Code No: RR220304 | RR | SET-1

B.Tech II Year - II Semester Examinations, April/May-2012
MECHANICS OF SOLIDS
(COMMON TO AME, ME, MEP)

Time: 3 hours **Max. Marks: 80**

Answer any five questions
All questions carry equal marks

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1.a) Define factor of safety? Discuss its importance in designing of engineering components.

b) A steel tie rod 50 mm in diameter and 2.5 m long is subjected to a pull of 100 kN. To what length the rod should be bored centrally so that the total extension will increase by 15 percent under the same pull, the bore being 25 mm diameter? Take E = 200 GN/m^2. [16]

2. A steel rod 12 mm in diameter passes centrally through a copper tube 2.5 m long and having 36 mm and 48 mm as internal and external diameters respectively. The tube is closed at each end by 24 mm length by 0.5 m. The whole assembly is then raised in temperature by 60^0C. Calculate the stresses in copper and steel before and after the rise of temperature assuming that the thickness of the plates remains unchanged. Take Young's Modulus for steel is 210 GN/m^2 and for copper 105 GN/m^2 & coefficient of thermal expansion for steel 1.2×10^{-5} per ^{0}C and for copper 1.75×10^{-5} per ^{0}C. [16]

3. A uniform beam of span 8 m carries a uniformly distributed load of 30 kN/m over its entire length. It is simply supported at the ends and propped to the same level at the centre. Calculate the prop reaction and draw the shear force and bending moment diagrams. If however due to the load the prop sinks by 20 mm, determine the prop and end reactions. Take $E = 200 \times 10^6$ kN/m^2 and $I = 15 \times 10^{-6}$ m^4. [16]

4.a) Derive the bending stress equation from the first principles.

b) A short column of 20 cm external diameter and 15 cm internal diameter, when subjected to a load the stress measurements indicate that the stress varies from 150 MN/m^2 compressive at one end to 25 MN/m^2 tensile on the other end. Estimate the load and distance of the line of action from the axis of the column. [16]

5.a) How to evaluate the shear stress distribution in rectangular cross section?

b) A beam has triangular cross section with base b and height h is used with the base horizontal. Calculate the intensity of maximum shear stress and plot the variation of shear stress intensity along the section. [16]

6.a) A beam of 4 m span is carrying a point load of 40 kN at a distance of 3 m from the left end. Calculate the slope at the two supports and deflection under the load. Also calculate maximum deflection.

b) Derive the deflection and slope at the end of cantilever beam subjected to a uniformly distributed load over the entire length. [16]

7.a) A cylindrical air drum is 2.25 m in diameter with plates 1.2 cm thick. The efficiencies of the longitudinal and circumferential joints are 75% and 45% respectively. If the tensile stress in the plating is to be limited to 120 MN/m^2 find the maximum safe air pressure.

b) Draw the Mohr's stress circle for direct stresses of 65 MN/m^2 (tensile) and 35 MN/m^2(compressive) and estimate the magnitude and direction of the resultant stresses on planes making angles of 20^0 and 65^0 with the plane of the first principal stress. Find also the normal and tangential stresses on these planes. [16]

8. A compound shaft 1 m long is fixed at one end and is subjected to a twisting moment of 150 kN-m at the free end and of 200 kn-m at a distance of 750 mm from the fixed end. The shaft has a diameter of 120 mm for 750 mm from the fixed end and 90 mm for the remaining portion. Determine

i) maximum shearing stress in each portion of the shaft

ii) angle of twist at a distance of 750 mm from the fixed end and at the free end. Take G = 82 GN/m^2. [16]

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Code No: RR220304 | RR | SET-2

B.Tech II Year - II Semester Examinations, April/May-2012
MECHANICS OF SOLIDS
(COMMON TO AME, ME, MEP)

Time: 3 hours **Max. Marks: 80**

Answer any five questions
All questions carry equal marks

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1. A uniform beam of span 8 m carries a uniformly distributed load of 30 kN/m over its entire length. It is simply supported at the ends and propped to the same level at the centre. Calculate the prop reaction and draw the shear force and bending moment diagrams. If however due to the load the prop sinks by 20 mm, determine the prop and end reactions. Take $E = 200 \times 10^6$ kN/m^2 and $I = 15 \times 10^{-6}$ m^4. [16]

2.a) Derive the bending stress equation from the first principles.
b) A short column of 20 cm external diameter and 15 cm internal diameter, when subjected to a load the stress measurements indicate that the stress varies from 150 MN/m^2 compressive at one end to 25 MN/m^2 tensile on the other end. Estimate the load and distance of the line of action from the axis of the column. [16]

3.a) How to evaluate the shear stress distribution in rectangular cross section?
b) A beam has triangular cross section with base b and height h is used with the base horizontal. Calculate the intensity of maximum shear stress and plot the variation of shear stress intensity along the section. [16]

4.a) A beam of 4 m span is carrying a point load of 40 kN at a distance of 3 m from the left end. Calculate the slope at the two supports and deflection under the load. Also calculate maximum deflection.
b) Derive the deflection and slope at the end of cantilever beam subjected to a uniformly distributed load over the entire length. [16]

5.a) A cylindrical air drum is 2.25 m in diameter with plates 1.2 cm thick. The efficiencies of the longitudinal and circumferential joints are 75% and 45% respectively. If the tensile stress in the plating is to be limited to 120 MN/m^2 find the maximum safe air pressure.
b) Draw the Mohr's stress circle for direct stresses of 65 MN/m^2 (tensile) and 35 MN/m^2(compressive) and estimate the magnitude and direction of the resultant stresses on planes making angles of 20^0 and 65^0 with the plane of the first principal stress. Find also the normal and tangential stresses on these planes. [16]

6. A compound shaft 1 m long is fixed at one end and is subjected to a twisting moment of 150 kN-m at the free end and of 200 kn-m at a distance of 750 mm from the fixed end. The shaft has a diameter of 120 mm for 750 mm from the fixed end and 90 mm for the remaining portion. Determine
i) maximum shearing stress in each portion of the shaft
ii) angle of twist at a distance of 750 mm from the fixed end and at the free end.
Take G = 82 GN/m^2. [16]

7.a) Define factor of safety? Discuss its importance in designing of engineering components.

b) A steel tie rod 50 mm in diameter and 2.5 m long is subjected to a pull of 100 kN. To what length the rod should be bored centrally so that the total extension will increase by 15 percent under the same pull, the bore being 25 mm diameter? Take $E = 200\ GN/m^2$. [16]

8. A steel rod 12 mm in diameter passes centrally through a copper tube 2.5 m long and having 36 mm and 48 mm as internal and external diameters respectively. The tube is closed at each end by 24 mm length by 0.5 m. The whole assembly is then raised in temperature by 60^0C. Calculate the stresses in copper and steel before and after the rise of temperature assuming that the thickness of the plates remains unchanged. Take Young's Modulus for steel is 210 GN/m^2 and for copper 105 GN/m^2 & coefficient of thermal expansion for steel 1.2×10^{-5} per ^0C and for copper 1.75×10^{-5} per ^0C. [16]

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Code No: RR220304 | RR | SET-3

B.Tech II Year - II Semester Examinations, April/May-2012
MECHANICS OF SOLIDS
(COMMON TO AME, ME, MEP)

Time: 3 hours **Max. Marks: 80**

Answer any five questions
All questions carry equal marks
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1.a) How to evaluate the shear stress distribution in rectangular cross section?
b) A beam has triangular cross section with base b and height h is used with the base horizontal. Calculate the intensity of maximum shear stress and plot the variation of shear stress intensity along the section. [16]

2.a) A beam of 4 m span is carrying a point load of 40 kN at a distance of 3 m from the left end. Calculate the slope at the two supports and deflection under the load. Also calculate maximum deflection.
b) Derive the deflection and slope at the end of cantilever beam subjected to a uniformly distributed load over the entire length. [16]

3.a) A cylindrical air drum is 2.25 m in diameter with plates 1.2 cm thick. The efficiencies of the longitudinal and circumferential joints are 75% and 45% respectively. If the tensile stress in the plating is to be limited to 120 MN/m^2 find the maximum safe air pressure.
b) Draw the Mohr's stress circle for direct stresses of 65 MN/m^2 (tensile) and 35 MN/m^2(compressive) and estimate the magnitude and direction of the resultant stresses on planes making angles of 20^0 and 65^0 with the plane of the first principal stress. Find also the normal and tangential stresses on these planes. [16]

4. A compound shaft 1 m long is fixed at one end and is subjected to a twisting moment of 150 kN-m at the free end and of 200 kn-m at a distance of 750 mm from the fixed end. The shaft has a diameter of 120 mm for 750 mm from the fixed end and 90 mm for the remaining portion. Determine
i) maximum shearing stress in each portion of the shaft
ii) angle of twist at a distance of 750 mm from the fixed end and at the free end.
Take G = 82 GN/m^2. [16]

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8.a) Derive the bending stress equation from the first principles.

b) A short column of 20 cm external diameter and 15 cm internal diameter, when subjected to a load the stress measurements indicate that the stress varies from 150 MN/m^2 compressive at one end to 25 MN/m^2 tensile on the other end. Estimate the load and distance of the line of action from the axis of the column. [16]

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Code No: RR220304 | RR | SET-4

B.Tech II Year - II Semester Examinations, April/May-2012
MECHANICS OF SOLIDS
(COMMON TO AME, ME, MEP)

Time: 3 hours **Max. Marks: 80**

Answer any five questions
All questions carry equal marks

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1.a) A cylindrical air drum is 2.25 m in diameter with plates 1.2 cm thick. The efficiencies of the longitudinal and circumferential joints are 75% and 45% respectively. If the tensile stress in the plating is to be limited to 120 MN/m^2 find the maximum safe air pressure.

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i) maximum shearing stress in each portion of the shaft
ii) angle of twist at a distance of 750 mm from the fixed end and at the free end. Take G = 82 GN/m^2. [16]

3.a) Define factor of safety? Discuss its importance in designing of engineering components.

b) A steel tie rod 50 mm in diameter and 2.5 m long is subjected to a pull of 100 kN. To what length the rod should be bored centrally so that the total extension will increase by 15 percent under the same pull, the bore being 25 mm diameter? Take E = 200 GN/m^2. [16]

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b) A beam has triangular cross section with base b and height h is used with the base horizontal. Calculate the intensity of maximum shear stress and plot the variation of shear stress intensity along the section. [16]

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