C20-M–105

7053

BOARD DIPLOMA EXAMINATION, (C-20)

OCTOBER / NOVEMBER—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. Define *(a)* Resultant and *(ii)* Equilibrant

3. Define *(a)* Limiting angle of friction and *(ii)* Angle of repose

4. A block of 1000 N weight is resting on a horizontal plane. A horizontal force of 100 N is applied on the block. If the coefficient of friction between the block and surface is 0·3, determine the frictional force.

5. Define *(a)* Centre of Gravity *(b)* Centre of Mass and *(c)* Centroid.

6. Find the Moment of Inertia of a hollow circle of 100 mm inner diameter and 120 mm outer diameter about its any centroidal axis.

7. A car moving at 54 kmph accelerates uniformly at the rate of $1 m/s^2$ for the next 10 seconds. What is the velocity of the car after 10 seconds?

8. State D'Alembert's Principle.

9. Define *(a)* Kinematic Chain and *(b)* Mechanism.

10. State the conditions for self-locking in case of simple machines.

PART—B

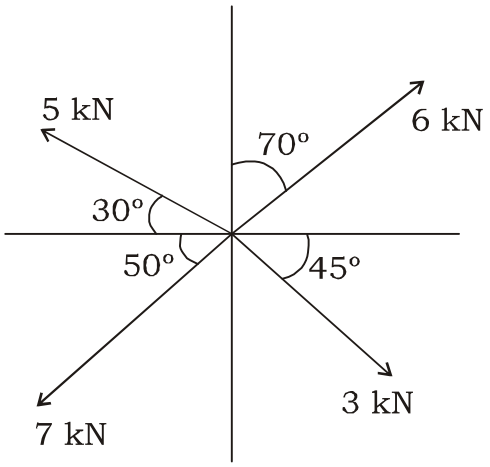
8×5=40

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

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

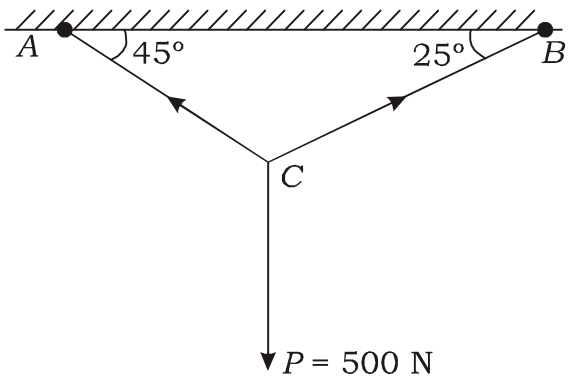
(3) Answers should be comprehensive and criterion for valuation is the content but not the length of the answer.

11. *(a)* Three coplanar concurrent forces are acting as shown in Fig. Find the magnitude and direction of the Resultant Force.

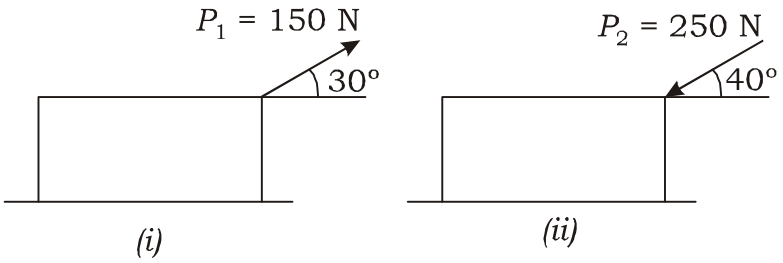


(OR)

(b) Two cables are tied together at C and are loaded as shown. Knowing that $P = 500\,N$, determine the tension *(i)* in cable AC, *(ii)* in cable BC.



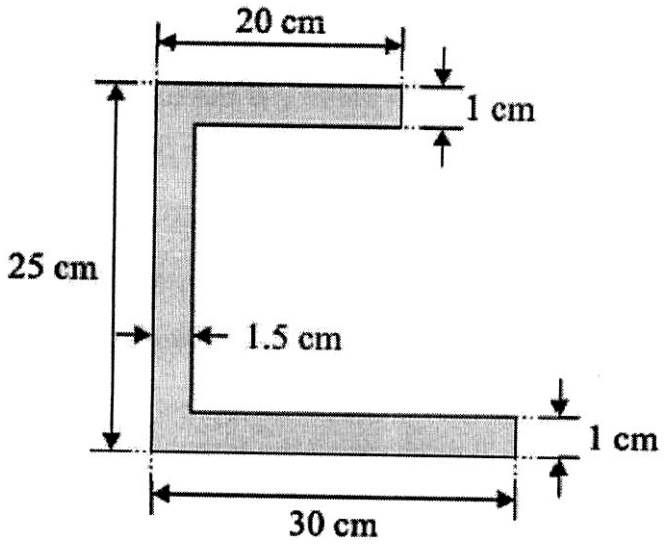
12. *(a)* A body resting on a horizontal rough surface requires a pull of 150 N inclined at 30° to the horizontal to initiate the motion, as shown in Fig.*(i)*. Also, it requires a push 250 N inclined at 40° to the horizontal to just start the motion, as shown in Fig.*(ii)*. Calculate the weight W of the body and the coefficient of friction.



(OR)

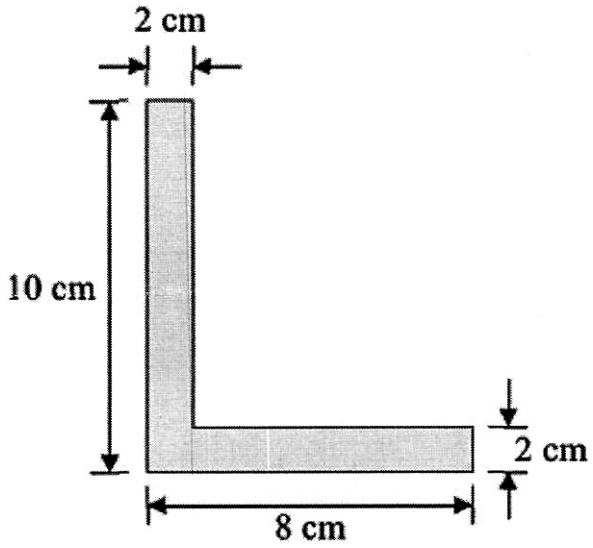
(b) Derive the value for the pull force "P" to be applied along the inclined plane, to just slide the body upwards along the inclined plane, when there exits a coefficient of friction μ between the contact surfaces. Assume weight of the body as 'W'.

13. *(a)* Find the centroid of the area shown in the fig.



(OR)

(b) Calculate the Moment of Inertia of the area shown in the fig. about horizontal centroidal axis.



14. *(a)* A stone is dropped from the top of a building. Two seconds later, another stone is thrown downwards with an initial velocity of 30 m/s. If both the stones reach the ground at the same time, determine *(i)* the time taken by the first stone to reach the ground *(ii)* the height of the building.

(OR)

(b) *(i)* State Newton's second low of motion. 3

(ii) A bullet of mass 0·1 kg is fired onto a target with a velocity of 350 m/s. The mass of target is 10kg and it is free to move. Find the loss of kinetic energy. 5

15. *(a)* In a simple machine, whose velocity ratio is 30, a load of 2400 N is lifted by an effort of 150 N and a load of 3000 N is lifted by an effort of 180 N. Find the law of machine and calculate the load that could be lifted by a force of 200 N. Calculate also :

(i) The amount of effort wasted in overcomming the friction,

(ii) Mechanical advantage and

(iii) The efficiency.

(OR)

(b) Draw the first order, second order and third order pulley systems and write the expression for their velocity ratios.

PART—C

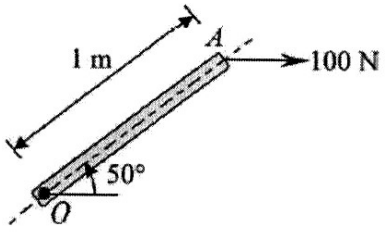
10×1=10

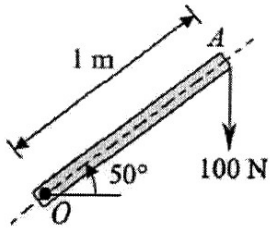
Instructions : (1) Answer the following question.

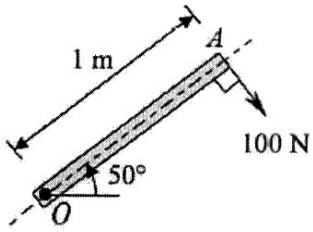
(2) The question carries **ten** marks.

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

16. A 100 N force is applied at the end *A* of a lever *OA* *(i)* horizontally, *(ii)* vertically and *(iii)* perpendicularly to the lever as shown in the figure below. Determine the moment of the force about O in each case. Write the inference from the three moments.







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