# PRESIDENCY UNIVERSITY
## BENGALURU

## SCHOOL OF ENGINEERING

### TEST - 1

**Even Semester**: 2018-19

**Course Code**: PHY101

**Course Name**: Engineering Physics

**Programme & Sem**: B.Tech (Physics Cycle) & II Sem

**Date**: 06 March 2019

**Time**: 1 Hour

**Max Marks**: 40

**Weightage**: 20%

## Instructions:

(i)    *Read the questions properly and answer accordingly.*

(ii)   *Question paper consists of 3 parts.*

(iii)  *Scientific and non-programmable calculators are allowed.*

(iv)   *Given: $m_e$ = 9.1 × $10^{-31}$ kg, h = 6.626 × $10^{-34}$ J-s, $K_B$ = 1.38 × $10^{-23}$ J/K, c = 3 × $10^8$ m/s*

## Part A

Answer **all** the Questions. **Each** question carries **four** marks.          (3Qx4M=12)

1. Define the following terms with suitable diagram. a) Population inversion b) Optical fiber.

2. What are Asymmetric stretching mode and Bending mode?

3. How does an optical fiber transmit light? Mention the types of optical fibers based on the refractive index profile.

## Part B

Answer **both** the Questions. **Each** question carries **eight** marks.          (2Qx8M=16)

4. Explain construction, principle and working of Semiconductor laser with necessary diagrams.

5. i) The core refractive index of the optical fiber is 1.45 and relative refractive index is 2.5%. Determine the numerical aperture and critical angle of the fiber.

   ii). Find the radius of the single mode fiber with core refractive index 1.48, cladding refractive index 1.46 operating at 750nm with V-number = 2.405.

**P.T.O**

## Part C

Answer **any one** Question. Question carries **twelve** marks.                    (1Qx12M=12)

6.  i). Derive the relation for numerical aperture and acceptance angle with proper schematics.

    ii) Calculate the ratio of stimulated to spontaneous emission for a system in thermal equilibrium at 300K in which radiation of wavelength 1.39 µm are emitted.

## OR

7.  i) For atomic transition derive the relations between Einstein's A & B coefficients.

    ii) The ratio of population of two energy levels (upper state to lower state) is given as $1.08 \times 10^{-31}$.Calculate the temperature of the system if the wavelength emitted is 632nm.

# PRESIDENCY UNIVERSITY
## BENGALURU

### SCHOOL OF ENGINEERING

### TEST - 2

**Even Semester**: 2018-19                    **Date**: 15 April 2019

**Course Code**: PHY 101                    **Time**: 1 Hour

**Course Name**: Engineering Physics          **Max Marks**: 40

**Program & Sem**: B.Tech & II Sem (Physics Cycle)     **Weightage**: 20%

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**Instructions:**

I.   *Read the question properly and answer accordingly*

II.  *Question paper consists of 3 parts*

III. *Scientific and Non-programmable calculators are permitted*

IV.  *Given* : $\varepsilon_0 = 8.854 \times 10^{-12}$ F/m; $\mu_0 = 4\pi \times 10^{-7}$ Henry/m

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## Part A

Answer **all** the Questions. **Each** question carries **four** marks.          (3Qx4M=12)

1. Define Critical Temperature and Critical magnetic field.

2. Define Magnetization and Magnetic Susceptibility.

3. Define Dielectric Constant, Dielectric Polarization and Polarizability.

## Part B

Answer **both** the Questions. **Each** question carries **eight** marks.          (2Qx8M=16)

4. a) Distinguish between Type-I and Type-II Superconductors.

   b) Calculate the flux density and magnetization of copper given magnetic field strength of $10^6$ A/m and magnetic susceptibility is $- 0.8 \times 10^{-5}$ .

5. a) Explain Electronic Polarization, Ionic Polarization and Orientation Polarization.

   b) Calculate the polarization produced in a dielectric medium of dielectric constant 6 when it is subjected to an electric field of 100 V/m.

## Part C

Answer **any one** Question. Question carries **twelve** marks.          (1Qx12M=12)

6. a) Distinguish between dia, para and ferromagnetic materials.

   b) A magnetic material has a magnetization of 2100 A/m and produces a flux density of 0.00314 $Wb/m^2$. Calculate the magnetizing force and relative permeability of the material.

### OR

7. a) Deduce the Clasius-Mossotti equation using the expression of internal field.
   b) The Polarizability of Ne gas is $0.35 \times 10^{-40}$ $Fm^2$. If the gas contains $2.7 \times 10^{25}$ atom/$m^3$ at 0°C and 1 atmospheric pressure, calculate its dielectric constant.

# PRESIDENCY UNIVERSITY
# BENGALURU

## SCHOOL OF ENGINEERING

### MAKE UP EXAMINATION JULY 2019

**Semester**: Make up July 2019

**Course Code**: PHY 101

**Course Name**: Engineering Physics

**Program & Sem**: B.Tech & II Sem (2018 Batch)

**Date**: 23 July 2019

**Time**: 3 Hours

**Max Marks**: 80

**Weightage**: 40%

## Instructions:

(i)    *Read the questions properly and answer accordingly.*

(ii)   *Question paper consists of 3 parts.*

(iii)  *Scientific and non-programmable calculators are allowed.*

(iv)   *Given: $K_B = 1.38 \times 10^{-23}$ J/k, $h = 6.626 \times 10^{-34}$ J-s, $\varepsilon_0 = 8.854 \times 10^{-12}$ F/m, $\mu_0 = 4\pi \times 10^{-7}$ H/m, $c = 3 \times 10^8$ m/s.*

## Part A

Answer **all** the Questions. **Each** question carries **one** mark.          (20Qx1M=20M)

1.

i. Which of the following is a unique property of laser?

a) Directional      b) Speed      c) Coherence      d) Wavelength

ii. When laser light is focused on a particular area for a long time, then that particular area alone will be heated.

a) True      b) False

iii. Principle of laser is

a) Spontaneous absorption   b) simulated emission   c) Induced emission   d) both b and c

iv. LASER is a short form of

a). Light Amplification by Spontaneous Emission of Radiation.

b). Light Amplification by Stimulated Emission of Radiation.

c). Light Absorption by Stimulated Emission of Radiation.

d). Light Absorption by Spontaneous Emission of Radiation.

v. What is the principle of fibre optical communication?

a). Frequency modulation

b). Population inversion

c). Total internal reflection

d). Doppler Effect.

vi. A single mode fibre has low intermodal dispersion than multimode.
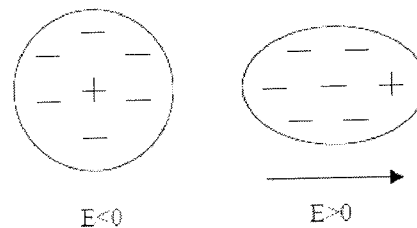
    a) True    b) False

vii. How does the refractive index vary in Graded Index fibre?

    a) Tangentially    b) Radially    c) Longitudinally    d) Transversely

viii. What is the value of dielectric constant of free space?

    a) $8.854 * 10^{-9}$ F m$^{-1}$    b) $8.854 * 10^{-12}$ F$^{-1}$    c) $8.854 * 10^{-15}$ F$^{-1}$    d) $8.854 * 10^{-6}$ F$^{-1}$

ix. Which polarization process does this figure represent?



E<0        E>0

    a) Ionic    b) Electronic    c) Orientation    d) Space charge

x. Polarization occurring due to magnetic moment is known as _____

    a) Ionic    b) Electronic    c) Orientation    d) Space charge

xi. Solids do not have which type of polarisation?

    a) Ionic    b) Orientational    c) Interfacial    d)Electronic

xii. The phenomena of super conductors was first discovered by _____

    a) Kammerlingh Onnes    b) Neils bohr    c) Richard Smalley    d) Otto lehman

xiii. Super conductors are discovered in the year _____

    a) 1900    b) 1991    c) 1911    d) 1905

xiv. The presence of parallel alignment of magnetic dipole moment is given by which materials?

    a) Diamagnetic    b) Ferrimagnetic    c) Paramagnetic    d) Ferromagnetic

xv. The susceptibility is independent of temperature in which material?

    a) Paramagnetic    b) Ferromagnetic    c) Diamagnetic    d) Ferromagnetic

xvi. In ferromagnetic materials the susceptibility is infinity. State True/False

    a) True    b)    False

xvii. Is it possible to determine the exact position and momentum of a moving particle accurately and Simultaneously.

    a) Yes    b)No

xviii. De Broglie wavelength associated with an electrons is given by

    a) $\lambda = \dfrac{h}{\sqrt{2meV}}$    b) $\lambda = \dfrac{c}{\sqrt{2meV}}$    c) $\lambda = \dfrac{h}{\sqrt{2V}}$    d) $\lambda = \dfrac{h}{\sqrt{2m}}$

xi. Consider a particle of a mass 'm' free to move in one dimension along positive -direction between 0 to L. The potential energy outside this region is _____

      a) Infinite    b) Zero   c) constant   d) None of these

xx. Efficiency of a solar cell can be estimated by

a) $\eta = \dfrac{Pmax}{Input\ optical\ power}$    b) $\eta = \dfrac{100}{Input\ optical\ power}$

c) $\eta = \dfrac{P\ out\ put\ poert}{Input\ optical\ power}$    d) $\eta = \dfrac{Pmax}{Input\ optical\ power} \times 100$

## Part B

Answer **all** the Questions. **Each** question carries **ten** marks.     (4Qx10M=40M)

2. Derive the relation between phase velocity and group velocity.

3. Derive the expression for wave function of a particle inside a potential well.

4. i) With a neat diagram, explain the principle, construction and working of

    solar cell.        (8 marks)

  ii) Find the energy band-gap of semiconductor diode which emits light of

    wavelength 1.15 µm.     (2 marks)

5. i) Find the De-Broglie wavelength of an electron accelerated through a potential

    difference of 100 V. mass of electron = $9.1 \times 10^{-31}$ kg, charge of electron = $1.6 \times 10^{-19}$ C.

        (5 marks)

  ii) Calculate the energy of an electron in the 5$^{th}$ excited state inside a 1 dimensional

    infinite potential well of 2nm width.    (5 marks)

## Part C

Answer **any 4** Questions. **Each** question carries **five** marks.   (4Qx5M=20M)

6. S.T superconductor are exhibiting perfect diamagnetic in nature.   (5 marks)

7. i) Draw the hysteresis curve for a ferromagnetic material neatly.   (2 marks)

  ii) A magnetic field of 1800 A/m produces a magnetic flux of $3 \times 10^{-5}$ Wb in an

    iron bar of cross sectional area 0.2 cm$^2$.Calculate the permeability.   (3 marks)

8. i) write a note on orientation and space charge polarization mechanisms with

    temperature?     (2 marks)

ii) Mention the frequencies at which electronic, ionic and orientation polarization mechanisms occurs in a dielectric material under the influence of A.C voltage.

(3 marks)

9. Explain the requisites of a laser system.                                    (5 marks)

10. Derive an expression between critical angle and refractive indices of the mediums considered.                                                         (5 marks)

11. i) Find the ratio of population of the higher to lower energy state in a diode laser that produces light of wavelength 6500 Å at 30°C.                (2.5 marks)

ii) Calculate the refractive indices of core and cladding from the following data:

Numerical aperture =0.27 and relative refractive index ($\Delta$)= 0.015       (2.5 marks)

## PRESIDENCY UNIVERSITY
## BENGALURU

### SCHOOL OF ENGINEERING

### END TERM FINAL EXAMINATION

**Even Semester**: 2018-19                                    **Date**: 21 May 2019

**Course Code**: PHY 101                                      **Time**: 3 Hours

**Course Name**: Engineering Physics                          **Max Marks**: 80

**Program & Sem**: B.Tech & II Sem (Physics cycle)            **Weightage**: 40%

**structions:**

(i)    *Read the question properly and answer accordingly.*
(ii)   *Question paper consists of 3 parts.*
(iii)  *Scientific and Non-programmable calculators are permitted.*
(iv)   *Constants:* $h = 6.625 \times 10^{-34} Js$, $k_B = 1.38 \times 10^{-23} J/K$, $c = 3 \times 10^8 \ m/s$. $m_e = 9.1 \times 10^{-31} kg$, $e = 1.6 \times 10^{-19} C$

### Part A

Answer **all** the Questions. **Each** question carries **one** mark.                (20Qx1M=20M)

1.  Choose the correct answer from the given options

    i.  The relation between B, M and H is

        (a) H = $\mu_o$(M+ B)      (b) $\mu_o$M = (H + B)      (c) B = $\mu_o$ (H + M)      (d) None of these.

    ii. Expulsion of magnetic fields in superconductors is called

        (a) Interference          (b) Paramagnetism   (c) Polarisation          (d) Meissner effect.

    iii. The emission of photon without being aided by any external agency is called

        (a) Spontaneous emission              (b) Induced absorption

        (c) Light amplification               (d) Stimulated emission.

    iv. The temperature at which super conductivity occurs is called

        (a) Low temperature                   (b) Critical temperature

        (c) Super temperature                 (d) High temperature

    v.  The area of the acceptance cone is a function of _____

        (a) The size difference between the fiber's core and cladding

(b) Velocity of light propagating through it.

(c) The refractive index difference between the fiber's core and cladding

(d) All of these.

vi. The polarization which can occur at a very high frequency of voltage, in the order of $10^{15}$ Hz is

(a) Space charge  (b) Orientation  (c) Ionic  (d) Electronic.

vii. Solar cell work on the principle of

(a) Photo- voltaic effect  (b) Photo- electric effect

(c) Photo-diffusivity  (d) Photoconductivity.

viii. The fill factor of the solar cell lies in the range of

(a) 0.8 -1  (b) 0.65 - 0.8  (c) 0.45 - 0.6  (d) 0.15 - 0.3.

ix. MRI is

(a) Magnetic Resistance Imaging  (b) Magnetic Resistance Induction

(c) Magnetic Resonance Imaging  (d) Magnetic Resonance Induction.

x. Measure of extent to which a substance becomes magnetized when it is placed in an external magnetic field is called

(a) Permeability  (b) Permittivity  (c) Resistivity  (d) susceptibility.

2. Fill in the blanks

i. LASER stands for ----------.
ii. ---------- type of optical fiber is used in telephone lines for long distance communications.
iii. ---------- is a parameter to determine the number of modes in a step index fiber.
iv. The pumping mechanism used in semiconductor laser is ------------.
v. The unit of intensity of magnetization is -----------.

3. Match the following
    i.   Superconductors          i.   Meissner effect
    ii.  Dielectric materials      ii.  Intrinsic semiconductors
    iii. Pure semiconductors       iii. Solar cells
    iv.  Maglev                    iv.  Insulators
    v.   Crystalline Silicon       v.   Diamagnetic

## Part B

Answer **all** the Questions. **Each** question carries **ten** marks.  (4Qx10M=40M)

4. Derive time independent Schrodinger equation in three dimensions.

5. Define Phase velocity and Group velocity, deduce the relation between them.

6. (i) An electron at rest is accelerated through a potential of 1000 V. Calculate the de-Broglie wavelength of matter wave associated with it.

(ii) Calculate the minimum energy of an electron in an infinite deep potential well of width 5 nm.

7. With a neat labelled diagram, explain the construction and working of a solar cell.

## Part C

Answer **any four** Questions. **Each** question carries **five** marks.  (4Qx5M=20M)

8. Distinguish between hard and soft magnetic materials.

9. Write short notes on (i) population inversion (ii) metastable state.

10. Discuss the effect of frequency on polarization with a neat diagram.

11. Explain Meissner effect. Show that the superconductors are perfectly diamagnetic in nature.

12. Find the wavelength at which the rates of spontaneous and stimulated emission become equal at a temperature of 500 K.

13. Give 5 advantages of fiber optic communication.