[Total No. of Questions - 9] [Total No. of Printed Pages - 4]
(2125)

15029

B. Tech 1st /2nd Semester Examination

Basic Mechanical Engineering (OS)

ME-1003

Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt five questions in all, selecting one question from each section A, B, C and D. The section E is compulsory with short answer type and all parts of this section are to be attempted. Missing data, if any, can be assumed suitably. Take r=1.4, R=0.29 KJ/kg ºC, c_v= 0.718

SECTION - A

1. (a) What do you mean by "Perpetual motion machine of second kind"? (5)

   (b) Explain the Joule's Law. (5)

   (c) Set up a relationship between the two specific heats. (10)

2. An oil engine has a volume of 60 liters and a compression ratio of 14.2 to 1. At the beginning of the compression stroke the pressure and temperature are 1 bar and 80ºC respectively. At the end of compression the pressure is 30 bars. The charge is now heated at constant pressure until the volume is doubled. Find (a) the index of compression, (b) the temperature at the end of compression, (c) the heat transfer (d) the heat received in constant pressure operation. (20)

[P.T.O.]

SECTION - B

3. (a) Explain the third law of thermodynamics. (5)

   (b) An ice plant working on a reversed Carnot cycle heat pump produces the 15 tonnes of ice per day. The ice is formed from water at 0ºC and formed ice is maintained at 0°C. The heat is rejected to the atmosphere at 25ºC. The heat pump used to run the ice plant is coupled to a Carnot engine which absorbs the heat from a source which is maintained at 220ºC by burning the liquid fuel of 44500 kJ/kg calorific value and rejects the heat to atmosphere. Determine the power developed by engine and fuel consumed per hr. Take enthalpy of fusion of ice =335kJ/kg. (15)

4. (a) What conditions are to be fulfilled by a process to be reversible? (5)

   (b) Explain the Kelvin-Planck statement of second law of thermodynamics. (5)

   (c) Derive an expression for change in entropy for polytropic process. (10)

SECTION - C

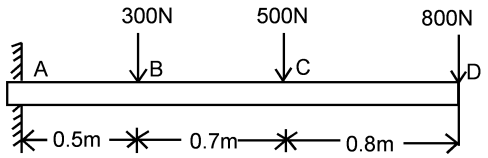
5. A steel rod of 13 cm diameter is enclosed centrally in a hollow copper tube of external diameter 5 cm and internal diameter of 4 cm. The composite bar is then subjected to an axial pull of 45000 N. If the length of each bar is equal to 15 cm, determine :

   (i) The stresses in the rod and tube, and

   (ii) Load carried by each bar.

   Take E for steel 2.1×10^5 N/mm^2 and for copper=1.1×10^5N/mm^2 (20)

6. A cantilever beam of length 2 m carries the point loads as shown in Fig. Draw the shear force and B.M. diagrams for the cantilever beam. (20)



SECTION - D

7. Derive the relation for a circular shaft when subjected to torsion as given below

$\frac{T}{J} = \frac{\tau}{R} = \frac{C\theta}{J}$ where

T = Torque Transmitted,

J = Polar Moment of Inertia,

τ = Maximum Shear Stress,

R = Radius of shaft,

θ = Angle of twist,

L = Length of shaft,

C = Modulus of rigidly.

Mention also the assumption made in derivation. (20)

8. A timber beam of rectangular section is to support a load of 20 kN uniformly distributed over a span of 3.6 m when beam is simply supported. If the depth of section is to be twice the breadth, and the stress in the timber is not to exceed 7 N/mm^2, find the dimensions of the cross-section. How would you modify the cross-section of the beam, if it carries a concentrated load of 20 kN placed at the centre with the same ratio of breadth to depth? (20)

[P.T.O.]

SECTION - E

9. (a) Define a thermodynamic system.

(b) Write down steady flow energy equation for a turbine.

(c) Differentiate between the closed and open system.

(d) Define the efficiency of Carnot engine.

(e) What is the significance of energy?

(f) Draw the stress strain diagram for ductile material and show the various important points on it.

(g) Define the Young's modulus and what is its importance?

(h) Explain the importance of shear force and bending moment diagram.

(i) What is the bending stress at neutral axis?

(j) Write down the section modulus equations for rectangular, hollow rectangular, circular and hollow circular section. (2x10=20)