

CBCS SCHEME

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BPHYS102/202

First/Second Semester B.E./B.Tech. Degree Examination, June/July2023
Physics for CSE Stream

Time: 3 hrs.

Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.

2. VTU Formula Hand Book is permitted.

3. M : Marks , L: Bloom's level , C: Course outcomes.

4. Constants : Speed of Light $C = 3 \times 10^8 \text{ m/s}$, Boltzmann const. $K = 1.38 \times 10^{-23} \text{ J/K}$,Planck's const $h = 6.625 \times 10^{-34} \text{ JS}$, Acceleration due to gravity $g = 9.8 \text{ m/s}^2$,
mass of electron $m = 9.1 \times 10^{-31} \text{ Kg}$

| Module – 1 | | | M | L | C |
|------------|----|---|----|----|-----|
| Q.1 | a. | Derive an expression for energy density in terms of Einstein's coefficients in Laser action. | 10 | L2 | CO1 |
| | b. | Explain types of optical fibers. | 6 | L2 | CO1 |
| | c. | The ratio of population inversion of two energy levels is 1.059×10^{-30} . Find the wavelength of Light emitted by spontaneous emissions at 330K. | 4 | L3 | CO1 |
| OR | | | | | |
| Q.2 | a. | Derive an expression for Numerical aperture in an optical fiber. | 8 | L2 | CO1 |
| | b. | Discuss construction and working of semiconductor diode Laser with energy level diagram. | 8 | L2 | CO1 |
| | c. | The angle of acceptance of an optical fiber is 30° , when kept in air. Find the angle of acceptance when it is in a medium of refractive index 1.33. | 4 | L3 | CO1 |
| Module – 2 | | | | | |
| Q.3 | a. | What is wave packet? Give physical significance and properties of wave function? Define group velocity. | 8 | L2 | CO1 |
| | b. | State and explain Heisenberg's uncertainty principle. Give its physical significance. Show that electron cannot exist inside the nucleus. | 8 | L2 | CO2 |
| | c. | A particle of mass 0.5 meV/c^2 has kinetic energy 100 eV . Find its de Broglie wavelength, where 'C' is the velocity of light. | 4 | L3 | CO2 |
| OR | | | | | |
| Q.4 | a. | Derive an expression for Schrödinger's Time independent equation one dimensional form. | 8 | L2 | CO2 |
| | b. | Obtain the expression for energy eigen values using Schrodinger's time independent equation. | 8 | L2 | CO2 |
| | c. | In a measurement of position and velocity of an electron moving with a speed of $6 \times 10^5 \text{ m/s}$, calculate highest accuracy with which its position could be determined, if the inherent error in the measurement of its velocity is 0.01% for the speed stated. | 4 | L3 | CO2 |

BPHYS102/202**Module – 3**

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|------------|----|--|----------|-----------|------------|
| Q.5 | a. | Explain single qubit gate and multiple qubit gate with example for each. | 8 | L2 | CO2 |
| | b. | Discuss CNOT gate and its operation on four different input states. | 8 | L2 | CO2 |
| | c. | Given $A = \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix}$ prove that $A^+ = A$. | 4 | L3 | CO2 |

OR

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|------------|----|---|----------|-----------|------------|
| Q.6 | a. | Elucidate the differences between classical computing and Quantum computing. | 8 | L2 | CO2 |
| | b. | Discuss the working of phase gate mentioning its matrix representation and truth table. | 8 | L2 | CO2 |
| | c. | Find the inner product of states $ 11\rangle$ and $ 10\rangle$ and draw conclusion on the result. | 4 | L3 | CO2 |

Module – 4

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|------------|----|--|----------|-----------|------------|
| Q.7 | a. | Distinguish between Type – I and Type – II superconductors. | 8 | L2 | CO3 |
| | b. | Discuss the effect of temperature and impurity on electrical resistivity of conductors and hence explain for superconductors. | 8 | L2 | CO3 |
| | c. | In a diffraction grating experiment the laser light undergoes second order diffraction, if the distance between screen and grating is 20cm, and average distance of 2 nd order spot 2.7cm grating constant 1×10^{-5} m, calculate the wavelength of laser light. | 4 | L3 | CO5 |

OR

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|------------|----|--|----------|-----------|------------|
| Q.8 | a. | Explain B.C.S theory of superconductivity. | 7 | L2 | CO1 |
| | b. | Define Fermi energy level. Discuss various energy states by the electrons at $T = 0\text{ K}$ and $T > 0\text{ K}$ on the basis of fermifactor. | 8 | L2 | CO1 |
| | c. | Calculate the acceptance angle and numerical aperture of given optical fiber having diameter of spot is 2.6cm and distance between screen and optical fiber 3.0cm. | 5 | L2 | CO1 |

Module – 5

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|------------|----|--|----------|-----------|------------|
| Q.9 | a. | Elucidate the importance of size and scale and weight and strength in animations. | 8 | L2 | CO4 |
| | b. | Discuss modeling probability of proton decay. | 8 | L2 | CO4 |
| | c. | The number of particles emitted per second by a random radioactive source has a Poisson's distribution with $\lambda = 4$. Calculate the probability of $P(X = 0)$ and $P(X = 1)$ | 4 | L3 | CO4 |

OR

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|-------------|----|--|----------|-----------|------------|
| Q.10 | a. | Discuss timing in Linear motion, uniform motion, show in and flow out. | 8 | L2 | CO4 |
| | b. | Discuss salient features of Normal distribution using Bell curves. | 8 | L2 | CO4 |
| | c. | A slowing in object in an animation has a first frame distance 0.5m and first slow in frame 0.35m. Calculate the base distance and the number of frames in sequence. | 4 | L3 | CO4 |

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