

INTERNAL ASSESMENT-2022

KANDI RAJ COLLEGE

DEPARTMENT OF PHYSICS

SEMESTER: 4th STREAM: Honours (Core)

**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

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1. Find the modulus and the argument of the complex number $z = \frac{3-2i}{4i-1}$.
 2. Express $\cos^3 \theta$ in terms of powers of $\cos 3\theta$ and $\cos \theta$ by using de Moivre's theorem.
 3. Solve the equation $z^6 - z^5 + 4z^4 - 6z^3 + 2z^2 - 8z + 8 = 0$.
 4. Show that the function $f(z) = \frac{1}{(1-z)}$ is analytic everywhere except at $z = 1$.
 5. Find the Fourier series for $f(x) = x$ in the range $-2 < x < 2$.
 6. Prove that $\delta(bt) = \delta(t)/|b|$.
 7. Find the Laplace transform of $f(t) = e^{at}$.
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PAPER CODE: PHY-H-CC-T-09

Full marks: 10

Answer any ten questions: 10×1=10

1. Which of the following is a magic number--

[A] 62

[B] 82

[C] 32

[D] 12

2. 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] $mc^2 = hv$. [D] None of the above
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° [D] The angle of scattering is 0°
6. The relation between half-life T of a radioactive sample and its mean life τ is:
 [A] $T = 0.693 \tau$ [B] $\tau = 0.693 T$ [C] $\tau = T$ [D] $\tau = 2.718 T$
7. The most important property of laser is --
 [A] Intensity [B] Directionality [C] Cohearence [D] Number of Photons
8. With reference to nuclear forces which of the following statement is incorrect—
 [A] Short range [B] Charge independent [C] Velocity dependent [D] Spin dependent
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 fixed bias transistor circuit. Write down its advantages and disadvantages.
 3. What is a pn junction diode? Draw the circuit diagram of a full wave rectifier and explain the working principle.
 4. What are the characteristics of an ideal opamp? Draw the circuit diagram of a non-inverting amplifier and calculate the voltage gain.
 5. What is Q-point of a transistor circuit? What is meant by a class B amplifier?
 6. Calculate the rectification efficiency and ripple factor of a half wave rectifier.
 7. What is feedback in amplifiers? What is the effect of negative feedback on the input impedance of an amplifier?
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PHY-H-GE-T-02

Full Marks-10

Answer any five questions

(2×5=10)

1. What are beats? Show that the beat frequency is equal to the difference between the frequencies of the component oscillations.
2. 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.
3. What is meant by phase and group velocity of a travelling wave? Find a relation between them.

4. What is polarization of light waves? How can one determine if a beam of light is unpolarized or circularly polarized?
 5. Write down the differences between Fraunhofer and Fresnel diffraction.
 6. What are Newton's rings? How can wavelength of light be measured with Newton's ring experiment?
 7. What is surface tension? Derive an expression for the excess pressure inside a liquid drop.
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PAPER CODE: PHY-H-SEC-T-02

Paper: APPLIED OPTICS

Full marks: 5

Answer Any Five questions of the following:

1×5=5

1. Why Pumping mechanism is used for laser mechanism?
2. What are the differences between spontaneous and stimulated emission?
3. Draw the energy band diagram of He-Ne laser. What is the wavelength of the laser beam?
4. What is Numerical Aperture of an optical fiber?
5. What are the difference between ordinary photography and Holography?
6. How hologram is recorded? Explain.