*Basavarajeswari Group of Institutions*

# BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT

(Autonomous Institute under Visvesvaraya Technological University, Belagavi)

| USN | | | | | | | | | | Course Code | 2 | 2 | P | H | Y | E | 2 | 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

## Second Semester B.E. Degree Examinations, Sept/Oct 2023

## PHYSICS FOR EEE STREAM

**Duration: 3 hrs** **Max. Marks: 100**

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

*2. Physical constants: Velocity of light (c) = 3 x $10^8$ m/s ; Plank's constant (h) = 6.63 x $10^{-34}$ J-S ; Mass of the electron (m) = 9.11 x $10^{-31}$ Kg ; Boltzmann constant (k) = 1.38 x $10^{-23}$ J/K ; Avagadro number ($N_A$) = 6.02 x $10^{26}$ /K mole Charge of the electron (e) = 1.603 x $10^{-19}$ C. Missing data, if any, may be suitably assumed*

| Q. No | | Question | Marks | (RBTL:CO: PI) |
|---|---|---|---|---|
| | | **MODULE – 1** | | |
| 1. | a | State & explain Heisenberg's uncertainty principle and Show that electron does not exist inside the nucleus by this principle. | 08 | (1 :1: 1.1.1) |
| | b | Starting from Schrödinger's time independent wave equation, Derive the expression for energy Eigen values for an electron in one-dimensional potential well of infinite height. | 08 | (2 :1: 1.1.1) |
| | c | The velocity of a hydrogen atom in the ground state is 2.19 x$10^6$ m/s. calculate wavelength of the de-Broglie's wave associated with its motion. | 04 | (3 :1: 1.2.1) |
| | | **OR** | | |
| 2. | a | Define phase velocity and group velocity and hence derive expression for group velocity. | 08 | (2 :1: 1.1.1) |
| | b | Derive one-dimensional Schrödinger's time independent wave equation. | 08 | (2 :1: 1.1.1) |
| | C | The ground state energy of an electron in an infinite potential well is 5.6meV.if the width of the potential well is doubled calculate the ground state energy. | 04 | (3 :1: 1.2.1) |
| | | **MODULE – 2** | | |
| 3. | a | Describe four types of polarization of mechanisms with neat diagrams. | 08 | (2 :2: 1.1.1) |
| | b | Derive relation between polarization and dielectric constant and also derive Clausius-Mossotti equation. | (04+04) | (2 :2: 1.1.1) |
| | c | If a sodium chloride crystal is subjected to an electric field of 1000V/m and the resulting polarization is 4.3x$10^{-8}$ C/$m^2$.calculate the dielectric constant lf sodium chloride. | 04 | (3 :2: 1.2.1) |
| | | **OR** | | |
| 4. | a | Describe superconductors into Soft and Hard superconductors using M-H graphs. | 08 | (1 :2: 1.1.1) |
| | b | Explain briefly MAGLEV vehicle and SQUID | 08 | (1 :2: 1.1.1) |
| | c | Calculate the critical magnetic field at 1K for a metal if its transition temperature of 4.15 K and the critical magnetic field at 0K is 3.276 × $10^6$ Am-1. | 04 | (3 :2: 1.2.1) |
| | | **MODULE – 3** | | |
| 5. | a | Derive expression for energy density in terms of Einstein's coefficient. | 08 | (2 :3: 1.1.1) |
| | b | Explain the construction and working of semiconductor laser with neat diagrams. | 08 | (2 :3: 1.1.1) |
| | c | A pulsed laser has average power output of 1.5mW per pulse and the pulse duration is 20nS. The number of photons emitted per pulse is estimated to be 1.0472x$10^8$. Find wavelength of the emitted laser. | 04 | (3 :3: 1.2.1) |
| | | **OR** | | |

Note: (**RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI - Performance Indicator)**

| | | | | |
|---|---|---|---|---|
| **6.** | **a** | Explain numerical aperture and acceptance angle and derive the expression for numerical aperture and acceptance angle of an optical fiber. | **08** | **(1 :3: 1.1.1)** |
| | **b** | Describe different types of optical fibers with neat diagrams for geometry, refractive index profile and propagation of waves | **08** | **(1 :3: 1.1.1)** |
| | **c** | Find the attenuation in an optical fiber of length 500m, when light signal of power 100mW emerges out of the fiber with a power 90mW. | **04** | **(3 :3: 1.2.1)** |

**MODULE – 4**

| | | | | |
|---|---|---|---|---|
| **7.** | **a** | Derive expression for Fermi level in intrinsic semiconductors | **05** | **(2 :4: 1.1.1)** |
| | **b** | Derive expression for Hall coefficient | **05** | **(2 :4: 1.1.1)** |
| | **c** | Define Fermi energy and explain determination of Fermi energy of a copper in the laboratory. | **10** | **(3 :5: 1.2.1)** |

**OR**

| | | | | |
|---|---|---|---|---|
| **8.** | **a** | Derive expression for electrical conductivity of a semiconductor. | **05** | **(2 :4: 1.1.1)** |
| | **b** | Explain about phototransistor in detail. | **05** | **(2 :4: 1.1.1)** |
| | **c** | What is Zener diode and explain determination of Knee voltage, Zener break down voltage and Forward resistance in the laboratory. | **10** | **(3 :5: 1.2.1)** |

**MODULE – 5**

| | | | | |
|---|---|---|---|---|
| **9.** | **a** | Explain Divergence and curl of electric field and magnetic field | **05** | **(2 :4: 1.1.1)** |
| | **b** | State and explain gauss divergence theorem | **05** | **(2 :4: 1.1.1)** |
| | **c** | Define resonance and explain determination of resonant frequency and quality factor in series and parallel circuit in the laboratory. | **10** | **(3 :5: 1.2.1)** |

**OR**

| | | | | |
|---|---|---|---|---|
| **10.** | **a** | Derive equation for displacement current. | **05** | **(2 :4: 1.1.1)** |
| | **b** | Write four Maxwell's equations in vacuum. | **05** | **(1 :4: 1.1.1)** |
| | **d** | What is transistor and explain determination input and output resistance and amplification factor in the laboratory. | **10** | **(3 :5: 1.2.1)** |

** ** **



Note: (**RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI - Performance Indicator)**