

Roll No.

OLE-3004

B. Tech. 1st Semester (Civil Engg.) Examination – April, 2021

MECHANICS

Paper : BSC-PHY-104-G

Time : Three Hours]

[Maximum Marks : 75

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Unit. Question No. 1 is *compulsory*. All questions carry equal marks.

1. (a) Explain the effect of rotational transformation on a scaler.
- (b) Discuss the effect of Coriolis force in formation of cyclons.
- (c) What do you mean by coefficient of friction ?
- (d) What are the Inertial and non-inertial frame of reference ?

- (e) A hollow sphere and a solid sphere having the same mass and same radius are rolled down a rough plane surface. Which one has a larger moment of inertia ? And why ?
- (f) Find out if the force field (i) $F(x, y) = F(x, y) = yz i + zx j + xy k$ is conservative or not. (where i, j and k are unit vector along x, y and z axis respectively)

$$6 \times 2.5 = 15$$

UNIT – I

2. Derive the expression for Newton second law in spherical polar co-ordinate. 15
3. (a) What do you mean by constraints motion, explain it with suitable examples. Write the equation of motion for a bead of mass m moving on a wire inclined at an angle α with the horizontal. 10
- (b) Write A short note on different type of Forces in nature. 5

UNIT – II

4. What are different type of fictitious forces in a uniformly rotating frame of reference ? And explain the effect of centrifugal force on acceleration due to gravity(g). 15

5. Drive the energy equations and its energy diagram in central force field. and hence discuss the condition for hyperbolic, parabolic, elliptical and circular orbits. 15

UNIT – III

6. (a) Define kinetic energy of rotation. Derive an expression between kinetic energy of rotation moment of inertia and angular velocity. 10
- (b) A sphere of radius of 0.3 m. Calculate its moment of inertia about any diameter. Density of material is $7.8 \times 10^3 \text{ kg/m}^3$. 5
7. (a) Discuss relation between angular momentum and angular velocity and hence define moment of inertia tensor. 8
- (b) Derive Euler's equation of motion of a rigid body. 7

UNIT – IV

8. (a) Write a short note on Friction by discussing its limiting and non-limiting case. 8
- (b) A mass of 10 kg is at rest on a floor. Value of coefficient of friction is $\mu_s = 0.3$. Find out the limiting friction. Further, what happens if force along horizontal axes applied is (i) 25N (ii) 30N ? 7

9. (a) Define trusses and explain perfect and non perfect trusses. What are the main assumptions in truss analysis? 7

(b) Analyse the given truss of BC=5m span, loaded and supported as shown in figure. Find the magnitude and nature of the force in all members. 8

