

**B.Tech. Civil (Construction Management) /
B.Tech. Civil (Water Resources Engineering) /
BTCLEVI/BTMEVI/BTELVI/BTECVI/BTCSVI**

Term-End Examination

December, 2015

ET-202(A) : ENGINEERING MECHANICS

Time : 3 hours

Maximum Marks : 70

Note : Answer any **five** questions. Use of scientific calculator is allowed.

1. (a) A weightless beam BCD is held with the help of a tie rod AC as shown in Figure 1. Determine the reactions at B and tension in the tie rod AC.

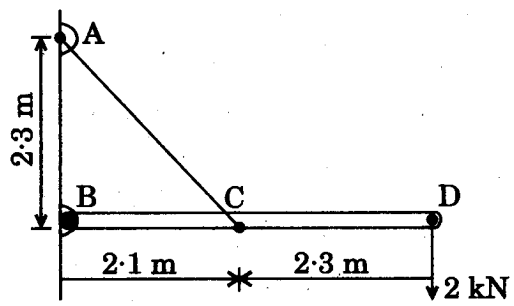


Figure 1

(b) What do you understand by a couple ? Explain its properties in detail. Also discuss the replacement of a force by a force and couple. 7

2. (a) Write down the reactions for the given plane and space structures. 7

Plane Structures :

- (i) Cable
- (ii) Link
- (iii) Roller
- (iv) Pin
- (v) Fixed Support

Space Structures :

- (i) Single Hinge
- (ii) Fixed Support
- (iii) Ball and Socket Joint
- (iv) Single Smooth Pin
- (v) Single Journal Bearing

(b) Write down the laws of friction. Also derive the Eytelwein's formula for the friction (Belt and Rope). 7

3. (a) A block of weight $W_1 = 200 \text{ N}$ rests on a horizontal surface and supports on top of it another block of weight $W_2 = 50 \text{ N}$. The block W_2 is attached with the vertical wall by string AB as shown in Figure 2. Find the amount of horizontal force P , applied to the lower block necessary for impending slipping. Coefficient of friction = 0.3 (All surface).

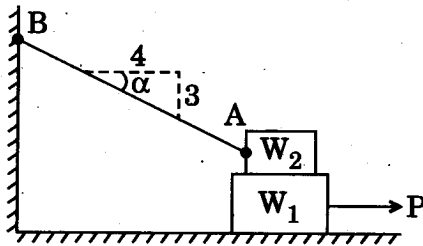


Figure 2

- (b) Determine the centroid of an area shown in Figure 3.

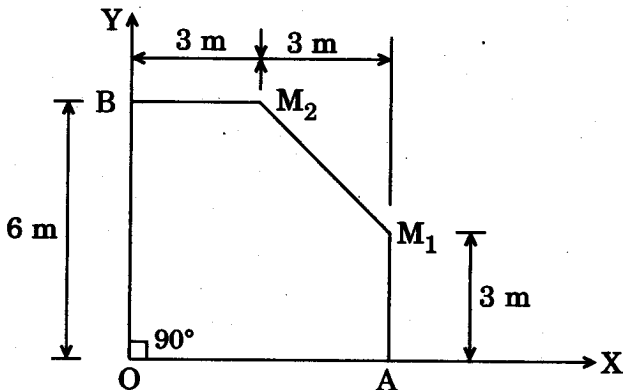


Figure 3

4. (a) The displacement of a particle is defined by $x = 5 + 3 \cos 3t$. Find the position of the particle at $t = 3$ sec. Also calculate the amplitude and frequency of the particle. 7
- (b) Define the following : 7
- (i) Rigid body
 - (ii) Curvilinear motion
 - (iii) Motion of translation
 - (iv) SHM

5. (a) Derive Impulse - Momentum equation. A mass of weight 29.4 N is subjected to a time varying force $F(t) = 3t^3 + 5$ along x-direction. Determine the velocity of the mass after 3 sec., if V_0 (velocity at $t = 0$) = 4 m/sec. 7

- (b) Define the following :
- (i) Work
 - (ii) Power
 - (iii) Energy

Also explain the principle of conservation of energy. 7

6. (a) Draw SFD and BMD for the beam shown in Figure 4. Also calculate the location and magnitude of maximum BM. 7

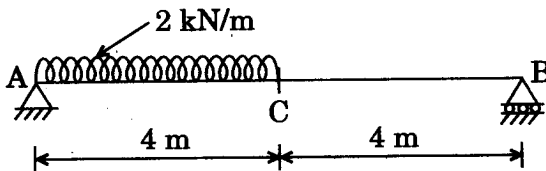


Figure 4

- (b) What is a Truss ? Also discuss the graphical method for analysis of trusses. 7

7. (a) What is Hooke's law ? Also discuss the S-S curve for ductile and brittle materials in detail.

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(b) A composite member is rigidly fixed at its ends as shown in Figure 5. Find the maximum stresses in steel and copper when the member is subjected to an axial compressive force of 14.4 kN. $E_s = 200$ GPa, $E_c = 100$ GPa.

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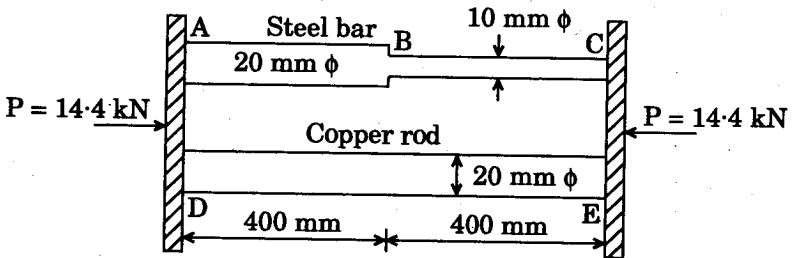


Figure 5