Write the following information in the first page of Answer Script before starting answer

ODD SEMESTER EXAMINATION: 2020-21

Exam ID Number_____

Course_____ Semester_____

Paper Code _____Paper Title _____

Type of Exam: _____ (Regular/Back/Improvement)

Important Instruction for students:

1. Student should write objective and descriptive answer on plain white paper.
2. Give page number in each page starting from 1st page.
3. After completion of examination, Scan all pages, convert into a single PDF, rename the file with Class Roll No. **(2019MBA15)** and upload to the Google classroom as attachment.
4. Exam timing from 10am – 1pm (for morning shift).
5. Question Paper will be uploaded before 10 mins from the schedule time.
6. Additional 20 mins time will be given for scanning and uploading the single PDF file.
7. Student will be marked as ABSENT if failed to upload the PDF answer script due to any reason.

B.Sc. CHEMISTRY
FIRST SEMESTER
PHYSICS-I
BSP-711

Duration : 3 hrs. **Full Marks : 70**

(PART-A : Objective)

Time : 20 min. **Marks : 20**

Choose the correct answer from the following: ***1X20=20***

1. Which one of the following represents Newton's 1st law?
- **a.** dp/dt = 0
- **b.** dp/dt = F , (where F is finite)
- **c.** da/dt = 0 (where a is acceleration)
- **d.** M dv/dt = 2F , (where F is finite)

2. Under Galilean transformation, the distance is variant. This statement is:
- **a.** True
- **b.** False
- **c.** Depends upon the frame of reference
- **d.** None

3. Consider two objects, one is in rest state in centre and other is rotating in a circular orbit with constant speed, the frames of reference associated with them will be:
- **a.** Inertial, Inertial
- **b.** Inertial, non-inertial
- **c.** Non-Inertial, inertial
- **d.** Non-Inertial, non-inertial

4. Which one of the following is a property of a rigid body?
- **a.** The relative distance between the constituent particles changed under external force
- **b.** Shape of the object changed under external force
- **c.** The relative distance between the constituent particles not changed under external force
- **d.** None

5. Which one of the following relation defines the conservation of linear momentum (under Newtonian mechanics)?
- **a.** Vi - Vf = 0
- **b.** Vi +Vf = 0
- **c.** 2Vi – Vf = 0
- **d.** Vi +2 Vf = 0

6. Mass is measured by ……in rotational motion.
- **a.** Linear mass
- **b.** Linear momentum
- **c.** Angular momentum
- **d.** Moment of inertia

7. The relation between SI and CGS unit of moment of inertia is:
- **a.** 1 kg-m^2 = 10^5 gm-cm^2
- **b.** 1 kg-m^2 = 10^6 gm-cm^2
- **c.** 1 kg-m^2 = 10^7 gm-cm^2
- **d.** 1 kg-m^2 = 10^8 gm-cm^2

8. Which one of the following represents the Galilean transformation?
- **a.** x′ = x-vt, y′ =2y, z′=z and t′ = t
- **b.** x′ = x-vt, y′ =2y, z′=2z and t′ = t
- **c.** x′ = x-vt, y′ = y, z′=z
- **d.** x′ = x-vt, y′ = y, z′=z and t′ = t

9. If A, B and C are three vectors then which of the following the correct relation?
- **a.** AX(BXC) = B(A.C) + C(A.B)
- **b.** AX(BXC) = B(A.C) - C(A.B)
- **c.** AX(BXC) = A(B.C) - B(C.A)
- **d.** AX(BXC) = B(A.C) + C(A.B)

10. If A and B are two vectors, then direction of AXB will be:

a. Parallel to both A and B
b. Parallel to A and perpendicular to B
c. Parallel to B and perpendicular to A
d. Perpendicular to both A and B

11. Gradient of scalar function 'a' is defined as (where i, j and k are the unit vectors along X, Y and Z-directions):

a. grad a = i $\partial a/\partial x$ + j $\partial a/\partial y$ + k $\partial a/\partial z$
b. grad a = i $\partial a/\partial x$ - j $\partial a/\partial y$ + k $\partial a/\partial z$
c. grad a = i $\partial a/\partial x$ + j $\partial a/\partial y$ - k $\partial a/\partial z$
d. grad a = i $\partial a/\partial x$ - j $\partial a/\partial y$ - k $\partial a/\partial z$

12. Divergence of a vector A is defined as:

a. div A = i $\partial A_x/\partial x$ + j $\partial A_y/\partial y$ + k $\partial A_z/\partial z$
b. div A = $\partial A_x/\partial x + \partial A_y/\partial y + \partial A_z/\partial z$
c. div A = $\partial A_x/\partial x - \partial A_y/\partial y - \partial A_z/\partial z$
d. div A = i $\partial A_x/\partial x$ - j $\partial A_y/\partial y$ + k $\partial A_z/\partial z$

13. Which one of the following is the correct relation for the theorem of parallel axis? (Symbols have their usual meaning)

a. $I = I_{cm} + 2M a^2$
b. $I = I_{cm} + M a^2$
c. $I = I_{cm} - M a^2$
d. $I = I_{cm} - 2M a^2$

14. Which one of the following is the correct relation for the theorem of perpendicular axis? (Symbols have their usual meaning)

a. $I = I_x$
b. $I = I_y$
c. $I = I_x + I_y$
d. $I = I_x - I_y$

15. The property by which liquid opposes the relative motion between its different layers is known as:

a. Surface tension
b. Viscosity
c. Critical velocity
d. Surface energy

16. Force of attraction between the molecules of different substances is known as:

a. Force of adhesion
b. Force of cohesion
c. Viscous force
d. Surface tension

17. The SI unit and dimension of surface tension:

a. N-m, $[MT^2]$
b. N-m, $[ML^{-1}]$
c. N/m, $[MT^2]$
d. N/m, $[MT^{-2}]$

18. The capillary action is due to the effect of:

a. Viscosity
b. Surface tension
c. Adhesion
d. Cohesion

19. Consider the two simple harmonic motions, x = a Sin (ωt +Φ) and y = b Sin (ωt) vibrating simultaneously at right angle. If the phase phi is zero then the resultant vibrations will look like:

a. Circle
b. Straight line
c. Ellipse
d. Parabola

20. The time period(T) of a simple pendulum is given by: (where symbols have their usual meaning)

a. $T = 2\pi\sqrt{(L/2g)}$
b. $T = 2\pi\sqrt{(g/L)}$
c. $T = 2\pi\sqrt{(2L/g)}$
d. $T = 2\pi\sqrt{(L/g)}$

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(PART-B : Descriptive)

Time : 2 hrs. 40 min. **Marks : 50**

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

1. **a)** Define (ALL) Newton's law of motion. Show that 1st law is a special case of 2nd law. 5+5=10
b) Define inertial and non-inertial frame of reference. Show that the distance is invariant under Galilean transformation.

2. **a)** Define conservative and non-conservative forces with examples. 5+5=10
b) Define (dot and cross) products of the vectors with suitable examples. Consider two non-zero vectors, A and B then explain such possibilities where dot and cross products become zero?

3. **a)** Define Keplar's law of planetary motion. Show that square of the time period is proportional to the cube of semi-major axis. 7+3=10
b) What is wave motion? Define plane progressive wave and write down the differential equation and general solution of wave equation.

4. **a)** What is moment of Inertia? 2+8=10
b) Derive the expression for theorem of parallel and perpendicular axis.

5. **a)** Define (Proof is not required): 6+4=10
i. Divergence of a vector
ii. Gauss's theorem (proof is not required)
iii. Stokes theorem (proof is not required)
b) Prove that div(AXB) = B. Curl A – A. Curl B

6. **a)** Find the moment of Inertia of a circular disc about its diameter. 5+5=10
b) Find the moment of Inertia of a solid sphere about a tangent.

7. **a)** Derive the Poiseuille's formula for a flow of a liquid through a capillary tube. 6+4=10
b) The equation of a progressive wave is,
$y = a \sin [2\pi (t/0.05 - 0.5 x)+2]$ cm.
Find the amplitude, frequency, velocity and wave length.

8. What is Lissajous figure? Define the resultant of two simple harmonic motions with equal frequencies vibrating perpendicularly with phase (Φ) = $\pi/2$ (or 90 degree). 10

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