volumetric composition:

CO_2 = 8%, O_2 = 4%, N_2 = 75%, CO = 13%

Calculate:

i) Gravimetric composition.

ii) Molecular weight of the mixture.

iii) R of the mixture.

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Roll No ....

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

B.E. III Semester

Examination, June 2015

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.

Unit - I

1. a) State Zeroth law of thermodynamics. What is its significance?

b) Derive the expression for work done in a polytropic process.

c) Differentiate between point and path functions with necessary equations and curves.

d) A single cylinder, double acting, reciprocating water pump has an indicator diagram which is a rectangle 0.075 m long and 0.05 m high. The indicator spring constant is 147 MPa/m. The pump runs at 60 rpm. The pump cylinder diameter is 0.15 m and the piston stroke is 0.30 m. Find the rate in kW at which the piston does work on the water.

OR

Derive the expression for a steady flow and deduce its energy equation.

Unit - II

2\. a) Explain why Carnot's cycle is not possible practically?

b) Give Kelvin Planck's and Clausius statements for the 2nd law of thermodynamics.

c) Differentiate between the performance of a heat engine and heat pump.

d) What is Clausius inequality? Derive its expression.

OR

19 kg of air at 1.85 bar and 286k is compressed to 24.5 bar according to the law $Pv^{1.82}$ = Constant and then cooled at constant volume to 288 k. Determine .

i) Volume and temperature at the end of compression.

ii) Change of entropy during compression and during constant volume cooling.

Unit - III

3\. a) Give the limitations of vendor walls equation.

b) What is the utility of a P-V-T surface?

c) Give the law of corresponding states. Also, explain the importance of compressibility factor and generalized compressibility chart.

d) Derive the expressions for Maxwell's relations and Clapeyron equation. Also, give their importance.

OR

Derive the expressions to calculate critical temperature, critical pressure and critical volume in terms of vender wall's constants.

Unit - IV

4\. a) What is dryness fraction of steam? Give its formula.

b) Give various properties of steam.

c) How a Mollier chart is prepared? What is its utility?

d) Explain the process of steam generation (upto super heated stage) With the help of diagrams, equations and graphs, starting from -25°C ice.

OR

A rigid tank of 3 m^3 volume is filled with dry saturated steam at 0.3 MPa. Due to poor insulation of the tank, the pressure of the steam dropped to 0.1 MPa after some time. Determine change in internal energy during this process.

Unit - V

5\. a) Give various properties of mixture of ideal gases.

b) What do you understand by air standard cycles? Give examples.