| | |
|---|---|
| "MAHARAJA INSTITUTE OF TECHNOLOGY MYSORE<br>Department of Physics<br>1st Internal Assessment<br>Second semester | Subject Name: Applied Physics for CSE Stream<br>Subject code: BPHYS202<br>Time: 75min<br>Total Marks : 30<br>Faculty: Dr Vijaylakshmi Dayal, Shamantha M S, Chandan K, Sahana A. R |

**Answer any one full question**
**(CSE Stream- C,D,E,F,G & H Section)**

| Q | | Question Description | Marks | BTL | CO |
|---|---|---|---|---|---|
| 1 | A | Deduce the expression for energy density of radiation at equilibrium in terms of Einstein coefficient's and thus conclude on $B_{12} = B_{21}$. | 8 | L4 | 3 |
| | B | With the neat block diagram discuss the application of Optical fiber in Point-to-point communication | 7 | L3 | 2 |
| | C | The NA of an optical fiber is 0.3 when surrounded by air. Determine refractive index of core , given that the refractive index of cladding 1.50 and also find the acceptance angle when fiber is in water. | 5 | L3 | 2 |
| | | OR | | | |
| 2 | A | Categorize the different types of optical fiber based on modes of propagation and RI Profile with neat diagram merits , demerits and application | 8 | L4 | 3 |
| | B | Illustrate the construction and working of Semiconductor LASER with a neat sketch and energy level diagram | 7 | L3 | 2 |
| | C | Calculate the ratio of population for a given pair of energy levels corresponding to emission of radiation 684.3 nm at a temperature of 400K. | 5 | L3 | 2 |
| 3 | A | Derive an expression for de Broglie wavelength in terms of accelerated electrons by analogy and mention the properties of wave function. | 6 | L3 | 2 |
| | B | The velocity of an electron was measured to be $5 \times 10^5$m/s with an uncertainty of 1%. Find the uncertainty involved in the measurement of its position. | 4 | L3 | 2 |
| | | OR | | | |
| 4 | A | Discuss the Heisenberg's uncertainty principle. Show that electron does not exist inside the nucleus using Heisenberg's uncertainty principle | 6 | L3 | 2 |
| | B | A particle of mass 0.65MeV/$C^2$ has a kinetic energy 81 eV. Find the de Broglie wavelength. | 4 | L3 | 2 |

MAHARAJA INSTITUTE OF TECHNOLOGY MYSORE

Department of Physics

2nd Internal Assessment

Second semester

Subject code: BPHYS202

Time: 02:15 PM-03:30 PM

Total Marks: 30

Faculty: Dr. Vijaylakshmi Dayal

Chandan K, Shamantha M S, Sahana A R

**Answer any one full question**

**(CSE Stream- Section –C, D, E, F, G and H)**

| Q | | Question Description | Marks | BTL | CO |
|---|---|---|---|---|---|
| 1 | a. | Setup time independent Schrodinger wave equation for a free particle in one dimension. | 7 | L3 | 2 |
| | b. | Calculate the zero point energy of an electron confined in a box of width 0.12 nm. Also, find energy values for the first two excited states. | 3 | L3 | 2 |
| | | **OR** | | | |
| 2 | a. | Assuming a time-independent Schrödinger wave equation, derive the expression for Eigen energy value and Eigen function for a particle in one- dimensional infinite potential well. | 7 | L3 | 2 |
| | a. | An electron is bound in a one-dimensional potential well of width 4 Å. Find its energy values in eV in the ground state and first two excited states. | 3 | L3 | 2 |
| | | **AND** | | | |
| 3 | a. | Visualize the Qubit state $\|\psi>$ on a 3D Bloch sphere by determining the appropriate polar angle ($\theta$) and azimuthal angle ($\phi$). | 8 | L4 | 3 |
| | b. | Explain the operations of the Phase gate (S–gate) and prove that the S-Gate is unitary. Show that the S-Gate can be formed by connecting two T–gates in series. | 8 | L4 | 3 |
| | c. | Two vectors are given by $\|\psi>=\begin{pmatrix}-3i\\5i\\1\end{pmatrix}$ and $\|\phi>=\begin{pmatrix}1\\0\\-i\end{pmatrix}$. Find the Inner product of $<\psi\|\phi>$ and $<\phi\|\psi>$. | 4 | L4 | 3 |
| | | **OR** | | | |
| 4 | a. | Describe the working of the controlled-Z gate and Toffoli gate mentioning its matrix representation, Circuit symbol and truth table. | 8 | L4 | 3 |
| | b. | Explain the Pauli matrices ($\sigma x$, $\sigma y$ and $\sigma z$)and apply Pauli matrices on the state $\|0>$ and $\|1>$ and get the output. | 8 | L4 | 3 |
| | c. | Consider the following two kets $\|\psi>=\begin{pmatrix}1-i\\2\\3+2i\end{pmatrix}$ and $\|\phi>=\begin{pmatrix}4\\-i\\6\end{pmatrix}$. Check if, $\psi>$ and $\|\phi>$ are normalized and if not normalize it. | 4 | L4 | 3 |

| | | |
|---|---|---|
| | **MAHARAJA INSTITUTE OF TECHNOLOGY MYSORE**<br>**Department of Physics**<br>**3rd Internal Assessment**<br>**Second semester** | **Subject Name: Applied Physics for CSE**<br>**Subject code: M23BPHYS202**<br>**Time: 02:15 PM-03:30 PM**<br>**Total Marks : 30**<br>**Faculty: Dr.Vijaylakshmi Dayal, Shamantha M S, Chandan K & Sahana A R** |

**Answer any one full question.**
**(CSE Stream- C, D, E, F, G & H Section)**

| Q | | Question Description | Marks | BTL | CO |
|---|---|---|---|---|---|
| 1. | a. | Describe Fermi factor. Evaluate the Fermi factor based on the variation of energy level with temperature. | 6 | L3 | 2 |
| | b. | With a neat diagram depending on the critical magnetic field categorize Superconductors and explain. (Type I And Type II). | 6 | L4 | 3 |
| | c. | Calculate the probability electron occupying an energy level 0.06 eV below the Fermi level at 300 K. | 3 | L3 | 2 |
| | | **OR** | | | |
| 2. | a. | Describe the failures of classical free electron theory. | 6 | L3 | 2 |
| | b. | Based on the DC Josephson effect describe the construction and working of DC SQUID with a neat diagram. | 6 | L4 | 3 |
| | c. | The Critical field for Niobium is $4\times 10^5\ A/m$ at 7K and $2\times 10^5\ A/m$ at 0K. Find the transition temperature of the element. | 3 | L3 | 2 |
| | | **AND** | | | |
| 3. | a. | Discuss the salient features of Normal distribution using bell curves. | 6 | L3 | 2 |
| | b. | Analyze the odd rule and odd rule scenarios with a suitable example. | 6 | L3 | 2 |
| | c. | In the case of the Jump action, the push height is 0.6m and the Jump magnification is 4. Calculate the jump height, and push acceleration. Acceleration due to gravity = 9.8 m/s$^2$. | 3 | L3 | 2 |
| | | **OR** | | | |
| 4. | a. | Categorize the Linear motion timing, Uniform motion timing, slow in and slow out motion with a neat diagram. | 6 | L3 | 2 |
| | b. | Describe the general pattern of the Monte Carlo method and hence estimate the value of Pi. | 6 | L3 | 2 |
| | c. | The number of particles emitted randomly by a radioactive sample obeys the Poisson distribution with $\lambda$ =6. Calculate P (x=0), P (x =1), P(x =2), P(x=3). | 3 | L3 | 2 |