Enrolment No/Seat No.: _____

R.N.G.PATEL INSTITUTE OF TECHNOLOGY-RNGPIT

(An Autonomous Institute U/s UGC Act 1956)

B.Tech. SEMESTER-I, SEMESTER END EXAMINATION – WINTER 2025

SUBJECT CODE: 2ME102 **DATE: 22-12-2025**

SUBJECT NAME: ENGINEERING MECHANICS

TIME: 11:00 AM to 01:30 PM **TOTAL MARKS: 70**

Instructions

1. It is **compulsory** for students to write **Enrolment No. /Seat No.** on the question paper.
2. Write answers of **Section A** and **Section B** in **separate answer books**.
3. Attempt all questions from both **Section A** and **Section B**.
4. Each section carries **35 marks**, with a total of **70 marks** for the examination.
5. The figures to the right of each question indicate full marks, make suitable assumptions with justification.
6. BL - Cognitive Level (As per Revised Bloom's Taxonomy) (R-Remember, U-Understanding, A –Application, N –Analyze, E – Evaluate, C -Create), CO - Course Outcomes.

SECTION A

			Marks	BL	CO
Q.1	**(a)**	Differentiate between the terms centroid, center of gravity, and center of mass	**03**	**U**	**3**
	(b)	Find the centroid of an unequal angle section 100 mm × 80 mm × 20 mm, as shown in Figure 1.	**04**	**A**	**3**

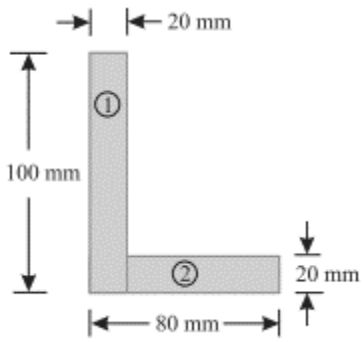
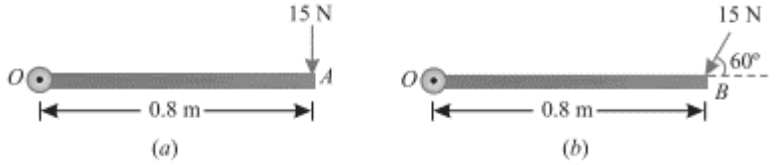


Figure 1

Q.2	**(a)**	State lami's theoram and explain its significance is mechanics.	**03**	**U**	**1**
	(b)	State the parallelogram law of forces and derived its expression.	**04**	**A**	**1**
	(c)	The following forces act at a point: (i) 20 N inclined at 30° towards North of East, (ii) 25 N towards North, (iii) 30 N towards North West, and (iv) 35 N inclined at 40° towards South of West. Find the magnitude and direction of the resultant force.	**07**	**A**	**1**

OR

Q.2	**(a)**	Explain Force system with neat sketch.	**03**	**U**	**1**
	(b)	What is meant by moment of a couple? And differentiate between moment and couple.	**04**	**U**	**1**
	(c)	A force of 15 N is applied perpendicular to the edge of a door 0.8 m wide as shown in Fig. (a). Find the moment of the force about the hing	**07**	**A**	**1**



If this force is applied at an angle of 60° to the edge of the same door, as shown in Fig. (b), find the moment of this force.

Q.3	**(a)**	Define: (1) Simple Machine (2) Output of Machine (3) Efficiency of Machine	**03**	**R**	**2**
	(b)	Explain the relationship between efficiency, MA and VR of a Lifting machine.	**04**	**U**	**2**
	(c)	In a lifting machine, whose velocity ratio is 50, an effort of 100 N is required to lift a load of 4 kN. Is the machine reversible? If so, what effort should be applied, so that the machine is at the point of reversing?	**07**	**A**	**2**

OR

Q.3	**(a)**	Define: (1) Mechanical Advantage (2) Velocity ratio (3) Irreversibility of a Machine.	**03**	**R**	**2**
	(b)	Explain the condition for the reversibility of a machine and explain certain weight lifting machine of velocity ratio 30 can lift a load of 1500 N with the help of 125 N effort. Determine if the machine is reversible.	**04**	**A**	**2**
	(c)	The law of a certain lifting machine is: P = W/50 + 8 The velocity ratio of the machine is 100. Find the maximum possible mechanical advantage and the maximum possible efficiency of the machine. Determine the effort required to overcome the machine friction, while lifting a load of 600 N. Also calculate the efficiency of the machine at this load.	**07**	**A**	**2**

SECTION B

			Marks	BL	CO
Q.4	**(a)**	Determine the moment of inertia for a circular-shaped cross-section.	**03**	**U**	**4**
	(b)	State and prove the theorem of Perpendicular Axes applied to moment of inertia.	**04**	**U**	**4**
Q.5	**(a)**	List the fundamental assumptions considered while analyzing a truss structure.	**03**	**R**	**5**
	(b)	Compare and contrast statically determinate trusses with statically indeterminate trusses.	**04**	**U**	**5**
	(c)	Determine the forces in the members of the truss shown in Figure 1 by the method of joints.	**07**	**N**	**5**

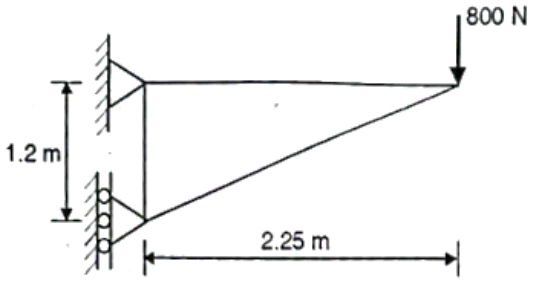


Figure 1

OR

Q.5	**(a)**	Define: 1. Truss 2. Stable truss 3. Unstable truss	**03**	**R**	**5**
	(b)	Explain the different types of trusses used in engineering structures.	**04**	**U**	**5**
	(c)	Determine the forces in the members of the truss shown in Figure 2 by the method of joints.	**07**	**N**	**5**

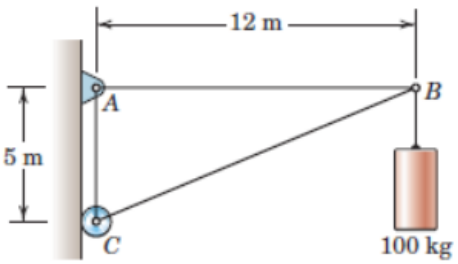


Figure 2

Q.6	**(a)**	Match the types of friction with their correct descriptions:	**03**	**R**	**6**

Column A	Column B
A. Coefficient of friction	1. Perpendicular force exerted by surface
B. Angle of repose	2. Ratio of friction force to normal reaction
C. Normal reaction	3. Angle at which body just begins to slide

(b) Explain the laws of friction. **04** **U** **6**

(c) An 8 m long ladder rests against a vertical wall with which it makes an angle of 45°. A man whose weight is one half of that ladder, climbs it. Determine the distance of the man from the wall when the ladder just start to slip. The coefficient of friction is 0.3 between ladder and wall & 0.5 between ladder and floor. **07** **A** **6**

OR

Q.6 **(a)** Match the types of friction with their correct descriptions: **03** **R** **6**

Column A	Column B
A. Sliding motion	1. Rolling friction
B. Rolling motion	2. Static friction
C. Resting condition	3. Sliding friction

(b) How will you distinguish between static friction and dynamic friction? **04** **U** **6**

(c) A block is lying on an inclined plane shown in Figure 3, determine whether the block will slide or remains at rest. Also, determine the frictional force developed. **07** **A** **6**

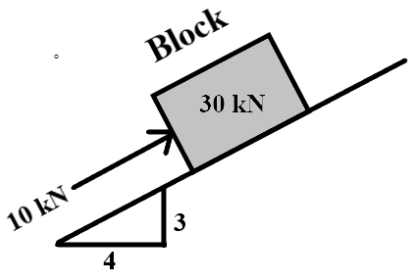


Figure 3

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