

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

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Department /School SCSET

BENNETT UNIVERSITY, GREATER NOIDA

Mid-Term Examination, SPRING SEMESTER 2022-23

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.

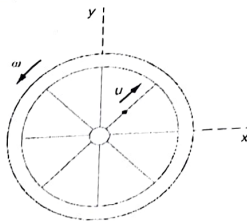
1. A) A particle of mass 4 units moves in a force field depending on time t given by

$$\vec{F} = 48t^2\hat{i} + (72t + 16)\hat{j} - 24t\hat{k}.$$

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 momentum and position at any time t .

4 marks

- B) Consider a bead moving along the spoke of a rotating wheel as shown in the figure. Assume both u and ω are constant. Calculate the velocity and acceleration of the bead in plane polar coordinates.



2. A) A force applied on a system is given by $\vec{f} = 3\hat{i} + z\hat{j} + y\hat{k}$. Determine whether the given force is conservative. Find the potential energy function, if it exists.

3 marks

- B) Verify Stokes' theorem for a given vector field, $f = y\hat{i} - x\hat{j} + z\hat{k}$ taken around a hemispherical surface $x^2 + y^2 + z^2 = a^2$ with $z \geq 0$.

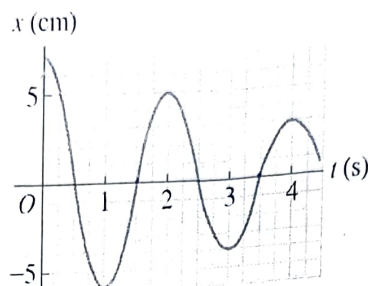
4 marks

Given the surface element is $d\vec{S} = a^2 \sin \theta d\theta d\phi \hat{r}$

3. A) A mass is vibrating at the end of a spring of force constant 225 N/m . Figure below shows a graph of its position x as a function of time t .

- At what times is the mass not moving?
- How much energy did this system originally contain?
- How much energy did the system lose between $t = 1 \text{ s}$ and $t = 4 \text{ s}$? where did this energy go?

4 marks



B) A paperweight suspended from a hefty rubber band has a period of 1.2 s and the amplitude of oscillation decreases by a factor of 2 after three periods. What is the estimated Q of this system?

2 marks