



K. K. Wagh Institute of Engineering Education & Research, Nashik
(An Autonomous Institute From A.Y. 2022-23)

| SUMMER-2024 | |
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| Exam Seat No.: | |
| Academic Year: 2023-2024 | Semester: II |
| Class: FY | Program: B.Tech |
| Branch Code: FYE | Pattern: 2023 |
| Name of Course: Applied Physics (A) | Course Code: 2300103A |
| Max. Marks: 60 | Duration: 2:30 Hrs. |

Instructions: Candidates should read carefully the instructions printed on the Question Paper and on the cover page of the Answer Book, which is provided for their use.

1. This question paper contains 2 page(s).
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required, but justify it.
4. Draw the neat labelled diagrams, wherever necessary.
5. The last columns indicates the Course Outcome and level of Blooms Taxonomy of the Question/sub-question.
6. Given Constant : - Charge of electron / proton = 1.6×10^{-19} C

Mass of electron = 9.1×10^{-31} Kg
Mass of proton = 1.673×10^{-27} Kg
Mass of neutron = 1.673×10^{-27} Kg
Planks constant = 6.626×10^{-34} J.s
Permeability $\mu_0 = 4\pi \times 10^{-7}$
Velocity of light = 3×10^8 m/sec

Question No. 1 Attempt following Question

- 1a) How does understanding magnetic circuits help engineers design efficient transformers for power distribution? (2) CO1
- 1b) Consider an air-cored solenoid with a length of 15 cm and an inside diameter of 1.5 cm. The solenoid contains 900 turns. Calculate the total magnetic flux within the solenoid when the current passing through the coil is 100 mA. ($\mu_0 = 4\pi \times 10^{-7}$). (4) CO4

Question No. 2 Attempt following Question

- 2a) How does the difference between intrinsic and extrinsic semiconductors impact the performance of electronic devices like transistors and diodes? (2) CO2
- 2b) How much impurity should be added in a germanium sample by a manufacturer to manufacture the semiconductor having resistivity of $8 \Omega \text{ cm}$. (Given - $\mu_e = 1600 \text{ cm}^2/\text{Vs}$) (4) CO5

Question No. 3 Attempt following Question

- 3a) What is LASER? Explain its any two properties. Differentiate between spontaneous emission and stimulated emission. (6) CO1

OR

- 3b) What is total internal reflection? Explain the construction of optical fiber cable. (6) CO1
- 3c) State the phenomena of double refraction. Explain Huygen's principle of double refraction. (6) CO3

OR

- 3d) What do you understand by polarization of light? Distinguish between polarized and unpolarized light (Any 2). What is meant by plane polarized, circularly polarized and elliptically polarized light? (6) CO3
- 3e) A glass microscope lens ($\mu = 1.5$) is coated with magnesium fluoride ($\mu_f = 1.38$) film to increase the transmission of normally incident light $\lambda = 5800 \text{ \AA}$. What minimum film thickness should be deposited on the lens? (4) CO5

OR

- 3f) Find the half angular width of the central maxima in the Fraunhofer diffraction pattern of slit having width of $5 \times 10^{-5} \text{ cm}$. When illuminated by light having wavelength 5000 \AA . (4) CO5

Question No. 4 Attempt following Question

- 4a) State the De-broglie hypothesis. Explain the postulates of quantum mechanics. (6) CO3

OR

- 4b) Explain the wave function. State the conditions of the well-behaved wave function. (6) CO3
- 4c) Show that the de Broglie wavelength for electron is found to be equal to $\frac{0.286}{\sqrt{V}} \text{ \AA}$. (6) CO1

OR

- 4d) Derive the expression of the Schrödinger time-dependent wave equation for three-dimensional particles. (6) CO1
- 4e) Calculate the energy (in eV) with which a proton has to acquire a de-Broglie wavelength of 0.1 \AA . (4) CO4
- 4f) Calculate the de Broglie wavelength of an α -particle accelerated through a potential difference of 400 volts. ($m_\alpha = 6.68 \times 10^{-27} \text{ kg}$, charge on alpha particle = $3.2 \times 10^{-19} \text{ C}$) (4) CO4

Question No. 5 Attempt following Question

- 5a) What are first-generation solar cells, and what are the different types of absorbents used in them? (6) CO1

OR

- 5b) Explain the process of formation and working of p-n junction diode with zero bias energy band diagram. (6) CO1
- 5c) Explain how quantum dot technology is used in making the 3rd generation solar cell. (6) CO2

OR

- 5d) What is the function of a wind turbine, and what are the different types of wind farms used for generating electricity? (6) CO2
- 5e) The wind is blowing at 12 m/sec , how much total power is the wind hitting the wind turbine if the blades are 45 m long, assuming the turbine is at sea level? (Air density at sea level = 1.225 kg/m^3). (4) CO5

OR

- 5f) Solar insolation on a rectangular module (1.5 m x 2.0 m) of photovoltaic cells is 550 w/m^2 . If the efficiency of the cells is 12%. What is the power output of the module? (4) CO5

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