Code No: RR220304 **RR** **Set No. 2**

II B.Tech II Semester Examinations,December 2010
MECHANICS OF SOLIDS
Common to Mechanical Engineering, Production Engineering, Automobile Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. A solid conical bar tapers uniformly from a diameter of 6cm to 2cm in a length of 100 cm. It is suspended vertically at the 6cm diameter, the 2 cm diameter end being downward. Calculate the elongation of the bar due to self-weight. Take unit weight of the bar material as 78.5 kN/m^3 and E = 204 kN/mm^2. [16]

2. (a) Define slenderness ratio. State the limitations of Euler's formula. [4]
   (b) Derive an expression for the Rankine's crippling load for a column. [8]
   (c) How will you justify the Rankine's formula is applicable for all lengths of columns, ranging from short to long columns. [4]

3. (a) Briefly explain thermal stresses. [4]
   (b) A bar of brass 25 mm diameter is enclosed in a steel tube 50 mm initially external diameter and 25 mm internal diameter. The bar and tube are both initially 1.5 m long and rigidly fastened at both ends using 20 mm diameter pins. Find the stresses in both material and the increase in length when the temperature rises from 30^{0}C to 100^{0}C. E for steel ; 200 Gpa, E for brass = 100 Gpa, α for steel = 11.6 $\times 10^{-6}/^0$C, α for brass = 18.7$\times 10^{-6}/^0$C. Also determine the shear stress induced in the pins. [12]

4. (a) Derive an expression for the proportional increase in capacity of a thin cylindrical shell when it is subjected to an internal pressure. [8]
   (b) A vertical gas storage tank is made of 25 mm thick mild steel plate and has to withstand maximum internal pressure of 1.5 MN/m^2. Determine the diameter of the tank if stress is 240 MN/m^2, factor of safety is 4 and joint efficiency is 80%. [8]

5. (a) Define shear force and bending moment. [4]
   (b) A horizontal beam AB of length 4m in hinged at A and supported on rollers at B. the beam carries inclined loads of 100N, 200N and 300N incised towards the roller support at $60^0, 45^0$ and 30^0 Respectively to the horizontal, at 1m, 2m and 3m respectively from A. draw the SF and BM diagrams. [12]

6. (a) What is Macaulay's method for finding out the slope and deflection? of a beam? Discuss the cases, where it is of a particular use. [6]
   (b) A 3 meters long cantilever is loaded with a point load of 450 N at the free end. If the section is rectangular 80 mm (wide) $\times$ 160 mm (deep), and E = 10 GN/m^2, calculate slope and deflection. [10]

i. at the free end of the cantilever,

ii. at a distance of 0.55 m from the free end.

7. Two close coiled concentric helical springs of the same length, are wound out of the same wire, circular in cross section and supports a compressive load 'P'. The inner spring consists of 20 turns of mean diameter 16cm and the outer spring has 18 turns of mean diameter 20cm. Calculate the maximum stress produced in each spring if the diameter of wire = 1cm and P = 1000N. [16]

8. (a) A beam of square section is used as beam with one diagonal horizontal. Obtain the magnitude and location of maximum shear stress in the beam. Draw the variation of shear stress across the section. [8]

   (b) A beam is of T-section, flange 145mm × 15mm, web 18mm × 120mm. If it is subjected to a shear force of 30kN, find the maximum intensity of shear stress and sketch the distribution of shear stress across the section. [8]

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Code No: RR220304 **RR** **Set No. 4**

II B.Tech II Semester Examinations,December 2010
MECHANICS OF SOLIDS
Common to Mechanical Engineering, Production Engineering, Automobile Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What is Macaulay's method for finding out the slope and deflection? of a beam? Discuss the cases, where it is of a particular use. [6]
   (b) A 3 meters long cantilever is loaded with a point load of 450 N at the free end. If the section is rectangular 80 mm (wide) × 160 mm (deep), and E = 10 GN/m^2, calculate slope and deflection. [10]
      i. at the free end of the cantilever,
      ii. at a distance of 0.55 m from the free end.

2. A solid conical bar tapers uniformly from a diameter of 6cm to 2cm in a length of 100 cm. It is suspended vertically at the 6cm diameter, the 2 cm diameter end being downward. Calculate the elongation of the bar due to self-weight. Take unit weight of the bar material as 78.5 kN/m^3 and E = 204 kN/mm^2. [16]

3. (a) Define shear force and bending moment. [4]
   (b) A horizontal beam AB of length 4m in hinged at A and supported on rollers at B. the beam carries inclined loads of 100N, 200N and 300N incised towards the roller support at $60^0, 45^0$ and 30^0 Respectively to the horizontal, at 1m, 2m and 3m respectively from A. draw the SF and BM diagrams. [12]

4. (a) A beam of square section is used as beam with one diagonal horizontal. Obtain the magnitude and location of maximum shear stress in the beam. Draw the variation of shear stress across the section. [8]
   (b) A beam is of T-section, flange 145mm × 15mm, web 18mm × 120mm. If it is subjected to a shear force of 30kN, find the maximum intensity of shear stress and sketch the distribution of shear stress across the section. [8]

5. (a) Define slenderness ratio. State the limitations of Euler's formula. [4]
   (b) Derive an expression for the Rankine's crippling load for a column. [8]
   (c) How will you justify the Rankine's formula is applicable for all lengths of columns, ranging from short to long columns. [4]

6. (a) Derive an expression for the proportional increase in capacity of a thin cylindrical shell when it is subjected to an internal pressure. [8]
   (b) A vertical gas storage tank is made of 25 mm thick mild steel plate and has to withstand maximum internal pressure of 1.5 MN/m^2. Determine the diameter of the tank if stress is 240 MN/m^2, factor of safety is 4 and joint efficiency is 80%. [8]

7. (a) Briefly explain thermal stresses. [4]

   (b) A bar of brass 25 mm diameter is enclosed in a steel tube 50 mm initially external diameter and 25 mm internal diameter. The bar and tube are both initially 1.5 m long and rigidly fastened at both ends using 20 mm diameter pins. Find the stresses in both material and the increase in length when the temperature rises from 30^0C to 100^0C. E for steel ; 200 Gpa, E for brass = 100 Gpa, α for steel = 11.6 $\times 10^{-6}/^0$C, α for brass = $18.7 \times 10^{-6}/^0$C. Also determine the shear stress induced in the pins. [12]

8. Two close coiled concentric helical springs of the same length, are wound out of the same wire, circular in cross section and supports a compressive load 'P'. The inner spring consists of 20 turns of mean diameter 16cm and the outer spring has 18 turns of mean diameter 20cm. Calculate the maximum stress produced in each spring if the diameter of wire = 1cm and P = 1000N. [16]

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Code No: RR220304 **RR** **Set No. 1**

II B.Tech II Semester Examinations,December 2010
MECHANICS OF SOLIDS
Common to Mechanical Engineering, Production Engineering, Automobile Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What is Macaulay's method for finding out the slope and deflection? of a beam? Discuss the cases, where it is of a particular use. [6]
   (b) A 3 meters long cantilever is loaded with a point load of 450 N at the free end. If the section is rectangular 80 mm (wide) × 160 mm (deep), and E = 10 GN/m^2, calculate slope and deflection. [10]
      i. at the free end of the cantilever,
      ii. at a distance of 0.55 m from the free end.

2. Two close coiled concentric helical springs of the same length, are wound out of the same wire, circular in cross section and supports a compressive load 'P'. The inner spring consists of 20 turns of mean diameter 16cm and the outer spring has 18 turns of mean diameter 20cm. Calculate the maximum stress produced in each spring if the diameter of wire = 1cm and P = 1000N. [16]

3. A solid conical bar tapers uniformly from a diameter of 6cm to 2cm in a length of 100 cm. It is suspended vertically at the 6cm diameter, the 2 cm diameter end being downward. Calculate the elongation of the bar due to self-weight. Take unit weight of the bar material as 78.5 kN/m^3 and E = 204 kN/mm^2. [16]

4. (a) Briefly explain thermal stresses. [4]
   (b) A bar of brass 25 mm diameter is enclosed in a steel tube 50 mm initially external diameter and 25 mm internal diameter. The bar and tube are both initially 1.5 m long and rigidly fastened at both ends using 20 mm diameter pins. Find the stresses in both material and the increase in length when the temperature rises from 30^{0}C to 100^{0}C. E for steel ; 200 Gpa, E for brass = 100 Gpa, α for steel = 11.6 $\times 10^{-6}/^0$C, α for brass = 18.7$\times 10^{-6}/^0$C. Also determine the shear stress induced in the pins. [12]

5. (a) Derive an expression for the proportional increase in capacity of a thin cylindrical shell when it is subjected to an internal pressure. [8]
   (b) A vertical gas storage tank is made of 25 mm thick mild steel plate and has to withstand maximum internal pressure of 1.5 MN/m^2. Determine the diameter of the tank if stress is 240 MN/m^2, factor of safety is 4 and joint efficiency is 80%. [8]

6. (a) Define slenderness ratio. State the limitations of Euler's formula. [4]

(b) Derive an expression for the Rankine's crippling load for a column. [8]

(c) How will you justify the Rankine's formula is applicable for all lengths of columns, ranging from short to long columns. [4]

7. (a) Define shear force and bending moment. [4]

(b) A horizontal beam AB of length 4m in hinged at A and supported on rollers at B. the beam carries inclined loads of 100N, 200N and 300N incised towards the roller support at $60^0, 45^0$ and 30^0 Respectively to the horizontal, at 1m, 2m and 3m respectively from A. draw the SF and BM diagrams. [12]

8. (a) A beam of square section is used as beam with one diagonal horizontal. Obtain the magnitude and location of maximum shear stress in the beam. Draw the variation of shear stress across the section. [8]

(b) A beam is of T-section, flange 145mm × 15mm, web 18mm × 120mm. If it is subjected to a shear force of 30kN, find the maximum intensity of shear stress and sketch the distribution of shear stress across the section. [8]

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Code No: RR220304 **RR** **Set No. 3**

II B.Tech II Semester Examinations,December 2010
MECHANICS OF SOLIDS
Common to Mechanical Engineering, Production Engineering, Automobile Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Define slenderness ratio. State the limitations of Euler's formula. [4]
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2. (a) A beam of square section is used as beam with one diagonal horizontal. Obtain the magnitude and location of maximum shear stress in the beam. Draw the variation of shear stress across the section. [8]
   (b) A beam is of T-section, flange 145mm × 15mm, web 18mm × 120mm. If it is subjected to a shear force of 30kN, find the maximum intensity of shear stress and sketch the distribution of shear stress across the section. [8]

3. (a) Derive an expression for the proportional increase in capacity of a thin cylindrical shell when it is subjected to an internal pressure. [8]
   (b) A vertical gas storage tank is made of 25 mm thick mild steel plate and has to withstand maximum internal pressure of 1.5 MN/m^2. Determine the diameter of the tank if stress is 240 MN/m^2, factor of safety is 4 and joint efficiency is 80%. [8]

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5. (a) What is Macaulay's method for finding out the slope and deflection? of a beam? Discuss the cases, where it is of a particular use. [6]
   (b) A 3 meters long cantilever is loaded with a point load of 450 N at the free end. If the section is rectangular 80 mm (wide) × 160 mm (deep), and E = 10 GN/m^2, calculate slope and deflection. [10]
      i. at the free end of the cantilever,
      ii. at a distance of 0.55 m from the free end.

6. (a) Define shear force and bending moment. [4]
   (b) A horizontal beam AB of length 4m in hinged at A and supported on rollers at B. the beam carries inclined loads of 100N, 200N and 300N incised towards the roller support at $60^0, 45^0$ and 30^0 Respectively to the horizontal, at 1m, 2m and 3m respectively from A. draw the SF and BM diagrams. [12]

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