Total number of printed pages–5

53 (ME 201) ENMC

2021

ENGINEERING MECHANICS

Paper : ME 201

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. *(a)* Differentiate between statics, kinetics and kinematics. 4

   (b) State the effects, which a force may produce, when it acts on a body. 4

   (c) What is a system of forces ? Enumerate the characteristics of a force. 4

   (d) State the unit of force into CGS, MKS and SI system of units. How are they related to each other ? 3

Contd.

(e) State and prove parallelogram law of forces. 5

2. (a) Three coplanar forces acting at a point are stated to be in equilibrium. Show that each force is proportional to the sine of the angle between the other two forces. 6

(b) Define the term free body diagram and state the importance of drawing such a diagram. 4

(c) A force of $200N$ is resolved into two components. If one of the components is equal to $120N$ and makes an angle of $30°$ with the $200N$ force, find the other component and the angle between the components. 6

(d) Three forces $2P$, $3P$ and $4P$ act along three sides of an equilateral triangle taken in order. Find the magnitude and line of action of the resultant force. 4

3. (a) Define moment and moment of force. State Varignon's theorem. 3

(b) Find the magnitudes of the two like parallel forces acting at a distance of $24cm$, whose resultant is $200N$ and its line of action is at a distance of $6cm$ from one of the forces. 3

(c) Three like parallel forces $20N$, $40N$ and $60N$ are acting at points A, B and C respectively on a straight line ABC. The distances are $AB = 3m$, $BC = 4m$. Find the resultant and also the distance of the resultant from point A on line ABC. 4

(d) A lamp weighing $5N$ is suspended from the ceiling by a chain. It is pulled aside by a horizontal chord until the chain makes an angle of 60° with the ceiling. Determine the tensions in the chain and the chord. 7

(e) The resultant of two equal forces (P) acting at a point also equals to (P). Determine the angle between the two forces. 3

4. (a) Differentiate between : 5

(i) Static and kinetic friction

(ii) Sliding and rolling friction.

(b) Define the following terms : 4

(i) Angle of friction

(ii) Cone of friction.

(c) The force required to pull a body of weight $100N$ on a rough horizontal plane is $30N$. Determine the co-efficient of friction, if the force applied is at an angle of 15° with the horizontal. 5

(d) Find the least friction required to pull a body of weight (W) placed on a rough horizontal plane, when the force is applied at an angle (θ) with the horizontal. 6

5. (a) Find the centre of gravity of an I-section with top flange $100mm \times 20mm$, web $200mm \times 30mm$ and bottom flange $300mm \times 40mm$. 6

(b) How many centres of gravity a body has? How would you find out the centre of gravity of a section with a cutout hole? 4

(c) Find the moment of inertia of a T-section with flange as $150mm \times 50mm$ and web as $150mm \times 50mm$ about X-X and Y-Y axes through the centre of gravity of the section. 10

6. A cantilever truss is loaded as shown in *Fig. (i)*. Find the forces in all members of the truss. 20