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

Duration: 3 hrs.   Full Marks: 70

(**Objective**)

Time: 30 min.   Marks: 20

Choose the correct answer from the following: $1 \times 20 = 20$

1. When a constant force is applied to a body, it moves with uniform
   a. Acceleration   b. Velocity
   c. Speed   d. Momentum

2. Work done by a centripetal force is always
   a. Positive   b. zero
   c. Negative   d. Both positive & Negative

3. In an inverse law of force, the gravitational potential is-
   a. $\frac{k}{r}$ b. $\frac{k}{r^2}$
   c. $-\frac{k}{r^2}$ d. $-\frac{k}{r}$

4. Scalar product of two vectors is maximum when angle between them is-
   a. $\frac{\pi}{2}$ b. π
   c. 0^0 d. $\frac{\pi}{4}$

5. The resultant of two equal vectors is zero when angle between them is?
   a. π b. $\frac{\pi}{2}$
   c. 0^0 d. $\frac{\pi}{4}$

6. If 2 J work is done in 2 Sec, the power is said to be-
   a. 2 Watt   b. 1 Watt
   c. 3 Watt   d. 4 Watt

7. When a torque acting on a system is zero, what is conserved?
   a. Angular velocity   b. Linear momentum
   c. Force   d. Angular momentum

8. The moment of inertia of a ring of mass M and radius R about anyone of its diameter is-
   a. $M R^2$ b. $\frac{M R^2}{4}$
   c. $\frac{M R^2}{2}$ d. $\frac{3 M R^2}{2}$

9. The relation between angular momentum L and moment of inertia I is-
   a. $L = M I$
   b. $L = \omega I$
   c. $I = L \omega$
   d. $\omega = L I$

10. Moment of inertia in rotational motion has its analogue in translator motion-
   a. Mass
   b. Force
   c. Velocity
   d. Torque

11. The gradient of the scalar field f (x, y, z) = (x y-y z) is
   a. $y \hat{\imath} + (x - z) \hat{\jmath} - y \hat{k}$
   b. $y \hat{\imath} - (x + z) \hat{\jmath} - y \hat{k}$
   c. $(z + y) \hat{\imath} + x \hat{\jmath} - y \hat{k}$
   d. $x \hat{\imath} + (y - z) \hat{\jmath} - z \hat{k}$

12. If $\vec{a}$ is a constant vector field, then $\vec{\nabla}(\vec{a} \circ \vec{r})$ is-
   a. $\vec{r}$
   b. $\vec{a}$
   c. $\vec{a} \circ \vec{r}$
   d. 0

13. A vector field is said to be solenoidal if-
   a. Divergence of the vector field is zero
   b. Divergence of the vector field is non-zero
   c. Curl of the vector field is zero
   d. Gradient of the vector field is zero

14. Laws of physics are same in

   P. Accelerated frames of reference

   Q. Every inertial frames of reference

   Which one of the following is true-

   a. P is true & Q is false
   b. P & Q are false
   c. P & Q are true
   d. P is false & Q is true

15. Which one of the following identity is correct?
   a. $\text{Div}\left(\text{curl}\left(\vec{F}\right)\right) = 0$
   b. $\text{Curl}\left(\text{div}\left(\vec{F}\right)\right) = 0$
   c. $\text{Div}\left(\text{div}\,\vec{F}\right) = 0$
   d. $\text{Curl}\left(\text{curl}\left(\vec{F}\right)\right) = 0$

16. The value of acceleration due to gravity 'g' is maximum at
   a. Center of the Earth
   b. Equator
   c. Poles
   d. Both Poles and Equator

17. Escape velocity for an object of mass 'm' to escape from the gravitational attraction of a massive body of mass M and radius R is-
   a. $v_{esc} = 2\sqrt{g R}$
   b. $v_{esc} = \sqrt{2 g R}$
   c. $v_{esc} = \sqrt{g R}$
   d. $v_{esc} = \sqrt{3 g R}$

18. According to which transformations relations, acceleration of a body remain same in every inertial frame
   a. Lorentz Transformations
   b. Galileo Transformation
   c. Both Galileo & Lorentz Transformations
   d. None of these

19. The propagation vector K of a wave is related with its wave-length λ -
    a. $K = \frac{\pi}{\lambda}$

    b. $K = \frac{1}{\lambda}$

    c. $K = \frac{\lambda}{2\pi}$

    d. $K = \frac{2\pi}{\lambda}$

20. Surface tension of a liquid-
    a. increases with rise in temperature
    b. decreases with rise in temperature
    c. increases with decrease in temperature
    d. decreases with decrease in temperature

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$\left[\underline{\textbf{Descriptive}}\right]$

Time : 1 hr. 15min.   Marks : 25

[Answer question no.1 & any two (2) from the rest]

1. a. State Kepler's law of orbit and law of period in planetary motions.   4+6=10

    b. Using law of gravitation prove that the square of the time period of revolution (T) of a planet around the sun is directly proportional to the cube of the semi-major axis (R).

2. a. Find Galilean transformation relations.   4+6=10

    b. Show that Newton's second law of motion is valid in Galilean transformation relations.

3. a. What do you mean by viscosity?   2+6+2 =10

    b. Find the expression of viscous force acting between two liquid layers.

    c. Define 1 Decapoise.

4. Derive the expression for velocity and acceleration of a particle executing SHM in terms of displacement. Plot a graph showing the variation velocity and acceleration with displacement.   10

5. a. Define radius of gyration.   2+8=10

    b. Find the moment of inertial of a circular solid disc of mass M, radius R about an axis passing through its center and perpendicular to its plane.

6. a. What do you mean escape velocity?   2+6+2 =10

    b. Find an expression of escape velocity of an artificial satellite projected from the surface of earth.

    c. Write two important applications of artificial satellites.

[4]

7. **a.** State superposition principle of waves. $\quad$ 2+8=10

   b. Two harmonic waves of displacements $y_1 = a \sin \omega t$ and $y_2 = b \sin(\omega t + \delta)$ superimpose each other. Using the superposition principle find the amplitude and phase angle of the resultant displacement of the wave.

8. Show that $\quad$ 6+4=10
   a. $\vec{A} \times (\vec{B} \times \vec{C}) = (\vec{A} \circ \vec{C})\vec{B} - (\vec{A} \circ \vec{B})\vec{C}$
   b. Find an unit vector perpendicular to the vectors $\vec{A} = -2\,\hat{\imath} + 3\,\hat{\jmath} - 2\,\hat{k}$ and $\vec{B} = 3\,\hat{\imath} - 2\,\hat{\jmath} + 3\,\hat{k}$.

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