Reg. No. | | | | | | | | | | | | | |

## B.E. / B.TECH. DEGREE EXAMINATIONS, MAY 2023

Second Semester

## CE22202 – ENGINEERING MECHANICS FOR CIVIL ENGINEERS

**(Regulation 2022)**

**TIME: 3 HOURS** **MAX. MARKS: 100**

| COURSE OUTCOMES | STATEMENT | RBT LEVEL |
|---|---|---|
| CO 1 | Apply the concepts of mechanics to solve problems on statics of particles in two and three dimensions. | 3 |
| CO 2 | Solve problems on equilibrium of rigid bodies in two and three dimensions. | 3 |
| CO 3 | Evaluate centroid and moment of inertias of simple plane figures and composite plane areas | 3 |
| CO 4 | Determine member forces in truss using different methods of analysis. | 3 |
| CO 5 | Draw the Shear force and Bending moment diagrams for determinate beams. | 3 |

**PART- A (20 x 2 = 40 Marks)**

(Answer all Questions)

| | | CO | RBT LEVEL |
|---|---|---|---|
| 1. | Two forces of 100 N and 120 N are acting simultaneously at a point. What is the resultant of these two forces, if the angle between them is 50°? | 1 | 3 |
| 2. | Find the unit vector of the line rOA = 4i-5j+8k. | 1 | 2 |
| 3. | A force F = (6i -15j +10k) N acts through the origin. What is the magnitude of this force and the angles it makes with x, y and z axes? | 1 | 3 |
| 4. | Explain Lami's theorem with an example. | 1 | 2 |
| 5. | Explain the Varignon's theorem of moments. | 2 | 2 |
| 6. | Explain free body diagram with an example. | 2 | 2 |
| 7. | State the different types of loads acting on the beams. | 2 | 2 |
| 8. | A beam of span 6 m carries an uniformly distributed load of 20 kN/m acting over the entre span of the beam. What is the total load acting on the beam? | 2 | 2 |
| 9. | State parallel axis theorem. | 3 | 2 |
| 10. | Calculate the moment of inertia of a rectangular section of breadth 200 mm and depth 300 mm about its centroidal axes. | 3 | 3 |
| 11. | Find the moment of inertia of a hollow rectangular section about its centre of gravity if the external dimensions are breadth 60 mm, depth 80 mm and internal dimensions are breadth 30 mm and depth 40 mm respectively. | 3 | 3 |
| 12. | Find the moment of inertia of a circular section of 50 mm diameter about an axis passing through its centre. | 3 | 3 |
| 13. | List the assumptions made in the analysis of member forces of a perfect truss. | 4 | 2 |
| 14. | What is tension coefficient and state its unit. | 4 | 2 |
| 15. | Differentiate perfect and imperfect trusses. | 4 | 2 |
| 16. | Differentiate method of joints and method of sections of analysis of trusses. | 4 | 2 |
| 17. | What is meant by determinate and indeterminate beams? | 5 | 2 |
| 18. | Differentiate sagging and hogging bending moment. | 5 | 2 |

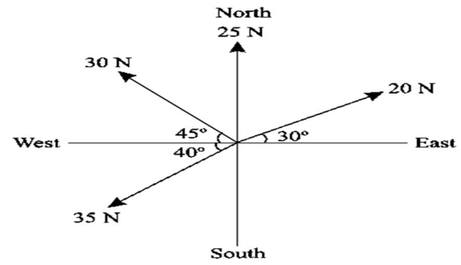




| | | | |
|---|---|---|---|
| 19. | State the bending equation and explain the terms in the bending equation. | 5 | 2 |
| 20. | Derive the section modulus of a rectangular section of breadth b and depth d. | 5 | 2 |

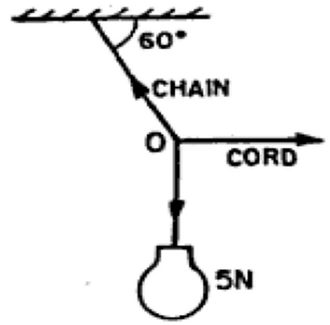
**PART- B (5 x 10 = 50 Marks)**

| | | Marks | CO | RBT LEVEL |
|---|---|---|---|---|
| 21. (a) | For the system of forces shown in the figure, find the magnitude and the direction of the resultant force. | (10) | 1 | 3 |

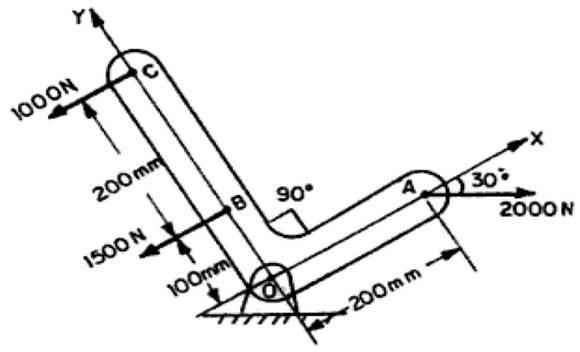



**(OR)**

| | | | | |
|---|---|---|---|---|
| (b) | A lamp weighing 5N is suspended from the ceiling by a chain. It is pulled aside by a horizontal cord until the chain makes an angle of 60° with the ceiling. Find the tensions in the chain and the cord by applying Lami's theorem. | (10) | 1 | 3 |

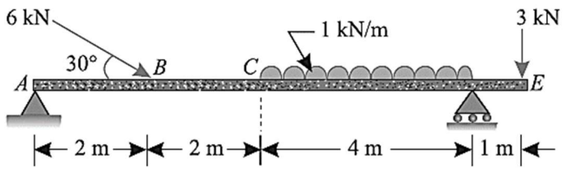



| | | | | |
|---|---|---|---|---|
| 22. (a) | Determine the Force -Couple equivalent system through the point O. | (10) | 2 | 3 |

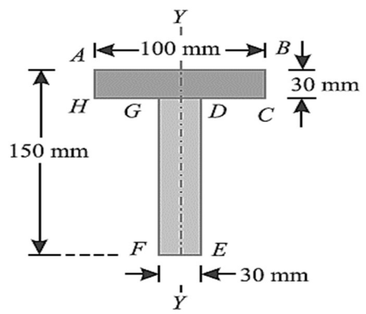



**(OR)**

**(b)** A beam ABCDE hinged at A and supported on rollers at D, is loaded as shown in Figure, Find the reactions at the hinged support A and the roller support at D. **(10) 2 3**

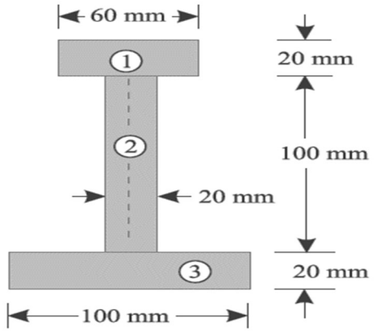



**23. (a)** Find the centre of gravity of a 100 mm × 150 mm × 30 mm T-section shown in figure. **(10) 3 3**

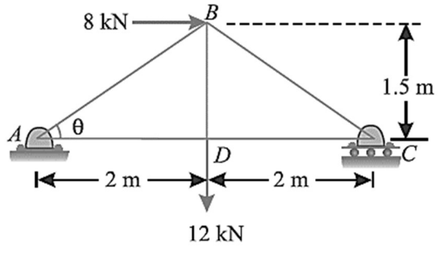



**(OR)**

**(b)** An I-section is made up of three rectangles as shown in figure. Find the moment of inertia of the section about the horizontal axis passing through the centre of gravity of the section. **(10) 3 3**




**24. (a)** Using method of joints, determine the forces in the members of the truss shown in figure. **(10) 4 3**

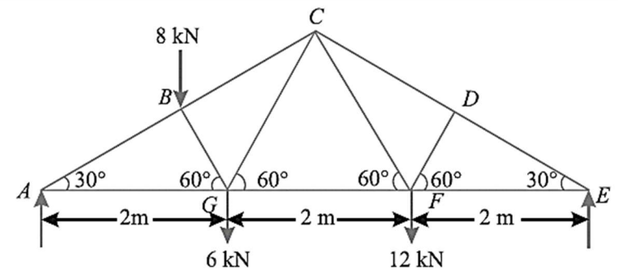




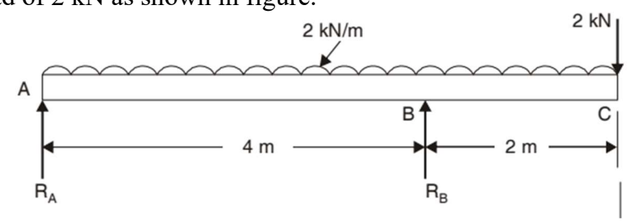



**(OR)**

**(b)** Determine the force in the members BC, GC and GF of the truss shown in figure using the method of sections. **(10) 4 3**




**25. (a)** Draw the Shear force and bending moment diagrams for the overhanging beam carrying an uniformly distributed load of 2 kN/m over the entire length and a point load of 2 kN as shown in figure. **(10) 5 3**



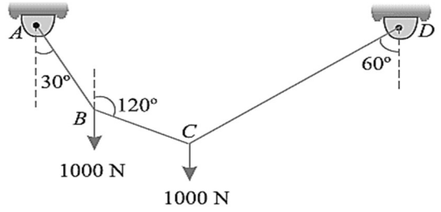

**(OR)**

**(b)** A beam is simply supported and carries an uniformly distributed load of 40 kN/m run over the whole span. The section of the beam is rectangular having depth as 500 mm. If the maximum stress in the material of the beam is 120 $N/mm^2$ and moment of inertia of the section is $7 \times 10^8$ $mm^4$, find the span of the beam. **(10) 5 3**

## PART- C (1 x 10 = 10 Marks)

(Q.No.26 is compulsory)

| | | Marks | CO | RBT LEVEL |
|---|---|---|---|---|
| **26.** | A string ABCD, attached to fixed points A and D has two equal weights of 1000 N attached to it at B and C. The weights rest with the portions AB and CD inclined at angles as shown in Figure. Find the tensions in the portions AB, BC and CD of the string, if the inclination of the portion BC with the vertical is 120°. | **(10)** | 1 | **5** |

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