



Seat No. _____

HB-003-2016033

B. Sc. (Sem. VI) (CBCS) Examination

April - 2023

Electrodynamics and Applied Optics : P-603

(New Course)

Faculty Code : 003

Subject Code : 2016033

Time : $2\frac{1}{2}$ / Total Marks : 70

Instructions :

- (1) All questions are compulsory.
- (2) Figure on right side indicate full marks.
- (3) Symbols have their usual meaning.

1 (a) Objective type questions : **4**

- (1) $\nabla \times \mathbf{E} =$ _____
- (2) The integrands are evaluated at the retarded time, these are called _____.
- (3) When charges accelerate their fields can transport energy irreversibly out to infinity, the process is called _____.
- (4) $P(\mathbf{r}, t) = \oint \mathbf{B} \cdot d\mathbf{a}$. (True/False)

(b) Answer in brief : (any one) **2**

- (1) Find the charge and current distributions that would give rise to the potential.

$$V = 0, \mathbf{A} = \begin{cases} \frac{\mu_0 k}{4C} (Ct - |x|)^2 \hat{Z}, & \text{for } |x| < ct, \\ 0, & \text{for } |x| > ct. \end{cases}$$

Where K is a constant and $C = \frac{1}{\sqrt{\epsilon_0 \mu_0}}$

- (2) Explain blueness of sky and redness of sunset with proper figure.

- (c) Answer in detail : (any one) 3
 (1) What do you mean by gauge transformation ?
 (2) What is radiation ?
- (d) Write a note on : (any one) 5
 (1) Explain Jefimenko's equations.
 (2) Explain electric dipole radiation.
- 2 (a) Objective type questions : 4
 (1) Moving objects are shortened is called _____.
 (2) Moving clock run slow. True/False
 (3) In classical mechanics, _____ is mass times velocity.
 (4) The relativistic energy is non zero even when the object is stationary, the energy is called _____.
- (b) Answer in brief : (any one) 2
 (1) A muon is traveling through the laboratory at $\frac{3}{5}$ the speed of light. How long does it last ?
 (Take life time of muon 2×10^{-6} S)
 (2) Two lumps of clay each of rest mass m , collides head-on at $\frac{3}{5} C$. When they stick together, find the mass of composite lump.
- (c) Answer in detail : (any one) 3
 (1) Write and explain Einstein's postulates.
 (2) Explain structure of space time.
- (d) Write a note on : (any one) 5
 (1) Explain Lorentz transformation.
 (2) Explain relativistic energy and momentum.
- 3 (a) Objective type questions : 4
 (1) In which process light amplification occur ?
 (2) In Nd-YAG laser _____ ions are active centres.
 (3) The full form of LIDAR is _____.
 (4) _____ laser is used in CD player.
- (b) Answer in brief : (any one) 2
 (1) The wavelength of emission is 6000 \AA and the coefficient of spontaneous emission is $10^6/\text{S}$. Determine the coefficient for the stimulated emission.
 (Take $\mu = 1$ $h = 6.62 \times 10^{-34} \text{ J.S}$)

- (2) Find the value of R_1 for $f = 5 \times 10^{14}$ Hz at $T = 300$ K.
(Take $K = 1.38 \times 10^{-23}$ J/K)
- (c) Answer in detail : (any one) 3
- (1) Explain : Optical resonant cavity.
(2) Explain : Population inversion.
- (d) Write a note on : (any one) 5
- (1) Explain the construction and working of Ruby laser.
(2) Explain : Holography.
- 4** (a) Objective type questions : 4
- (1) The intensity _____ with increase in order of diffraction.
(2) X-rays are produced whenever high speed _____ are stopped abruptly by target.
(3) Formation of Laue spots can be explained with the help of _____ law.
(4) X-ray produce chemical effect on photographic plate. True/False.
- (b) Answer in brief : (any one) 2
- (1) Find the wavelength of 2nd order X-rays by NaCl crystal at an angle of 4° (The grating element of NaCl is 2.81 \AA)
(2) An X-ray tube operating at 50 KV produces continuous X-ray spectrum. If $C = 3 \times 10^8$ m/s, $h = 6.624 \times 10^{-34}$ J.S and $e = 1.6 \times 10^{-19}$ coulomb find the short wavelength limit.
- (c) Answer in detail : (any one) 3
- (1) Obtain the expression for Bragg's law.
(2) Write the properties of X-rays.
- (d) Write a note on : (any one) 5
- (1) With neat diagram explain Bragg's spectrometer.
(2) Obtain Brillouin zones for bcc lattice.
- 5** (a) Objective type questions : 4
- (1) The angle of incident for which the angle of refraction is 90° , is called _____.
(2) The innermost cylindrical region of optical fibre is known as _____.
(3) Optical fibre works on the principle of _____.
(4) _____ is the measure of how much light can be collected by optical fibre.

- (b) Answer in brief : (any one) 2
- (1) Calculate the numerical aperture of an optical fibre with a clad index of 1.50 and core index of 1.55.
 - (2) Calculate the fractional index change for a given optical fibre, if the refractive indices of the core and the cladding are 1.563 and 1.498 respectively.
- (c) Answer in detail : (any one) 3
- (1) Give medical applications of optical fibre.
 - (2) Discuss : Attenuation.
- (d) Write a note on : (any one) 5
- (1) Derive an expression for acceptance angle of the optical fibre.
 - (2) Draw the block diagram of fibre optics communication system and discuss the function of its components.
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