KINGS

COLLEGE OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING
QUESTION BANK

Subject code/Name: ME2254/STRENGTH OF MATERIALS

Year/Sem:II / IV

UNIT – I STRESS, STRAIN DEFORMATION OF SOLIDS

PART – A (2 MARKS)

1. Define stress.
2. Define strain
3. State Hooke's law.
4. Define shear stress and shear strain.
5. Define Poisson's ratio.
6. State the relationship between Young's Modulus and Modulus of Rigidity.
7. Define strain energy
8. Give the relationship between Bulk Modulus and Young's Modulus.
9. What is compound bar?
10. Define- elastic limit
11. Define – Young's modulus
12. Define Bulk-modulus
13. Define- lateral strain

PART –B (16 MARKS)

1. A rod of 150 cm long and diameter 2.0cm is subjected to an axial pull of 20 KN . If the modulus of elasticity of the material of the rod is 2x 10^5 N/mm^2; determine 1. Stress 2. the strain 3. the elongation of the rod

2. The extension in a rectangular steel bar of length 400mm and thickness 10mm is found to 0.21mm .The bar tapers uniformly in width from 100mm to 50mm . If E for the bar is 2x 10^5 N/mm^2 ,determine the axial load on the bar

3. A rod of 250 cm long and diameter 3.0cm is subjected to an axial pull of 30 KN . If the modulus of elasticity of the material of the rod is 2x 10^5 N/mm^2; determine 1. Stress 2. the strain 3. the elongation of the rod

4. Find the young's modulus of a rod of dia 30mm and of length 300mm which is subjected to a tensile load of 60 KN and the extension of the red is equal to 0.4 mm

5. The extension in a rectangular steel bar of length 400mm and thickness 3mm is found be 0.21mm .The bar tapers uniformly in width from 20mm to

60mm E for the bar is 2x 10^5 N/mm^2 ,determine the axial load on the bar
6. The ultimate stress for a hollow steel column which carries an axial load of 2Mn is 500 N/mm2 .If the external diameter of the column is 250mm, determine the internal diameter .Take the factor of safety as 4.0

UNIT – II LOADS AND STRESSES
PART –A (2 MARKS)

1. Define beam?
2. What is mean by transverse loading on beam?
3. What is Cantilever beam?
4. What is simply supported beam?
5. What is mean by over hanging beam?
6. What is mean by concentrated loads?
7. What is uniformly distributed load.
8. Define point of contra flexure? In which beam it occurs?
9. What is mean by positive or sagging BM?
10. What is mean by negative or hogging BM?
11. Define shear force and bending moment?
12. When will bending moment is maximum?
13. What is maximum bending moment in a simply supported beam of span 'L' subjected to UDL of 'w' over entire span?
14. In a simply supported beam how will you locate point of maximum bending moment?
15. What is shear force?
16. What is shear force and bending moment diagram?
17. What are the types of beams?
18. What are the types of loads?
19. In which point the bending moment is maximum?
20. Write the assumption in the theory of simple bending?
21. Write the theory of simple bending equation?

PART –B (16 MARKS)

1. At a point in a strained material, the principal stresses are 100 N/mm2 (T) and 40 N/mm2 (C) Determine the direction and magnitude in a plane inclined at 600 to the axis of major principal stress. What is the maximum intensity of shear stress in the material at the point

2. Three planks of each 50 x200 mm timber are built up to a symmetrical I section for a beam. The maximum shear force over the beam is 4KN. Propose an alternate rectangular section of the same material so that the maximum shear stress developed is same in both sections. Assume then width of the section to be 2/3 of the depth.

3. A beam of uniform section 10 m long carries a udl of KN/m for the entire length and a concentrated load of 10 KN at right end. The beam is freely supported at the left end. Find the position of the second support so that the maximum bending moment in the beam is as minimum as possible. Also compute the maximum bending moment

4. A beam of size 150 mm wide, 250 mm deep carries a uniformly distributed load of w kN/m over entire span of 4 m. A concentrated load
1 kN is acting at a distance of 1.2 m from the left support. If the bending stress at a section 1.8 m from the left support is not to exceed 3.25 N/mm2 find the load w.

5. a) The stiffness of close coiled helical spring is 1.5 N/mm of compression under a maximum load of 60 N. The maximum shear stress in the wire of the spring is 125 N/mm2. The solid length of the spring (when the coils are touching) is 50 mm. Find the diameter of coil, diameter of wire and number of coils. C = 4.5

6. At a point in a strained material, the principal stresses are 200 N/mm2 (T) and 60 N/mm2 (C) Determine the direction and magnitude in a plane inclined at 600 to the axis of major principal stress. What is the maximum intensity of shear stress in the material at the point

UNIT –III TORSION
PART –A (2 MARKS)

1. Define Torsion
2. What are the assumptions made in Torsion equation
3. Define polar modulus
4. Write the polar modulus for solid shaft and circular shaft.
5. Why hollow circular shafts are preferred when compared to solid circular shafts?
6. Write torsional equation
7. Write down the expression for power transmitted by a shaft
8. Write down the expression for torque transmitted by hollow shaft
9. Write down the equation for maximum shear stress of a solid circular section in diameter ‘D’ when subjected to torque ‘T’ in a solid shaft.
10. Define torsional rigidity
11. What is composite shaft?
12. What is a spring?
13. State any two functions of springs.
14. What are the various types of springs?
15. Classify the helical springs.
16. What is spring index (C)?
17. What is solid length?
18. Define spring rate (stiffness).
19. Define pitch.
20. Define helical springs.
21. What are the differences between closed coil & open coil helical springs?

PART –B (16 MARKS)

1. Determine the diameter of a solid shaft which will transmit 300 KN at 250 rpm. The maximum shear stress should not exceed 30 N/mm2 and twist should not be more than 10 in a shaft length 2m. Take modulus of rigidity = $1x\ 10^5$N/mm2.

2. The stiffness of the closed coil helical spring at mean diameter 20 cm is made of 3 cm diameter rod and has 16 turns. A weight of 3 KN is dropped on this spring. Find the height by which the weight should be dropped before striking the spring so that the spring may be compressed by 18 cm. Take C= $8x10^4$ N/mm2.

3. A compound tube consist of steel tube 140mm internal diameter and 160mm external diameter and an outer brass tube 160mm internal diameter and 180mm external diameter. The two tubes are of same length. The compound tube carries an axial load of 900 KN. Find the stresses and the load carried by each tube and the amount it shortens. Length of each tube is 140mm. Take E for steel as 2 x 10^5 N/mm2

4. It is required to design a closed coiled helical spring which shall deflect 1mm under an axial load of 100 N at a shear stress of 90 Mpa. The spring is to be made of round wire having shear modulus of 0.8 x 10^5 Mpa. The mean diameter of the coil is 10 times that of the coil wire. Find the diameter and length of the wire.

5. A steel shaft ABCD having a total length of 2400 mm is contributed by three different sections as follows. The portion AB is hollow having outside and inside diameters 80 mm and 50 mm respectively, BC is solid and 80 mm diameter. CD is also solid and 70 mm diameter. If the angle of twist is same for each section, determine the length of each portion and the total angle of twist. Maximum permissible shear stress is 50 Mpa and shear modulus 0.82 x 10^5 MPa

6. A compound tube consist of steel tube 240mm internal diameter and 260mm external diameter and an outer brass tube 260mm internal diameter and 280mm external diameter. The two tubes are of same length. The compound tube carries an axial load of 880 KN. Find the stresses and the load carried by each tube and the amount it shortens. Length of each tube is 140mm. Take E for steel as 2 x 10^5 N/mm2

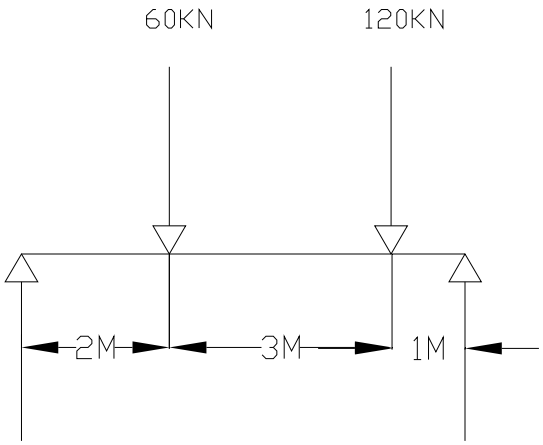
UNIT –IV BEAM DEFLECTION
PART –A (2 MARKS)

1. What are the methods for finding out the slope and deflection at a section?
2. Why moment area method is more useful, when compared with double integration?
3. Explain the Theorem for conjugate beam method?
4. Define method of Singularity functions?
5. What are the points to be worth for conjugate beam method?
6. What are the different sections in which the shear stress distribution is to be

obtained?
7. What do you mean by shear stress in beams?
8. What is the formula to find a shear stress at a fiber in a section of a beam?
9. What is the shear stress distribution rectangular section?
10. What is the shear stress distribution Circular section?
11. State the main assumptions while deriving the general formula for shear stresses
12. Define: Shear stress distribution
13. What is the ratio of maximum shear stress to the average shear stress for the rectangular section?
14. What is the ratio of maximum shear stress to the average shear stress in the case of circular section?
15. What is the shear stress distribution value of Flange portion of the I-section?
16. What is the value of maximum of minimum shear stress in a rectangular cross section?
17. What is the shear stress distribution for I-section?
18. How will you obtained shear stress distribution for unsymmetrical section?
19 Where the shear stress is max for Triangular section?
20. Where shear stress distribution diagram draw for composite section?

PART –B (16 MARKS)

1. Obtained the deflection under the greater load for the beam shown in fig using the conjugate beam method.



2. A 2m long cantilever made of steel tube of section 150 mm external diameter and10mm thick is loaded as show in fig If E=200 GN/m2 calculate (1) The value of W so that the maximum bending stress is 150 MN/m (2) The maximum deflection for the loading

3. A simply supported beam of length 4 m carries two point loads 3 kN each at a distance of 1 m from each end. E = 2 x105 N/mm2. I = 108 mm4. Using conjugate beam method determine slope at each end and deflection under each load.

4. (a) A cantilever beam 4m span carries a point load of 10 kN at free end. Find the deflection and rotation at mid–span using principle of virtual work. EI = 25,000 kNm2

5. A simply supported beam of 10 m span carries a uniformly distributed load of 1 kN/m over the entire span. Using Castigliano's theorem, find the slope at the ends. EI = 30,000 kNm2.

6. A 2m long cantilever made of steel tube of section 150 mm external diameter and10mm thick is loaded as show in fig If E=200 GN/m2 calculate (1) The value of W so that the maximum bending stress is 150 MN/m (2) The maximum deflection for the loading

UNIT V ANALYSIS OF STRESSES IN TWO DIMENSION
PART –A (2 MARKS)

1. What is mean by perfect frame?
2. What are the different types of frames?
3. What is mean by Imperfect frame?
4. What is mean by deficient frame?
5. What is mean by redundant frame?
6. What are the assumptions made in finding out the forces in a frame?
7. What are the reactions of supports of a frame?
8. How will you Analysis of a frame?
9. What are the methods for Analysis the frame?
10. How method of joints applied to Trusses carrying Horizontal loads.
11. How method of joints applied to Trusses carrying inclined loads.
12. What is mean by compressive and tensile force?
13. How will you determine the forces in a member by method of joints?
14. Define thin cylinder?
15. What are types of stress in a thin cylindrical vessel subjected to internal pressure?
16. What is mean by Circumferential stress (or hoop stress) and Longitudinal stress?
17. What are the formula for finding circumferential stress and longitudinal stress?
18. What are maximum shear stresses at any point in a cylinder?
19. What are the formula for finding circumferential strain and longitudinal strain?
20. What are the formula for finding change in diameter, change in length and change volume of a cylindrical shell subjected to internal fluid pressure p?
21. What are the formula for finding principal stresses of a thin cylindrical shell subjected to internal fluid pressure p and a torque?

PART –B (16 MARKS)

1. A thin cylindrical shell 3 m long has 1m internal diameter and 15 mm metal thickness. Calculate the circumferential and longitudinal stresses induced and also the change in the dimensions of the shell, if it is subjected to an internal pressure of1.5 N/mm2 Take E = 2x105 N/mm2 and poison's ratio =0.3. Also calculate change in volume.

2. A closed cylindrical vessel made of steel plates 4 mm thick with plane ends, carriesfluid under pressure of 3 N/mm2 The diameter of the cylinder is 25cm and length is75 cm. Calculate the longitudinal and hoop stresses in the cylinder wall and determine the change in diameter, length and Volume of the cylinder. Take E =2.1x105 N/mm2 and 1/m = 0.286.

3. A rectangular block of material is subjected to a tensile stress of 110 N/mm2 on one plane and a tensile stress of 47 N/mm2 on the plane at right angle to the former. plane and a tensile stress of 47 N/mm2 on the plane at right angle to the former. Each of the above stress is accompanied by a shear stress of 63 N/mm2 Find (i) The direction and magnitude of each of the principal stress (ii) Magnitude of greatest shear stress

4. At a point in a strained material, the principal stresses are100 N/mm2 (T) and 40 N/mm2 (C). Determine the resultant stress in magnitude and direction in a plane inclined at 600 to the axis of major principal stress. What is the maximum intensity of shear stress in the material at the point?

5. A rectangular block of material is subjected to a tensile stress of 210 N/mm2 on one plane and a tensile stress of 28 N/mm2 on the plane at right angle to the former. plane and a tensile stress of 28 N/mm2 on the plane at right angle to the former. Each of the above stress is accompanied by a shear stress of 53 N/mm2 Find (i) The direction and magnitude of each of the principal stress (ii) Magnitude of greatest shear stress

6 A closed cylindrical vessel made of steel plates 5 mm thick with plane ends, carries fluid under pressure of 6 N/mm2 The diameter of the cylinder is 35cm and length is85 cm. Calculate the longitudinal and hoop stresses in the cylinder wall and determine the change in diameter, length and Volume of the cylinder. Take E =2.1x105 N/mm2 and 1/m = 0.286.

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