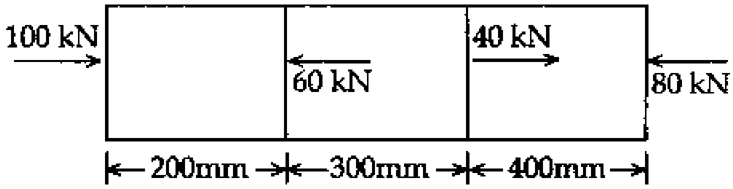
Problems Based on Simple Stress & Strain

2005–2006 (Sem. I) (TME101)

1. Explain Poisson's ratio and its significance.
2. Explain Complementary shear stress.
3. A steel bar is subjected to loads as shown in fig. If young's modulus for the bar material is 200 kN/mm^2 determine the change in length of bar. The bar is 200 mm in diameter.

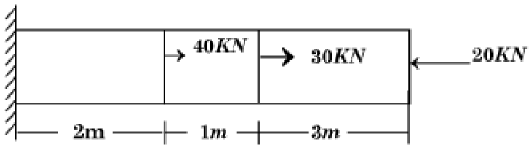


2005–2006 (Sem. II) (TME201)

1. Define; stress, strain and elasticity and differentiate between normal stress and shear stress. Draw the stress - strain diagram for mild steel showing salient points on it.
2. A bar of 25 mm diameter is subjected to a pull of 60 kN. The measured extension over a gauge length of 250 mm is 0.15 mm and change in diameter is 0.004 mm. Calculate the modulus of elasticity, modulus of rigidity and Poisson's ratio.

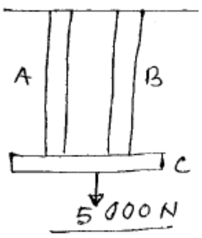
2006–2007 (Sem. II) (TME201)

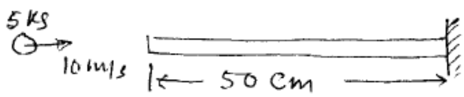
1. Draw stress-strain curve for a ductile and brittle material on a simple diagram. What are the differences between these two curves?
2. Determine the stress in all the three sections and total deformation of the steel rod shown in Fig. Cross sectional area = 10 cm^2, E = 200 GN/m^2.



2006–2007 (Sem. II) (ME201)

1. In fig. 1 the rods A and B are of same length. The cross sections of A and B are 4 cm^2 and 6 cm^2 respectively. Plate C is rigid and remains horizontal before and after a pull of 5000 N is applied. Find the displacement of the plate and the stresses in rods A and B. Given that the Young's' modulus of material of rod A is 200 kN/mm^2 and that of B is 100 kN/mm^2.





2. Differentiate between brittle and ductile materials. Draw stress-strain diagram for a ductile materials and show and explain the different points coming on it.

3. Explain the concept of complementary shear stress,
4. Define the following terms: (i) Shear strain, (ii) Poisson's Ratio.

2006–2007 (Sem. I & II) (TME101/TME201) [SCOP]

1. A tension test bar of circular C S. tapers uniformly from 20 mm to 16 mm in a length of 200 mm. When an axial load of 80 kN is applied the extension measured over its length was 0.32 mm. hind the modulus of elasticity of material. If the Poisson's ratio of this material is 1/3. Find the value of modulus of rigidity and bulk modulus.

2007–2008 (Sem. I) (TME101)

1. Explain the following:
   (a) Modulus of elasticity, modulus of rigidity, and bulk modulus.
   (b) Principal of super position for elongation of bars of varying cross-section.
   (c) Expression for resilience of a bar in terms of applied stress and Young's modulus.

2007–2008 (Sem. II) (TME201)

1. Draw stress-strain diagram for a ductile material and define different points shown on it.
2. A round bar 40 cm long has 5 cm diameter for middle half of its length and a reduced diameter at the two ends (ends are equal in diameter and length-wise). Bar carries axial load of 10 kN. Find the diameter and end section if the total allowable extension is 0.03 cm, $E = 200$ GN/m^2.

2008–2009 (Sem. I) (EME102)

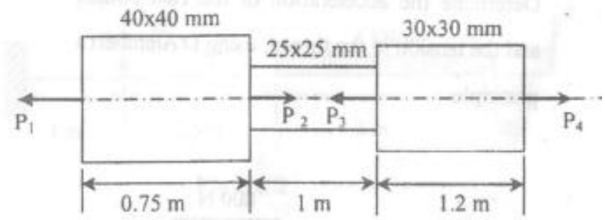
1. Derive the following expression for the elastic constants:

$$K = \frac{E}{3(1-2\mu)}.$$

2. Plot tensile test diagram for Mild Steel and explain all salient points. Derive an expression for strain energy in terms of strain and Young's modulus.

2008–2009 (Sem. II) (EME202)

1. A member is subjected to point loads P_1, P_2, P_3 and P_4 as shown in Figure. Calculate the force P_3 necessary for equilibrium if $P_1 = 120$ kN, $P_2 = 220$ kN and $P_4 = 160$ kN. Determine also the change in length of the member Take $E = 2 \times 10^5$ N/mm^2.



2009–2010 (Sem. I) (TME101) [COP]

1. Derive an expression for the elongation of a bar due to its own weight.

2. Plot tensile test diagram for Mild Steel and explain all salient points.

2009–2010 (Sem. II) (EME202)

1. A rectangular bar of uniform cross-section 4 cm × 2.5 cm and of length 2.2 m is hanging vertically from a rigid support. It is subjected to axial tensile loading of 10 kN. If density of steel is 8000 kg/m^3 and E = 200 GN/m^2, find the maximum stress and the elongation of the bar.

2009–2010 (Sem. II) (TME201) [COP]

1. Derive the following expression for the elastic constants:

$$K = \frac{E}{3(1-2\mu)}.$$

2. Derive an expression for strain energy in terms of strain and Young's modulus.

2010–2011 (Sem. I) (EME102)

1. Define Poisson's ratio. Prove that its value lies between zero and half.

2010–2011 (Sem. I) (TME101) [COP]

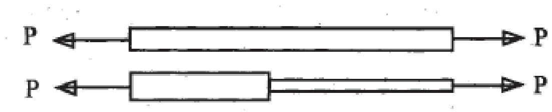
1. Derive an expression for the elongation caused by a tensile load P applied to a flat bar of thickness t, tapering from a width of w_1 to w_2 in a length l.

2. Draw tensile test diagram for Mild Steel and explain all salient points.

2010–2011 (Sem. II) (EME202)

1. A tapered bar whose diameter reduces from D_1 to D_2, over its length l is subjected to a tensile load P. Derive an expression for elongation of this bar.

2. A bar of length L and cross sectional area A is subjected to a tensile load P, find the strain energy (U_0) stored in the bar due to this load. If the cross sectional area of half of the above bar (length $L/2$) is doubled ($2A$) as shown in figure, determine the strain energy in this case in terms of U_0.



2010–2011 (Sem. II) (TME201) [COP]

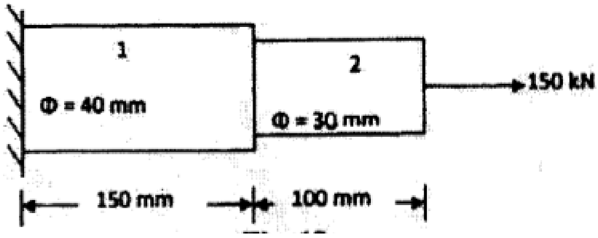
1. Derive an expression for the elongation caused by a tensile load P applied to a flat bar of thickness t, tapering from a width of w_1 to w_2 in a length l.

2011–2012 (Sem. I) (EME102)

1. Draw stress-strain diagram for mild steel and highlight salient points.

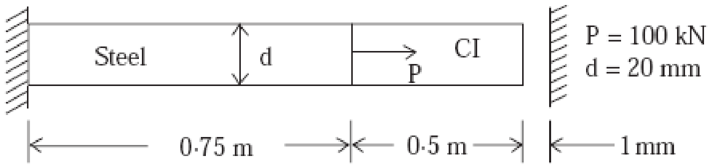
2. Prove that the theoretical value of Poisson's ratio lies between 0 and 0.5.

3. Determine the total extension of the bar loaded as shown in fig. Take $E = 2.5 \times 10^5$ N/mm^2.



2011–2012 (Sem. II) (EME202)

1. Define Engineering stress and True stress.
2. Define resilience and Proof resilience.
3. Determine the elongation of a uniform bar hanging under its own weight.
4. A compound bar made of steel and CI shown in Fig has a gap of 1 mm. If E_S = 200 GPa and E_{CI} = 105 GPa, find the stresses in the bars.

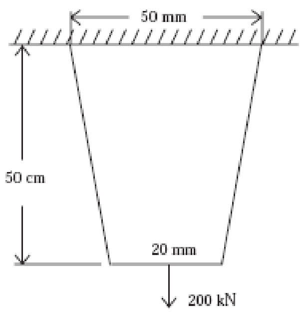


2011–2012 (Sem. II) (EME202) (MTU)

1. Differentiate between engineering sloes and true stress. Also draw the stress-strain diagram for a ductile material showing all the point on it.
2. Define rigid body. How it differs from elastic body?

2012–2013 (Sem. I) (EME102)

1. Young's modulus and Bulk modulus of steel are 2.1 × 10^{11} Pa and 8.4 × 10^{10} Pa respectively. Determine the value of Poisson's ratio.
2. A solid uniform rod of 2 m length is hanging vertically from the roof. The stress at a section 0.5 m away from the roof is 600 Pa. Determine the stress at a section of the rod at a distance of 1.5 m from the roof.
3. A tapered rod is shown in Fig. Young's modulus of the material of the rod is 200 GPa. Find the deformation and strain energy stored in the rod.



2012–2013 (Sem. I) (EME102) (MTU) [COP]

1. Draw stress-strain diagram for Mild Steel specimen under tension. Discuss all significant points on it.

2012–2013 (Sem. I) (TME101) [COP]

1. Derive the relationship between Young's modulus and modulus of rigidity.
2. A steel bar 4 cm is section 3 m long is subjected to an axial pull of 128 kN. Taking E = 200 GN/m^2, calculate alteration in the length of the bar. Calculate also the amount of energy stored in the bar during the extension.

2012–2013 (Sem. II) (TME201) [COP]

1. Draw stress-strain curve for ductile material specifying each point on the curve.
2. A metallic rectangular rod 1.5 m long, 40 mm wide and 25 mm thick is subjected to an axial tensile load of 120 kN. The elongation of the rod is measured as 0.9 mm. Calculate the stress, strain and modulus of elasticity.

2013–14 (Sem. I) (NME102)

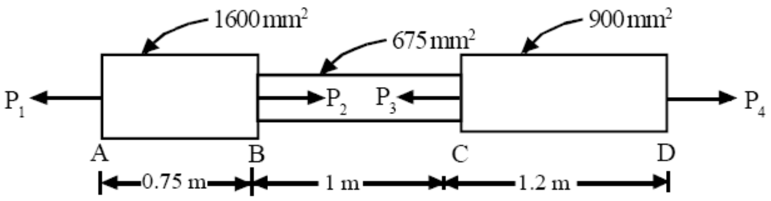
1. Explain the limit of proportionality and its relationship with Hooks' law.
2. Draw the stress-strain diagram for a ductile material and explain all salient points on it.

2013–14 (Sem. I) (EME102) [COP]

1. The extension of a bar uniformly tapering from a diameter of $d + a$ to $d - a$ in a length L calculated by treating it as a bar of uniform cross section of average diameter d. What is the percentage error?

2013–14 (Sem. I) (TME101) [COP]

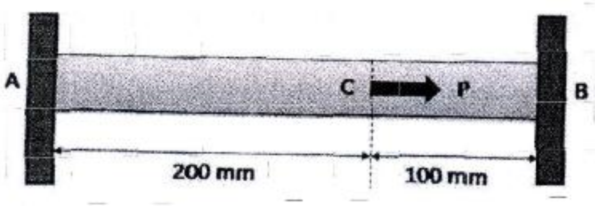
1. A member ABCD is subjected to point loads P_1, P_2, P_3 and P_4 as shown in Figure. Calculate the force P_3 necessary for equilibrium if P_1 = 120 kN, P_2 = 220 kN and P_4 = 160 kN. Determine also the change in length of the member Take $E = 2 \times 10^5$ N/mm^2.



2. Draw stress strain curve for mild steel.
3. Explain Generalised Hook's Law.
4. Write short notes on: Poisson ratio.

2013–14 (Sem. II) (NME202)

1. If the modulus of elasticity for a material is 200 GPa and Poisson's ratio is 0.25, find the modulus of rigidity of the material.
2. Draw the stress strain diagram for a ductile material and explain elasticity, limit of proportionality, elastic limit and yield limit.
3. A uniform bar of diameter 25 mm is rigidly held between two walls as shown in figure. When an axial force P of magnitude 2 kN is applied on the bar, determine the support reactions and stresses in the bar.



2014–15 (Sem. I) (NME102)

1. An 80 m long wire of 5 mm diameter is made of a steel with E = 200 GPa and an ultimate tensile strength of 400 MPa. If a factor of safety of 3.2 is desired, determine (a) the largest allowable tension in the wire, (b) the corresponding elongation of the wire.

2014–15 (Sem. I) (EME102) [COP]

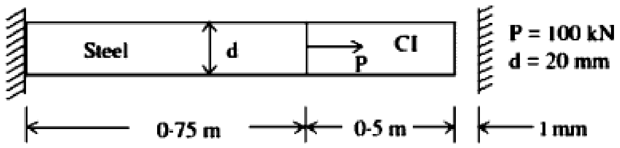
1. Define the term Poisson's ratio.
2. The extension of a bar uniformly tapering from d_1 to d_2 in a length l. Calculate by treating it as a bar of uniform cross section of average diameter d. What is the percentage error?

2014–15 (Sem. II) (NME202)

1. Draw stress strain diagram for mild steel indicating salient points.
2. Discuss the principle of Superposition for elongation.
3. A steel Bar 2m long, 20 mm wide, 10 mm thick is subjected to a pull of 20 kN in the direction of length. Find the changes in length, breadth, thickness of bar. Take $E = 2 \times 10^5$ N/mm^2 and Poisson's ratio 0.3.

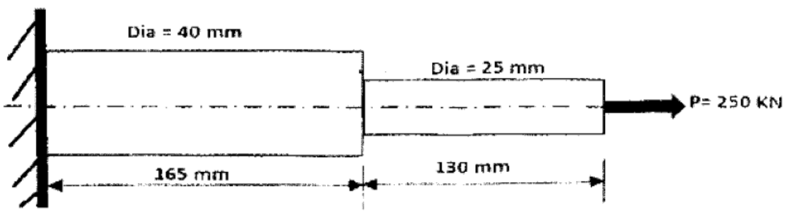
2014–15 (Sem. II) (EME202) [COP]

1. Define resilience and proof resilience.
2. Determine the extension of a uniform bar hanging under its own weight.
3. A compound bar made of steel and CI shown in Fig has a gap of 1 mm. If E_S = 200 GPa and E_{CI} = 105 GPa, find the stresses in the bars.



2014–15 (Sem. I) (NME202/NME102/EME202/EME102) [SCOP]

1. Define the longitudinal & lateral strain
2. Determine the total extension of the bar loaded as shown in diagram. Take E = 2.5 MPa.



2015–16 (Sem. I) (NME102)

1. What do you mean by strain energy?

2015–16 (Sem. I) (EME102) [COP]

1. Write down relation between E, G, μ and K.
2. An 80 m long wire of 5 mm diameter is made of steel E = 200 GPa ultimate tensile strength is 400 MPa. If factor of safety is 3.2, find out maximum tension and corresponding elongation.
3. Draw the Stress-Strain diagram for ductile material mild steel under tension and discuss all the salient points.
4. Define the term Poisson's ratio. Also establish the relation between modulus of elasticity and modulus of rigidity.

2015–16 (Sem. II) (NME202)

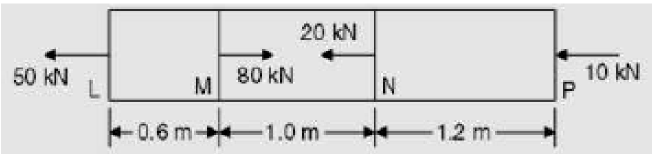
1. Define modulus of rigidity and modulus of elasticity.

2016–17 (Sem. I) (RME101)

1. Define Strength, Hardness, Stiffness and Toughness?
2. Draw the Stress-Strain diagram for ductile material mild steel under tension and discuss all the salient points.
3. A bar of uniform thickness t tapers from a width of b_1 at one end to b_2 at other end in a length L. Find the expression for its extension under the action of axial force P. A steel flat of thickness 10 mm tapers uniformly from 60 mm at one end to 40 mm at other end in a length of 600 mm. If a bar is subjected to a load of 80 kN. Find its extension. Take $E = 2 \times 10^5$ MPa. What is the percentage error if average area is used for calculating extension?

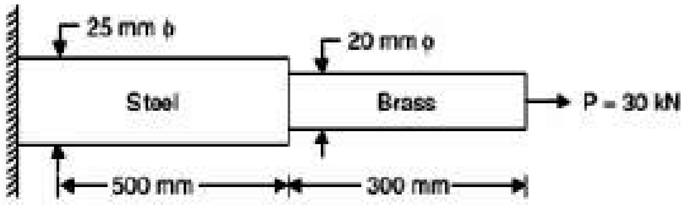
2016–17 (Sem. II) (RME201)

1. Define modulus of Elasticity and modulus of rigidity.
2. A brass bar having cross-sectional area of 1000 mm^2 is subjected to axial forces shown in Fig. Find the total elongation of the bar. Modulus of elasticity of brass = 100 GN/m^2.



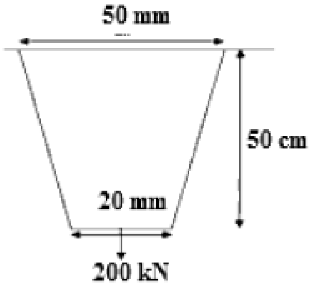
2016–17 (Sem. II) (NME202/EME202/ME201) [COP]

1. What is the difference between ductile and brittle material.
2. The composite bar shown in Fig., is subjected to a tensile force of 30 kN and the diameter of brass bar is 20 mm, diameter of steel bar is 25 mm. The extension observed is 0.44 mm. Find the Young's modulus of brass, if Young's modulus of steel is 2×10^5 N/mm^2.



2017–18 (Sem. I) (NME102/EME102) [COP]

1. Find the elongation for the tapered circular bar with given dimension in figure.



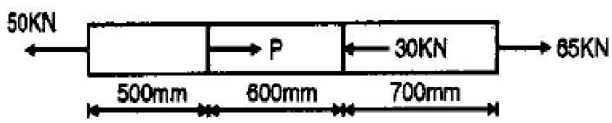
2. A member *ABCD* of uniform diameter 200 mm is loaded as shown in figure, find the net change in length if E = 200 GN/m^2.

2017–18 (Sem. II) (RME201)

1. Define the following term
   (i) Shear modulus
   (ii) Young's modulus
   (iii) Poisson's Ratio
   (iv) Bulk modulus

2017–18 (Sem. II) (NME202) [COP]

1. Draw the stress strain diagram for mild steel.
2. A circular bar having 200 mm^2 area is subjected to the axial load as shown in figure. Find the value of P and the total elongation. Take E = 200 kN/mm^2.



2017–18 (Sem. II) (EME202) [COP]

1. Define the total elongation of a prismatic bar with cross-sectional area A and length L. It is hanging freely under its own weight from a fixed support.
2. Distinguish isotropic material from homogeneous material.
3. Show that the instantaneous stress due to a suddenly applied load is twice the stress caused by gradual application of load. The load is axially acting on the bar. Find bulk modulus and lateral contraction for a circular bar of 45 mm diameter and

increase in length is 2.5 mm for gauge length of 2.5 m. given that $G = 0.43 \times 10^5$ N/mm^2 and $E = 1.15 \times 10^5$ N/mm^2.

4. Sketch stress-strain diagram for ductile material and explain its salient features.

2017–18 (Sem. II) (ME201) [COP]

1. Define stress and how it is different from pressure.

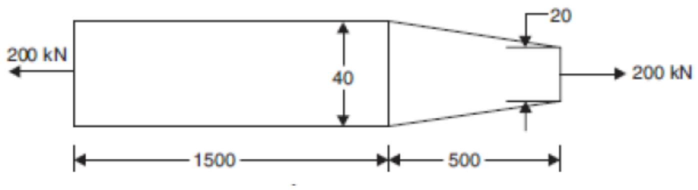
2. A bar 3 m long is made of two bars one of copper having E = 105 GN/m^2 and other of steel having E = 210 GN/m^2. Each bar is 25 mm broad and 12.5 mm thick. This compound bar is stretched by a load of 50 kN. Find the increase in length of the compound bar and stress produced in the steel and copper. The length of copper as well as of steel bar is 3 m each.

3. Sketch the stress strain curve for ductile material and Brittle material and explain it salient features.

2018–19 (Sem. I) (RME101)

1. State superposition theorem.

2. 2.0 m long steel bar is having uniform diameter of 40 mm for a length of 1 m and in the next 0.5 m its diameter gradually reduces from 40 mm to 20 mm as shown in Fig. Determine the elongation of this bar when subjected to an axial tensile load of 200 kN. Given E = 200 GN/m^2.

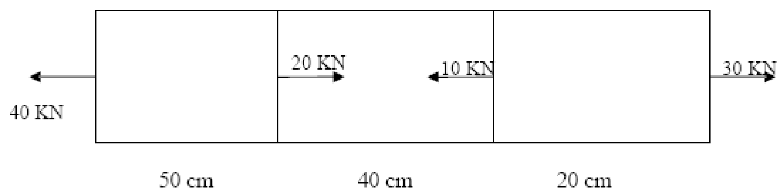


2018–19 (Sem. I) (NME102/EME102) [COP]

1. Define the term strain energy.

2. Draw the Stress – Strain diagram for ductile material mild steel under tension and discuss all the salient points.

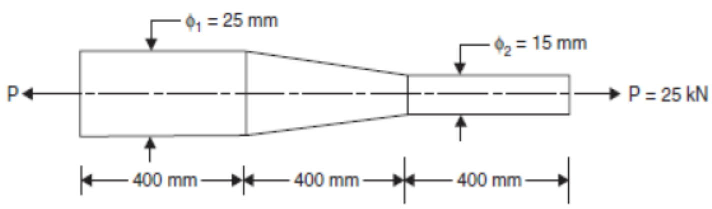
3. Find out total elongation of round steel bar of 25 mm diameter subjected to axial loads. E = 210 GPa.



2018–19 (Sem. II) (RME201)

1. Define young modulus and section modulus.

2. Find the extension of the bar shown in Fig under an axial load of 25 kN.



2018–19 (Sem. II) (NME202/EME202) [COP]

1. What is the difference between stress and strain?
2. Calculate the modulus of rigidity and bulk modulus of a cylindrical bar of diameter 30 mm and length 1.5 m if the longitudinal strain in a bar during a tensile stress is four times the lateral strain. Find the change in volume, when the bar is subjected to a hydrostatic pressure of 100 N/mm^2. Take $E = 1 \times 10^5$ N/mm^2.
3. Discuss stress strain diagram for ductile and brittle materials in detail with suitable diagram.

2019–20 (Sem. I) (RME101)

1. What do you mean by elasticity and plasticity?
2. Define modulus of rigidity and poisons ratio.
3. Explain stress strain diagram for mild steel in detail.

2019–20 (Sem. I) (NME102/EME102) [COP]

1. What is the difference between stress and strain?
2. Calculate the modulus of rigidity and bulk modulus of a cylindrical bar of diameter 30 mm and length 1.5 m if the longitudinal strain in a bar during a tensile stress is four times the lateral strain. Find the change in volume, when the bar is subjected to a hydrostatic pressure of 100 N/mm^2. Take $E = 1 \times 10^5$ N/mm^2.
3. Discuss stress strain diagram for ductile and brittle materials in detail with suitable diagram.