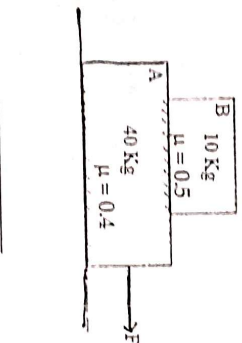


9. (a) Explain the limiting and non-limiting friction with an example. 5

(b) In the fig. given below, find the frictional force and acceleration of the blocks A & B. If the force(F) apply along the horizontal direction is given by : 10

- (i) $F = 100 \text{ N}$
- (ii) $F = 300 \text{ N}$
- (iii) $F = 500 \text{ N}$

It is given that the value of the coefficient of friction (static/dynamic) is 0.5 in between the blocks and 0.4 in between block A and ground.



3004- (P-4)/(Q-9)/(22) (4)

Roll No.

3004

B. Tech. (Civil Engg.) 1st Semester
Examination – December, 2022

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 at least one from each Unit. Question No. 1 is compulsory. All questions carry equal marks.

1. (a) What do you mean by a constraint motion in mechanics ? $5 \times 3 = 15$
- (b) Write down necessary and sufficient conditions of rigid body equilibrium for coplanar nonconcurrent force system in two dimensions.
- (c) A solid sphere and a hollow sphere have the same mass and radius. Will they have the same moment of inertia about their principle axes ? Explain.
- (d) What is the main difference between periodic and harmonic motion ?

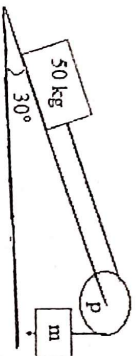
3004-55-(P-4)/(Q-9)/(22)

P. T. O.

- (c) Find out if the force field $F(x, y) = yz\mathbf{i} + xz\mathbf{j} + xy\mathbf{k}$ is conservative or not. (where \mathbf{i} , \mathbf{j} and \mathbf{k} are unit vectors along x , y and z -axis, respectively).

UNIT – I

2. (a) A 50 kg block is on an inclined plane of 30° and attached with a mass m by an inextensible string over a frictionless pulley(P), as shown in fig. given below. The coefficient of static friction between the block and the plane is 0.3, what is the range of m under which the block is resting ?



- (b) Show that Newton's second law is invariant in inertial frames. 7
3. State and explain Newton's laws and derive the differential equation of motion in polar coordinate. 15

UNIT – II

4. What do you understand by damped harmonic oscillations ? Derive its differential equation of motion and hence explain the term lightly damped, over damped and critically damped oscillations. 15

3004- (P-4)/(Q-9)/(22) (2)

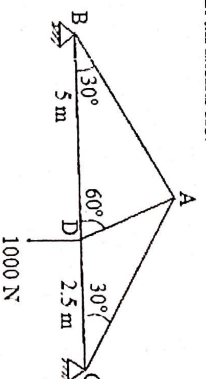
5. Derive the five-term acceleration formula for the rotating coordinate system and explain the fictitious forces. 15

UNIT – III

6. What do you understand by a rigid body ? Derive Euler's equation for rigid body motion. 15
7. (a) State and prove the perpendicular axis theorem for a moment of inertia for a plane lamina. 8
- (b) Briefly explains the kinetic energy of a rotating rigid body. 7

UNIT – IV

8. (a) Define trusses and explain perfect and non-perfect trusses. What are the main assumptions in truss analysis ? 5
- (b) Analyse the given truss of $BC = (BD+DC) = 5m + 2.5 m$ spans, loaded at D as shown in the fig. below. Find the magnitude and nature of the force in all members. 10



3004- (P-4)/(Q-9)/(22) (3) P. T. O.