# Unit Wise Question Bank

## Unit I

| S No. | Questions |
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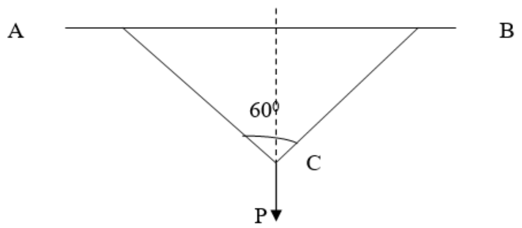
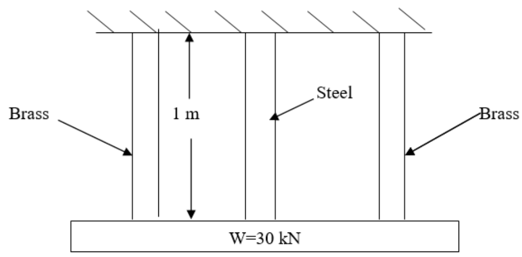
| | **Short Answer Questions** |
| 1 | Define elasticity and plasticity? |
| 2 | State Hooke's law with equation? |
| 3 | Define the terms Factor of Safety and Poisson's ratio? |
| 4 | What is the difference between Resilience and Proof Resilience? |
| 5 | What are the practical applications of impact loads? |
| 6 | Define Poisson's ratio, modulus of elasticity, bulk modulus, modulus of rigidity. |
| 7 | What do you mean by St.Venant's Principle? |
| | **Long Answer Questions** |
| 8 | A load 'P' is suspended from two rods as shown in figure 1. The rod AC is of steel having a circular c/s 30 mm in diameter, and an allowable stress of 160 MN/$m^2$; The rod BC is of Aluminium having diameter 40 mm and allowable stress of 60 MN/$m^2$. What is the maximum load P which can be suspended from these rods? <br> |
| 9 | Define and derive the relation between the various elastic constants? |
| 10 | A weight of 30 kN is supported by two brass rods and a steel rod each 10 mm in diameter and symmetrically placed as shown in Figure.1. When unloaded, each rod is 1 m long. Assuming E for steel and brass as 205 kN/$mm^2$ and 102 kN/$mm^2$ respectively, find the load carried by each rod. Also determine elongation of each rod. <br> |

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| 11 | A steel tube of 30 mm external diameter and 20 mm internal diameter encloses a copper rod of 15 mm diameter to which it is rigidly joined at each end. If at a temperature of $10^0$C there is no longitudinal stress, calculate the stresses in the rod and tube when the temperature is raised by $200^0$C.Take E for steel and copper as 2.1 x $10^5$ N/mm$^2$ and 1 x $10^5$ N/mm$^2$. Coefficient of thermal expansion for steel and copper are given as 11 x $10^{-6}$ /$^0$C and 18 x $10^{-6}$ /$^0$C. |
| 12 | Explain different types of stresses and strains. Derive an expression for strain energy stored in a body when the load is applied with an impact. |
| 13 | A load of 100 N falls through a height of 2 cm on to a collar rigidly attached to the lower end of a vertical bar 1.5 m long and of 1.5 cm$^2$ cross-sectional area. The upper end of the vertical bar is fixed.<br>determine<br>(i) maximum instantaneous stress induced in the vertical bar<br>(ii) maximum instantaneous elongation, and<br>(iii) strain energy stored in the vertical rod. |
| 14 | A reinforced concrete column 500mm ×500mm has four Reinforcement bars of Steel each 18 mm in diameter one in each corner. Find the stresses in concrete and steel bars when the column is subjected to a load of 2MN. Take E for steel is 2.1×$10^5$ N/mm$^2$ and for concrete as 1.4×$10^5$ N/mm$^2$. |
| 15 | A bar 3m long and 5cm diameter, hangs vertically and has a collar securely attached to the lower end. Find the maximum stress induced when, i) A weight of 250Kg falls 12.8 cm on to the collar. ii) A weight of 2500Kg falls 1.28 cm on to the collar. Take E= 2×$10^6$ Kg/cm$^2$. |

## Unit II

| S No. | Questions |
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| | **Short Answer Questions** |
| 1 | Define bending moment and shear force. |
| 2 | What do you mean by point of contra flexure? |
| 3 | Explain the different types of loads with diagram. |
| 4 | What is the use of SFD and BMD? |
| | **Long Answer Questions** |
| 5 | A simply supported beam of length 6 m carries a uniformly increasing load of 600 N/m at one end to 1500 N/m run at the other end. Draw SFD and BMD for the beam. And also calculate the position and magnitude of maximum bending moment. |

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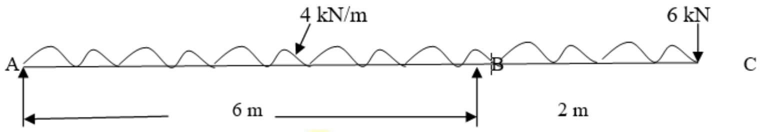
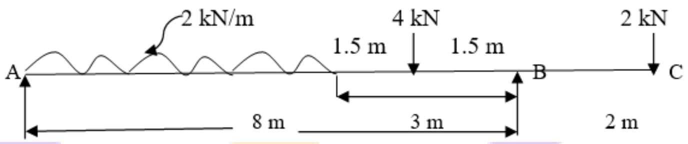
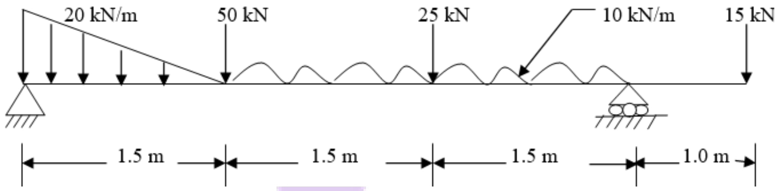
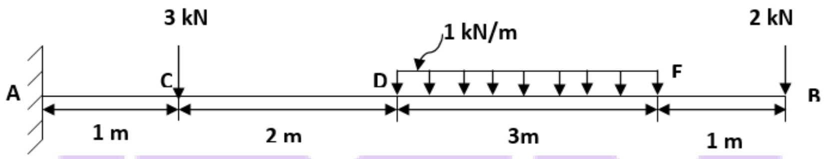
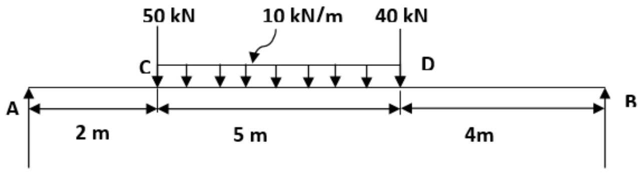
| 6 | An overhanging beam is shown in figure. Draw the shear force and bending moment diagrams.<br><br> |
| 7 | Calculate the reactions in the beam shown in figure. Draw the SFD and BMD. Determine the location of maximum bending moment and mark it clearly on each of the diagram.<br><br> |
| 8 | A cantilever beam of 1.5m long is loaded with a uniformly distributed load at 2KN/m run over a length of 1.25m from free end. It also carries a point load of 3KN at a distance of 0.25m from the free end. Draw Shear force and Bending moment diagram? |
| 9 | Draw the shear force and bending moment diagrams for a beam supported and loaded as shown in figure.<br><br> |
| 10 | Draw SFD and BMD for the cantilever beam loaded as shown in Figure.<br><br> |
| 11 | Draw SFD and BMD for the simply supported beam loaded as shown in Figure. Also calculate the maximum bending moment.<br><br> |

# Unit III

| S No. | Questions |
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| | **Short Answer Questions** |
| 1 | Define section modulus |
| 2 | What are the assumptions made in simple bending theory? |
| 3 | Write the bending equation, defining all the terms in the equation. |
| 4 | Draw the bending stress and shear stress profiles for a hollow rectangular beam section. |
| 5 | Define neutral axis. |
| 6 | Define bending and shear stress. |
| 7 | What is meant by the strength of section? |
| 8 | What is the theory of simple bending? |
| | **Long Answer Questions** |
| 9 | A beam of I –section has top flange 125 mm x 16 mm, bottom flange 150 mm x 20 mm and web of thickness 12 mm. The total depth of the beam is 250 mm and simply supported over a span of 5 m. The beam is subjected to uniformly distributed load of 50 kN/m over its entire span in addition to a concentrated load 60 kN at its mid-span. Draw the bending stress distribution across the depth of the beam cross-section at a section located 3 m from the left support. |
| 10 | Prove the relation: $\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$ |
| 11 | a) A rectangular timber beam 5m long has to carry a uniformly distributed load of 17.5 kN per meter run over its entire length and a concentrated load of 5 kN at the mid span. If the permissible bending stress is 10 $N/mm^2$, find the section taking depth as twice the width.<br>b) A rectangular beam 150mm wide and 300mm deep is subjected to a maximum shear force of 50kN. Determine the maximum shear stress. |
| 12 | A cantilever of length 1.5 m fails when a load of 2000 N is applied at the free end. Find the stress at failure if the C.S of the beam is 40 x 60 mm. Also calculate what amount of udl the cantilever can carry for the same maximum bending stress? |
| 13 | A cast iron beam is of I section as shown in the figure. The beam is simply supported on a span of 6 m. If the tensile stress is not to exceed 40 $N/mm^2$, find the safe uniformly load which the beam can carry. |

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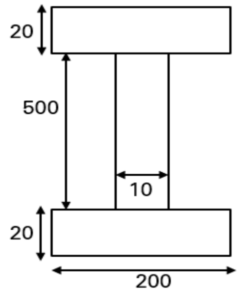
| |  |
| 14 | Prove that the maximum shear stress for a rectangular section is 1.5 times the average stress. |
| 15 | A 15 cm by 8 cm I section is subjected to a shearing force of 10 kN. Calculate the shear stress at the neutral axis and at the top of the web. Given I= 200 x $10^4$ $mm^4$, Area= 900 $mm^2$, web thickness = 1.5 cm and flange thickness = 2.5 cm. |
| 16 | Prove that the maximum shear stress for a circular section is 1.33 times the average stress. |

## Unit IV

| S No. | Questions |
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| | **Short Answer Questions** |
| 1 | What is deflection of beam? |
| 2 | What causes deflection of beam? |
| 3 | How do you control beam deflection? |
| 4 | What is meant by slope and elastic curve? |
| 5 | Differentiate between actual and conjugate beam. |
| | **Long Answer Questions** |
| 6 | Derive the relation between slope, deflection and radius of curvature |
| 7 | A simply supported beam of span 4 m carries a point load at its centre. The value of I for the for the left half portion is 0.5 x $10^8$ $mm^4$ and for the right half portion is 3 x $10^8$ $mm^4$. Find the slopes at the two supports. Take E = 200 GPa. |
| 8 | Find the deflection at the free end of a cantilever of length 'L' subjected to UDL of intensity 'w' per unit length over its entire span. Use Double integration method. |
| 9 | A simply supported beam AB of span 4m carries a point load of 100kN at 4m from the left end. The value of I for the left-hand portion is $10^8$ $mm^4$ and for the right-hand portion is 2 x$10^8$ $mm^4$. Determine the deflection under the point load using conjugate beam. method. Take E = 210 GPa |

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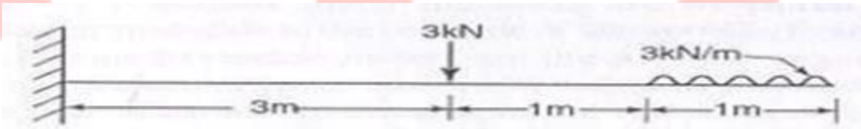
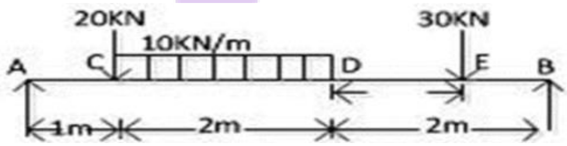
| 10 | Determine slope and deflection of a cantilever loaded with a point at the free end using Moment Area method. |
| 11 | Determine: (i) slope at the left support, (ii) deflection under the load and (iii) maximum deflection of a simply supported beam of length 6 m, which is carrying a point load of 5kN at a distance of 2 m from the left end. Take E = 2 x $10^5$ N/$mm^2$ and I = 1 x $10^8$ $mm^4$ |
| 12 | A beam of length 8 m is simply supported at its ends and carries two-point loads of 36 kN and 46 kN at a distance of 1.5 m and 4 m from the left support. Find: (i) deflection under each load. (ii) Maximum deflection and (iii) The point at which maximum deflection occurs, given E = 2 x $10^5$ N/$mm^2$ and I = 85 x $10^6$ $mm^4$. Use Macaulay's method |
| 13 | A cantilever of length 4 m carries a uniformly distributed load 3 KN/m over a length of 1.5 m from the free end and a point load of 2 KN at the free end. Find the slope and deflection at the free end if E = 2.1 x $10^5$ N/$mm^2$ and I = 6.667 x $10^7$ $mm^4$. |
| 14 | Find the slope and deflection at the free end of the cantilever shown in figure. Take EI = 1 x$10^{10}$ kN-$mm^2$   |
| 15 | Determine the deflections at points C, D and E in the beam shown in the figure. Take E=200kN/$mm^2$ and I=60 x$10^6$ $mm^4$   |

## Unit V

| **S No.** | **Questions** |
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| | **Short Answer Questions** |
| 1 | Define maximum principal strain theory. |
| 2 | A rectangular bar of cross-sectional area 10000 $mm^2$ is subjected to a tensile load of P. The permissible normal and shear stress on the oblique plane making an angle $30^0$ with the direction of maximum principal stress is given as 10N/$mm^2$ and 5N/$mm^2$. Determine the safe value of P. |
| 3 | Define Guest's theory. |
| 4 | What is the importance of Mohr's circle of stress? |

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| 5 | Write the formula for normal and tangential stress when a member is subjected to a simple shear stress. |
| 6 | Define principal plane and principal stress. |
| 7 | Define Haigh – Beltrami's theory |
| 8 | Write the formula for major and minor principal stress when a member is subjected to a simple shear stress. |
| | **Long Answer Questions** |
| 9 | Derive an expression for the normal stress on an oblique plane, when the body is subjected to direct stresses in two mutually perpendicular directions accompanied by a shear stress. |
| 10 | In a metallic body, the principal stresses are $50MN/m^2$(tensile), $120MN/m^2$(compressive tensile) and the third being zero. The elastic limit stress in tension as well in compression is $90MN/m^2$ respectively. Find the factor of safety if the criterion for failure is maximum principal stress theory and maximum shear stress theory. Take $\mu$ = 0.25 |
| 11 | The principal tensile stresses at a point across two perpendicular planes are $100MN/m^2$ and $80MN/m^2$. Determine the normal, tangential stresses and resultant stresses and its obliquity on a plane at $25^0$ with the major principal plane. |
| 12 | An element in a stressed material has tensile stresses of $300MN/m^2$ and $150MN/m^2$ on two mutually perpendicular planes and shear stresses of $60MN/m^2$ on these planes. Determine graphically (Mohr's circle of stresses) the value of normal, tangential, resultant and principal stresses. |
| 13 | In a metallic body, the principal stresses are $40MN/m^2$(tensile), $100MN/m^2$(compressive tensile) and the third being zero. The elastic limit stress in tension as well in compression is $80MN/m^2$ respectively. Find the factor of safety if the criterion for failure is<br>i) Maximum principal stress theory<br>ii) Maximum Principal Strain Theory<br>iii) Maximum Shear Stress Theory<br>iv) Maximum Strain Energy Theory<br>v) Maximum Shear Strain Energy Theory |
| 14 | In a steel member, at a point the major principal stress is $180MN/m^2$(tensile) and minor principal stress is compressive. If the tensile yield point of the steel is $225MN/m^2$, find the value of minor principal stress at which yielding will commence, according to each of the following criterion:<br>i) Maximum Shear Stress Theory<br>ii) Maximum Strain Energy Theory<br>iii) Maximum Shear Strain Energy Theory |

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| 15 | The principal tensile stresses at a point across two perpendicular planes are 120MN/m$^2$ and 60MN/m$^2$.<br>i) The normal, tangential stresses and resultant stresses and its obliquity on a plane at 20$^o$ with the major principal plane.<br>ii) The intensity of stress which acting alone can produce the same maximum strain. Take poisson's ratio as 0.25. |