CBCS SCHEME

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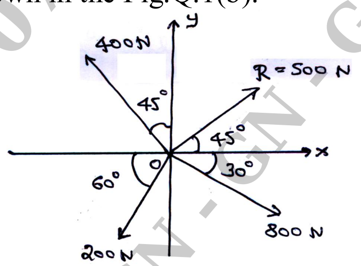
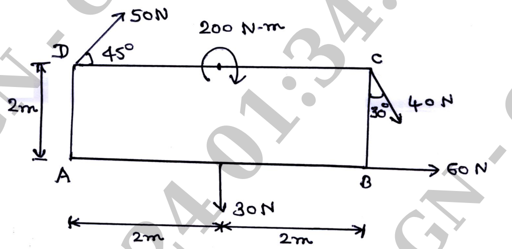
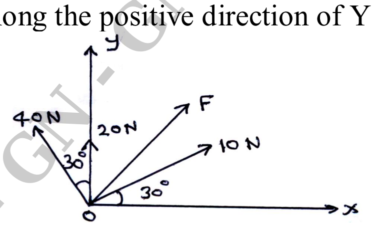
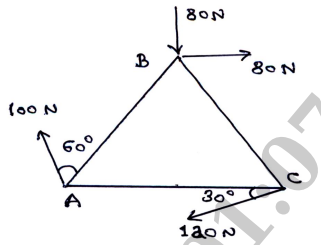
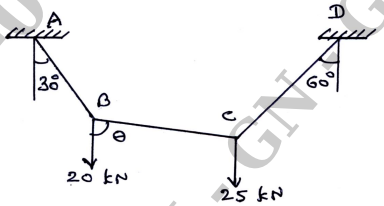
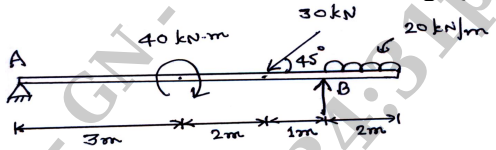
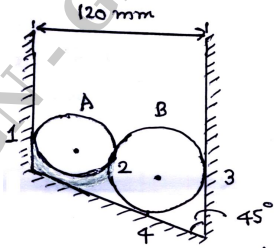
BCIVC103/203

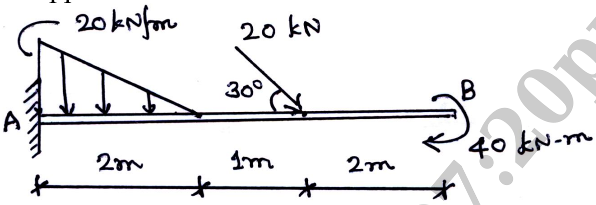
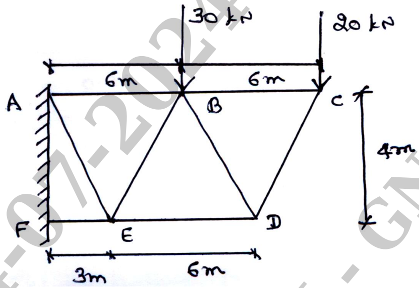
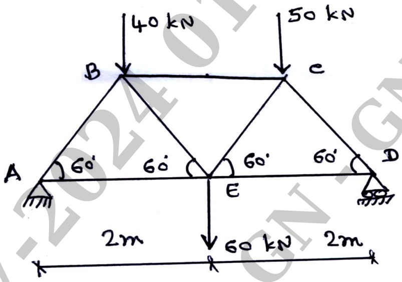
First/Second Semester B.E./B.Tech. Degree Examination, June/July2024
Engineering Mechanics

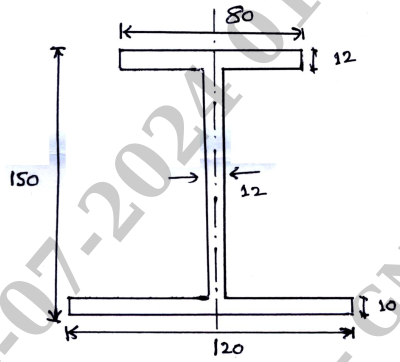
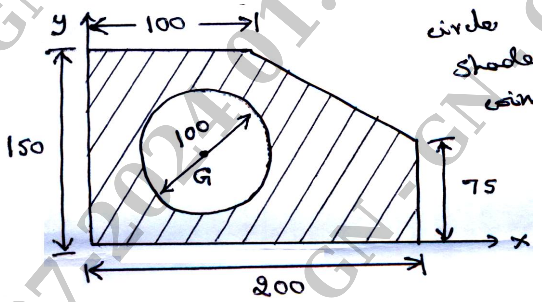
Time: 3 hrs. Max. Marks: 100

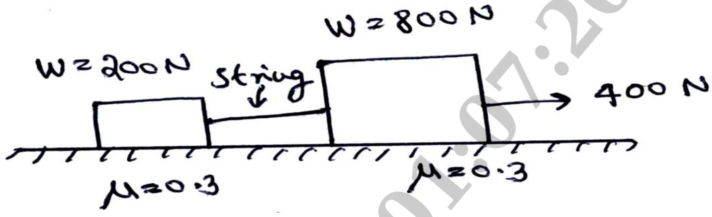
Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	**M**	**L**	**C**
Q.1	**a.**	Explain the following: i) Principle of transmissibility of a force ii) Composition of forces and resolution of a force.	**6**	**L2**	**CO1**
	b.	Determine the fourth unknown force in magnitude and direction so that the resultant $\vec{R}$ acts as shown in the Fig.Q.1(b).  Fig.Q.1(b)	**6**	**L3**	**CO1**
	c.	Compute the resultant of the force system shown in the Fig.Q.1(c) with respect to point A. Also, locate the point where the resultant cuts the line AB.  Fig.Q.1(c)	**8**	**L3**	**CO1, 2**
		OR			
Q.2	**a.**	State and prove principle of moments.	**6**	**L2**	**CO1**
	b.	Determine the unknown force $\vec{F}$ and its direction so that the resultant $\vec{R}$ of magnitude 72N acts along the positive direction of Y axis (↑).  Fig.Q.2(b)	**6**	**L3**	**CO1**

	c.	Compute the magnitude and direction of the resultant of the force system shown in the Fig.Q.2(c) with respect to point A of the equilateral triangle ABC. Side of triangle is 100mm. Also, find the location of the resultant along the edge AC.  Fig.Q.2(c)	**8**	**L3**	**CO1**
		Module – 2			
Q.3	**a.**	Define equilibrium. State the conditions for the equilibrium of coplanar i) Concurrent force system ii) non-concurrent force system.	**5**	**L2**	**CO2**
	b.	In the given string system, determine the tensions in the strings and the angle θ for equilibrium.  Fig.Q.3(b)	**7**	**L3**	**CO2**
	c.	Determine the reactions in the beam shown in the Fig.Q.3(c).  Fig.Q.3(c)	**8**	**L3**	**CO2**
		OR			
Q.4	**a.**	Distinguish between : i) Statically determinate and indeterminate beams. ii) Hinged support and fixed support.	**6**	**L2**	**CO2**
	b.	Compute the reactions at the contact points in the system shown (1, 2, 3, 4). Weight of sphere A = 50N Weight of sphere B = 80N Diameter of sphere A = 50mm Diameter of sphere B = 100mm.  Fig.Q.4(b)	**8**	**L3**	**CO2**

<table>
<tr><td></td><td>c.</td><td>Determine the support reactions in the beam shown :
 
Fig.Q.4(c)</td><td>6</td><td>L3</td><td>CO2</td></tr>
<tr><td colspan="6">Module – 3</td></tr>
<tr><td>Q.5</td><td>a.</td><td>Determine the forces in the members of the truss shown in the figure by the method of joints.
 
Fig.Q.5(a)</td><td>10</td><td>L3</td><td>CO3</td></tr>
<tr><td></td><td>b.</td><td>State the laws of dry friction.</td><td>3</td><td>L2</td><td>CO3</td></tr>
<tr><td></td><td>c.</td><td>A weight 500N just starts moving down a rough inclined plane supported by a force of 200N acting parallel to the plane and it is at the point of moving up the plane when pulled by a force of 300N parallel to the plane. Find the inclination of the plane and the coefficient of friction between the inclined plane and the weight.</td><td>7</td><td>L3</td><td>CO3</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>Q.6</td><td>a.</td><td>Compute the forces in the members of the truss shown in the Fig.Q.6(a) by the method of joints.
 
Fig.Q.6(a)</td><td>10</td><td>L3</td><td>CO3</td></tr>
<tr><td></td><td>b.</td><td>Distinguish between angle of friction and angle of repose. Illustrate with a sketch.</td><td>3</td><td>L2</td><td>CO3</td></tr>
<tr><td></td><td>c.</td><td>A uniform ladder 4m long weighing 300N is placed against a vertical wall with an angle 60° with the floor. The coefficient of friction between the wall and the ladder is 0.25 and that between floor and ladder is 0.35. The ladder has to support a load of 1500N at its top. Find the horizontal force P to be applied at the bottom of the ladder to just prevent slipping.</td><td>7</td><td>L3</td><td>CO3</td></tr>
</table>

		Module – 4			
Q.7	**a.**	From first principles, derive the expression for locating the centroid of a semi-circular section.	**6**	**L3**	**CO4**
	b.	Illustrate: i) Parallel axis theorem ii) Perpendicular axis theorem.	**4**	**L2**	**CO4**
	c.	Determine the polar moment of inertia of the I-section shown in Fig.Q.7(c). All the dimensions are in mms.  Fig.Q.7(c)	**10**	**L3**	**CO4**
		OR			
Q.8	**a.**	Derive the expression for the moment of inertia of a triangular section about its base. Hence, arrive at the expression about its parallel centroidal axis.	**6**	**L3**	**CO4**
	b.	Define and give the mathematical expressions for : i) Moment of inertia ii) Radius of gyration.	**4**	**L2**	**CO4**
	c.	Locate the centroid of the shaded lamina shown in the Fig.Q.8(c). Given that the centroid of the circle and the shaded lamina coinside.  Fig.Q.8(c)	**10**	**L3**	**CO4**
		Module – 5			
Q.9	**a.**	Derive the three fundamental equations of linear motion.	**6**	**L2**	**CO1**
	b.	Determine the least initial velocity with which a projectile is to be projected so that it clears a wall 4m height located at a distance of 5m, and strikes the horizontal plane through the foot of the wall at a distance 4m beyond the wall. The point of projection is at the same level as the foot of the wall.	**6**	**L3**	**CO5**

	c.	Compute the acceleration of the system and the tension in the string shown in the Fig.Q.9(c). Adopt D'Alembert's principle.  Fig.Q.9(c)	**8**	**L3**	**CO5**
		OR			
Q.10	**a.**	State and explain D'Alembert's principle. Give an example.	**6**	**L2**	**CO5**
	b.	A ball is thrown vertically upwards with an initial velocity of 36m/s. After 2 seconds, another ball is thrown vertically upwards. What should be its initial velocity so that it crosses first ball at a height of 30m?	**8**	**L3**	**CO5**
	c.	A projectile is aimed at a target on the horizontal plane and falls 12m short when the angle of projection is 15°, while it overshots by 24m when the angle is 45°. Determine the angle of projection to hit the target.	**6**	**L3**	**CO5**

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