3247

BOARD DIPLOMA EXAMINATION, (C–09)
MARCH/APRIL—2016
DME—THIRD SEMESTER 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 the parallelogram law of forces and give the mathematical expression.　　　　　　　2+1=3

2. A stone is dropped from a tower and strikes the ground after 4 seconds. Find the velocity of stone at the end of 4 seconds and height of the tower.　　　1½+1½=3

3. Define centripetal force and centrifugal force.　　1½+1½=3

4. Mention any three machine members where friction is desirable.　　　　　　　　1×3=3

5. What horizontal force is required to pull a load of weight 250 N along the horizontal surface? Take the coefficient of friction as 0·2.　　　　　　　　3

6. Define mechanical advantage and velocity ratio.　　1½+1½=3

7. A lifting machine consists of pulleys arranged in second order. There are four pulleys in each block. An effort of 150 N is applied to lift a load of 900 N. Calculate the efficiency of the system.   3

8. Define centre of gravity and centroid.   1½+1½=3

9. Find the moment of inertia of a rectangle of width 50 mm and depth 80 mm about its centroidal axes.   1½+1½=3

10. Define higher pair and lower pair. Give one example to each.   1½+1½=3

PART—B   10×5=50

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

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

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

11. The following forces act at a point :

(a) 15 kN inclined at 30° towards North of East

(b) 20 kN towards North

(c) 25 kN towards North-West

(d) 30 kN inclined at 40° towards South of West

Find the magnitude and direction of the resultant of force.   5+5=10

12. *(a)* A body is projected vertically upwards with a velocity of 14 m/s. Find the maximum height attained by the body and the velocity at 6 m height.   2+2=4

    (b) A body of mass 9 kg is moving along a smooth horizontal plane with a velocity of 15 m/s to the left when it is struck centrally by a bullet of mass 28 gram which passes right through it. The velocity of the bullet changes from 720 m/s to the right before impact to 120 m/s to the right after impact. Determine the velocity of the body just after impact.   6

13. A body of weight 1200 N is to be pulled up an inclined plane of angle 25°. The coefficient of friction between body and plane is 0·3. Find the effort required *(a)* when it is parallel to the plane and *(b)* when it is parallel to the base.   5+5=10

14. A load of 20 kN is lifted by a screw jack. Mean diameter of thread is 75 mm, pitch of screw thread is 12 mm, coefficient of friction for screw and bearing surfaces is 0·075, the effective mean radius of bearing surfaces is 60 mm. Determine the torque required to raise the load.   10

15. *(a)* A flywheel increases its speed from 30 r.p.m. to 60 r.p.m. in 10 seconds. Find the number of revolutions made by the wheel in 10 seconds and its angular acceleration.   5

   (b) In a double-purchase crab winch, teeth of pinions are 20 and 25 and that of spur wheels are 50 and 60. Length of the handle is 2 m and radius of load drum is 0·25 m. If the efficiency of the machine is 60%, find the effort required to lift the load of 720 N.   5

16. The law of a certain machine is $P = W/50 + 15$. The velocity ratio of the machine is 80. 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 1200 N. Also calculate the efficiency at this load.   3+3+2+2=10

17. Find the moment of inertia of I-section shown in the Figure 1 about its centroidal axes I_{XX} and I_{YY} :   6+4=10
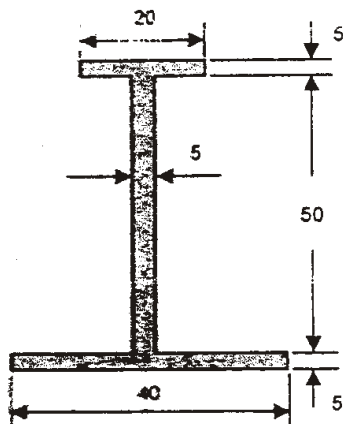

Fig. 1
(All dimensions are in mm)

18. *(a)* Find the centroid of channel section shown in the Figure 2, from its vertical edge 440 mm : 5
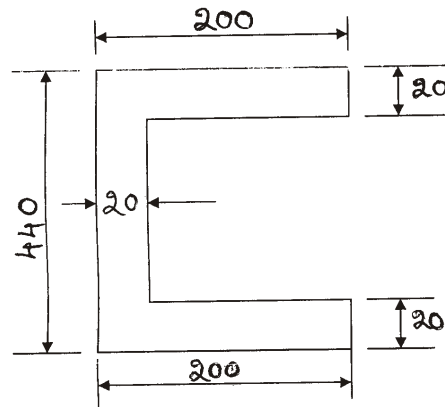

Fig. 2
(All dimensions are in mm)

(b) Draw a quadric cycle chain and identify the links. 5

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