B.SC.CHEMISTRY
SEMESTER-1ST
PHYSICS-I
BPH-711

Duration: 3 Hrs.

Marks: 70

$$\left\{ \begin{array}{l} \textbf{Part : A (Objective)} = \textbf{20} \\ \textbf{Part : B (Descriptive)} = \textbf{50} \end{array} \right\}$$

[PART-B : Descriptive]

Duration: 2 Hrs. 40 Mins.

Marks: 50

[Answer question no. One (1) & any four (4) from the rest]

1. What are Galelian transformations? Show that under Galelian transformation velocity is variant and acceleration is invariant. $2+4+4=10$

2. Evaluate a. $\iiint_v (\nabla . \vec{F}) dV$ b. $\iiint_v (\nabla \times \vec{F}) dV$ $5+5+10$

   Where V is the closed region bounded by the planes x=0, y=0, z=0 and $2x+2y+z=4$ and $\vec{F} = (2x^2 - 3z)\hat{i} - 2xy\hat{j} - 4x\hat{k}$.

3. (a)Define gradient, divergence and curl of a vector. $3+3+4=10$
   (b)State Gauss's theorem and give the mathematical expression,
   (c)Use divergence Theorem to show that
   $$\iint_s \nabla (x^2 + y^2 + z^2) d\vec{s} = 6V$$

   where S is any closed surface enclosing volume V.

4. Define inertial and non-inertial frame of reference. Is earth an inertial frame? Justify your answer.Define conservative and non-conservative force. Show that the force $\vec{F} = yz\hat{i} + zx\hat{j} + xy\hat{k}$ is a conservative force. $2+3+2+3=10$

5. State Kepler's 3rd law of planetary motion. Deduce Newton's law of gravitation from Kepler's law. Define escape velocity.A small artificial satellite is revolving round the earth very close to it. If the radius of the earth is about 6400km and acceleration due to gravity 9.8 m/sec2, find the period of revolution of the satellite. $1+4+1+4=10$

6. Define moment of inertia. Deduce the total kinetic energy of a rotating body. Calculate the moment of inertia of an annular ring about an axis (a) passing through the centre and perpendicular to its plane and (b) about its diameter. $1+3+3+3=10$

7. Explain simple harmonic motion and oscillatory motion. Deduce the differential equation of simple harmonic motion of a particle of mass 'm' and oscillating with an angular frequency ω. $4+6=10$

8. What are lissajous Figures? Show that resultant displacement of a particle under the influence of two simple harmonic motions of equal time periods acting at right angle traces a circle if the phase difference (α) of the two individual vibrations is 90° $2+8=10$

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[PART-A : OBJECTIVE]

Choose the correct answer from the following: 1×20=20

1. Two vectors A and B are such that |A+B|=|A-B|. The angle between the vectors A and B is
   a. 30^0
   b. 60^0
   c. 90^0
   d. 180^0

2. $\left(\hat{i}+\hat{j}\right)$ makes an angle with Y-axis
   a. 60^0
   b. 45^0
   c. 54.74^0
   d. 30^0

3. $\nabla^2[(1-x)(1-2x)]$ is equal to
   a. 2
   b. 3
   c. 4
   d. 6

4. The curl of the vector $\vec{A}=z\hat{i}+x\hat{j}+y\hat{k}$ is given by
   a. $\hat{i}+\hat{j}+\hat{k}$
   b. $\hat{i}-\hat{j}+\hat{k}$
   c. $\hat{i}+\hat{j}-\hat{k}$
   d. $-\hat{i}-\hat{j}-\hat{k}$

5. If $\vec{F}$ is the velocity of a fluid particle then $\int_c \vec{F}.dr$ represent
   a. Work done
   b. Circulation
   c. Flux
   d. Conservative field

6. The orbit of the artificial satellite is
   a. Circular
   b. Elliptical
   c. Hyperbolic
   d. Oval

7. A body under the action of inverse square force will follow an elliptic path if eccentricity is
   a. e=0
   b. e=1
   c. e>1
   d. e<1

8. If the eccentricity of a trajectory is zero, the trajectory is
   a. Parabola
   b. Circle
   c. Hyperbola
   d. Ellipse

9. The value of escape velocity is
   a. 11.2 km/sec
   b. 7.92 km/sec
   c. 22.4 km/sec
   d. 15.94 km/sec

10. Which one is invariant under Galelian transformation?
    a. Velocity
    b. Length
    c. Momentum
    d. Potential energy

11. Moment of inertia of a thin rod is
    a. $\dfrac{M l^2}{12}$
    b. $\dfrac{M l^4}{12}$
    c. $\dfrac{M^2 l^4}{12}$
    d. $\dfrac{M l^4}{12}$

12. Units of moment of inertia is
    a. Kg-m
    b. Kg-m^2
    c. Kg^2-m
    d. Kg^2-m^2

13. The dimension of viscosity is
   a. $M^1L^1T^1$
   b. $M^1L^1T^{-1}$
   c. $M^1L^{-1}T^{-1}$
   d. $M^{-1}L^{-1}T^{-1}$

14. The velocity profile of a liquid flowing through a capillary is
   a. Circular arcs
   b. Parabolic
   c. Hyperbolic
   d. Straight line

15. The angle of contact of mercury with glass is
   a. 0
   b. 90^0
   c. Less than 90^0
   d. More than 90^0

16. Example of an simple harmonic motion (SHM) is
   a. Vibration of a spring
   b. Motion of a pendulum
   c. None of a. and b.
   d. Both of a. and b.

17. Example of a SHM but not oscillatory
   a. Vibration of a spring
   b. Motion of a pendulum
   c. Motion of a siling fan
   d. All of them

18. A particle showing a SHM has a displacement that is proportional to
   a. Force acting along the direction of the particle
   b. Force acting along the opposite direction of the particle
   c. Mass of the particle towards the center of the earth
   d. Acceleration due to gravity (g) towards the center of the earth

19. When two simple harmonic vibrations superimposed, the result will be
   a. Straight line
   b. The vibration will disappear
   c. The vibration will be random
   d. Also simple harmonic in nature

20. Two vector **A** and **B** are collinear if
   a. **A.B**=0
   b. **A×B**=0
   c. **A.B**=1
   d. **A×B**=1

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UNIVERSITY OF SCIENCE & TECHNOLOGY, MEGHALAYA

[PART (A) : OBJECTIVE]

Duration : 20 Minutes

Serial no. of the main Answer sheet

Course :

Semester :   Roll No :

Enrollment No :   Course code :

Course Title :

Session :   2017-18   Date :

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Full Marks	Marks Obtained
20	

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Scrutinizer's Signature   *Examiner's Signature*   *Invigilator's Signature*