

## AMIETE – ET (OLD SCHEME)

Code: AE03  
Time: 3 Hours

**JUNE 2011**

Subject: APPLIED MECHANICS  
Max. Marks: 100

NOTE: There are 9 Questions in all.

- Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.
- The answer sheet for the Q.1 will be collected by the invigilator after 45 Minutes of the commencement of the examination.
- Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.
- Any required data not explicitly given, may be suitably assumed and stated.

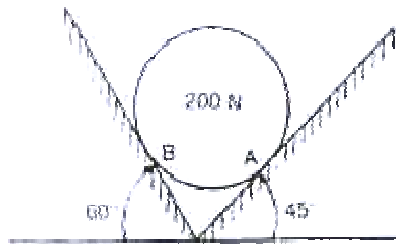
**Q.1 Choose the correct or the best alternative in the following (2×10)**

- a. For a cantilever beam of length 'L' having a point load 'P' at its free end, the bending moment at the fixed end is given by
- (A) PL (B) (P/2)L  
(C) P/L (D) L/P
- b. A body isolated from all the members which are connected to it is called the \_\_\_\_\_ body
- (A) free (B) rigid  
(C) plane (D) solid
- c. Analysis of bodies in motion without any references to forces causing the motion is known as
- (A) Dynamics (B) Kinetics  
(C) Kinematics (D) none
- d. In plane motion, the acceleration will be
- (A) non uniform (B) increasing  
(C) uniform (D) none
- e. Coulomb friction is friction between dry surfaces
- (A) True (B) False
- f. In a cantilever beam the bending moment is maximum at
- (A) the center (B) the free end  
(C) the fixed end (D) any point on the beam
- g. Centroid of a semicircle lies at a distance of  $0.424 r$  from the base, where 'r' is the radius of semicircle

- h. Moment of Inertia of an area  $dA$  at a distance  $x$  from a reference axis is
- (A)  $\int x dA$  (B)  $\int x^2 dA$   
 (C)  $\int x^3 dA$  (D)  $\int x^4 dA$
- i. A point in a body where the entire weight of the body is assumed to be concentrated is known as
- (A) axis (B) centre of gravity  
 (C) moment of inertia (D) centroid
- j. For determining the forces in truss members, using 'Method of Section', the imaginary section should not cut more than \_\_\_\_\_ number of members
- (A) 1 (B) 2  
 (C) 3 (D) 4

**Answer any FIVE Questions out of EIGHT Questions.  
 Each question carries 16 marks.**

- Q.2** a. Explain the parallelogram of forces. (6)
- b. A smooth sphere weighing 200 N is lying in a triangular groove as shown in Fig.1. Draw the free body diagram and find the reactions at the surfaces of contact, assuming surfaces of groove to be smooth. (10)



**Fig. 1**

- Q.3** a. Define work and energy. (4)
- b. A ladder AB supported as shown in Fig.2 carries a vertical load of 6000 N. Find the force P required horizontally at B to keep the ladder in equilibrium. Assume all contact surfaces as smooth. (12)

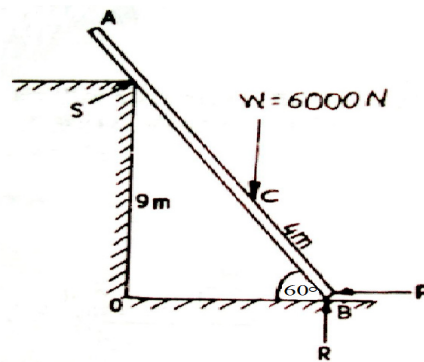


Fig. 2

Q.4 a. Define (i) Buoyancy (ii) Control volume (iii) Drag (iv) Turbulence (4)

b. A 10 gm bullet is shot horizontally in to wooden block of mass 1 kg. The bullet gets embedded in the block and the block is displaced on a rough horizontal table ( $\mu = 0.2$ ) through 1 m. what was the velocity of bullet? (12)

Q.5 a. Explain Impulse-momentum principle (5)

b. Determine the centroid of the plane shown in Fig.3. (11)

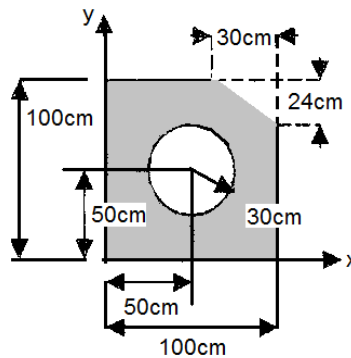


Fig.3

Q.6 Determine shear force and bending moments and construct the shear force and bending moment diagrams for the beam loaded as shown in Fig 4. (16)

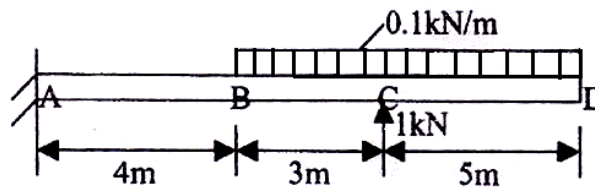


Fig. 4

Q.7 a. Explain stress, strain and Hooke's law. (6)

b. Derive the torque equation:  $\frac{T}{J} = \frac{fs}{r} = \frac{G\theta}{\ell}$  stating all the assumptions made in proving it. (10)

**Q.8**

If for a two dimensional flow the stream function is given by  $\psi = \frac{1}{3}x^3 - xy^2$ , calculate the velocity at the point (3, 6). Show that the potential  $\phi$  exists for this case and deduce it. (16)

**Q.9**

The velocity potential function  $\phi$  is given below:

$$\phi = -\frac{xy^3}{3} - x^2 + \frac{x^3y}{3} + y^2$$

Find the velocity components in x and y directions and show that  $\phi$  represents a possible case of flow. (16)