

DO NOT WRITE ANYTHING ON QUESTION PAPER EXCEPT YOUR NAME, DEPARTMENT AND ENROLMENT No.

POSSESSION OF MOBILE, SMART WATCH ETC, IN EXAMINATION IS A UFM PRACTICE

Name of Student _____ Enrolment No _____

Department /School _____

BENNETT UNIVERSITY, GREATER NOIDA

Mid-Term Examination, SPRING SEMESTER 2021-22

COURSE CODE: EPHY108L

MAX. DURATION: ONE HOUR

COURSE NAME: Mechanics

Weightage: 20

COURSE CREDIT: 3

MAX. MARKS: 20

Note

- Programmable calculator is not allowed.
- All questions are compulsory.

1. A) A particle of mass 2 units moves in a force field depending on time t given by

$$\vec{F} = 24t^2\hat{i} + (36t - 16)\hat{j} - 12t\hat{k}$$

Assuming that at $t = 0$ the particle is located at

$$\vec{r}_0 = 3\hat{i} - \hat{j} + 4\hat{k}$$

and has velocity

$$\vec{v}_0 = 6\hat{i} + 15\hat{j} - 8\hat{k}.$$

Find the velocity and position at any time t .

2 marks

- B) A particle moves in such a way that $\dot{\theta} = \omega$ (constant), and $r = r_0 e^{\beta t}$, where r_0 and β are constants. Write down its velocity and acceleration in plane polar coordinates. For what values of β will the radial acceleration of the particle be zero?

4 marks

2. A) Functions f and g are given as $f = xyz$ and $g = x + y + z$. Assuming a right-handed coordinate system, find the value of $\vec{\nabla} \cdot \vec{\nabla}(fg)$ at point P (2,0,1).

3 marks

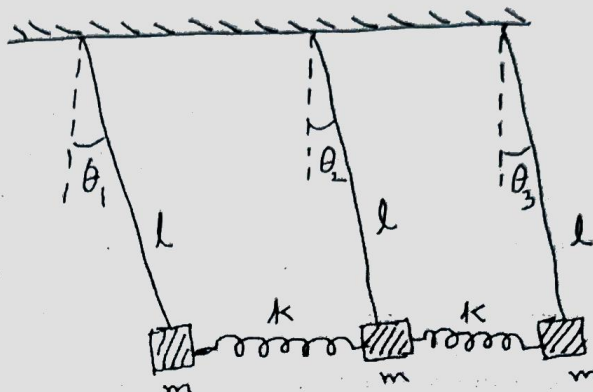
- B) Verify Stokes' theorem for a given vector field, $\vec{f} = (2xz + 3y^2)\hat{j} + (4yz^2)\hat{k}$ taken around a square (in yz -plane) having the vertices (0, 0), (1, 0), (1, 1) and (0, 1).

4 marks



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3. A) Three identical pendulums of length l having mass m suspended from each of them and coupled by identical springs with spring constant k are shown below and their respective angular displacements are indicated:



- Find the normal modes of the above-described system
- Find the normal mode frequencies

4 marks

B)

- A 1 kg mass is attached to a spring and oscillates at $1/2\pi$ Hz with a Q of 100. Find the spring constant and damping constant.

1.5 marks

- A musician's tuning fork rings at A above middle C, 440 Hz. A sound level meter indicates that the sound intensity decreases by a factor of $e = 2.718$ in 10 seconds. What is the Q of the tuning fork?

1.5 marks



Best of Luck