D 51016 (Pages : 3)

Name.....

Reg. No.....

THIRD SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, NOVEMBER 2013

CE 09 303—MECHANICS OF SOLIDS

Time : Three Hours Maximum : 70 Marks

Part A

Answer **all** *questions.*
Each question carries 2 *marks.*

I. (a) State Hooke's law.

(b) Define volumetric strain.

(c) Bring out the difference between statically determinate and indeterminate beams.

(d) Write the bending equation with usual meaning.

(e) Write down the secant formula.

(5 × 2 = 10 marks)

Part B

Answer any **four** *questions.*
Each question carries 5 *marks.*

II. (a) Define a composite bar. How will you find stresses and load carried by each member of a composite bar ?

(b) Draw SFD and BMD for a fixed beam carrying a UDL of intensity w per meter run.

(c) Derive the equation for strain energy due to bending with an example.

(d) Explain the theory of simple bending.

(e) Derive the Euler's formula for a column with one end hinged and other end is free.

(f) Derive an expression for change in volume for thin spherical shell.

(4 × 5 = 20 marks)

Part C

Answer **all** *questions.*
Each questiion carries 10 *marks.*

III. (a) A steel rod of 2 cm diameter is enclosed centrally in a hollow copper tube of external diameter 4 cm and internal diameter of 3.5 cm. The composite bar is then subjected to an axial pull of 50000 N. If the length of each bar is equal to 20 cm, determine (i) The stress in the rod and tube ; and (ii) Load carried by each bar.

Or

(b) A axial pull of 40000 N is acting on a bar consisting of three sections of length 30 cm, 25 cm, and 20 cm and of diameters 2 cm, 4 cm and 5 cm respectively. If the Young's modulus = 2×10^5 N/mm^2, determine (i) Stress in each section ; and (ii) Total extension of the bar.

IV. (a) Draw SFD and BMD for the beam shown in figure 1. Indicate the position and the magnitude of maximum bending moment.

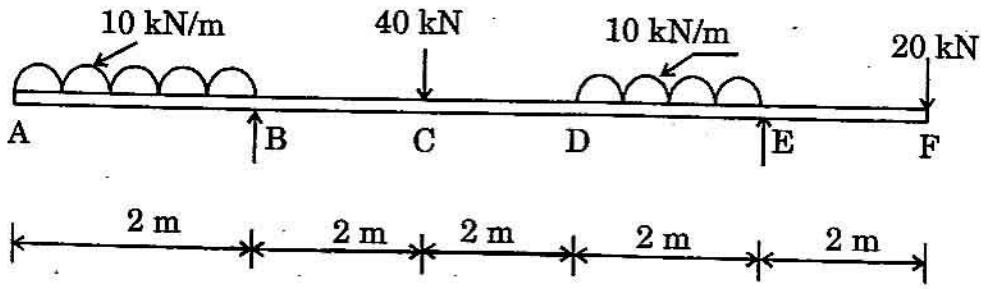

Figure 1

Or

(b) Draw SFD and BMD for the beam shown in figure 2. Indicate the position and the magnitude of maximum bending moment.

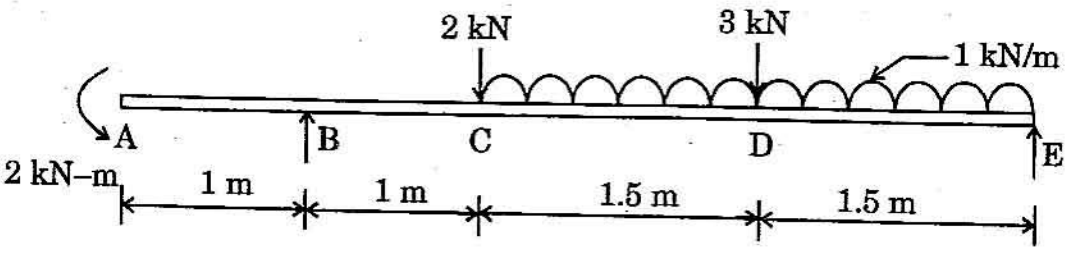

Figure 2

V. (a) The cross-section of a cast-iron beam is as shown in Figure 3. The top flange is in compression and bottom flange is in tension. Permissible stress in tension is 30 N/mm^2 and its value in compression is 90 N/mm^2. What is the maximum uniformly distributed load the beam can carry over a simply supported span of 5 m ?

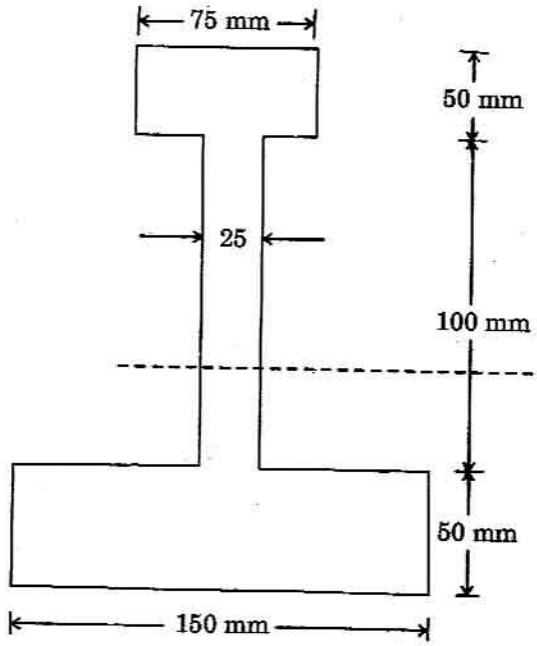

Figure 3

Or

(b) A simply supported beam of span 3.0 m has a cross-section 120 mm × 180 mm. If the permissible stress in the material of the beam is 10 N/mm^2, determine (i) Maximum uniformly distributed load it can carry ; (ii) Maximum concentrated load at a point 1 m from support it can carry. Neglect moment due to self weight.

VI. (a) A vertical steam boiler with 2 m internal diameter and 4 m high is constructed with 2 cm thick plates for a working pressure of 10 kg/cm^2. The end plates are flat. Calculate

(i) The stress in the circumferential plates due to pressure on the end plates.

(ii) Stress in the circumferential plates due to resisting the bursting effect.

(iii) Increase in length, diameter and the volume.

Take Poisson's ratio = 0.3 and E = 2×10^6 kg/cm^2.

Or

(b) A cylindrical shell 900 mm long, 150 mm internal diameter, having thickness of metal as 8 mm, is filled with a fluid at atmospheric pressure. If an additional 20000 mm^3 of fluid is pumped into the cylinder, find (i) pressure exerted by the fluid on the cylinder ; (ii) hoop stress induced.

(4 × 10 = 40 marks)