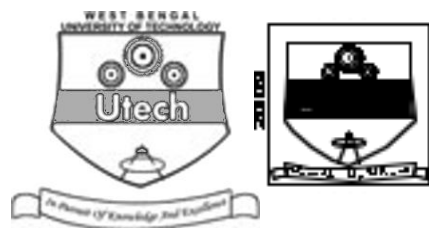


ENGINEERING PHYSICS (SEMESTER - 2)

CS/B.TECH(O+N)/SEM-2/PH-201/09



1.
Signature of Invigilator

2.
Signature of the Officer-in-Charge

Reg. No.

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Roll No. of the Candidate

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CS/B.TECH(O+N)/SEM-2/PH-201/09

ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE – 2009

ENGINEERING PHYSICS (SEMESTER - 2)

Time : 3 Hours]

[Full Marks : 70

INSTRUCTIONS TO THE CANDIDATES :

1. This Booklet is a Question-cum-Answer Booklet. The Booklet consists of **32 pages**. The questions of this concerned subject commence from Page No. 3.
2. a) In **Group – A**, Questions are of Multiple Choice type. You have to write the correct choice in the box provided **against each question**.
b) For **Groups – B & C** you have to answer the questions in the space provided marked 'Answer Sheet'. Questions of **Group – B** are Short answer type. Questions of **Group – C** are Long answer type. Write on both sides of the paper.
3. **Fill in your Roll No. in the box** provided as in your Admit Card before answering the questions.
4. Read the instructions given inside carefully before answering.
5. You should not forget to write the corresponding question numbers while answering.
6. Do not write your name or put any special mark in the booklet that may disclose your identity, which will render you liable to disqualification. Any candidate found copying will be subject to Disciplinary Action under the relevant rules.
7. **Use of Mobile Phone and Programmable Calculator is totally prohibited in the examination hall.**
8. You should return the booklet to the invigilator at the end of the examination and should not take any page of this booklet with you outside the examination hall, **which will lead to disqualification**.
9. Rough work, if necessary is to be done in this booklet only and cross it through.

No additional sheets are to be used and no loose paper will be provided

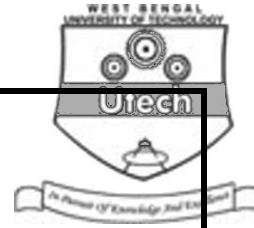
FOR OFFICE USE / EVALUATION ONLY

Marks Obtained

	Group – A										Group – B					Group – C					Total Marks	Examiner's Signature
Question Number																						
Marks Obtained																						

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Head-Examiner/Co-Ordinator/Scrutineer

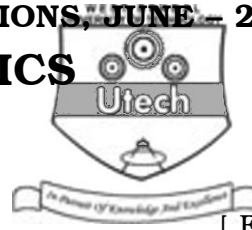
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ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE - 2009

ENGINEERING PHYSICS**SEMESTER - 2**

Time : 3 Hours]

[Full Marks : 70

GROUP - A**(Multiple Choice Type Questions)**1. Choose the correct alternatives for any *ten* of the following : 10 × 1 = 10

i) Newton's ring experiment is based on

- a) division of amplitude
- b) division of wave-front
- c) none of these.

ii) de Broglie wavelength of a particle of mass m and kinetic energy E is

- a) $\lambda = \frac{h}{2mE}$
- b) $\frac{h}{\sqrt{2mE}}$
- c) $\frac{\sqrt{2mE}}{h}$.

iii) Mass of a photon of frequencies ν is given by

- a) $\frac{h\nu}{c}$
- b) $\frac{h\nu}{c^2}$
- c) $\frac{h\nu^2}{c}$

iv) The eigenvalue of the eigenfunction e^{ix} for the operator $\frac{d^2}{dx^2}$ is

- a) 1
- b) 0
- c) - 1.



- v) Miller indices of a plane which cut intercepts of 2, 3 and 4 units along the three axes are
- a) (2, 3, 2)
- b) (2, 3, 4)
- c) (6, 4, 3).
- vi) In a plane transmission grating, light
- a) diffracts to produce the resultant pattern
- b) diffracts and interfares to produce the resultant pattern
- c) interfares to produce the resultant pattern.
- vii) The atomic radius of a face centred cubic crystal of lattice constant a is
- a) $\frac{a}{2}$
- b) $\frac{\sqrt{3}a}{4}$
- c) $\frac{\sqrt{2}a}{4}$.
- viii) An X-ray tube is subjected to a potential difference of 50 kV with the corresponding current of 8 mA through it. The number of electrons striking per second on the target material is
- a) 5×10^{16}
- b) 6×10^{11}
- c) none of these.
- ix) In He-Ne laser, the laser light emits due to the transition from
- a) $3s \rightarrow 2p$
- b) $3s \rightarrow 3p$
- c) $2s \rightarrow 2p$.
- x) For an optical fibre, if n_0 , n_1 and n_2 are the refractive index of air, core and cladding region respectively, then
- a) $n_0 > n_2 > n_1$
- b) $n_1 > n_2 > n_0$
- c) $n_2 > n_1 > n_0$.



xi) If the speed of an electron increases, the specific charge

- a) increases
- b) decreases
- c) remains constant.

xii) One milligram of matter converted into energy will give

- a) 90 joule
- b) 9×10^{10} joule
- c) None of these.

xiii) Relative velocity of two particles moving with velocity (C) of light in opposite direction is

- a) C
- b) $2C$
- c) O .

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following.

$3 \times 5 = 15$

2. a) What is the difference between temporal coherence and spatial coherence ? 2
- b) If the amplitudes of two coherent light waves are in the ratio 1 : 4, find the ratio of maximum and minimum intensity in the interference pattern. 3
3. a) What is Compton effect ? Calculate the Compton wavelength for an electron. $1 \frac{1}{2} + 1 \frac{1}{2}$
- b) Why does the unmodified line appear in Compton scattering ? 2
4. a) Deduce the formulae for interplaner spacing of a simple cubic crystal. 4
- b) Why X-ray diffraction is used for crystal structure analysis ? 1
5. Find the possible arrangements of two particles in three cells for
 - i) Bose-Einstein Statistics &
 - ii) Fermi-Dirac Statistics. $2 \frac{1}{2} + 2 \frac{1}{2}$



6. a) Describe briefly the working principle of laser action. 3
- b) Mention at least three main advantages of optical fibre over wire or cable ? 2
7. a) What are the basic postulates of special theory of relativity ? 2
- b) Show that for $V \ll C$, Lorentz transformation reduces to the Galilean transformation. 3
8. a) Discuss the important characteristics of nuclear forces. 2
- b) Why nuclear fission reaction must be done first before nuclear fusion ? 3

GROUP – C

(Long Answer Type Questions)

Answer any *three* questions.

3 × 15 = 45

9. a) What is double refracting crystal ? 2
- b) Discuss Nicol prism as polarizer and analyzer. 4
- c) Determine the Brewster's angle for glass of refractive index 1.5 immersed in water of refractive index 1.33. 3
- d) Prove that the intensities of secondary maxima formed for Fraunhofer diffraction at a single slit are of decreasing order. 3
- e) In a plane transmission grating the angle of diffraction for 2nd order maxima for wavelength 5×10^{-5} cm is 30° . Calculate the number of lines in one centimetre of the grating surface. 3
10. a) State and explain de Broglie hypothesis. 2
- b) Prove that the product of phase velocity and group velocity for a de Broglie wave is equal to the square of the velocity of light. 5
- c) Compute the smallest possible uncertainty in the position of an electron moving with velocity 3×10^7 m/s. The rest mass of electron is 9.1×10^{-31} kg. 3
- d) Derive the Wein's displacement law from Planck's radiation law. 5
11. a) Write down the postulates of Fermi-Dirac statistics. 3
- b) Plot electron distribution function governed by Fermi-Dirac statistics in metal at $T = 0\text{K}$ and $T > 0\text{K}$. Explain their physical significance. 2 + (3 + 3)
- c) Why Compton effect can not be observed with visible light but can be observed due to X-rays ? 4



12. a) Discuss the operation of a Ruby laser with the help of energy level diagram. 5 + 1
- b) Find the numerical aperture and angle of acceptance of a given optical fibre. [Given, the refractive indices of core and cladding are 1.562 and 1.497 respectively]. 3
- c) In a He-Ne laser transition from 3s to 2p level gives a laser beam of wavelength 632.8 nm. If the 2p level has energy equal to 15.2×10^{-19} J, calculate the required pumping energy (assuming no loss of energy). 4
- d) What is the role of optical resonator in laser production ? 2
13. a) Write down Schrödinger equation for one dimensional motion of a free particle in a one dimensional potential box. Find its eigenfunction and eigenenergy. 1 + 3 + 3
- b) Prove that the first excited energy state of a free particle in a cubical box has three fold degeneracy. 4
- c) Copper has FCC structure and the atomic radius is 0.1278 nm. Find its density and the interplanar spacing for (321) planes. The atomic weight of copper is 63.5. 4
14. a) What are the differences between inertial and non-inertial frame of references ? 2
- b) Deduce an expression of time dilation on the basis of Lorentz transformation equation. 5
- c) Find the mass and speed of 2 MeV electron. 2 + 2
- d) If the total energy of a particle is thrice of its rest energy, find the velocity of the particle. 4
15. a) What is nuclear binding energy ? 2
- b) Draw a binding energy curve. What informations do you set from such a curve ? 2 + 5
- c) Find the energy released for the following nuclear fussion reaction : 3
- $$4\text{ }_1\text{H}^1 \rightarrow \text{}_2\text{He}^4 + 2\text{ }_{+1}\text{e}^0 + \text{energy}$$
- Given that
- mass of $_1\text{H}^1$ atom = 1.007825 amu
- mass of $_2\text{He}^4$ atom = 4.0026 amu
- mass of $_{+1}\text{e}^0$ (positron) = 0.00055 amu.
- d) Differentiate conductor, insulator and semiconductor on the basis of energy band diagram. 3



END

