2019/TDC/ODD/SEM/PHSGE/
PHSDSC-101T/071

TDC (CBCS) Odd Semester Exam., 2019

PHYSICS

(1st Semester)

Course No. : PHSGE/PHSDSC-101T

(Mechanics)

Full Marks : 50
Pass Marks : 20

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer **all** questions

UNIT—I

1. *(a)* Answer any *three* questions from the following : 1×3=3

(i) What is parallelogram law of vector addition?

(ii) What is the scalar product of two oppositely directed vectors?

(iii) Does commutative law hold good in the scalar product?

(iv) For the orthogonal triad of unit vectors $\hat{i}$, $\hat{j}$ and $\hat{k}$, what is the value of $\hat{i} \times \hat{i}$ and $\hat{i} \times \hat{j}$?

(b) Answer any *one* question from the following : 2

(i) Find the unit vector perpendicular to each of the vectors $\vec{a} = 3\hat{i} + \hat{j} + 2\hat{k}$ and $\vec{b} = 2\hat{i} - 2\hat{j} + 4\hat{k}$.

(ii) If $\vec{A} = 4\hat{i} + 6\hat{j} - 3\hat{k}$ and $\vec{B} = 2\hat{i} + 5\hat{j} + 7\hat{k}$, find the angle between $\vec{A}$ and $\vec{B}$.

2. Answer *either (a) or (b)* :

(a) Prove that $\vec{A} \times (\vec{B} \times \vec{C}) = \vec{B}(\vec{A} \cdot \vec{C}) - \vec{C}(\vec{A} \cdot \vec{B})$. 5

(b) What do you mean by first-order homogeneous differential equation? Solve $y' + 0 \cdot 05y = 0$, given $y = 100$ and $x = 0$. 2+3=5

UNIT—II

3. (a) Answer any *three* questions from the following : 1×3=3

(i) Define non-inertial frame of reference.

(ii) Give an example of application of Newton's third law of motion.

(iii) State the law of conservation of momentum.

(iv) Define torque.

(b) Answer any *one* question from the following : 2

(i) Explain in brief the centre of mass of a system of particles.

(ii) Define kinetic energy and potential energy.

4. Answer *either (a) or (b)* :

(a) State ane prove work-energy principle. 5

(b) State Newton's second law of motion. Show that first law is contained in the second law of motion. 2+3=5

UNIT—III

5. *(a)* Answer any *three* questions from the following : 1×3=3

(i) What is GPS?

(ii) What do you mean by a central force?

(iii) Define universal gravitational constant.

(iv) State Kepler's first law.

(b) Answer any *one* question from the following : 2

(i) Explain in brief weightlessness of a body.

(ii) State Newton's law of gravitation.

6. Answer *either (a) or (b)* :

(a) Write short notes on *(i)* orbital velocity and *(ii)* geosynchronous orbit. 2½+2½=5

(b) Estimate the mass of the sun, assuming the orbit of the earth round the sun to be a circle. The distance between the sun and the earth is $1{\cdot}49\times10^{11}$ m and $G = 6{\cdot}66\times10^{-11}\ Nm^2kg^{-2}$. Assume the time period of earth's motions round the sun is 365 days. 5

UNIT—IV

7. *(a)* Answer any *three* questions from the following : 1×3=3

(i) Define Young's modulus.

(ii) What is elasticity of a material?

(iii) What do you mean by elastic limit?

(iv) State Hooke's law.

(b) Answer any *one* question from the following : 2

(i) Define Poisson's ratio.

(ii) What is the work done in stretching a wire?

8. Answer *either (a) or (b)* :

(a) Write a short note on torsional pendulum. 5

(b) Derive the expression relating three elastic constants. 2+3=5

UNIT—V

9. *(a)* Answer any *three* questions from the following : 1×3=3

(i) What is the dimension of coefficient of viscosity of a liquid?

(ii) Write the Poiseuille's formula for the flow of a liquid through a capillary tube.

(iii) Define surface tension of a liquid.

(iv) Write the expression for sum of two relativistic velocities.

(b) Answer any *one* question from the following : 2

(i) What are the postulates of special theory of relativity?

(ii) Define coefficient of viscosity.

10. Answer *either (a) or (b)* :

(a) Write short notes on *(i)* length contraction and *(ii)* time dilation. 2½+2½=5

(b) Deduce the expression for excess pressure inside a spherical liquid drop. 5

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