(b) In a tug of war (shown in figure 2) when team C pulls with a 4000N force then how much force team A and B are exerting. 7

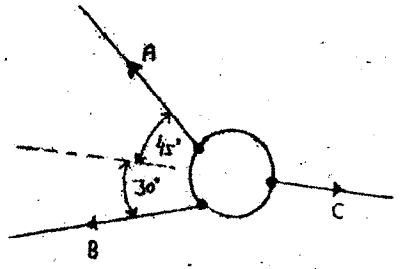

Figure 2

9. (a) What is a truss and discuss their types ? 8

(b) Find the force components on the pin C of the frame shown in figure 3. Neglect friction everywhere as well as the weight of rods and ropes. ($g = 10\ ms^{-2}$). 7

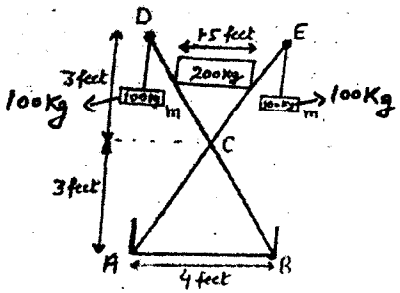

Figure 3

B.Tech. (Civil Engg.) 2nd Semester G-Scheme

Examination, May-2019

MECHANICS

Paper-BSC-PHY-104-G

Time allowed : 3 hours] *[Maximum marks : 75*

Note : *Attempt **five** question in all, by selecting **one** question from each unit but **Question No. 1 is compulsory.** Each question carries equal marks.*

1. (a) Define damped and undamped oscillations. 2.5

(b) Define equipotential surface and show that conservative force is perpendicular to equipotential surface. 2.5

(c) If potential energy $(V)=xyz + xy^2$ then write the equation of force at point P (1,–1,–2) by using equation $\vec{F} = -\vec{\nabla}V$. 2.5

(d) Write short notes on frame of references. 2.5

(e) What do you mean by satellite maneuvers ? 2.5

(f) What do you mean by equilibrium (translational and rotational) and write down conditions for two and three dimensional equilibrium. 2.5

Unit-I

2. (a) Show how scalar and vector product of two vectors transform under rotation. 8

   (b) Convert Cartesian coordinates into polar coordinates for planar, cylindrical and spherical systems with proper diagram. 7

3. (a) Show that newton's 2nd law is invariant under Galilean transformation and also derive equation of velocity and acceleration in polar coordinates. 8

   (b) A hollow cylinder is rotating about its axis with a constant angular speed ω. Because of this rotation, a body of mass m on the wall of the cylinder does not slip down (see figure 1). If the coefficient of friction between the cylinder wall and the body is μ. What is the minimum value of ω for this to happen ? 7

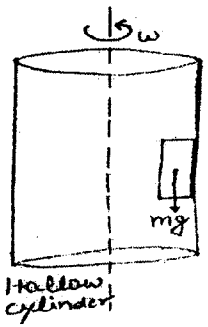

Figure 1

Unit-II

4. (a) What do you mean by conservative and non-conservative forces ? Show that curl of conservative force is always zero. 8

   (b) What is Foucault's pendulum and explain how it helps to show earth's rotation ? 7

5. What do you mean by forced harmonic oscillator ? Discuss the vibration of a system executing simple harmonic motion when subjected to an external periodic force. When does resonance occur and how sharpness of resonance depend upon damping force ? 15

Unit-III

6. (a) Discuss motion rigid body in three dimensions. Explain how angular velocity, angular acceleration and moment of inertia in three dimensions are different than two dimensions. 8

   (b) Explain Euler's equations of motion of rigid body. Also discuss what these equations suggest about motion of rigid body ? 7

7. (a) What do you mean by inertia tensor, principle axes and principle moment of inertia ? How will you determine the principle moment of inertia of a rigid body and direction of principle axis ? 8

   (b) Derive the expression of rotational kinetic energy of a rigid body. 7

Unit-IV

8. (a) Write short notes on joints and supports and their types. 8