BE Semester- I ( ) Question Bank

(MECHANICS OF SOLIDS)

All questions carry equal marks(10 marks)

Q.1	(a) Write the SI units of following quantities and also mention whether it is scalar or vector: (i) Force (ii) Moment (iii) Density (iv) Pressure (v) Work (b) Find the resultant of following Coplanar Concurrent forces as shown in **fig 1**.
Q.2	(a) State: 1) Variganon's theorem 2) Lami's theorem (b) Two forces, P and Q are acting on a bolt as shown in **fig. 2**. Find the Resultant force in the terms of magnitude and direction, if the angle between two forces is 150°.
Q.3	(a) State Law of parallelogram of forces (b) Given two forces of magnitude 10 KN and 20 KN, are having a resultant of 15 KN. Find the angle between two forces and the direction of the resultant.
Q.4	(a) Differentiate between ***Resultant & equilibrant*** (b) Calculate the magnitude and direction of the resultant of the coplanar concurrent forces shown in **fig. 3.**
Q.5	(a) State the conditions of Equilibrium for concurrent forces (b) Find the resultant of following Coplanar Concurrent forces acting as shown in **fig. 4**.
Q.6	(a)Two forces act at an angle of 60˚, their resultant force is 50 N acting at 30˚ with one of the forces, find the value of forces. (b) Find the known weight 'W' in a given force system shown in **fig. 5**
Q.7	(a) Define: (i) Moment (ii) Couple (b) Law of triangle of forces (c) Find the resultant of force shown in **fig. 6** about point 'A' .
Q.8	(a) State Law of Polygon (b) Find reactions at support A and B for the simply supported beam shown in **fig. 7**
Q.9	(b) Explain with suitable figure: 1) Types of support 2) Types of loads 3) Types of beam (b) Find the reaction developed at supports for the beam shown in **fig.8**.
Q.10	(a) Define Resultant and Equilibrant. (b) Find the reactions of the beams shown in **fig.9**.
Q.11	(a) Differentiate between Centroid and Center of gravity (b) Locate the centroid of the channel section shown in **fig. 10** about point 'O'.
Q.12	(a) State : 1) Parallel axes theorem 2) Perpendicular axes theorem (b) Find the centroid of the I- section shown in **fig. 11** about point 'O'.

Q.13	(a) Define: Moment of inertia of lamina (b) Find moment of inertia of I- section shown in **fig. 11** about both centroidal axis.
Q.14	(a) Locate the centroid of angle section as shown in **fig. 12** about point 'O'. (b) For an angle section shown in **fig. 12**, Calculate the moment of inertia about both centroidal axes.
Q.15	(a) State Pappus – Guldinus first and second theorem (b) Locate the centroid of the T-section shown in **fig. 13**, about point 'O'.
Q.16	(a) Explain Polar Moment of Inertia (b) Find moment of inertia of T-section shown in **fig. 13** about in both the centroidal axes.
Q.17	(a) Define : Friction and Co-efficient of Friction (b) Find the frictional force for the block shown in **fig. 14** and state whether the block is in equilibrium or in motion. Take μ=0.2
Q.18	(a) Define: Angle of Friction and Cone of Friction (b) State the Laws of Friction (c) A block weighing 50KN is placed on a rough plane inclined at 30˚ to horizontal. If coefficient of friction is 0.25. Find out the force applied on the block as shown in **fig. 15** parallel to the plane. So that the block is just on the point of moving up the plane. Also find angle of friction.
Q.19	(a) Write down the basic assumption made in analysis of truss. (b) Analyse the truss loaded as shown in **fig. 16** .
Q.20	(a) Distinguish between perfect, redundant and deficit truss. (b) Calculate member forces in simply supported truss shown in **fig. 17**.
Q.21	Draw typical stress strain curve for mild steel bar showing all important points on it. A tensile test was conducted on a mild steel bar the following results were obtained. (i) Diameter of bar before test = 20 mm (ii) Gauge length marked = 100 mm (iii) Extension of bar at 20 kN load = 0.032 mm (iv) Load at yield point = 82 kN (v) Maximum load observed = 133 kN (vi) Dia. After test = 126 mm (vii) Breaking load = 100 kN. Determine Young's modulus, yield stress, ultimate stress, breaking stress, % elongation, % reduction in area.
Q.22	Define : Stress and strain An axial pull of 35000 N is acting on a bar consisting of three lengths as shown in fig.(a) If E = 2.1x 10^5 N / mm^2. Determine stresses in each portion and total elongation of bar.
Q.23	Define: Modulus of Elasticity, lateral stain. The bar 25 mm diameter is loaded as shown in fig.(b) Determine the stresses in each part and the total elongation. E= 210 GPa
Q.24	A member ABCD is subjected to point loads P1, P2, P3 and P4 as shown in fig.(c). Calculate the force P2 necessary for equilibrium if P1 = 45 kN, P3 = 450 kN and P4 = 130 kN. Determine the total elongation of the member assuming the modulus of elasticity to be 2.1x 10^5 N / mm^2
Q.25	A load of 2 MN is applied on a short concrete column 500 mm x 500 mm in section. The column is reinforced with four steel bars of 10 mm diameter one in each corner. Find the stresses in the concrete & steel bars. Take Es = 210 GPa, Ec = 14 GPa

Q.26	Define: Thermal stress and thermal strain A steel rod 30 mm diameter and 5 m long is connected to two grips and the rod is maintained at a temperature of 45 º C. Determine the stress and pull exerted when the temperature increases to 90 º C If (i) the ends do not yield (ii) the ends yield by 0.12 cm
Q.27	Define: Bulk modulus, Poisson's ratio Derive relation between Bulk modulus, Modulus of elasticity and Poisson's ratio with usual notations
Q.28	Define: shear stress and Bending moment in beam. Derive relation between shear force, bending moment and rate of loading with usual notations
Q.29	Define: Point of zero shear Draw shear force and bending moment diagrams for the beam loaded as shown in fig (d)
Q.30	Define: Point of contaflexure Draw shear force and bending moment diagrams for the beam loaded as shown in fig (e)
Q.31	Draw shear force and bending moment diagrams for the beam loaded as shown in fig (f)
Q.32	Draw shear force and bending moment diagrams for the beam loaded as shown in fig (g)
Q.33	Draw shear force and bending moment diagrams for the beam loaded as shown in fig (h)
Q.34	Describe the assumptions made in theory of pure bending. Derive Equation for pure bending with usual notations.
Q.35	Define : Section modulus A rectangular beam 200 mm deep and 300 mm wide is simply supported over a span of 8 m. What uniformly distributed load per metre the beam may carry, if the bending stress is not to exceed 120 N/mm^2.
Q.36	A square beam 20 mm x 20 mm in section and 2 m long is supported at the ends. The beam fails when a point load of 400 N is applied at the centre of the beam. What uniformly distributed load per metre length will break cantilever beam of the same material 40 mm wide & 60 mm deep and 3 m long?
Q.37	Draw Shear stress distribution across the sections for following sections (i) Rectangle section (ii) Triangle with horizontal base (iii) H section (ii) T section Find average vertical shear stress over a circular section having diameter 100 mm carrying shear force 200 kN.
Q.38	Write assumptions made in theory of pure torsion. Derive equation for torsion with usual notations.
Q.39	Determine the diameter of shaft, which will transmit 120 kW at 200 rpm , the maximum shearing stress is limited to 80 N/mm^2
Q.40	A steel shaft transmits 30 kW power at 120 rpm. Find the diameter of the solid shaft if the angle of twist is limited to 2º in a length of 20 times the diameter of the shaft. Take modulus of rigidity as 80 kN/mm^2. What should be the value of the maximum shear stress developed?

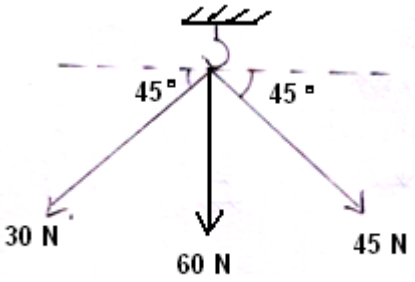


Fig..1

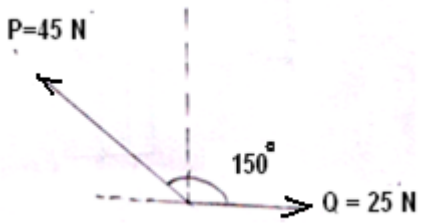


Fig.. 2

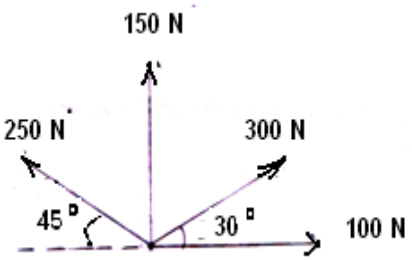


Fig. 3

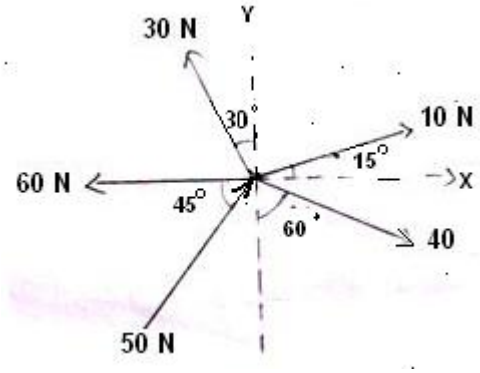
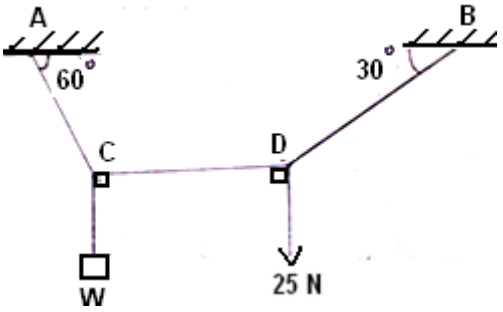


Fig. 4



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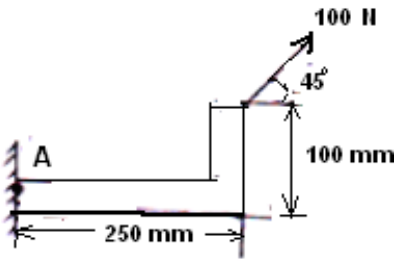

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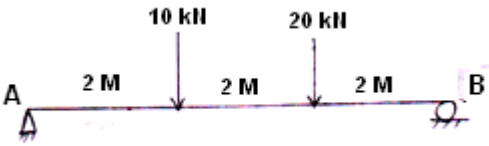

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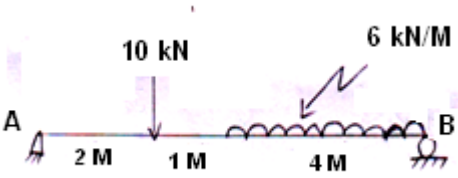


Fig. 8.

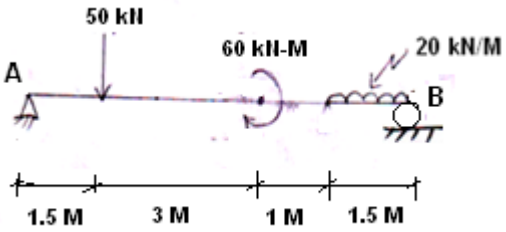


Fig. 9

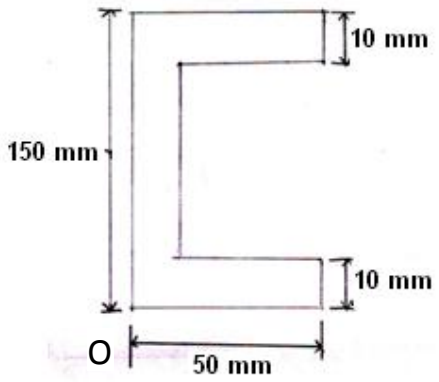


Fig. 10

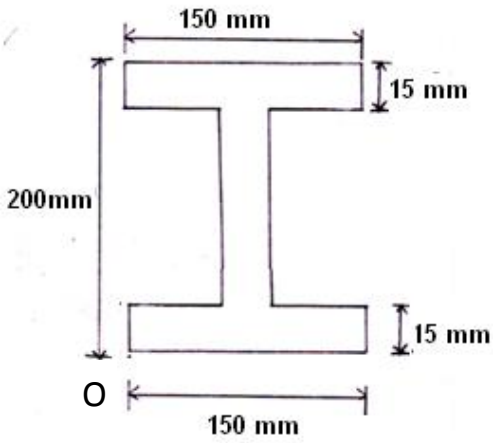


Fig. 11

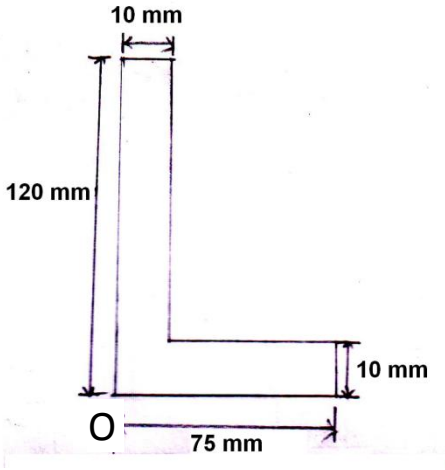


Fig. 12

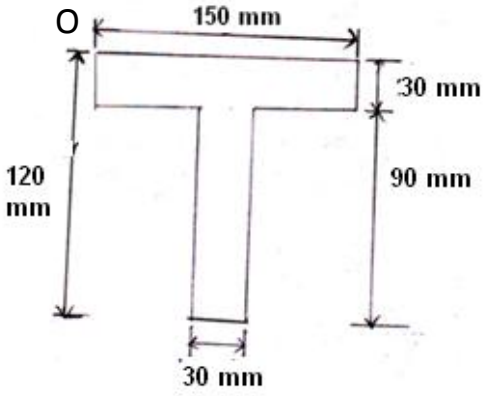
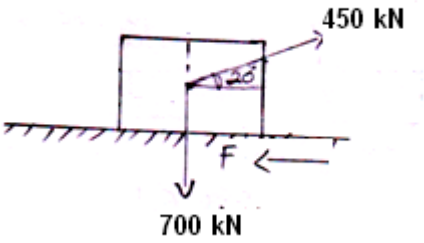


Fig. 13



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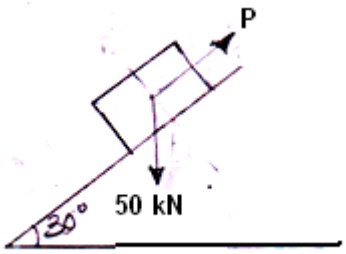

Fig..15

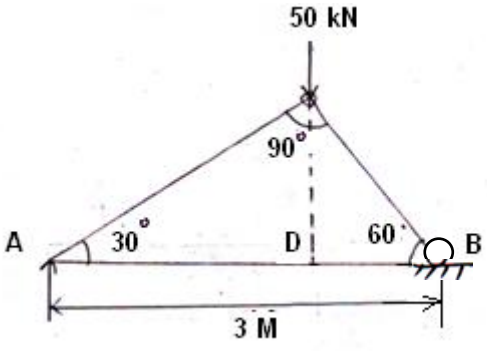

Fig. 16

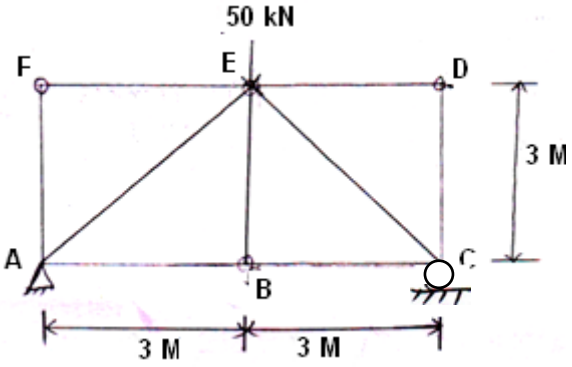

Fig. 17

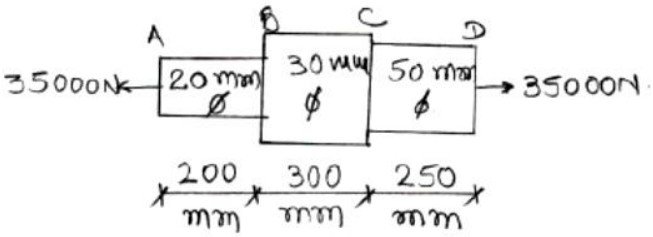

Fig (a)
Q: 22

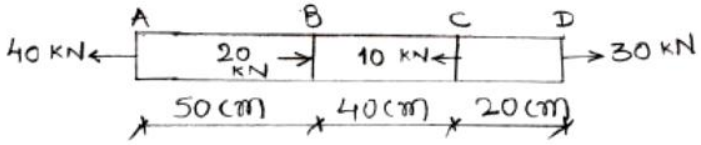

Fig (b)
Q: 23

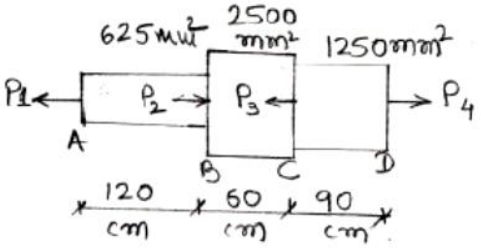

Fig (c)
Q: 24

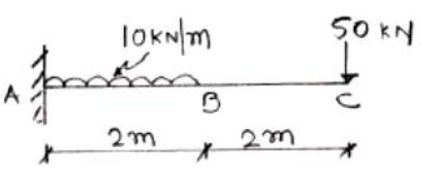

Fig (d) Q: 29

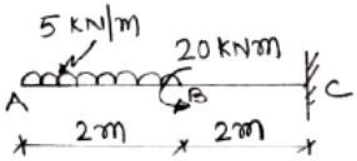

Fig (e) Q: 30

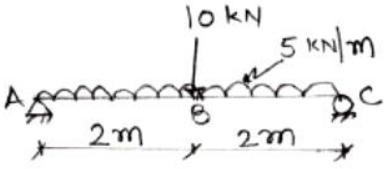

Fig (f) Q: 31

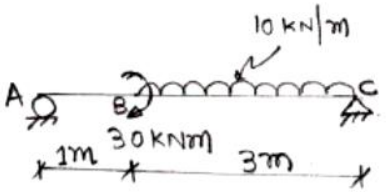

Fig (g) Q: 32

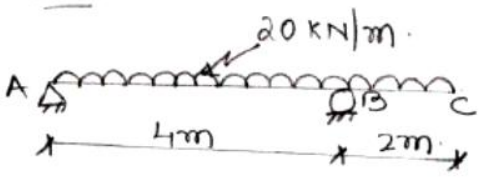

Fig (h) Q: 33