Faculty of Engineering / Science
End Semester Examination May 2025
EN3BS16 / BC3BS06 Engineering Physics

Programme	:	B.Tech. / B.Sc.	Branch/Specialisation	:	ALL
Duration	:	3 hours	Maximum Marks	:	60

Note: *All questions are compulsory. Internal choices, if any, are indicated. Assume suitable data if necessary. Notations and symbols have their usual meaning.*

		Marks	CO	BL
Section 1 (Answer all question(s))				

Q1. The wave function associated with a material particle is-   **1 2 2**
- ○ Only finite
- ○ Only continuous
- ○ Only single valued
- ◉ Finite, continuous and single valued

Q2. An electron, proton and a car all have the same wavelength. The one possessing highest velocity is-   **1 1 3**
- ◉ Electron
- ○ Proton
- ○ Car
- ○ All have same velocity

Q3. The value of grating element depends on-   **1 2 1**
- ○ Width of opaque space
- ○ Width of slit
- ◉ Width of opaque space and slit
- ○ Distance between source and screen

Q4. Which of the following materials exhibits double refraction?   **1 2 1**
- ○ Water
- ○ Glass
- ◉ Calcite
- ○ Air

Q5. The liquid drop model explains: **1 2 1**
- ○ The discrete energy levels of nucleons
- ○ The stability of noble gases
- ◉ Nuclear binding energy and fission process
- ○ The behavior of ideal gases

Q6. What two fields are used in the velocity selector of the Bainbridge mass spectrograph?   **1 3 1**
- ○ Gravitational and electric
- ◉ Magnetic and electric
- ○ Thermal and electromagnetic
- ○ Optical and sound

Q7. The number of atoms in FCC structure is: **1 3 1**
- ○ 1
- ○ 2
- ○ 3
- ◉ 4

Q8. The interracial angles of a triclinic crystal system are given by-   **1 3 2**
- ○ $\alpha = \beta = \Upsilon = 90$ degree
- ○ $\alpha = \beta = 90$ degree $\Upsilon = 120$ degree
- ○ $\alpha = \beta = \Upsilon \neq 90$ degree
- ◉ $\alpha \neq \beta \neq \Upsilon \neq 90$ degree

Q9. According to Einstein's relation, ratio of probability of spontaneous emission to stimulated emission depends on-   **1 3 2**
- ○ Momentum
- ◉ Frequency
- ○ Temperature
- ○ Mass

Q10. If V-Number of fiber is 3.55 then it is a _____ fiber.   **1 4 3**
- ○ Single mode
- ○ Graded index
- ○ Step index
- ◉ Multimode

Q11. An electron has a momentum 5.4×10^{-26} kg.m/ sec with an accuracy of 0.05%. Find the minimum   3   4   3
uncertainty in the location of the electron.

Rubric	Marks
Correct Formula	1
Remaining calculation	2

Q12. (a) What is Compton's effect? Obtain the expression for Compton's shift. Why does the Compton   7   4   3
Effect primarily occur with high-energy photons, rather than with visible light?

Rubric	Marks
Compton Effect	1
Diagram	1
Derivation	4
Reason for only high energy photons	1

(OR)

(b) Obtain Schrodinger's wave equation for a particle in a square well potential and discuss energy
levels when the well is infinitely deep.

Rubric	Marks
Upto Boundary Conditions and Schrodinger's Eq	2
Full Derivation	4
Explanations of energy levels	1

Q13. The Newton's ring are seen in reflected light of wavelength 5896 angstrom. The radius of curvature of   3   4   3
plano convex lens is 1 m and air film is replaced by a liquid whose refractive index is to be calculated
under the condition if 16th ring is dark and its diameter is 5.1 mm.

Rubric	Marks
Correct Formula	1
Remaining calculation	2

Q14. (a) Explain the formation of interference fringes by means of Fresnel's biprism when a monochromatic source of light is used, and derive the expression for the fringe width. Write the formula for determination of wavelength of monochromatic light using biprism method.　　　**7　2　1**

Rubric	Marks
Explanation of fringe formation	2
Diagrams	1
Fringe width derivation	3
Wavelength measurement	1

(OR)

(b) Discuss difference between Fraunhofer and Fresnel diffraction. Derive an expression for the intensity due to single slit diffraction.

Rubric	Marks
difference between Fraunhofer and fresnel diffraction (only two required)	2
Diagram	1
Derivation	4

Section 4 (Answer all question(s))　　　**Marks CO BL**

Q15. The magnetic induction in a cyclotron which is accelerating protons is 1.5 weber $/m^2$. How many times per second should the potential across the Dees reverse?　　　**3　4　3**

Rubric	Marks
Correct Formula -1	1
Remaining calculation	2

Q16. (a) What is a LINAC? Explain its working principle with suitable diagram. What are the limitations of LINAC?　　　**7　2　1**

Rubric	Marks
What is a LINAC	1
Diagram	2
working principle	3
limitations of LINAC	1

(OR)

(b) Explain the principle, construction and working of G. M. Counter. How is quenching achieved in it?

Rubric	Marks
Diagrams	2
principle, construction and working	4
quenching	1

Section 5 (Answer all question(s))　　　**Marks CO BL**

Q17. Write a short note on intrinsic and extrinsic semiconductors. What would be the position of Fermi level in these semiconductors?　　3　　3　2

Rubric	Marks
Intrinsic and extrinsic semiconductors	2
Fermi level position	1

Q18. (a) Explain the concept of Miller indices. How they are calculated? In a crystal, a lattice plane makes intercepts at a length of a, b/2 and c. Find the miller indices of the plane.　　7　　4　1

Rubric	Marks
concept of Miller indices	1
Process of calculation	3
Solution of problem	3

(OR)

(b) What is the Meissner Effect? What are the applications of superconductivity?

Rubric	Marks
What is the Meissner Effect	3
Diagrams	1
Applications of superconductivity	3

Section 6 (Answer all question(s))

Marks CO BL

Q19. An optical fiber has a numerical aperture of 0.22 and relative refractive index difference Δ is 0.012. Determine the refractive index of the core, refractive index of the cladding and acceptance angle of the fiber.　　3　　4　3

Rubric	Marks
Correct Formula	1
Remaining calculation	2

Q20. (a) Explain the working principle of optical fiber. Classify the fibers on the basis of modes and on the basis of refractive index profile.　　7　3　1

Rubric	Marks
Working principle of optical fiber	2
on the basis of modes with diagram	2.5
on the basis of refractive index profile with diagram	2.5

(OR)

(b) Explain the construction and working of He-Ne laser with the help of block diagram and energy level diagram. Can we use optical pumping in this laser? Justify your answer.

Rubric	Marks
Block diagram	1
Energy level diagram	2
Construction and working	3
question on optical pumping	1

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