[03–2111]

II/IV B.E. DEGREE EXAMINATION.

First Semester

Mechanical Engineering

ENGINEERING MECHANICS – I

(Common with Dual Degree Program in Mechanical Engineering)

(Effective from the admitted batch of 2006-2007)

Time : Three hours Maximum : 70 marks

Question No. 1 is compulsory.

Answer any FOUR from the remaining.

All questions carry equal marks.

1. (a) State the conditions for the equilibrium of a two dimensional rigid body.

(b) Write and explain the differential equation for free vibration.

(c) What is the use of belt friction?

(d) Define radius of gyration of a body.

(e) Define rotation about a fixed axis.

(f) Explain what is center of percussion.

(g) Explain Impulse-Momentum Principle.

impact, calculate the angle θ_2 through which the larger pendulum will swing after the impact.

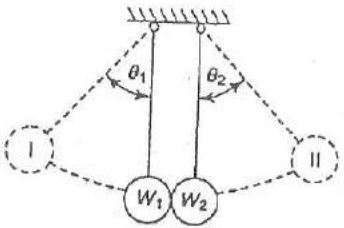

Figure 5

8. (a) Write the equations of plane motion of a rigid body. (5)

(b) A thin circular disk CD of radius r and weight W is attached at its center to a shaft AB, and its plane makes with the plane normal to the axis of the shaft a small angle α as shown in figure 6. If the disk rotates with constant angular velocity ω. Find the bearing reactions at A and B due to this rotation.

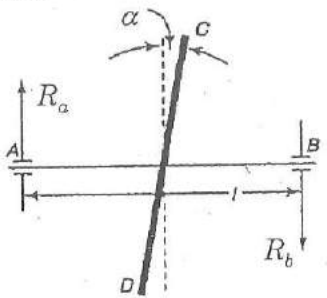

Figure 6

2. Determine the force on each member of truss as shown in figure below

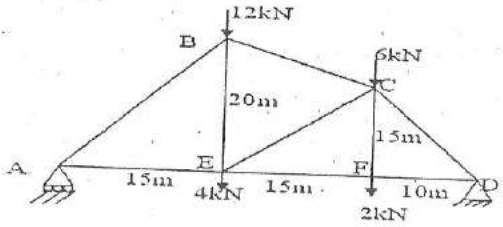

Figure 1

3. (a) State and prove principal of virtual work. (6)

(b) Two beams AE and BD are supported by roller at D and C as shown in figure 2. Determine the reactions at the point B and D using the method of virtual work. (8)

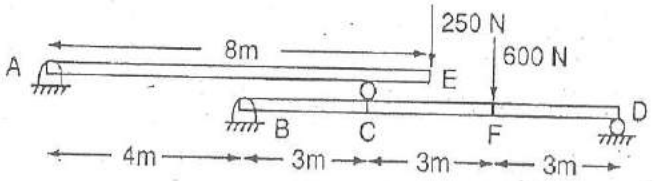

Figure 2

4. What is the least value of 'p' required to cause the motion to impend. Assume coefficient of friction on all contact surfaces as 0.2.

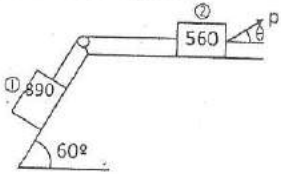

Figure 3

5. (a) Explain equivalent length of compound pendulum. (5)

(b) A system of weights and pulleys is arranged in a vertical plane as shown in figure 4. Neglecting friction and the inertia of the pulleys find the acceleration of each weight. (9)

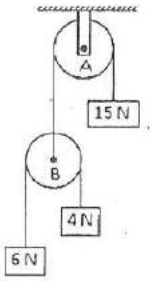

Figure 4

6. (a) Derive the equation for frequency of torsional pendulum. (5)

(b) Derive the expressions for (9)

(i) The horizontal range

(ii) The maximum height attained by the particle

(iii) The time of flight

7. Referring to below figure 5, assume that the ball I of weight W is released from rest in the position $\theta_1 = 60$ and swings downward to where it strikes the ball II of weight 3W. Assuming an elastic