Total No. of printed pages = 8

END SEMESTER (REGULAR/RETEST) EXAMINATION, JUNE – 2024

Semester : 2nd

Subject Code : Me–201

ENGINEERING MECHANICS

Full Marks – 70

Time – Three hours

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

1. Fill in the blanks of the following :   1×5=5

   (a) The value of Kinetic friction slightly decreases with the ____ in speed.

   (b) The centre of gravity of a triangle lies at the point of intersection of ____.

   (c) The second moment of a force is also said to be ____.

   (d) For reversible machine the efficiency is ____ than 50%.

   (e) The unit of moment is same as unit of ____.

[Turn over

2. Choose correct answers from the following :

$1 \times 5 = 5$

(a) The maximum M.A. of a lifting machine is

(i) m

(ii) m × VR

(iii) 1/m

(iv) 1/(m×VR)

(b) The unit of work done is

(i) Watt

(ii) Horse power

(iii) Joule

(iv) Newton

(c) Section Modulus for a circular section of diameter 'd' is

(i) $\pi d^3 / 32$

(ii) $\pi d^4 / 32$

(iii) $\pi d^4 / 64$

(iv) None of these

(d) The centre of gravity of a semicircle lies on its vertical radius at a distance of

(i) $4r / 3\pi$

(ii) $3r / 4\pi$

(iii) $4\pi / 3r$

(iv) $3\pi / 4r$

(e) Two equal like parallel forces acting some distant apart forms a

(i) Moment

(ii) Couple

(iii) Torque

(iv) Moment of Inertia.

3. State True or False : 1×5=5

(a) In Kinetics the magnitude of motion of a body is related to the amount of applied force.

(b) Unlike parallel forces are divergent.

(c) Lami's theorem is applicable to three concurrent forces in equilibrium.

(d) Friction acting on a body depends on the area of contact.

(e) Acceleration of a body is due to change in velocity with time.

4. (a) (i) Two forces act at an angle of 120°. The larger force is 40 kg and resultant is perpendicular to smaller force. Find the smaller force. 3

Or

(ii) Find the angle between two equal forces 'P' when their resultant is P/2. 3

(b) The following forces act simultaneously on a particle

(i) 20 kg at 50° to horizontal

(ii) 15 kg horizontally

(iii) 12 kg at 120° to horizontal

(iv) 25 kg at 220° to horizontal.

Find the magnitude and direction of their resultant.   5

5. (a) (i) State Varignon's principle of moments for concurrent forces.   2

Or

(ii) Define moment. How a moment of force can be geometrically represented ?   2

(b) State Lami's theorem. A body of weight 70. kg is suspended by two strings of 4m and 3m length attached at same horizontal level 5m apart. Find the tension in strings.   1+3=4

(c) (i) A weightless rod of 120 cm length is supported at both ends. The support at left can't bear pressure more than 30 kg. A weight of 70 kg attached to the Rod at a point 'C', such that the left support is about to fall. Find the distance of 'C' from left support.   3

Or

(ii) Find the value of two like parallel forces acting at 40 cm apart and whose resultant is 70 gm. The resultant acts at a distance of 15 cm from left force.   3

6. (a) (i) Distinguish between Centre of Gravity and Centroid. 2

Or

(ii) Show the position of centre of gravity for a Hemisphere and Semicircle with sketch. 2

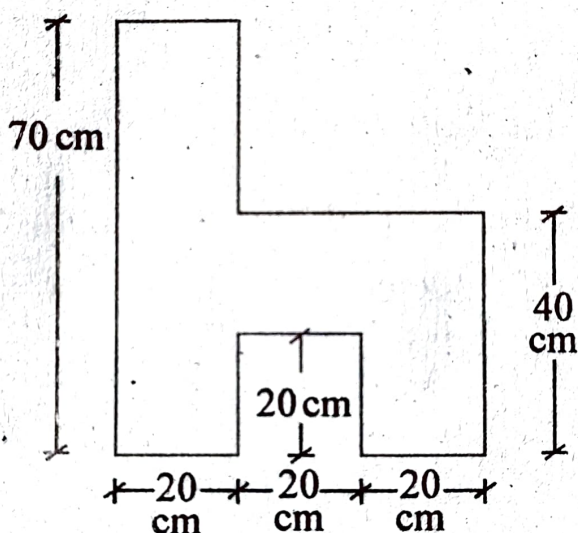(b) Find the position of centre of gravity for plane lamina shown in Fig-I below : 6

70 cm

40 cm

20 cm

20 cm ⊢—20—⊢—20—⊢—20—⊣ cm

Figure – I

7. (a) (i) State the law of Static friction. 3

Or

(ii) Define the terms : 3

(i) Co-efficient of friction

(ii) Limiting friction

(iii) Angle of friction.

(b) A body of 60 kg weight is moved up an inclined plane of inclination 25° with horizontal by applying an external horizontal force of 30 kg. Find the Co-efficient of Friction. 4

8. (a) (i) Give expression for Moment of Inertia for a triangular lamina about the base and the axis passing through centre of gravity but parallel to base. 2

Or

(ii) Explain theorem of Parallel axis. 2

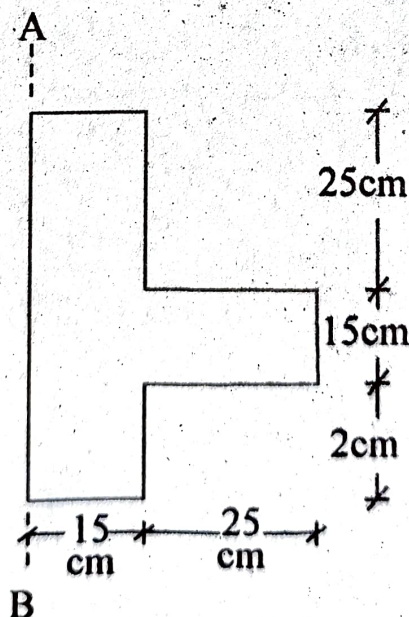(b) Find the MOI of the plane lamina about line AB, shown in Fig. II below : 6

Figure – II

9. (a) (i) Write the equations of motion under gravity. 2

Or

(ii) Write the units of Velocity, Acceleration, Work done and Power. 2

(b) (i) A body starts from rest with a constant acceleration of 1.5 m/s². After what time it's velocity will be 9.5 m/s and what distance it will travel during this time. 3

Or

(ii) The motion of a body is given by equation $S = 3t^3 + 2t$. (S-distance and t-time). Find the velocity (after 3 seconds) Acceleration (at the end of 4 seconds) and Distance Coverd in 6 seconds. 3

(c) Find the Kinetic Energy of a bullet of mass 60 gm moving with a velocity of 800 m/sec. 1½×2=3

(d) Find the work done is drawing a bucket full water of 15 kg weight from a 20m deep well. 2

10. (a) (i) Write the expression for friction in a machine in terms of effort. 2

(ii) Define efficiency of machine. Distinguish between Reversible and self-locking machine. 2

(b) In a simple wheel and axle the radius of wheel and axle are 25 cm and 5 cm respectively. If an effort of 50 kg lift a load of 600 kg, find the efficiency of the machine. 3