REV-01
BSC/04/09

2023/06

SET A

B.Sc. PHYSICS
SECOND SEMESTER
PHYSICS II
BSP – 721 [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: ***1X20=20***

1. The magnetic field outside the infinite solenoid is
   a. Zero
   b. $\frac{\mu_0 I}{2r}$
   c. $\frac{\mu_0 I}{4r}$
   d. $\frac{\mu_0 I}{r}$

2. According to kinetic theory of gases the relation between pressure P, density ρ and mean square velocity C' is
   a. $P = \frac{1}{3}\rho C'^2$
   b. $P = \frac{1}{2}\rho C'^2$
   c. $P = \frac{1}{2}\rho C'$
   d. $P = \frac{1}{3}\rho C'$

3. Work done in carrying *2C* charge in a circular path of radius *3m* around a charge of *10C* is
   a. zero
   b. 6.66 J
   c. 15 J
   d. 6 J

4. $\vec{E} = -\vec{\nabla} U$. Here Negative sign signifies that
   (where $\vec{E}$ is the electric field and U is the electric potential)
   a. *E* is directed in the direction of decreasing *U*
   b. *E* is opposite to *U*
   c. *E* is negative
   d. *E* increases when *U* decreases

5. Which of the following substance have *positive permeability* and *negative susceptibility*?
   a. Diamagnetic
   b. Ferromagnetic
   c. paramagnetic
   d. Anti-ferromagnetic

6. Increase in temperature results in
   a. Adiabatic compression
   b. Adiabatic expansion
   c. Isothermal compression
   d. Isothermal expansion

7. Entropy of a system remains constant in
   a. Reversible process **b.** Irreversible process
   c. Adiabatic Process **d.** None of these

8. The unit of entropy are
   a. Joules K^{-1} **b.** Joules K
   c. Joules **d.** K

9. Net entropy change of a system in Carnot's engine is
   a. Zero **b.** Positive
   c. Negative **d.** more than 1

10. The value $\gamma(\frac{C_p}{C_v})$ for a diatomic gas molecule is
   a. 1.4 **b.** 1.66
   c. 1.33 **d.** 1

11. Superposition of two light waves gives rise to which phenomenon?
   a. Diffraction **b.** Interference
   c. Polarization **d.** Dispersion

12. Which of the following satisfies the condition for maximum interference?
   a. $\phi = \pi n$ **b.** $\phi = (2n+1)\pi$
   c. $\phi = 2\pi n$ **d.** $\phi = \frac{\pi n}{2}$

13. When the amplitudes of two interfering light waves are equal, what is the minimum intensity of the resultant wave?
   a. $4a^2$ **b.** $2a^2$
   c. a^2 **d.** 0

14. On reflection from a denser medium, the path difference is
   a. 2λ **b.** λ
   c. $\frac{\lambda}{2}$ **d.** 0

15. Which of the following is essential for observing diffraction?
   a. Two coherent sources **b.** A narrow slit
   c. A screen **d.** White light

16. Which one of the following is the relation between polarizing angle and refractive index of a material?

a. $\mu = \tan\theta$ b. $\mu = \cos\theta$

c. $\mu = \sin\theta$ d. $\mu = \text{cosec}\,\theta$

17. What of the following is the shape of Newton's rings?

a. Square b. Rectangular

c. Circular d. Elliptical

18. Which of the following is the expression for Bohn magneton?

a. $\mu_B = \dfrac{\text{h}}{2em}$ b. $\mu_B = \dfrac{2e\text{h}}{m}$

c. $\mu_B = \dfrac{em}{2\text{h}}$ d. $\mu_B = \dfrac{e\text{h}}{2m}$

19. Which of the following is required to observe Stark effect?

a. electric field b. magnetic field

c. Both electric and magnetic fields d. None

20. Wien's displacement law is a special case of

a. Newton's law b. Planck's law

c. Stefan's law d. Maxwell's law

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Descriptive

Time : 2 hrs. 30 min. **Marks : 50**

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

1. Discuss Rayleigh- Jean's law of black body radiation. How did Planck remove the shortcomings of this law? **10**

2. State Ampere's law. **2+4+4=10**
Using Ampere's law calculates the magnetic field at a point inside a long current carrying solenoid.

   Also prove that if the magnetic field induction $\vec{B}$ is not a function of time,

   $curl\ \vec{B} = \mu_0 \vec{J}$

   Where symbols have usual meaning.

3. a. Write the limitation of first law of thermodynamics and also state the second law of thermodynamics. **4+6=10**

   b. A system is taken from A to B along the path ACB when 60 Joules of heat enter into it and system does 25 Joules of work.
   i. How much heat will enter into the system along the path ADB when the work done along the path is 10 Joule?

   ii. When the system returns from state B to A along path BA work done is 15 Joule. Calculate the amount of heat transfer.

4. a. Find an expression for the energy of a gas on kinetic theory of gases. **4+2+4=10**

   b. What do you mean by ***mean free path*** and ***mean free time*** of a gas molecule?

   c. Show that mean free path of the molecules of a gas is inversely proportional to the density of the gas.

5. a. Define capacitance and the unit to measure it. **2+5+3 =10**

   b. Derive an expression for the capacitance of a parallel plate capacitor.

   c. A potential difference of ***3000V*** is applied across the two plates of a parallel plate capacitor separated by a distance of ***2cm*** and area $4m^2$. The potential falls to ***1000V*** when a sheet of dielectric is introduced. Determine electric field and capacity with air a dielectric.

6. a. Define and explain interference of light with mathematical derivation. **6+4=10**

   b. Explain how interference fringes are produced by Fresnel's biprism.

7. a. Describe the experimental arrangement to produce Newton's rings. **5+5=10**

   b. How is plane polarized light produced by a Nicol's prism?

8. a. What are spontaneous and stimulated emissions? Explain. **3+3+4 =10**

   b. Describe the working of a He- Ne laser with an appropriate figure.

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