SE - Sem - II - Mech - CBSGS - Thermodynamics

15/5/1

Q.P. Code : 554901

(3 Hours) **[Total Marks : 100**

N.B. : (1) Question No.1 is **Compulsory.**
(2) Answer **any three** from remaining **five** questions.
(3) Assume suitable data wherever required.
(4) Assumptions made should be stated clearly.

1. Solve the following (**Any Four**) **20**
   (a) Explain zeroth law of thermodynamics with neat sketch. State its significance.
   (b) Write both the statements of second law of thermodynamics.
   (c) Define: enthalpy of combustion, enthalpy of formation and standard reference state.
   (d) Define : available energy, dead state and irreversibility.
   (e) Define : compression ratio, clearance ratio and mean effective pressure.
   (f) Explain process of phase change of ice into steam with the help of T-S diagram.

2. (a) A system containing 0.2 m^3 of air at a pressure of 4 bar and 160°C expands isentropically to a pressure of 1.06 bar and after this 65 kJ of heat is supplied at constant pressure. Calculate combined work done of both processes. Now assuming that these processes are replaced by a single reversible polytropic process producing the same amount of work between initial and final state. Find the index of expansion for polytropic process. **12**

   (b) Prove that entropy is property of the system. **8**

3. (a) Steam enters a nozzle at a pressure of 7 bar and 20°C with an initial enthalpy of 2850 kJ /kg and leaves at a pressure of 1.5 bar. Initial velocity of steam at the entrance is 40 m/ s and exit velocity from nozzle is 700 m/s. The mass flow rate of steam is 1400 kg/hr. The heat loss from the nozzle is 11705 kJ/hr. Determine the final enthalpy of steam and the nozzle area if the sp volume is 1.24 m^3 /kg. **8**

   (b) Explain heat pump and refrigerator with neat sketch. **6**

TURN OVER

(c) Explain Carnot theorem with neat sketch. 6

4. (a) Compare Exergy (Availability) and energy based upon their characteristics. 6

(b) Write four Maxwell relations. 4

(c) A heat pump is run by a reversible heat engine operating between reservoirs at 800°C and 50°C. The heat pump working on Carnot cycle picks up 15 kW heat from reservoir at 10°C and delivers it to a reservoir at 50°C. The reversible engine also runs a machine that needs 25 kW. Determine the heat received from highest temperature reservoir and heat rejected to reservoir at 50°C. 10

5. (a) Define Joule-Thomson coefficient. 2

(b) A steam power plant working on Rankine cycle uses steam at 50 bar (dry and saturated) and the steam is condensed at 0.05 bar in condenser. Determine thermal efficiency of the cycle and plot the cycle on T-S chart. 10

(c) Determine the enthalpy of combustion of liquid octane C_8H_{18} at 25°C and 1 atm using
following data :-
Enthalpy of formation for CO_2 at 25°C & 1 atm = -393520 kJ/kmol.
Enthalpy of formation for $H_2O(l)$ = -285830 kJ/kmol.
Enthalpy of formation for $C_8H_{18}(l)$ = -249950 kJ/kmol
Calculate in kJ /kg of C_8H_{18}. Take molar mass of C_8H_{18} = 114.23 kg/kmol. 8

6. (a) Derive an expression for air standard efficiency of Otto cycle. State assumption also. 8

(b) Calculate specific enthalpy and specific entropy of steam at a pressure of 10 bar and having dryness fraction of 0.85 4

(c) An engine working on air standard Diesel cycle compresses the air from 1 bar and 26°C. Max temperature in the cycle is 1370°C. If the clearance volume is 12.5% of stroke volume, find (i) Compression ratio & cutoff ratio (ii) thermal efficiency of the cycle. 8

T1823 / T1479 STRENGTH OF MATERIALS

24/5/17

S-E- sem-III - CBSGS - Mechanical

Q. P. Code : 555000

Time: 3hrs **Marks: 80**

Instructions
1. All questions carry equal marks.
2. Assume suitable data if necessary.
3. Figures to the right indicate full marks.
3. Question No. 1 is compulsory & Attempt any three questions from remaining five questions.

Q.1 Attempt any **FOUR** **20**

a. What do you mean by Core of a section? Obtain the core of a hollow circular section.

b. Draw SFD and BMD for a simply supported beam carrying udl (w) over the full span (L).

c. Derive flexural formula

d. Establish the relationship between Young's modulus, Modulus of rigidity and Bulk modulus.

e. Derive an expression for the elongation of bar having rectangular section due to its self-weight.

f. A rectangular beam 300 mm deep is simply supported over a span of 4 m. What udl the beam can carry if the bending stress is not to exceed 120 MPa. Take $I = 8 \times 10^6$ mm^4.

Q.2 **a.** A beam has a cross section in the form of an isosceles triangle with the base 90 mm and height 150 mm. If the maximum value of permissible shear stress is 0.8 MPa, what is the maximum value of vertical shear force the section can withstand? Also determine shearing stresses at 40 mm from apex and at centroid of the triangle. **8**

b. Write the assumptions made in theory of torsion and derive torsional formula. **6**

c. A rod of 16 mm in diameter is stretched by 4 mm under a steady axial load of 15 kN. What stress would be induced in a bar by a 900 N weight falling through 60 mm, if it is originally unstretched? Take $E = 2 \times 10^5$ MPa. **6**

Q.3 **a.** A cylindrical shell is 3 m long, 1 m in diameter is subjected to an internal pressure of 1 MPa. If the thickness of the shell is 12 mm, find the change in length, diameter, and volume of the shell. Take $1/m = 0.27$ and $E = 2 \times 10^5$ N/mm^2. **10**

b. A high voltage overhead cable 100 m long consists of six strands of 3 mm diameter steel wire, enclosed by 28 strands of 2 mm diameter aluminium wire. If the cable is subjected to a tensile force of 8 kN. Find the stresses in each material and extension of the cable. Take $E_s = 190$ GPa, $E_A = 68$ GPa **10**

[TURN OVER]

Q.4 **a.** Find slope and deflection at B, C, and D. for the beam shown in Figure 1. **10**

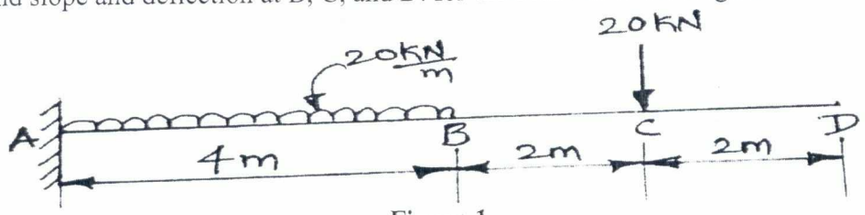

Figure 1

b. A short column has a hollow circular cross section of outside diameter 230 mm and wall thickness 30 mm. An axial compressive load of 400 kN is applied together with a parallel compressive load of 300 kN offset 100 mm from the axis. **10**

i) Calculate the maximum tensile and maximum compressive stresses in the column.

ii) Determine the maximum eccentricity that the 300 kN load can have for no tension condition.

Q.5 **a.** Determine the crippling load for a T section having dimensions 100 mm x 100 mm x 20 mm and length is 5 m, when it is used as strut with both the ends hinged. Take $E = 2 \times 10^5$ MPa. **10**

b. A bimetallic thermal control shown in Figure 2 is made of brass bar of length 750 mm and cross sectional area 100 mm^2 and magnesium bar of length 1300 mm and cross sectional area 200 mm^2. The two bars are arranged so that the gap between their free ends is 2 mm at room temperature. Calculate **10**

i) The temperature rise at which the two bars come in contact.

ii) The stress in the materials when the temperature increase is 300^0 C.
take E_b = 150 GPa, E_m = 65 GPa, $\alpha_b = 10 \times 10^{-6}/\,^{\circ}C$, $\alpha_m = 14.5 \times 10^{-6}/\,^{\circ}C$.

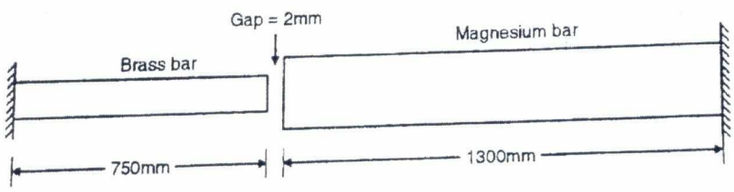

Figure 2

[TURN OVER]

Q.6 **a.** A beam simply supported at its ends has a span of 6 m. It is loaded with a gradually varying load of zero from left hand support to 1500 N/m to the right hand support. Draw SFD and BMD. **6**

b. A beam 8.5 m long rests on the supports 5 m apart, the beam carries load as shown in Figure 3. Draw SFD and BMD showing all the important points. **10**

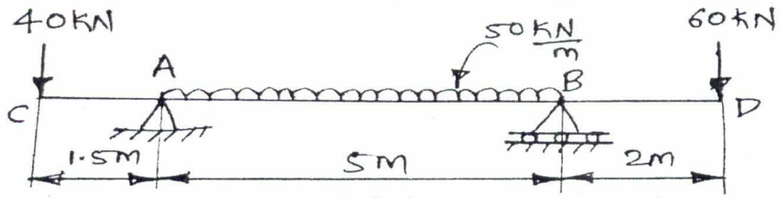

Figure 3

c. Find the maximum power that can be transmitted by a 50 mm diameter shaft at 200 rpm, if the permissible shear stress for the shaft material is 60 MPa. **4**

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(34)

30/5/17

Q.P. Code : 555101

(3 Hours) **[Total Marks : 80**

N.B. : (1) Question no. **1** is **compulsory.**
(2) Attempt any **three** questions out of remaining **five** questions
(3) Figures to right indicate full marks
(4) Assume suitable data if necessary

1. Write short note on any **four** of the following **20**
   (a) Rolling defects
   (b) friction welding
   (c) Blow moulding process.
   (d) Tube drawing operation
   (e) Pattern allowances

2. (a) With a neat sketch explain the principle and working of electroslag welding process. Also discuss its advantages ,limitations, and applications. **8**
   (b) Differentiate soldering and brazing. **6**
   (c) Describe the common types of forging hammers **6**

3. (a) Write in brief the basic steps of powder metallurgy process. **8**
   (b) With a neat sketch explain Termit welding operation. **6**
   (c) Write short note on microstructure of welds. **6**

4. (a) What is NDT. List various methods of NDT. Explain Die- penetrant method of crack detection. **8**
   (b) With a neat sketch explain the working principle of plastic injection mounding process. **6**
   (c) Write applications of powder metallurgy. **6**

5. (a) Define weldability. Differentiate between TIG and MIG welding process. **10**
   (b) Describe ten types of casting defects with their remedies **10**

6. (a) With the help of diagrams discuss the various type of cores used in sand mounding process. **8**
   (b) Write short note on application of plastics in industries. **6**
   (c) Explain vacuum forming process of polymers. **6**
