Code: 9A01101

1

B.Tech I Year (R09) Regular & Supplementary Examinations, June 2013

ENGINEERING MECHANICS

(Common to AE, CE, ME and BT)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

*****

1 Define the following terms:

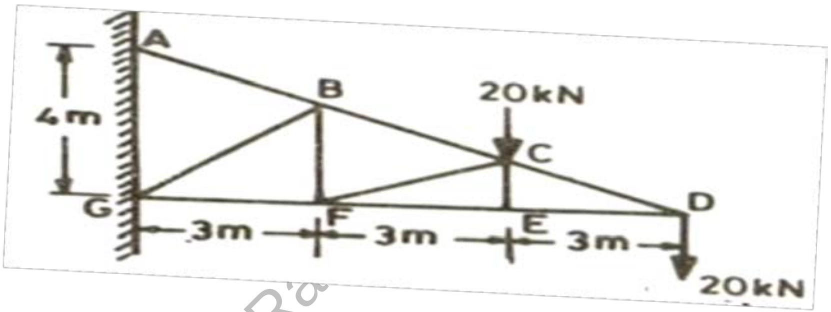
(a) Rigid body.

(b) Principle of transmissibility.

(c) Triangle law of forces.

(d) Deformable body.

2 Determine the forces in all the members of the frame shown in below figure. Indicate the nature of forces also (Tension as +ve and Compression as -ve).

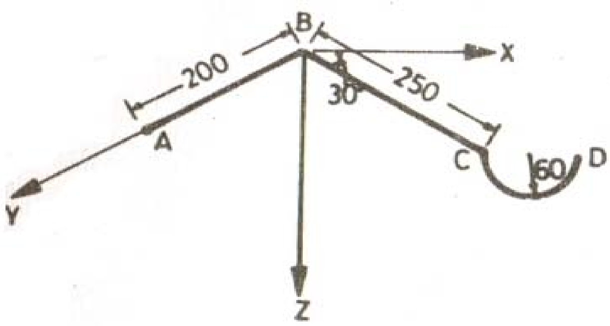


3 (a) Explain the difference between angle of frication and angle of repose.

(b) State coulomb friction.

(c) Differentiate between static and dynamic friction.

4 Locate the center of gravity of wire shown in figure. Portion BC is in X-Y plane and semi circle CD is parallel to X-Z plane. All the dimensions are shown in mm.

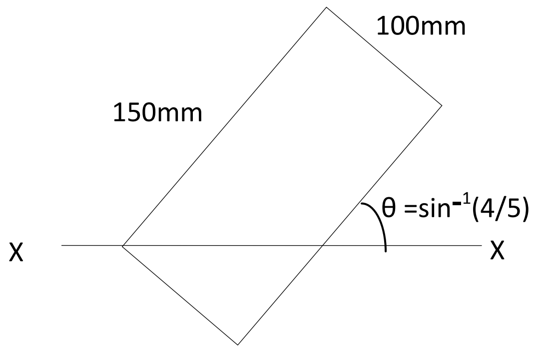


Contd. in Page 2

Code: 9A01101

1

5 Determine the moment of inertia of a triangle above x-x axis as shown in figure.



6 (a) Ram and Rahim are sitting in cars A and B respectively. The cars are 300 m apart and at rest. Ram starts the car and moves towards B with an acceleration of 0.5 m/sec^2. After 3 seconds, Rahim starts his car towards A with an acceleration of 1 m/sec^2. Calculate the time and the point at which two cars meet with respect to A.

(b) A projectile is fired at a speed of 800 m/sec at an angle of elevation of 50^0 from the horizontal. Neglecting the resistance of air, calculate the distance of the point along the inclined surface at which the projectile will strike the inclined surface which makes an angle of 15^0 with the horizontal.

7 A solid cylinder of weight 'w' and radius 'r' rolls, down an inclined plane which makes an angle θ with the horizontal axis. Determine the minimum coefficient of friction and the acceleration of the mass center for rolling, without slipping.

8 (a) The amplitude and maximum velocity of a particle is 40 cm and 2 m/s. A particle moves in SHM. Determine the maximum acceleration of the particle and the period of its motion.

(b) The particle which moves in SHM has maximum velocity of 100 mm/sec. and maximum acceleration of 2 m/s^2. Determine the amplitude and frequency of the motion.

*****

Code: 9A01101

2

B.Tech I Year (R09) Regular & Supplementary Examinations, June 2013

ENGINEERING MECHANICS

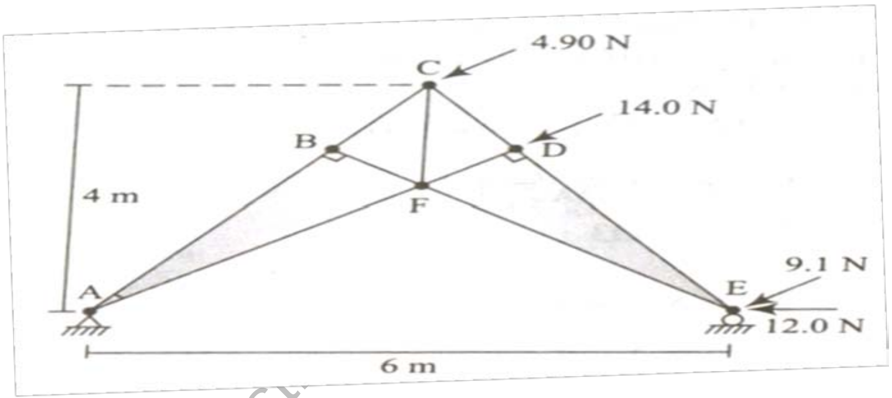
(Common to AE, CE, ME & BT)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions
All questions carry equal marks
*****

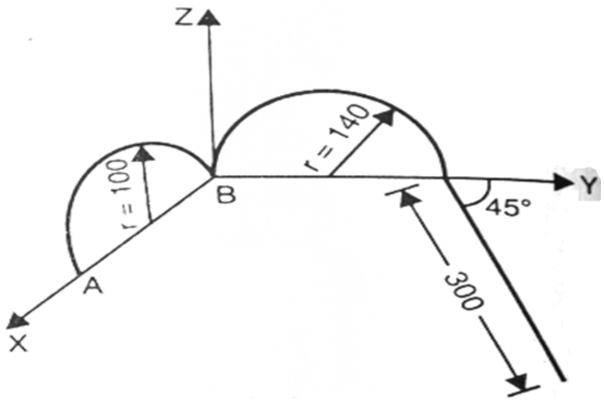
1 (a) State and prove Lami's theorem.
  (b) State and prove theorem of Varignon.

2 Neglecting the horizontal components of forces in support A. determine the axial forces induced in all the members of the given frame as shown in the below figure.



3 With neat sketch explain the frictional phenomena associated with working principle of screw jack and also derive the equation for its maximum efficiency.

4 Locate the centroid of the wire as shown in the below figure. Portion AB is in x-z plane, BC in y-z plane and CD in x-y plane. AB and BC are semicircular in shape. All the dimensions are shown in mm.



Contd. in Page 2

Code: 9A01101

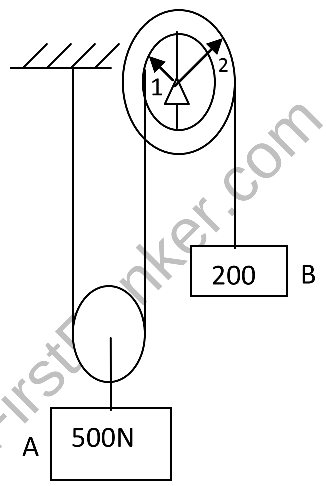
2

5 A brass cone with base diameter of 400 mm and height of 225 mm is placed on a vertical aluminium cylinder of height 300 mm and diameter 400 mm. density of brass = 85 kN/m^3 and density of aluminium = 25.6 kN/m^3. Determine the mass moment of the inertia of the composite body about the vertical geometrical axis.

6 (a) The distance covered by a freely falling body in the last one second of its motion and that covered in the last but one second are in the ratio 5:4. Calculate the height from which the body was dropped and the velocity with which it strikes the ground.

(b) A ball projected vertically upward attains a maximum height of 400 m. Calculate the velocity of projection and compute the time of flight in air. At what altitude will this ball meet a second ball projected vertically upward 4 seconds later with a speed of 120 m/sec.

7 Determine the velocity of body A in the figure. After it has moved 12 m starting from rest. Assume the pulleys to be frictionless and of negligible weight.



8 The weight of 10 N attached to a spring oscillates at a frequency of 60 oscillations per minute. If the maximum amplitude is 30 mm. Find the tension induced in the spring. Also find the spring constant and maximum velocity in the spring.

*****

Code: 9A01101

3

B.Tech I Year (R09) Regular & Supplementary Examinations, June 2013

ENGINEERING MECHANICS

(Common to AE, CE, ME & BT)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

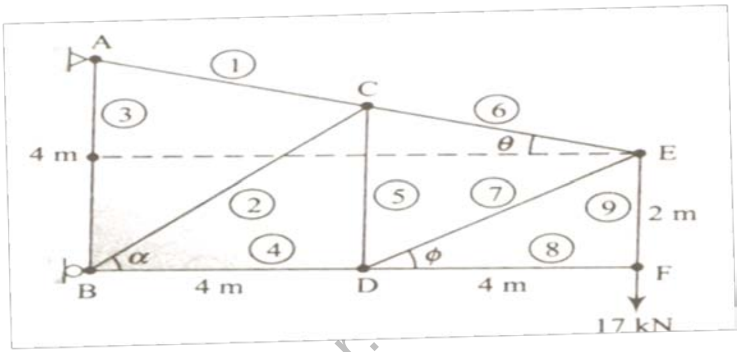
All questions carry equal marks

*****

1 (a) Show how force acting on a body can be replaced by an equivalent force couple system.

(b) Define moment and couple and differentiate them.

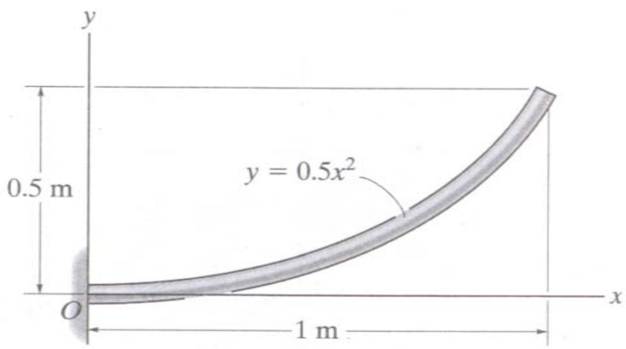
2 Find the forces in the members of loaded frame as shown in the below figure



3 (a) A body weighting 200 N is at rest on a rough horizontal plane. If a horizontal force of is just cause to slide. Find the co-efficient of friction.

(b) Explain the difference between simple and differential screw jacks.

4 Determine the distance $\overline{X}$ to the center of gravity of the homogenous rod bent into parabolic shape. If the rod has weight per unit length of 5 N/m, determine the reactions at fixed support O.



Contd. in Page 2

Code: 9A01101

3

5 (a) Differentiate between polar moment of inertia and product of inertia.
(b) Find the moment of inertia and radius of gyration about the horizontal centroidal axis.

6 (a) A balloon is ascending with a velocity of 20 m/sec above a like a stone is dropped to fall from the balloon and the sound of the splash is heard 6 seconds later. Find the height of the balloon when the stone was dropped. Velocity of sound is 340 m/sec.
(b) The acceleration of a particle in rectilinear motion is defined by the relation a = 25 – $4S^2$. Where 'a' is expressed in m/sec^2 and 'S' is position coordinate in meters. The particle starts with no initial velocity at the position S = 0. Determine:
(i) The velocity when S = 3 m
(ii) The position where the velocity is again zero
The position where the velocity is maximum.

7 (a) What is the energy of the motion for a rigid body rotating about a fixed axis?
(b) A 70 kg sprinter starts from rest and accelerate uniformly for 5.8 s over a distance of 34.5 m. Neglecting air resistance, determine the average power developed by the sprinter.

8 The central deflection of a simply supported beam with a central point load is given by $\delta = WL^3/48EI$. Where L = 5 m, E = 2 $\times 10^5$ N/mm^2, I = 1.73 $\times 10^{-5}$ m^4. The beam is of uniform cross section with a static load 'W'. Determine equivalent spring constant of the beam. The frequency of vibration of a 60 kg block attached to the center of the beam. Neglect the mass of the beam and assume that the load remaining in contact with the beam.

*****

Code: 9A01101

4

B.Tech I Year (R09) Regular & Supplementary Examinations, June 2013

ENGINEERING MECHANICS

(Common to AE, CE, ME & BT)

Time: 3 hours Max. Marks: 70

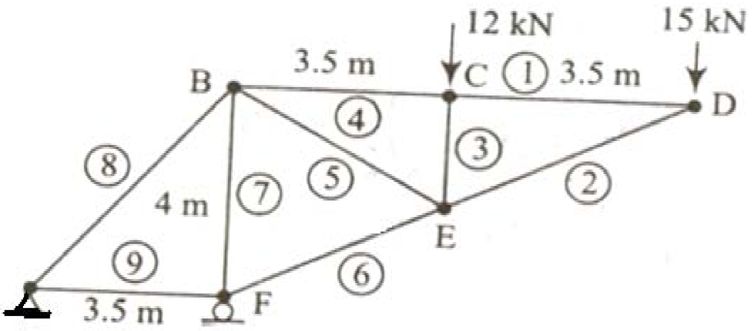
Answer any FIVE questions

All questions carry equal marks

*****

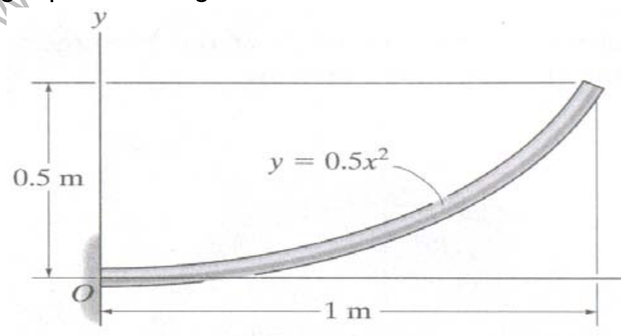
1 Write brief notes on free body diagram and explain with suitable example.

2 Determine the member forces of the overhang frame as shown in the below figure.



3 A body weighting 200 N rest on a horizontal surface, coefficient of friction is 0.25.
(i) Find the horizontal force to be applied on a body so as to just move it.
(ii) What least horizontal force would cause the body to slide if an additionally 100 N to the body.

4 Determine the distance $\overline{Y}$ to the center of gravity of homogenous rod bent in to the parabolic shape whose rod weight per unit length is 5 N/m.



Contd. in Page 2

Code: 9A01101 **4**

5 (a) Define mass moment of inertia and explain transfer formula for mass moment of inertia.
(b) Determine the mass moment of inertia of slender rod of length '*l*' about its centroidal axis normal to the rod.

6 A ladder AB of 3 m length remains in contact with the vertical wall and horizontal floor and the angle of inclination of the ladder with horizontal is 60^0. The ladder moves such that its ends remain in contact with the vertical wall at B and horizontal floor at A. If the end 'A' moves with a linear velocity of 0.1 m/s, find the velocity of its upper end B. If the linear acceleration of the end 'A' is 0.05 m/s^2, find the acceleration of the end 'B' and the resultant acceleration of the ladder AB.

7 (a) What is the advantage of work-energy theorem?
(b) A shaft of radius 'r' rotates with constant angular speed 'w' in bearings for which are coefficient of friction is μ. Through what angle 'Ø' will it rotate after the driving force is removed.

8 (a) Explain how a simple pendulum differs from a compound pendulum, briefly with the help of differential mathematical equations.
(b) Determine the stiffness in N/cm of a vertical spring to which a weight of 50 N is attached and is set vibrating vertically. The weight makes 4 oscillations per second.

*****