Paper:[Mathematical Physics-III+Elements of Modern Physics+Analog Systems and Applications]

PAPER CODE: PHY-H-CC-T-08
Full marks: 10

Answer any five questions: 5X2=10

1. Find the modulus and the argument of the complex number $z = \frac{3+2i}{4i-1}$.
2. Express $\sin 3\theta$ and $\cos 3\theta$ in terms of powers of $\sin \theta$ and $\cos \theta$ by using de Moivre's theorem.
3. Show that the function $f(z) = 2y + ix$ is not differentiable anywhere in the complex plane.
4. Show that the function $f(z) = \frac{1}{(1-z)}$ is analytic everywhere except at $z = 1$.
5. Find the Fourier transform of the following exponential decay function:
$$f(t) = 0 \text{ for } < 0 ;$$
$$f(t) = Ae^{-\lambda t} \text{ for } t \geq 0 \ (\lambda > 0).$$
6. Find the Laplace transform of $\frac{d^2 f}{dt^2}$.
7. Find the Laplace transform of $f(t) = t \sin bt$.

PAPER CODE: PHY-H-CC-T-09

Full marks: 10

Answer any ten questions: 10×1=10

1. With reference to nuclear forces which of the following statement is incorrect—
[A] Short range   [B] Charge independent   [C] Velocity dependent   [D] Spin dependent

2. The relation between half-life T of a radioactive sample and its mean life τ is:

[A] T = 0.693 τ [B] τ = 0.693 T [C] τ = T [D] τ = 2.718 T

3. The total energy of the electron in the hydrogen atom in the ground state is -13.6 eV. Which of the following is its kinetic energy in the first excited state?
[A] 13.6 eV [B]] 1.825eV[C] 3.4 eV[D] 6.8 eV

4. Davison Germer experiment indicates
[A]   Interference[B] Polarization   [C] Election diffraction   [D] Refraction

5. In Compton scattering, the change in wavelength is maxed if
[A] The angle of scattering is 90° [B] The angle of scattering is 60°
[C] The angle of scattering is 180°   [DThe angle of scattering is 0°

6. Select an alternative from of uncertainly principle from the following
[A] $\Delta E \cdot \Delta t = h$[B] $\Delta E = h/m\Delta c(1-\cos\theta)$[C] $mc^2 = h\nu$. [D]   None of the above

7. The most important property of laser is --
[A] Intensity   [B] Directionality   [C] Cohearence   [D] Number of Photons

8. Which of the following is a magic number--
[A] 62   [B] 82[C]32   [D] 12

9. According to quantum mechanics, for the particle moving in a box—
[A] The energy levels are discrete and equispaced[B] The energy levels are continuous
 [C] The energy levels are discrete and not equispaced[D] The energy is always zero

10. For the wave function $\psi = A \exp i(\alpha x - \omega t)$, the probability current density will be
[A] $\frac{\hbar\omega}{m}|A|^2$ [B] $\frac{\hbar\omega}{\alpha}|A|^2$ [C] Zero   [D] Infinite

11. Nuclear fusion of protons is possible due to —
[A] C-C cycle   [B] C-N cycle   [C] N-N cycle   [D] none of the above

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PAPER CODE: PHY-H-CC-T-10

Full marks: 10

Answer any five questions: 5×2=10

1. Define current gains α and β of a transistor. Find the relation between them.
2. Draw the circuit diagram of a voltage divider bias circuit. Write down its advantages and disadvantages.
3. What is a Zener diode? How can voltage be regulated with it?
4. What are the characteristics of an ideal opamp? Draw the circuit diagram of an inverting amplifier and calculate the voltage gain.
5. What is Q-point of a transistor circuit? What is meant by a class A amplifier?
6. Calculate the rectification efficiency and ripple factor of a full wave rectifier.
7. What is feedback in amplifiers? What is the effect of negative feedback on the input impedance of an amplifier?

PAPER CODE: PHY-H-SEC-T-02   **Paper: APPLIED OPTICS**

Full marks: 5

Answer Any Five questions of the following: 1×5=5

1. Write down the full form of LASER?

2. What is the difference between spontaneous and stimulated emission?

3. What are the differences between conventional light and laser?

4. What is Numerical Aperture of an optical fiber?

5. What are the difference between ordinary photography and Holography?

6. What are the different parts of an optical fiber?

PHY-H-GE-T-02   **Full Marks-10**

Answer any five questions   (2×5=10)

8. What are beats? Show that the beat frequency is equal to the difference between the frequencies of the component oscillations.

9. Show that two harmonic oscillations, at right angles to each other of equal amplitudes and equal frequencies but with phases differing by $\pi/2$, are equivalent to a uniform circular motion, the radius of the circle being equal to the amplitude of either oscillation.

10. What is meant by phase and group velocity of a travelling wave? Find a relation between them.

11. What is polarization of light waves? How can one determine if a beam of light is unpolarized or circularly polarized?

12. Write down the differences between Fraunhofer and Fresnel diffraction.

13. What are Newton's rings? How can wavelength of light be measured with Newton's ring experiment?

14. What is surface tension? Derive an expression for the excess pressure inside a liquid drop.