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: 1ME102 **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 - Bloom's Taxonomy Levels (R-Remember, U-Understanding, A –Application, N –Analyze, E – Evaluate, C -Create), CO - Course Outcomes.

SECTION A

		Marks	BL	CO
Q.1	**Multiple-Choice Questions**	**[05]**		
(a)	In an ideal machine, the mechanical advantage is _____ velocity ratio.	**1**	**R**	**2**
	(i) Less than **(ii)** Greater than			
	(iii) Reciprocal of **(iv)** Equal to			
(b)	A framed structure of triangular shape is	**1**	**U**	**4**
	(i) Redundant truss **(ii)** Imperfect truss			
	(iii) Deficient truss **(iv)** Perfect truss			
(c)	A redundant truss is also called	**1**	**R**	**4**
	(i) Perfect truss **(ii)** Deficient truss			
	(iii) Imperfect truss **(iv)** none of these			
(d)	Which of the following statement is correct?	**1**	**U**	**5**
	(i) The force of friction does not depend upon the area of contact **(ii)** The static friction is slightly less than the limiting friction			
	(iii) The magnitude of limiting friction bears a constant **(iv)** All of these			

ratio to the normal reaction
between the two surfaces

(e)	The magnitude of the force of friction between two bodies, one lying above the depends upon the roughness of the **(i)** Upper body **(ii)** Both the bodies **(iii)** Both the bodies **(iv)** The body having more roughness	**1**	**U**	**5**

Q.2 Attempt Any Two **[10]**

(a)	Explain how the efficiency of a simple machine is determined?	**5**	**U**	**2**
(b)	In a certain machine, an effort of 100 N is just able to lift a load of 840 N, Calculate efficiency and friction both on effort and load side, if the velocity ratio of the machine is 10.	**5**	**A**	**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?	**5**	**A**	**2**

Q.3 Attempt Any Two **[10]**

(a)	How would you distinguish between a deficient truss and a redundant truss?	**5**	**U**	**4**
(b)	Write the detailed classification of truss.	**5**	**U**	**4**
(c)	What are the assumptions made, while finding out the forces in the various members of a trussed structure?	**5**	**R**	**4**

Q.4 Attempt Any Two **[10]**

(a)	Distinguish between static friction and dynamic friction.	**5**	**U**	**5**
(b)	Define with neat sketch: Coefficient of friction, limiting friction and angle of friction	**5**	**R**	**5**
(c)	A load of 1.5 kN, resting on an inclined rough plane, can be moved up the plane by a force of 2 kN applied horizontally or by a force 1.25 kN applied parallel to the plane. Find the inclination of the plane and the coefficient of friction.	**5**	**A**	**5**

SECTION B

		Marks	BL	CO
Q.5	**Multiple-Choice Questions**	**[05]**		
(a)	In order to determine the effects of a force acting on a body, we must know **(i)** Its magnitude and direction of the line along which it acts. **(ii)** Its nature (whether push or pull). **(iii)** Point through which it acts on the body. **(iv)** All of the above.	**1**	**R**	**1**
(b)	The Lami's Theorem is applicable only for **(i)** Coplaner forces **(ii)** Concurrent forces **(iii)** Coplaner and concurrent forces **(iv)** Any type of forces	**1**	**R**	**1**
(c)	The centre of gravity of a right circular cone of diameter (d) and height (h) lies at a distance of ..... from the base measured along the vertical radius. **(i)** h/4 **(ii)** h/8 **(iii)** 1/4h **(iv)** 1/4r	**1**	**A**	**3**
(d)	If the area of a section is in mm^2 and the distance of the centre of area from a lines is in mm, then units of the moment of inertia of the section about the line is expressed in **(i)** mm^2 **(ii)** mm^4 **(iii)** mm^3 **(iv)** mm	**1**	**U**	**3**
(e)	Theorem of perpendicular axis is used in obtaining the moment of inertia of a **(i)** triangular lamina **(ii)** square lamina **(iii)** circular lamina **(iv)** semicircular lamina	**1**	**U**	**3**
Q.6	**Attempt Any Two**	**[10]**		
(a)	State and prove parallelogram law of forces.	**5**	**U**	**1**
(b)	State and prove Lami's Theorem.	**5**	**U**	**1**
(c)	A triangle ABC has its side AB = 40 mm along positive x-axis and side BC = 30 mm along positive y-axis. Three forces of 40 N, 50 N and 30 N act along the sides AB, BC and CA respectively. Determine magnitude of the resultant of such a system of forces.	**5**	**A**	**1**

Q.7	**Attempt Any Two**	**[10]**		
(a)	Define: simple machine, compound machine, mechanical advantage, efficiency of machine, ideal machine	**5**	**R**	**2**
(b)	Derive the relation between mechanical advantage, velocity ratio and efficiency of a machine.	**5**	**U**	**2**
(c)	In a certain weight lifting machine, a weight of 1 kN is lifted by an effort of 25 N. While the weight moves up by 100 mm, the point of application of effort moves by 8 m. Find mechanical advantage, velocity ratio and efficiency of the machine.	**5**	**A**	**2**
Q.8	**Attempt Any Two**	**[10]**		
(a)	How will you distinguish between static friction and dynamic friction?	**5**	**U**	**3**
(b)	State the laws of friction.	**5**	**R**	**3**
(c)	A ladder 5 meters long rests on a horizontal ground and leans against a smooth vertical wall at an angle 70° with the horizontal. The weight of the ladder is 900 N and acts at its middle. The ladder is at the point of sliding, when a man weighing 750 N stands on a rung 1.5 m from the bottom of the ladder. Calculate the coefficient of friction between the ladder and the floor.	**5**	**N**	**3**

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