7053

C20-M–105

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BOARD DIPLOMA EXAMINATION, (C-20)

SEPTEMBER/OCTOBER—2021

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. Define Composition and Resolution of forces. 1½+1½=3

2. State Triangle Law of forces and draw a system of forces diagram which depicts Triangle Law. 2+1=3

3. State laws of Static friction. 3

4. Define the following terms :

(a) Normal Reaction

(b) Coefficient of friction

5. Find the Moment of Inertia of a rectangular lamina 30 mm wide and 90 mm deep. Also determine the least Radius of Gyration. 2+1=3

6. State Perpendicular axis theorem. 3

7. Write the differences between Distance and Displacement. 3

8. A body is pulled through a distance of 18 m along a level track. The force applied is 450 N, acting at 30° to the direction of motion. Find the work done. 3

9. Define *(a)* Lower pair and *(b)* Mechanism. Give examples for each. 1+1+½+½=3

10. A body of weight 6000 N is lifted by means of inclined plane making an angle of 25° with the ground. Neglecting friction, determine the force required to be applied in a direction parallel to the plane to haul up the load. 3

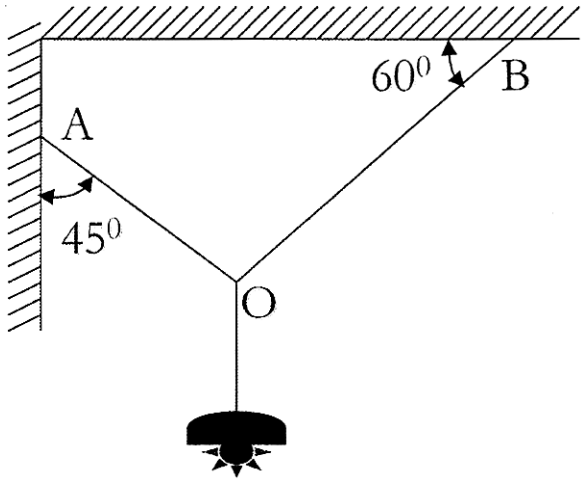
PART—B

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)* State Varignon's principle. An electric light fixture weighing 30 N hangs from a point 'O' by means of two strings OA and OB as shown in Figure. Determine the forces in the strings. 3+5=8



OR

(b) State Parallelogram Law of forces. A roller of diameter 600 mm and weight 2000 N is to be taken up a step 50 mm high. Find magnitude and direction of the minimum pull required on the handle to pull the roller up a step. 3+5=8

12. *(a)* A body of weight 1500 N is to be pulled up on an inclined plane of angle 25°. The coefficient of friction between body and plane is 0·28. Draw the force diagrams and find the effort required when the pull is *(i)* parallel to base and *(ii)* inclined to plane at 10°. 8

(solve by using Lami's theorem only)

OR

(b) A body resting on a rough horizontal plane requires a pull of 110 N inclined at 30° to the plane and a push of 180 N inclined 25° to the plane just to move it. Determine the weight of the body and coefficient of friction. 8

13. *(a)* State Parallel axis theorem. Find the centroid of I-section made up of top flange 70×22 mm, web 120×20 mm and bottom flange 100×18 mm. 3+5=8

OR

(b) Find the moment of inertia of a T-section having flange and web as 100 mm × 22 mm rectangles, about its centroidal axes (I_{xx}, I_{yy}). 4+4=8

14. *(a)* An engine and a train having a load of 250 tonnes are moving on a straight horizontal track with uniform speed of 48 kmph. If the frictional resistance is 60 N per tonne, calculate the power exerted by the engine. What additional power is required to maintain the same speed, if the train moves up a gradient of 1 in 150. 8

OR

(b) Write any three differences between weight and mass. Find the height of tower from the top of which an object falls freely and during the last second of its motion, the object travels a distance equal to 3/4 th of the height of the tower. Take g = 10 m/s^2. 3+5=8

15. *(a)* State Law of the machine. In a simple lifting machine, an effort of 500 N is required to lift a load of 6 kN. The velocity ratio of the machine is 25. Determine *(i)* frictional effort, *(ii)* frictional load and *(iii)* Efficiency. 3+2+2+1=8

OR

(b) Explain Inversions of the QUADRIC cycle chain. 8

PART—C

10×1=10

Instructions : (1) Answer the following question.

(2) It carries **ten** marks.

16. A double purchase winch crab has the following parameters :

L = length of handle in 'm' to apply effort of 'E'.

R = radius of load drum in 'cm' to lift a weight of 'W'.

T_1, T_3 = Number of teeth on pinions.

T_2, T_4 = Number of teeth on Spur gears.

T_1 is mounted on effort axel, T_4 is mounted on load axel. T_2, T_3 are mounted on intermediate axel and T_1 meshes with T_2. T_3 meshes with T_4.

Draw a neat sketch and Write the formulae to calculate Velocity ratio, distance moved by *(i)* the effort and *(ii)* the load (W) for one revolution of effort handle. 4+2+2+2=10

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