17304

21415

3 Hours/100 Marks

Seat No. | | | | | | | | |

***Instructions** : (1) **All** questions are **compulsory**.*

*(2) Illustrate your answers with **neat** sketches **wherever** necessary.*

*(3) Figures to the **right** indicate **full** marks.*

*(4) **Assume** suitable data, **if necessary**.*

*(5) **Use** of Non-programmable Electronic Pocket Calculator is permissible.*

MARKS

1. A) Attempt **any six** of the following : **12**

a) Define fatigue and creep.

b) Define principal plane and principal stress.

c) State the relation between B.M. and S.F.

d) Give the four assumptions in theory of bending.

e) Draw the core section for circular column of diameter 'd'.

f) Give the relationship between E, G and K.

g) State the value of two different angles of the planes with principal plane where the tangential stress is maximum.

h) Draw stress distribution on rectangular section subjected to bending. When used as cantilever and simply supported beam ?

B) Attempt **any two** of the following : **8**

a) Find the required diameter of steel rod that has to carry an axial pull of 40 kN, if the permissible stress is 150 MPa.

b) A seamless pipe 1 m diameter contains a fluid pressure of 1.5 N/mm^2. If the ultimate tensile stress is 450 N/mm^2. Find the minimum thickness of pipe. Take factor of safety as 4.5.

c) A symmetrical I-section of overall depth of 300 mm, has its flanges 150 mm × 10 mm, and web 10 mm thick. Find the M.I. about its centroidal axis parallel to the flanges.

P.T.O.

MARKS

2. Attempt **any four** of the following : **16**

a) i) Draw the sketch of uniformly varying section showing axial load.

ii) State the effective length for one end fixed and other end hinged column.

b) Write the assumptions made in the Euler's column theory.

c) A rod 300 mm long and 20 mm in diameter is heated through 100°C and at the same time pulled by a force 'P'. If the total extension is 0.4 mm. What is the magnitude of 'P' ?

Take E = 2 × 10^5 N/mm^2 and $\alpha = 12 \times 10^{-6} / °C$.

d) A member ABCD is subjected to loads as shown in Fig. 1. Find the force 'P' and net change in length of the member.

Take E = 2 × 10^5 N/mm^2 .

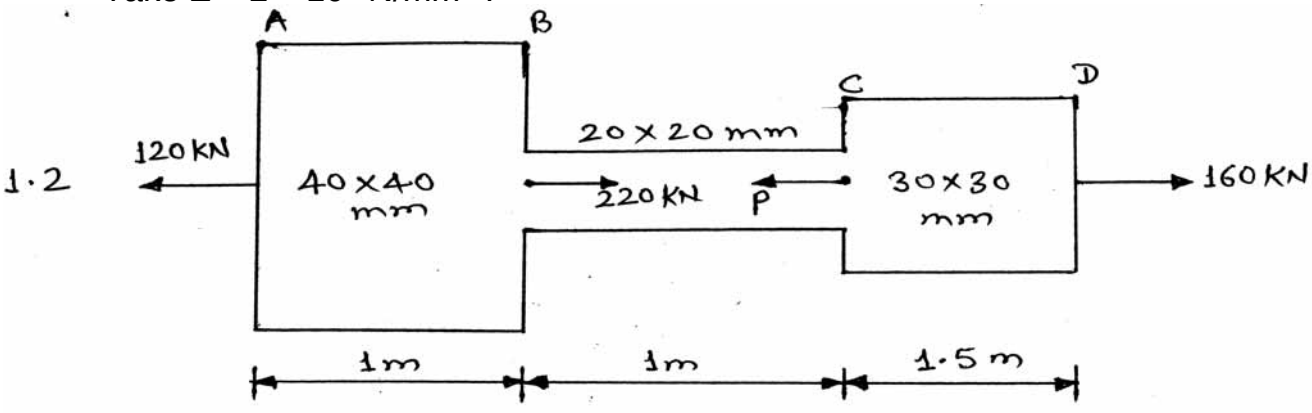

Fig. 1

e) A straight bar of uniform cross section has a diameter of 10 mm. It is subjected to an axial pull of 20 kN. Find the normal and tangential stresses on a plane inclined at an angle of 30° to the axis of bar.

f) A cylindrical shell is 3 m long, 1m internal diameter and 15 mm metal thickness. Calculate circumferential strain and longitudinal strain, if cylindrical shell is subjected to internal pressure of 1.5 N/mm^2.

Take E = 2 × 10^5 N/mm^2 and $\mu = 0.25$.

3. Attempt **any four** of the following : **16**

a) Draw S.F. and B.M. diagrams for a simply supported beam of a span 'L' carrying a central point load 'W'. State the values of maximum S.F. and Maximum B.M. and their locations.

b) A simply supported beam ABC which supported at A and B, 6 m apart with an overhang BC 2 m long, carries a udl of 15 kN/m over AB and a point load of 30 kN at C. Draw S.F. and B.M. diagrams.

c) A cantilever beam 4 m long carries a udl of 2kN/m over 2 m from free end and a point load of 4kN at free end. Draw S.F. and B.M. diagrams.

MARKS

d) Draw S.F. and B.M. diagrams of a cantilever beam AB 4 m long having its fixed end at A and loaded a udl of 1kN/m up to 2 m from B and with a point load of 2 kN at 1 m from A.

e) A simply supported beam of span 4 m carries two point loads of 5kN and 7 kN at 1.5 m and 3.5 m from the left hand support respectively. Draw SFD and BMD showing important values.

f) A circular disc has M.I. about its anyone tangent is 6.283×10^5 mm^4. Calcualte diameter of disc.

4. Attempt **any four** of the following : **16**

a) Determine the M.I. of a solid rectangular section 40 mm wide and 60 mm deep about its smaller side.

b) An I-section have the following diamension
Top flange – 80 mm × 20 mm
Bottom flange – 120 mm × 20 mm
Web – 120 mm × 20 mm
Calculate the M.I. about X – X axis.

c) Find I_{yy} for an unequal angle section having vertical leg of 125 × 10 mm and horizontal leg of 75 × 10 mm.

d) An isosceles triangular section ABC has base width 80 mm and height 60 mm. Determine the M.I. of the section about the C.G. of the section and about the base BC.

e) State bending eqn. and define moment of resistance.

f) Draw shear stress distribution diagram for rectangular section. Also state the relationship between maximum and average shear stress.

5. Attempt **any four** of the following : **16**

a) A timber beam 100 mm wide and 150 mm deep supports a udl over a span of 2 m. If the safe stresses are 28N/mm^2 in bending and 2N/mm^2 in shear. Calculate the maximum load which can be supported by the beam.

b) Calcualte the limit of eccentricity for a circular section having diameter 80 mm. (Not by using direct formula but from basic principle)

c) A rectangular column 150 mm wide and 100 mm thick carries a load of 150 kN at an eccentricity of 50 mm in the plane bisecting the thickness. Find the maximum and minimum intensities of stress in the section.

d) A hollow circular column having external and internal diameters of 40 cm and 30 cm respectively, carries a vertical load of 150 kN at the outer edge of the column. Calculate the maximum and minimum intensities of stresses in the section.

MARKS

e) A rectangular rod of size 50 mm × 100 mm is bent into "C" shape as shown in Fig. 2 and applied load of 40 kN at point A. Calcualte resultant stress developed at section X – X.

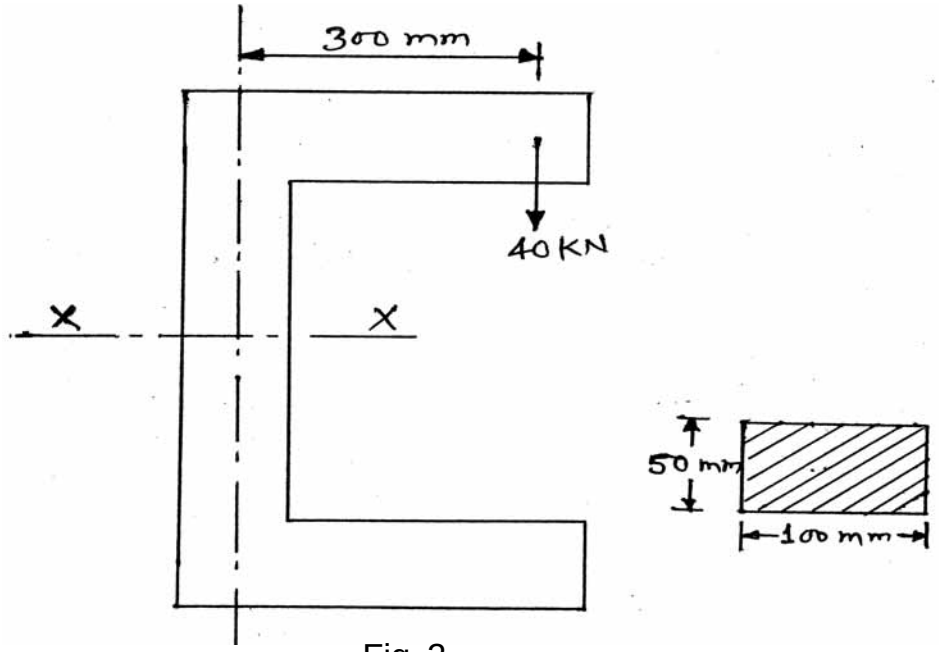

Fig. 2

f) Calcualte the limit of eccentricity of a rectangular cross section of size 1000 mm × 2000 mm and sketch it.

6. Attempt **any four** of the following : **16**

a) State the assumption in theory of pure torsion.

b) A shaft required to transmit 20 kW power at 150 r.p.m. The maximum torque may exceed the average torque by 40%. Determine the diameter of the shaft if shear stress is not to exceed 50 MPa.

c) Find the power that can be transmitted by a shaft of 40 mm diameter rotating at 200 r.p.m., if maximum shear stress is not to exceed 85 MPa.

d) A shaft is transmitting 150 kW at 200 r.p.m. If allowable shear stress is 80 N/mm^2 and allowable twist is 1.5° per 4 m length. Find the diameter of shaft. Take $G = 0.8 \times 10^5$ N/mm^2.

e) Find the maximum stress in a propeller shaft 400 mm external and 200 mm internal diameter, when subjected to a twisting moment of 4650 Nm. If the modulus of rigidity is 82 GPa. Calcualte the twist in a length 20 times the external diameter.

f) i) Define neutral axis

ii) Compare solid shaft and hollow shaft.
