7053

BOARD DIPLOMA EXAMINATION, (C-20)

MAY—2023

DME - FIRST YEAR EXAMINATION

ENGINEERING MECHANICS

Time : 3 Hours] [*Total Marks* : 80

PART—A

3×10=30

Instructions : (1) Answer **all** questions.

(2) Each question carries **three** marks.

(3) Answers should be brief and straight to the point and shall not exceed five simple sentences.

1. State Parallelogram law of forces.

2. State Varignon's theorem.

3. State the laws of static friction.

4. Define angle of repose.

5. Find the moment of inertia of a rectangular lamina of 40 mm wide and 80 mm deep about Centroidal x-axis (I_{xx}).

6. State Parallel axis theorem.

7. Initial velocity of a body moving with uniform acceleration of 6 m/s^2 is 10 m/s. Find the velocity after 10 seconds and also distance travelled in this time.

8. State the law of conservation of momentum.

9. Define *(a)* mechanical advantage and *(b)* velocity ratio in case of simple machines.

10. Define the terms kinematic link and kinematic pair.

PART—B

8×5=40

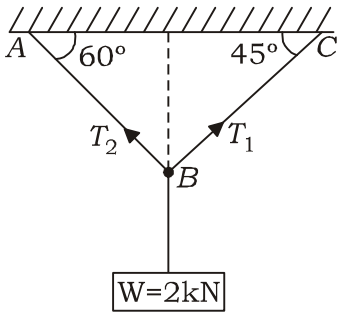
Instructions : (1) Answer **all** questions.

(2) Each question carries **eight** marks.

(3) Answers should be comprehensive and criterion for valuation is the content but not the length of the answer.

11. *(a)* *(i)* State Lami's theorem. 3

(ii) A weight of 2 kN is supported by two strings as shown in figure. Find the tensions in the strings. 5



(OR)

(b) Find the magnitude and direction of the single force that brings the following system of concurrent forces into equilibrium. 8

- A force of 20 N acting due East
- A force of 25 N acting 40 degree north of East
- A force of 10 N acting 50 degree west of North
- A force of 30 N acting vertically downwards

12. *(a)* A body of weight 490.5 N rest on a plane, inclined at 20 degree to the horizontal. A horizontal force of 250 N just move the body up the plane. Find the coefficient of friction. 8

(OR)

(b) A body resting on a horizontal plane required a pull of 18 kN inclined at 30° to the plane just move it. It was also found that a push of 22 kN inclined at 30° to the plane just moved the body. Determine the weight of the body and the coefficient of friction. 8

13. *(a)* *(i)* Differentiate between centroid and centre of gravity. 3

(ii) A T-section has flange 100 mm wide and 8 mm thick. The web is 82 mm deep and 10 mm thick. Find its centroid. 5

(OR)

(b) An I-section is made up of top flange 80 × 20 mm, web 120 × 20 mm bottom flange 100 × 20 mm. Determine the moment of inertia of the I-section about its centroidal axes (I_{xx} and I_{yy}). 8

14. *(a)* A body having a mass of 5 kg starts from rest and attains a speed of 4 m/s in 6 seconds. Find the force required to move the body, with uniform acceleration on a horizontal surface. Take coefficient of friction as 0.25. 8

(OR)

(b) A bullet of mass 0.05 kg is fired into a freely suspended target of mass 5 kg. With this impact, the target and bullet move with a velocity of 7 m/s. Find the initial velocity of bullet and the loss of kinetic energy. 8

15. *(a)* The law of certain lifting machine is $P = (W/50) + 15$. 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 friction while lifting a load of 1500 N. Also calculate the efficiency at this load.

(OR)

(b) *(i)* Draw a neat sketch of differential wheel and axle and label the parts. 4

(ii) In simple wheel and axle, the diameter of wheel is 500 mm and the diameter of axle is 40 mm. If an effort of 950 N required to lift 7000 N. Find the efficiency of the machine. 4

PART—C

10×1=10

Instructions : (1) Answer the following question.

(2) The question carries **ten** marks.

(3) Answer should be comprehensive and the criterion for valuation is the content but not the length of the answer.

16. In a lifting machine, an effort of 150 N raised a load 7700 N. What is the mechanical advantage? Find the velocity ratio, if the efficiency at this load is 60%. If on the machine an effort of 250 N raise a load of 13200 N, what is the efficiency? What will be the effort required to raise a load of 5000 N? Calculate the maximum mechanical advantage and the maximum efficiency.

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