Diploma in Civil Engineering / Diploma in Electrical & Mechanical Engineering

00662

Term-End Examination

June, 2010

BET-014 : APPLIED MECHANICS

Time : 2 hours *Maximum Marks : 70*

Note : *Attempt question number **1.** which is **compulsory** and **any four** from the remaining. Assume suitable data wherever necessary. Use of calculator is allowed.*

1. Choose the correct answer from the given alternatives : **7x2=14**

(a) Two forces P and Q are acting at a point with angle 'α' between them. The resultant 'R' is given as :

(i) $R=\sqrt{P^2+Q^2+2PQ\sin\alpha}$

(ii) $R=\sqrt{P^2+Q^2+2PQ\cos\alpha}$

(iii) $R= P + Q + 2PQ \sin\alpha$

(iv) $R= P + Q + 2PQ \cos\alpha$

(b) The condition of equilibrium for co-planer non-concurrent forces are :

(i) $E_H=0$; $E_V=0$

(ii) $E_V=0$; $E_M=0$

(iii) $E_H=0$; $E_V=0$; $E_M=0$

(iv) None of the above

(c) A perfect frame of a truss should satisfy the relation :

(i) $m = 2j - 3$

(ii) $m = 3j + 2$

(iii) $m = 3j - 2$

(iv) $m = 2j + 3$

(d) Velocity ratio of a differential wheel and axle is :

(i) $\frac{(d_1 - d_2)}{2D}$

(ii) $\frac{(d_1 - d_2)}{D}$

(iii) $\frac{2D}{(d_1 - d_2)}$

(iv) $\frac{D^2}{(d_1 - d_2)^2}$

(e) In a simple Screw Jack (single threaded) with l as the length of the effort handle and p as pitch of screw, its velocity ratio is given by :

(i) $\frac{2\pi l}{p}$ (ii) $\frac{\pi l}{2p}$

(iii) $\frac{2\pi p}{l}$ (iv) $\frac{\pi p}{2l}$

(f) Law of dry friction between two sliding bodies states that total frictional force developed will be :

(i) directly proportional to normal force acting on contact surface and also the area of contact.

(ii) directly proportional to normal force but independent of the area of contact.

(iii) directly proportional to normal force but inversely proportional to area of contact

(iv) directly proportional to area of contact but independent of the normal force.

(g) Range of a projectile, is defined as :

(i) vertical distance between the point of projection and the highest point reached.

(ii) horizontal distance between the point of projection and the point at which its velocity is zero.

(iii) the curvilinear path travelled by the projectile.

(iv) the horizontal distance between the point of projection and the point, where the projectile hits the ground.

2. (a) State the various methods of analysing a statically determinate truss. Describe one method briefly. **4**

(b) A cantilever truss supported on rollers at E and hinged at A is loaded as shown in figure No - 1. **10**

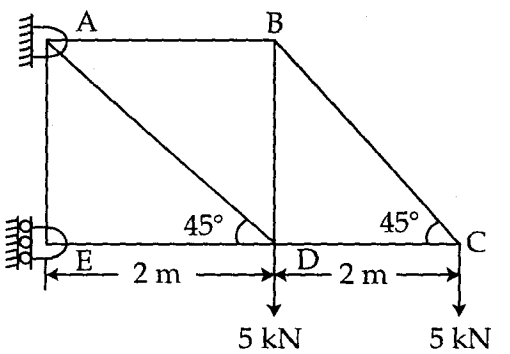

Figure No. 1

Determine the forces in various members of the truss. Also determine the reactions at A and E.

3. (a) Define the term 'centroid' and centre of gravity and describe how these can be determined. **4**

(b) Find the moment of inertia of a T - section shown in figure -2 about (X - X) and (Y - Y) axis through the C. G of the section. **10**

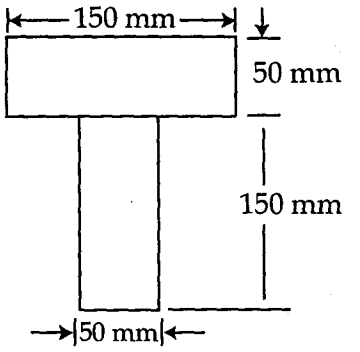

Figure No. 2

4. (a) State the laws of static friction and dynamic friction. **4**

(b) A body weighing 500 N is resting on an inclined plane making an angle of 30° with the horizontal. The coefficient of friction is 0.3. A force 'P' is applied parallel to and up the inclined plane. Determine the least value of 'P' when the body is just on the point of movement : **10**

(i) Case I : moving down, and

(ii) Case II : moving up

5. A string ABCD, attached to two fixed points A and D has equal weights of 1000 N attached to it at B and C. The weight rests with portion AB and CD inclined at angles of 30° and 60°, respectively to the vertical as shown in figure - 3. **14**

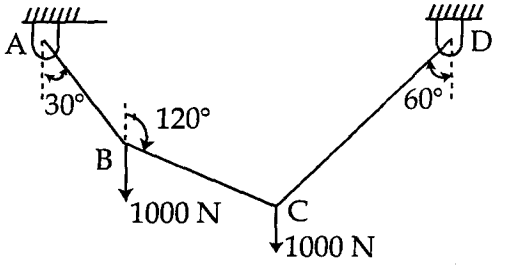

Figure No. 3

Find the tensions in the portions AB, BC and CD of the string, if the inclination of the portion BC with the vertical is 120°.

6. (a) Prove the following equation of motion of a particle in a straight line : **7**

(i) $v = u + at$

(ii) $S = ut + \frac{1}{2}at^2$

(iii) $v^2 = u^2 + 2as$

(b) Body A is thrown with a velocity of 10 m/s at an angle of 60° to the horizontal. If another body B is thrown at an angle of 45° to the horizontal, find its velocity if it has the same : **7**

(i) horizontal range

(ii) maximum height

(iii) time of flight, as the body A

7. (a) What do you understand by the terms : **4**

(i) Work

(ii) Power and

(iii) Energy

(b) A train with a total weight of 1000 tonne is resting on an inclined track of 1 in 100 with tractive resistance of 5 N per kN. The train is pulled downwards by a locomotive with a constant pull of 5 tonnes. Assuming $g=10m/sec^2$, calculate the power developed by the locomotive, after it has travelled a distance of 1 Km. **10**