

R.N.G.PATEL INSTITUTE OF TECHNOLOGY-RNGPIT
(An Autonomous College U/s UGC Act 1956)

B. TECH SEMESTER-I SEMESTER END EXAMINATION – SUMMER 2025

Subject Code: 1ME102

Date: 11-06-2025

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) The condition for an irreversible (self-locking) machine is:	1	U	2
(i) Efficiency = 100%			
(ii) Efficiency < 50%			
(iii) Efficiency > 50%			
(iv) Efficiency = 0%			
(b) A frame that has just enough members to resist the loads without deformation is called:	1	U	4
(i) Imperfect frame			
(ii) Perfect frame			
(iii) Deficient frame			
(iv) Redundant frame			
(c) In the Method of Joints for truss analysis, the conditions of equilibrium used are:	1	U	4
(i) $\Sigma M = 0$			
(ii) $\Sigma F_x = 0$ and $\Sigma F_y = 0$			
(iii) $\Sigma F_z = 0$			
(iv) ΣM and $\Sigma F_z = 0$			
(d) The maximum value of static friction before the body just starts moving is called:	1	R	5
(i) Dynamic friction			
(ii) Rolling friction			
(iii) Limiting friction			
(iv) Sliding friction			

- (e) The angle between the inclined plane and the horizontal at which a body placed on it just starts to slide down is known as:
- | | | | | |
|-----------------------|------------------------------|---|---|---|
| (i) Angle of friction | (ii) Angle of rotation | 1 | R | 5 |
| (iii) Angle of repose | (iv) Coefficient of friction | | | |

Q.2 Attempt Any Two [10]

- (a) The larger and smaller diameters of a differential wheel and axle are 80 mm and 70 mm respectively. The effort is applied to the wheel of diameter 250 mm. What is the velocity ratio? Find efficiency and frictional effort lost, when a load of 1050 N is lifted by an effort of 25 N. 5 A 2
- (b) A simple wheel and axle has wheel and axle of diameters of 300 mm and 30 mm respectively. What is the efficiency of the machine, if it can lift a load of 900 N by an effort of 100 N. 5 A 2
- (c) Distinguish clearly between a 'simple wheel and axle' and a 'differential wheel and axle'. 5 U 2

Q.3 Attempt Any Two [10]

- (a) Define the following terminologies along with interpretation : 5 R 4
- I. Statically Determinate Truss
- II. Statically Indeterminate Truss
- III. Unstable Truss
- (b) What is truss? Write assumption made in analysis of truss. 5 R 4
- (c) Explain different types of trusses. 5 U 4

Q.4 Attempt Any Two [10]

- (a) Explain following terms: 5 U 5
- I. Coefficient of friction
- II. Limiting friction
- III. Angle of friction
- (b) State and explain briefly 'Laws of dry friction'. 5 U 5
- (c) A block is resting on a horizontal plane. A force of 100 N acts at 45° with horizontal, sets the block in motion. If coefficient of friction at contacting surface is 0.20, calculate the weight of block. 5 A 5

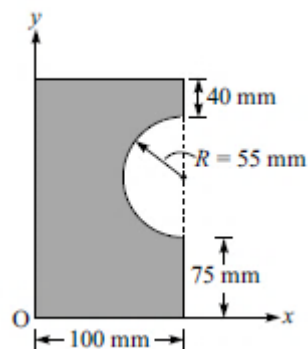
SECTION B

	Marks	BL	CO
Q.5 Multiple-Choice Questions	[05]		
(a) The dimensions of torque are (i) $M L^2 T^{-2}$ (ii) $M L T^2$ (iii) $M L T^{-1}$ (iv) $M T^{-2}$	1	R	1
(b) If a number of force act simultaneously on a particle, it is possible (i) Not to replace them by a single force (ii) To replace them by a single force (iii) To replace them by a single couple (iv) To replace them by a force and couple	1	U	1
(c) Unit of coefficient of friction is _____ (i) mm (ii) Newton (iii) radian (iv) None of the above	1	R	1
(d) If a small hole is scooped out of a body and is then filled with a denser material, its Center of gravity, (i) Moves away from the hole (ii) Moves towards the hole (iii) Remains the same (iv) Changes its position	1	U	3
(e) Moment of inertia of a circular area about an axis perpendicular to the area passing through its centre is given as (i) $\frac{\pi d^4}{8}$ (ii) $\frac{\pi d^4}{16}$ (iii) $\frac{\pi d^4}{32}$ (iv) $\frac{\pi d^4}{64}$	1	R	3
Q.6 Attempt Any Two	[10]		
(a) State lami's theoram and explain its significance in mechanics.	5	U	1
(b) Explain the principal of transmissibility of a force with its limitations.	5	U	1
(c) Two ends of a string ABCD are tied to fixed points A and D. Two equal weight of the string with the vertical are shown in Fig. 1 . Determine the tension in the parts AB, BC, and CD of the string.	5	A	1
Q.7 Attempt Any Two	[10]		
(a) Define: (1) Mechanical Advantage (2) Output of Machine (3) Efficiency of Machine (4) Ideal machine (5) Velocity ratio	5	R	2

- | | | | |
|---|---|---|---|
| (b) Differentiate between centre of gravity, centre of mass and centroid. | 5 | N | 3 |
| (c) In a single purchase winch crab, the numbers of teeth on the pinion and wheel are 16 and 110 respectively. The diameter of the load axel is 200 mm and the lever arm of the handle is 900 mm. Find the velocity ratio of the machine. If a 4 kN load required an effort of 200 N and an 8 kN load requires 300 N effort, find the law of machine, the maximum efficiency and the maximum mechanical advantages. Also find the efficiency and effort lost in friction for both the loads | 5 | A | 2 |

Q.8 Attempt Any Two **[10]**

- | | | | |
|--|---|---|---|
| (a) State and prove the parallel-axis theorem. | 5 | R | 3 |
| (b) Determine the centroid of the section shown in Figure below. | 5 | A | 3 |



- | | | | |
|---|---|---|---|
| (c) Determine the moment of inertia of T-section shown in Fig.2 about the horizontal and vertical axes passing through the CG of the section. | 5 | A | 3 |
|---|---|---|---|

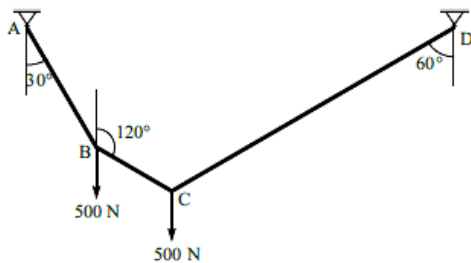


Fig. 1

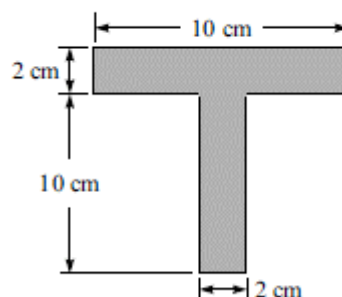


Fig. 2
