DECEMBER 2007

Code: AE03 **Subject: APPLIED MECHANICS**
Time: 3 Hours **Max. Marks: 100**

NOTE: There are 9 Questions in all.

- **Question 1 is compulsory and carries 20 marks. Answer to Q. 1. A must be written in the space provided for it in the answer book supplied and nowhere else.**
- **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 best alternative in the following: (2x10)

a. _____ deals with relationship between forces and the resulting motion of bodies on which they act

(A) Dynamics **(B)** Statics
(C) Kinetics **(D)** Kinematics

b. The axes for which $I_{xy} = 0$ are known as

(A) principal axes **(B)** major axes
(C) minor axes **(D)** neutral axes

c. A wedge is generally used for lifting a

(A) heavy load through large distance
(B) heavy load through small distance
(C) light load through large distance
(D) light load through small distance

d. If a horizontal force is moving up, on which a body of mass 'm' is placed and acceleration of surface is 'a', then the force causing motion is given by

(A) m (g + a) **(B)** m (g – a)
(C) m (a – g) **(D)** ma

e. The time period of a simple pendulum is given by

(A) $T = 2\pi/lg$ **(B)** $T = 2\pi l/g$
(C) $T = 2\pi g/l$ **(D)** none of these

f. Acceleration of a particle is given by $a = 100 - kx$ m/s^2 and acceleration becomes zero at x = 0.2m. The value of k will be

(A) 500 **(B)** 500 s^{-1}

(C) 500 s^{-2} **(D)** 500 ms^{-2}

g. A glass ball is dropped on to a smooth horizontal floor from which it bounces to height of 10 m. On the second bounce it attains a height of 6m. The coefficient of restitution between the glass ball and the floor will be

(A) 1.0 **(B)** 0.843
(C) 0.775 **(D)** 0.600

h. The C.G. of a semicircle is at a distance of

(A) $4R/3\pi$ **(B)** $4\pi/3R$
(C) $4\pi R/3$ **(D)** none

i. All materials follow Hooke's Law within

(A) plastic limit **(B)** elastic limit
(C) infinite limits **(D)** strain hardening limit

j. The most appropriate governing equation of ideal fluid flow is

(A) Euler's equation **(B)** Navier Stoke's equation
(C) Reynolds equation **(D)** Hage poisullie equation

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

Q.2 a. State (i) parallelogram law of forces (ii) triangle law of forces (iii) polygon law of forces **(6)**

b. Fig. 1 shows a bar 4 m long subjected to a vertical load of 400 N and horizontal load of 200N. The ends of the bar are supported by smooth surfaces. Determine the equilibrium position of the bar as defined by angle 'θ', it makes with the horizontal. Neglect the self weight of the bar. **(10)**

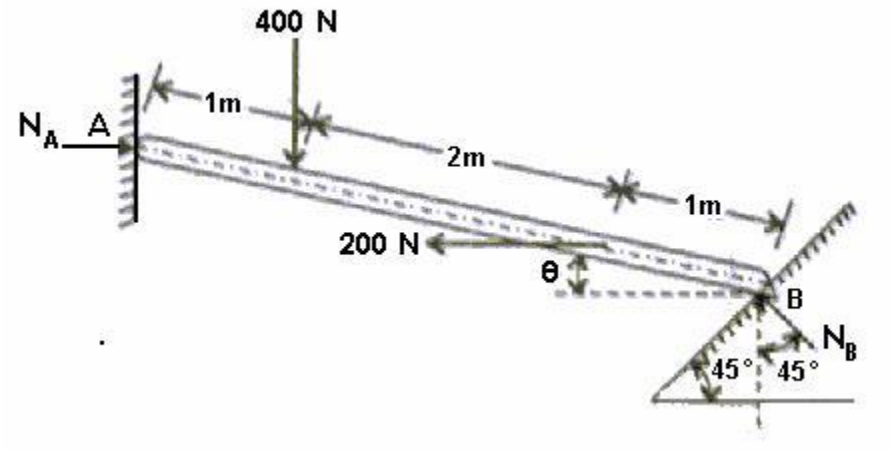
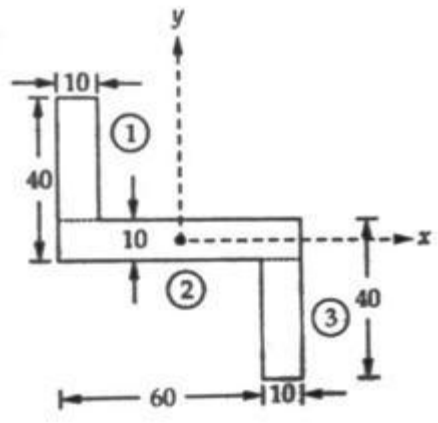


Fig. 1

Q.3 a. Explain perpendicular axis theorem. **(4)**



b. Determine the centroid and the moments of inertia about the centroidal X and Y axes of a beam of cross section comprising of section 1,2 and 3 as shown in Fig.2. (All dimensions are in cm)
(12)

Fig.2

Q.4 Using method of joints, determine the forces in all the members of a 2-D truss shown in Fig. 3. **(16)**

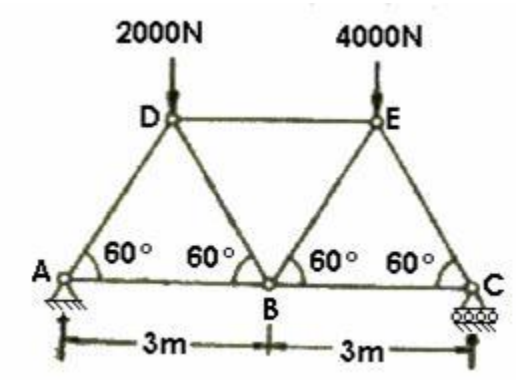


Fig.3

Q.5 a. State the laws of dynamic friction. **(4)**

b. Two blocks of weight 500 N and 800 N are connected by a string and rest on a horizontal planes as shown in Fig.4. Determine the force 'P' that should be applied to induce sliding. Take $\mu = 0.3$. **(12)**

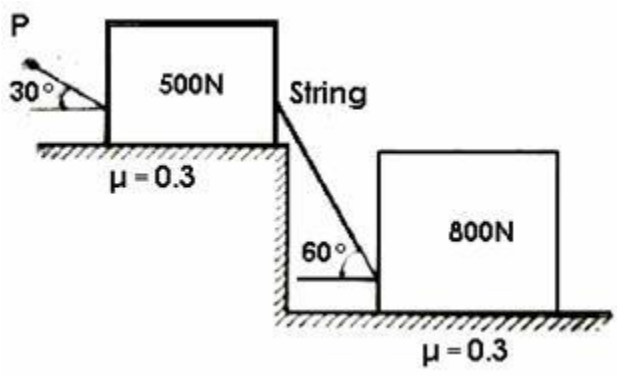


Fig.4

Q.6 a. State Newton's laws of motion. **(3)**

b. A man weighing 600 N dives in to a swimming pool from a tower of height 19.6 m. He was found to go down in water by 2 m and then started rising. Calculate the average resistance of water. Neglect air resistance. **(13)**

Q.7 a. Derive the equation for power developed by a torque **(4)**

b. A 10 gm bullet is shot horizontally into a 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.8 Draw shear force diagram and bending moment diagram for the beam shown in Fig.5. Determine the location of point of contraflexure on the beam. **(16)**

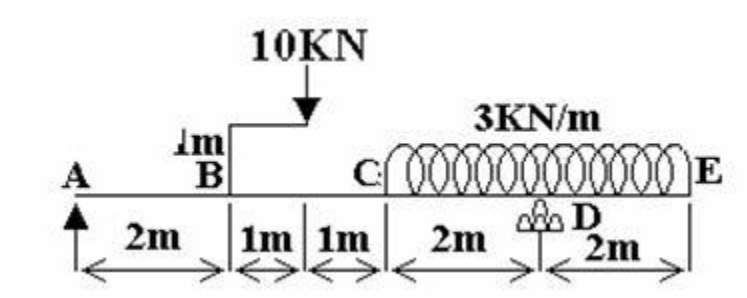


Fig.5

Q.9 a. Derive the equations for the centre of pressure of a vertical lamina. **(8)**

b. A rectangular plate 1 m wide and 1.5 m deep is held vertically in water so that its upper edge is 1.25 m below the free water surface. Find the total pressure on one face of the plate and the depth of the centre of pressure Sp. wt. of water = 9810 N/m^3 **(8)**