

**End Semester /Reappear (II) Examination May 2025**

**Programme: Diploma (MiE)**  
**Course: Engineering Mechanics**  
**Course Code: 9D.153**  
**Enrolment no. \_\_\_\_\_**

**Full Marks: 70**  
**Time: 3 Hrs.**

**Section I**

**1. Short Answer type questions. Answer any four. 4 x 5 = 20**

- Illustrate what is force with its S.I unit. Also explain effect and characteristic of force.
- What do you mean by the equilibrium of forces and what are the conditions of equilibrium?
- Explain reversibility and non-reversibility of a machine.
- Write the characteristics of frictional force.
- What do you understand by the term friction? What are the different types of friction?
- Define simple lifting machine, Load & Effort with suitable examples.

**Section II**

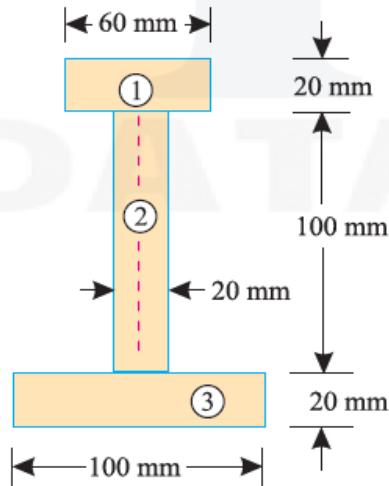
**Long Answer type questions. Answer any three. 3 x 10 = 30**

- Determine the magnitude and direction of the resultant of the following set of forces acting on a body
  - 200 N inclined  $30^\circ$  with east towards north.
  - 250 N towards the north,
  - 300 N towards north west, and
  - 350 N inclined at  $40^\circ$  with west towards south
- A beam AB of span 6 m carries a point load of 1500 N at a distance 2m from A and 2000 N at a distance of 4m from A. Determine the beam reaction.
- Elaborate the laws of friction. A body of weight 300 N is lying on a rough horizontal plane having a coefficient of friction as 0.3. Find the magnitude of the force, which can move the body, while acting at an angle of  $25^\circ$  with the horizontal.
- Derive the relation between efficiency, mechanical advantage and velocity ratio. Determine the effort required to lift a load of 150 N if the lifting machine is stated to have velocity ratio 15 and efficiency 60 percent. Also setup an equation prescribing the law of machine if the frictional resistance of the machine is constant. Proceed to find the effort to run this machine at: (i) no load, (ii) a load of 100 N.
- A wooden block of weight 50 N rests on a horizontal plane. Determine the forces required to just (a) pull it, and (b) push it. Take coefficient of friction between the mating surfaces is 0.4. Also comment on result.

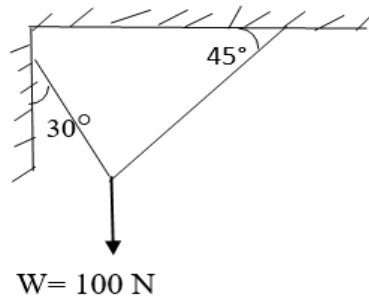
**Section III**

**Application based questions. Answer any one. 1 x 20 = 20**

- Locate the centroid of the following plane figures – Rectangle, triangle, semicircle & a uniform rod.
  - An I-section is made up of three rectangles as shown in figure below. Find the centre of gravity of the section.



8. a. The resultant of two forces one of which is double the other is 260 N. If the direction of the larger force is reversed and the other remains unaltered, the resultant reduces to 180 N. Determine the magnitude of the forces and the angle between them.
- b. A weight of 100 N hangs from a point C by means that the strings AC and BC as shown in figure below. Using Lami's theorem, determine the forces in the string.



9. State and prove the law of parallelogram of forces. Show that the resultant  $R = \sqrt{F_1^2 + F_2^2}$  when the two forces  $F_1$  and  $F_2$  are at right angles to each other. Find the value of R if the angle between the forces is zero.

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