Total No. of Questions : 6]

SEAT No. :

PF12250

[Total No. of Pages : 4

[6624]-602

E.E.

BSC-102-BES : ENGINEERING PHYSICS

(2024 Credit Pattern) (Semester - I/II)

Time : 2½ Hours] *[Max. Marks : 60*

Instructions to the candidates:

1) *Q1 is compulsory. Attempt any one of the remaining questions.*
2) *Figures to the right indicate full marks.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Use of non-programmable Electronic pocket calculators is allowed.*
5) *Assume suitable data, if necessary.*

Physical Constants:

- *Plank's constant, $h = 6.63 \times 10^{-34}$ J.S*
- *Mass of electron, $m_e = 9.1 \times 10^{-34}$ Kg*
- *Charge on electron, $e = 1.6 \times 10^{-19}$ C*

Q1) Write the correct option with answers for the following questions (1 mark each). **[10]**

a) Which of the following is not a characteristic of laser light?
   i) Monochromatic
   ii) Coherent
   iii) Highly divergent
   iv) High intensity

b) The numerical aperture (NA) of an optical fiber depends on
   i) Core and cladding refractive indices
   ii) Length of fiber
   iii) Wavelength only
   iv) Ambient temperature

c) According to de Broglie, the wavelength of a particle is inversely proportional to
   i) Square of mass
   ii) Its momentum
   iii) Square of its velocity squared
   iv) None of the above

d) A quantum bit (qubit) can exist in
   i) Only 0 state
   ii) Only 1 state
   iii) Either 0 or 1 at a time
   iv) A superposition of 0 and 1

P.T.O.

SPPUQuestionPapers.com
CEGP019071
103.157.122.163 05/06/2026 13:33:06 in pnq-static-163-122-157-103

e) Polarized light has

i) Vibrations in all directions
ii) Vibrations in a single plane
iii) No specific vibration direction
iv) Random phase relation

f) In a wedge shaped film, the fringe width is given as

i) $\beta = \frac{\lambda}{2\mu\theta}$

ii) $\beta = \frac{\theta}{2\mu\lambda}$

iii) $\beta = \frac{\lambda}{2\mu}$

iv) $\beta = \frac{\lambda}{2\theta}$

g) The Hall coefficient in a semiconductor is used to determine

i) Band gap energy
ii) Carrier concentration
iii) Density of the material
iv) Dielectric constant

h) Ultrasonic waves used in non-destructive testing have frequency typically above

i) 20 Hz
ii) 20 kHz
iii) 1 kHz
iv) 5 Hz

i) Nanoparticles have at least one dimension in the range of

i) 1–100mm
ii) 1–100 cm
iii) 1–100 nm
iv) 1–100 μm

j) The Meissner effect in superconductivity refers to

i) Zero electrical resistance
ii) Expulsion of magnetic field
iii) Increase in energy gap
iv) Thermal conductivity enhancement

SPPUQuestionPapers.com
CEGP01967 | 103.157.122.163 05/06/2026 13:33:06 in-pnq-static-163-122-157-103

Q2) a) Solve anyone

i) What is holography? Explain, with the help of a neat diagram, the process of recording of a hologram using a laser source. **[5]**

ii) Explain construction and working of CO_2 laser. **[5]**

b) Solve any one

i) What is meant by attenuation losses in an optical fiber? Explain any two types of attenuation losses briefly. **[5]**

ii) State the relation between the acceptance angle and the acceptance cone of an optical fiber. An optical fiber has a core refractive index of 1.72 and a cladding refractive index of 1.63. Calculate the numerical aperture of the fiber and determine its corresponding acceptance angle. **[5]**

Q3) a) Solve any one

i) Derive the equation for the energy of a particle enclosed in a one dimensional rigid box or infinite potential well. **[5]**

ii) Explain properties of matter waves (any four). An electron is confined in a one-dimensional rigid box of length 2 Å. Calculate the energy of the electron in its ground state. **[5]**

b) Solve any one

i) Explain fundamental principles of quantum computing. Discuss the potential applications of quantum computing in various fields. **[5]**

ii) State the de Broglie hypothesis and hence calculate the kinetic energy (in ev) that an electron must possess in order to have a de Broglie wavelength of 12.5 nm. **[5]**

Q4) a) Solve any one

i) What is a wedge-shaped thin film? State the conditions for maxima and minima in reflected and transmitted light for wedge-shaped thin film. **[5]**

ii) What is a thin film of uniform thickness? Give one example. A parallel beam of monochromatic light of wavelength 622 nm is incident on a glass plate of refractiveindex 1.5 such that the angle of refraction inside the plate is 60°. Calculate the minimum thickness of the glass plate for which it appears daric in reflected light. **[5]**

SPPUQuestionPapers.com

b) Solve any one

i) Explain the phenomenon of double refraction on the basis of Huygens's theory. **[5]**

ii) State Malus' law with the necessary formula. A polarizer and an analyzer are initially arranged such that the transmitted light intensity is maximum. Determine the intensity of the transmitted light when the analyser is rotated through (1) 30° and (2) 90°. **[5]**

Q5) a) Solve any one

i) What is meant by the Fermi energy in a semiconductor? Draw a neat and labelled diagram for a PN junction diode showing Fermi energy levels in (1) Unbiased (zero bias) state (2) Forward bias. **[5]**

ii) State and explain Hall effect? A doped silicon sample has an electrical conductivity of 100 $\Omega^{-1}m^{-1}$ and a Hall coefficient of 3.6×10^{-4} m^3 C^{-1}. Calculate the mobility of the charge carriers. **[5]**

b) Solve any one

i) With the help of a neat and labeled diagram, explain the generation of ultrasonic waves using piezoelectric oscillators. **[5]**

ii) State the properties of ultrasonic waves (any two). An ultrasonic pulse of frequency 200 kHz is transmitted through a steel block, and the reflected echo is received after 3.0 μs. If the velocity of ultrasonic waves in steel is 6000 m/s, calculate the thickness of the steel block. **[5]**

Q6) a) Solve any one

i) What is nanotechnology? Explain quantum confinement and surface to volume ratio in case of nanoparticles. **[5]**

ii) Explain any two applications of nanoparticles in brief. **[5]**

b) Solve any one

i) State and explain the Meissner effect. Hence, show that a superconductor exhibits perfect diamagnetism. **[5]**

ii) Explain critical magnetic field for superconductors with a suitable diagram. A superconductor has a critical magnetic field of 0.08 T at 0 K. Calculate its critical magnetic field at 4 K, given that the critical temperature is 8 K. **[5]**

✪ ✪ ✪

SPPUQuestionPapers.com