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C16-M-105

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BOARD DIPLOMA EXAMINATION, (C-16)

AUGUST/SEPTEMBER—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. The resultant of two given forces is equal to each of the forces. Find the angle between the forces.

2. Define equilibrium and equilibrant.

3. Prove that the angle of repose is equal to angle of friction at the limiting condition.

4. State the laws of static friction.

5. Define Center of gravity and Radius of gyration.

6. A body moving with SHM has amplitude of 0.8 m and period of complete oscillation is 2 seconds. Determine the maximum velocity and maximum acceleration.

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7. State the law\*of conservation of momentum.
8. What is self locking? Mention the condition for self locking.
9. In a simple lifting machine, an effort of 500 N raised a load of 12·5 kN. If the machine has an efficiency of 65%, determine the mechanical advantage and velocity ratio.
10. Define (a) structure and (b) mechanism.

### PART—B

Instructions : (1) Answer *any* five questions.

(2) Each question carries ten marks.

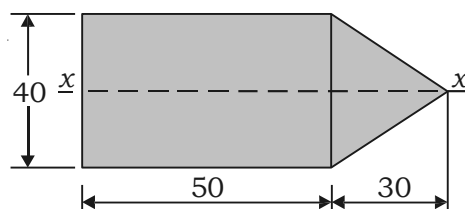
(3) Answers should be comprehensive and criterion for valuation is the content but not the length of the answer.

11. (a) Three forces acting on a particle are in equilibrium. Angle between first two forces is  $90^\circ$  and that between second and third is  $120^\circ$ . Find the ratio of the forces. 5+5=10

(b) Define a couple. List out any three practical applications of a couple.

- \* 12. (a) Define moment of a force. State VARIGNON'S principle. 5+5=10

(b) Locate the centroid of the following section.



13. A body resting on a rough horizontal plane required a pull of 180 N inclined at  $30^\circ$  to the plane just to move it. It was found that a push of 220 N inclined at  $30^\circ$  to the plane just moved the body. Determine the weight of the body and the coefficient of friction. 10
14. Find MI about centroidal axis parallel to base for a symmetrical I-section with the following dimensions : Top and Bottom flanges : 160 mm  $\times$  10 mm ; Web : 180 mm  $\times$  10 mm. 10
15. A bullet of mass 0.03 kg is fired with a velocity of 500 m/s. What is the kinetic energy of the bullet? If the bullet penetrates into a block of wood 300 mm deep, what is the resistance offered by wood to the bullet? What is the exit velocity, if the same bullet is fired into a 150 mm thick wood? 10
16. (a) An elevator lifting a weight of 4450 N starts to move upwards with a uniform acceleration of  $0.6 \text{ m/s}^2$ . Find the tension in the cable during upward motion. 5+5=10
- (b) A wheel rotating about a fixed axis at 20 rpm is uniformly accelerated for 70 seconds, during which time it makes 50 revolutions. Find the angular velocity at the end of this interval.
17. In a differential wheel and axle, the difference between axle diameters is 50 mm and the diameter of the effort wheel is 750 mm. If a load of 2500 N is lifted by an effort of 175 N and a load of 3250 N is lifted by an effort of 210 N, determine : (a) law of the machine, (b) load lifted by an effort of 225 N, (c) mechanical advantage, (d) velocity ratio and (e) efficiency. 10
- \* 18. (a) Draw the following line diagrams of simple pulleys, second system of pulleys, third system machines of pulleys. 5+5=10
- (b) Explain Ackermann Steering Gear mechanism with a neat line diagram.

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