[Total No. of Questions - 9] [Total No. of Printed Pages - 4]

Dec-22-0110

ME-101 (Engineering Mechanics)

B.Tech-2nd (CBCS)

Time : 3 Hours **Max. Marks : 60**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note: Attempt one question from each of sections A, B, C and D of the question paper. However, Section E is compulsory.

SECTION A

1. (a) State and explain Varignon's theorem of moments. (4)

   (b) A system of connected flexible cables shown in Figure 1 is supporting two vertical forces 200 N and 250 N at points. B and D. Determine the forces in various segments of the cable. (6)

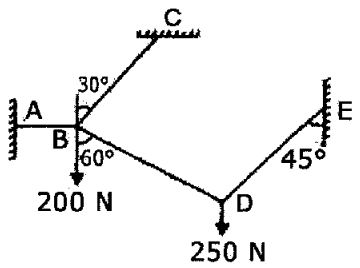

Figure 1

or

2. (a) State and prove law of parallelogram. (4)

   (b) A heavy cylinder of mass 200 kg is to be pulled over an obstacle of height 5 cm by a horizontal force F applied by means of a rope wound around the cylinder shown in

Figure 2. Determine the magnitude of pull for the impending motion over the obstacle (neglecting friction), while the radius of the cylinder is 13 cm. (6)

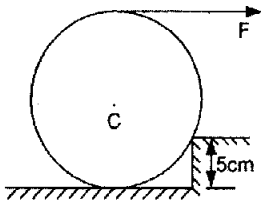

Figure 2

SECTION B

3. (a) State Coulomb's law of friction. Also discuss the 'Angle of friction' and 'Angle of repose'. (4)

   (b) What is the least value of P in the system shown in Figure 3 to prevent the motion? Assume the pulley is smooth and coefficient of friction between the other contact surfaces is 0.3. (6)

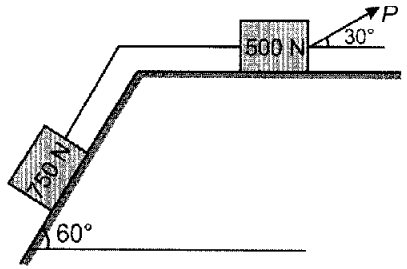

Figure 3

or

4. (a) Define Centroid, Centre of gravity, polar moment of inertia and radius of gyration. (4)

   (b) Determine the centroid of shaded area of figure 4 about the origin. (6)

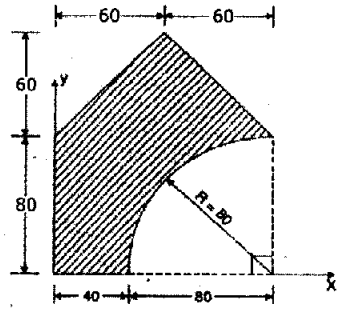

Figure 4

[P.T.O.]

SECTION C

5. (a) State the assumptions made in the analysis of pin jointed trusses. Bring out the differences among perfect, deficient and redundant trusses. (4)

(b) Analyse forces of member of truss as shown in Figure 5. In given truss joint A is pin joint whereas joint C is simple supported joint. (6)

or

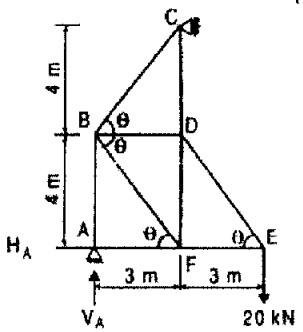

Figure 5

6. (a) Derive the relationship between,
   (i) Shear force and load intensity
   (ii) Bending moment and shear force (4)

(b) Draw the Shear force diagram (SFD) and Bending Moment Diagram (BMD) of given beam as shown Figure 6. (6)

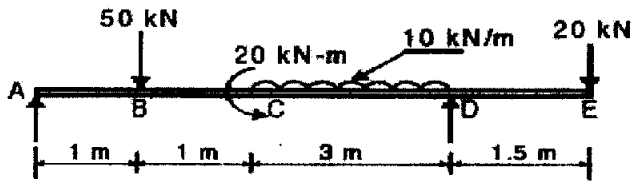

Figure 6

SECTION D

7. (a) The equation of motion of a particle moving in a straight line is given by : $s = 18t + 3t^2 - 2t^3$ where (s) is in metres and (t) in seconds. Find (1) velocity and acceleration at start, (2) time, when the particle reaches its maximum velocity, and (3) maximum velocity of the particle. (4)

(b) A cylindrical roller 50 cm in diameter is in the contact with two belts at top and bottom as shown in figure 7. If the belts run at the uniform speed of 5 m/sec and 8 m/sec, find the linear velocity and angular velocity of the roller. (6)

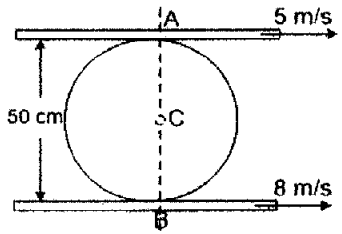

Figure 7

or

8. (a) State the Work-Energy principle and Impulse momentum principle. (4)

(b) Two rough planes inclined at 30° and 60° to horizontal are placed back as shown in figure 8. The blocks of weights 60 N and 120 N are placed on the faces and are connected by a string running parallel to planes and passing over a frictionless pulley. If the coefficient of friction between planes and blocks is 0.3, find the resulting accelerations and tension in the string. (6)

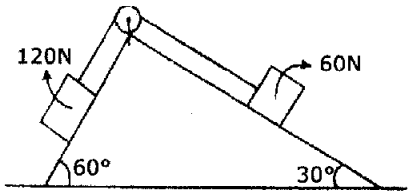

Figure 8

SECTION E (Compulsory Question)

9. Write short answers of the following (10×2=20)
   a. State and prove the Lami's theorem.
   b. State Coulomb's law of friction.
   c. Explain the terms moment of inertia.
   d. Write down the support with suitable sketch.
   e. Define the motion and types of the motion.
   f. Define the D'Alembert's principle.
   g. Discuss the Strain energy and proof resilience,
   h. State and prove the theorems of parallel axis.
   i. Discuss the free body diagram with suitable sketches
   j. Define the Beam and the types of the beam.