R09

Code No: 51003

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech I Year Examinations, December - 2017
ENGINEERING MECHANICS
(Common to CE, ME, MMT, AE, AME, MIE, PTM)

Time: 3 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
Illustrate your answer with NEAT sketches wherever necessary

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1. A system of four forces P, Q, R and S of magnitudes 5 kN, 6 kN, 8 kN, and 4 kN respectively acting on a body are shown in rectangular coordinates in figure 1. Find the moments of the forces about the origin **O**. Also find the resultant moment of the forces about **O**. [Coordinates of: **A**(6,10), **B**(10,8), **C**(9,7) – all distances are in meters and the figure 1 is not to scale]. [15]

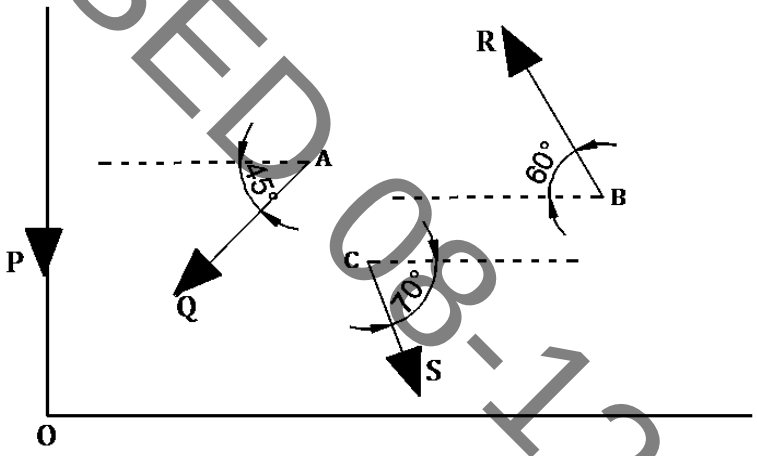

Figure: 1

2.a) State and prove Lami's theorem.

b) A boat is moved uniformly along a canal by two horses pulling with forces P = 890 N, and Q = 1068 N, acting under an angle $\alpha = 60^0$. Determine the magnitude of the resultant pull on the boat, and find the angles β and γ. (Refer to Figure 2). [7+8]

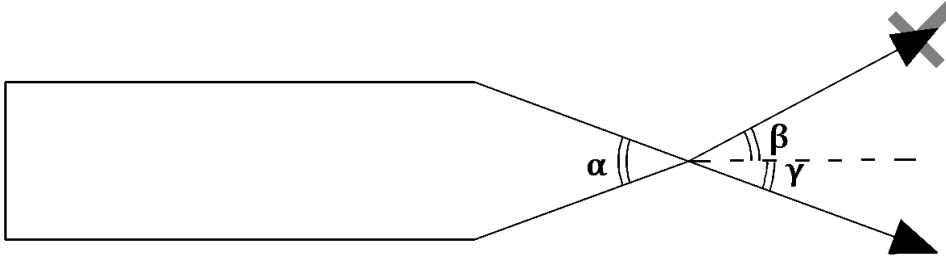

Figure: 2

3.a) A steel ball of diameter 150 mm rests centrally over a concrete cube of size 150 mm. Determine the centre of gravity of the system, taking the weight of concrete as 25,000 N/m^3 and that of steel as 80,000 N/m^3.

b) Establish the work – energy equation for translation. [7+8]

4. A rectangular R.C.C. column is centrally cast over an R.C.C. bed as shown in figure 3. The column is of section 30 × 45 cm and height 4 m. The concrete bed is of size 3 × 4.5 m and thickness 30 cm. Find the mass moment of inertia of the column and bed combination about its vertical centroidal axis. Mass density of concrete = 2500 kg/m^3. [15]

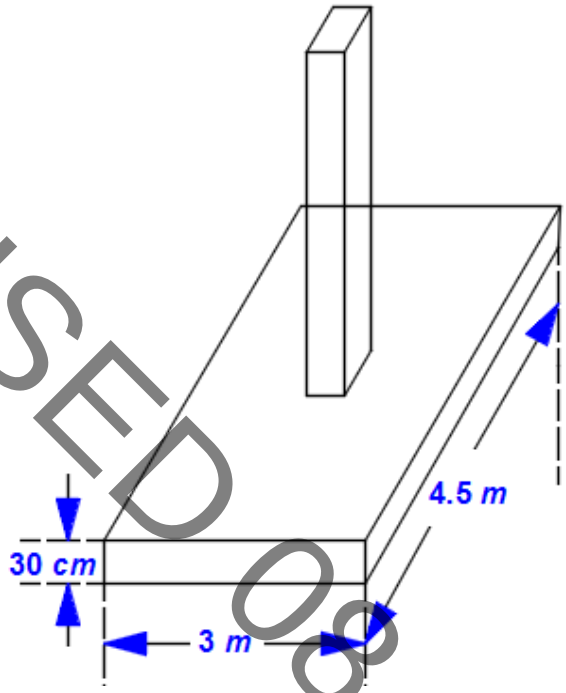

Figure: 3

5. Using the method of sections, determine the forces in the members GE, GC and BC of the plane shown in figure 4. Indicate whether these members are in tension or compression. [15]

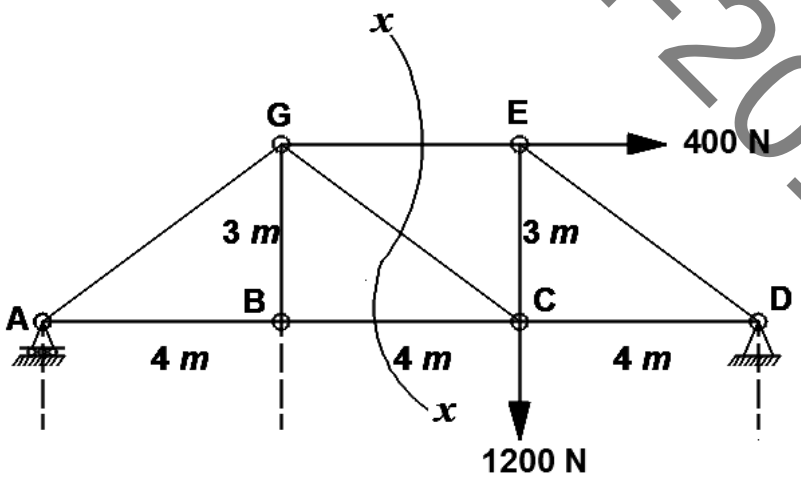

Figure: 4

6. A stone dropped into a well falls vertically down with a constant acceleration of 9.81 m/s^2. The sound of impact of stone on the bottom of the well is heard after 6.5 s. If the velocity of sound is 336 m/s, what is the depth of the well? [15]

7. Find the axial forces in the bar DE of the simple truss which is loaded as shown in figure 5. Use the method of virtual work. [15]

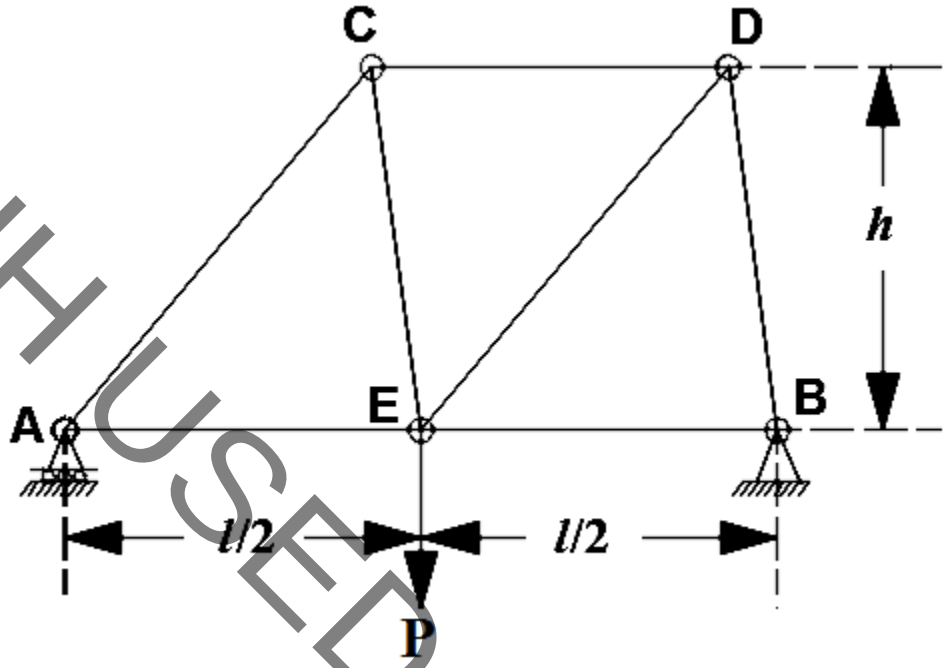

Figure: 5

8.a) When should we use the Work – Energy Principle and when should we use F = ma? Explain with examples.

b) Explain the Work – Energy Applications to particle motion in Connected Systems. [7+8]

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