

Roll No.

3004

**B. Tech 1st Semester (Civil Engg.)
Examination – December, 2019**

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.

1. (a) What do you mean by equipotential surface ?
- (b) What is the main difference between a scalar and vector ?
- (c) Explain conservative force with the help of an example ?
- (d) What is the physical significance of moment of inertia ?

- (e) What is free body diagram ?
- (f) What does gradient of a vector mean. $6 \times 2.5 = 15$

UNIT – I

2. (a) State and explain Newton's laws of motion. 8
- (b) If A_x, A_y, A_z are component of vector in a reference frame then write component of the vector if the original frame of reference is rotated by an angle θ . 7

3. Derive the expression for Newton's second law in spherical polar co-ordinate. 15

UNIT – II

4. (a) Show that a central force is always conservative. 7
- (b) If a particle moves under a central force, show that its angular momentum is conserved. 8
5. (a) What do you mean by damping ? Prove that the damping force is independent of acceleration and displacement and is proportional to velocity. 10
- (b) Discuss characteristic properties of conservative forces and hence drive a relationship that connect conservative force with its potential. 5

UNIT – III

6. (a) Calculate the moment of inertia of a disc of mass M and radius R about one of its diameter ? 8
- (b) State and prove theorem of perpendicular axis for moment of inertia for a plane lamina. 7
7. (a) Derive Euler's equation of motion of a rigid body. 8
- (b) State and prove theorem of parallel axes for moment of inertia. 7

UNIT – IV

8. (a) What do you mean by equilibrium? What are their types ? And what are conditions of equilibrium in three and two dimension. 8
- (b) Define trusses and explain perfect and non perfect trusses. What are the main assumptions in truss analysis ? 7
9. (a) Explain the limiting and kinetic friction and give some example. 5
- (b) What are the factors on which limiting friction depends ? 4
- (c) 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 ? 6