

B.Sc. PHYSICS
FIRST SEMESTER
PHYSICS-I
BSP – 711 [REPEAT]
[USE OMR FOR OBJECTIVE PART]

Duration : 3 hrs.

Full Marks : 70

Time : 30 min.

[Objective]

Marks : 20

Choose the correct answer from the following:

1X20=20

1. Curl grad $\vec{F} = ?$
a. 0
b. 1
c. 3
d. ∞
2. If a vector field $\vec{F} = x\hat{i} + 2y\hat{j} + 3z\hat{k}$, then $\nabla \times \nabla \times \vec{F}$ is
a. 0
b. \hat{i}
c. $2\hat{i}$
d. $3\hat{k}$
3. The work done of vectors force F and distance d, separated by angle θ can be calculated using
a. Cross product
b. Dot product
c. Vector addition
d. Vector subtraction
4. Pick the wrong answer
a. The dot product of two vectors is a scalar
b. The cross product of two vectors is a vector.
c. Addition of vector is commutative.
d. Curl of gradient of a vector is infinity
5. The divergence of position vector is
a. 0
b. 1
c. 2
d. 3
6. If the surface of a liquid is plane, then the angle of contact of the liquid with the walls of container is
a. Acute angle
b. Obtuse angle
c. 90°
d. 0°
7. When there are no external forces, the shape of a liquid drop is determined by
a. Surface tension of the liquid
b. Density of liquid
c. Viscosity of liquid
d. Temperature of air only
8. The dimension of gravitational constant G is
a. $M^{-1}L^2T^{-2}$
b. $M^{-1}L^3T^{-2}$
c. $M^1L^2T^{-2}$
d. $M^{-1}L^2T^{-1}$

9. An inertial frame of reference is that frame
- a. in which the Newton's 1st law is valid
 - b. in which law of inertia is valid
 - c. which is not moving with uniform velocity
 - d. in which both 1st law of motion and law of inertia is valid
10. Earth is
- a. A non-inertial frame
 - b. An inertial frame
 - c. Both of a. and b.
 - d. None of a. and b.
11. Moment of inertia of a solid sphere is
- a. $\frac{2}{3}M^2r^2$
 - b. $\frac{3}{2}Mr^2$
 - c. $\frac{2}{5}Mr^2$
 - d. $\frac{5}{2}Mr^2$
12. The surface of water in contact with glass wall is
- a. Plane
 - b. Concave
 - c. Convex
 - d. Both (a) and (b)
13. The calculation of the moment of the body due to the loadings involve a quantity called
- a. Moment
 - b. Inertia
 - c. Moment of Inertia
 - d. Rotation
14. The axis about which moment of area is taken is known as
- a. Axis of area
 - b. Axis of moment
 - c. Axis of reference
 - d. Axis of rotation
15. The condition for conservative force is
- a. $F = \nabla.U$
 - b. $F = -\nabla.U$
 - c. $F = -\nabla U$
 - d. $F = -\nabla^2.U$
16. According to Kepler, the line joining a planet to the sun sweeps out _____ in equal interval of time. (Fill the blank)
- a. Equal area
 - b. Equal length
 - c. One third of area
 - d. None of these
17. 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
18. The maximum displacement of a vibrating particle is called its
- a. Velocity
 - b. Amplitude
 - c. Acceleration
 - d. Phase

19. The time period of a vibrating particle is

a. $T = 2\pi \sqrt{\frac{\text{Displacement}}{\text{Acceleration}}}$

c. $T = \sqrt{\frac{\text{Displacement}}{\text{Acceleration}}}$

b. $T = 2\pi \sqrt{\frac{\text{Acceleration}}{\text{Displacement}}}$

d. $T = 2\pi \sqrt{\frac{\text{Displacement}^2}{\text{Acceleration}}}$

20. A vector point A vertically upward and point B towards north. The vector product $A \times B$ is

- a. along west
c. zero

- b. along east
d. vertically downward

(Descriptive)

Time : 2 hrs. 30 min.

Marks : 50

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

1. Calculate the minimum velocity and period of revolution of an artificial satellite at a height h from the surface of the earth. 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/sec^2 , find the period of revolution of the satellite. 6+4=10

2.
 - (i) Define escape velocity. 1+3+2+4
 - (ii) Derive an expression for escape velocity in terms of acceleration due to gravity and radius of the earth. =10
 - (iii) Calculate the value of escape velocity if the radius of earth is $6.4 \times 10^6 \text{ m}$ and $g = 9.8 \text{ ms}^{-2}$.
 - (iv) Moon has no atmosphere. Why?

3.
 - (i) Define moment of inertia. 1+3+3+3
 - (ii) Calculate the moment of inertia of a rectangular lamina (a) when the axis passing through the centre and perpendicular to its length and (b) when axis passing through the centre and perpendicular to the plane of lamina. =10
 - (iii) Assuming earth to be a sphere of uniform density 5520 kg.m^{-3} and radius 6400 km, calculate the moment of inertia about its axis.

4.
 - (i) Define angle of contact. 2+8=10
 - (ii) Show that the height of liquid risen in a capillary tube varies inversely as the radius of the tube.

5.
 - (i) Write a short note on (a) Surface tension, (b) surface energy and capillarity. 2+2+2+4
 - (ii) A soap film is formed on a rectangular frame 7cm dipping into the soap solution. The frame hangs from the arms of a balance. An extra weight of 0.38g is to be placed in the opposite pan to balance the pull on the frame. Calculate the surface tension of the soap solution. =10

6. (i) State Gauss's divergence theorem. 2+4+4
=10
- (ii) If $\vec{A} = (3x^2 + 6y)\hat{i} - 14yz\hat{j} + 20xz^2\hat{k}$, evaluate the line integral $\oint \vec{A} \cdot d\vec{r}$ from (0,0,0) to (1,1,1) along the curve C. $x = t, y = t^2, z = t^3$.
- (iii) If $\vec{F} = 2z\hat{i} - x\hat{j} + y\hat{k}$, evaluate $\iiint_V \vec{F} \cdot d\vec{v}$ where, v is the region bounded by $x=0, x=2, y=0, y=4, z=x^2, z=2$. -
7. Define divergence of a vector function. When a vector function is said to be solenoidal. If \mathbf{a} is a constant vector then prove that $\nabla \cdot (\mathbf{a} \times \mathbf{r}) = 0$. Also find the value of $\nabla \cdot \left(\frac{\mathbf{a} \times \mathbf{r}}{|\mathbf{r}|^n} \right)$, where $\mathbf{r} = x\hat{i} + y\hat{j} + z\hat{k}$ 1+1+3+5
=10
8. Explain simple harmonic motion. Show that for a body vibrating simple harmonically the time period is given by $T = 2\pi \sqrt{\frac{\text{displacement}}{\text{acceleration}}}$. Represent Simple harmonic motion graphically. 2+5+3
=10

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