

S.No. : 616

NBS4102

No. of Printed Pages : 04

Following Paper ID and Roll No. to be filled in your Answer Book.

PAPER ID : 49902

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B. Tech Examination 2023-24

(Odd Semester)

ENGINEERING PHYSICS

Time : Three Hours]

[Maximum Marks : 60

Note :- Attempt all questions.

SECTION - A

1. Attempt all parts of the following :

$1 \times 8 = 8$

- What do you mean by optic axis?
- What do you mean by coherent sources?
- What do you mean by grating element?
- Define metastable state. *egⁿ of continuity*
- What is numerical aperture?
- What was the objective of conducting the Michelson-Morley experiment?

[P. T. O.]

- (g) What is ~~holography~~? *specific rotation*
- (h) Show that the rest mass of a photon is zero.

SECTION - B

2. Attempt any two parts of the following. $6 \times 2 = 12$

- (a) A thin film of soap solution is illuminated by white light at an angle of incidence $i = \sin^{-1}(4/5)$. In reflected light, two dark consecutive overlapping fringes are observed corresponding two wavelengths $6.1 \times 10^{-7} \text{ m}$ and $6.0 \times 10^{-7} \text{ m}$. The refractive index for soap solution is $4/3$. Calculate the thickness of the film.

- (b) ~~A communication system uses a 10 km fibre~~ *1000 Watt lamp.*
having a loss of 2.5 dB/Km . Compute the output power if the input power is $500 \mu \text{ W}$. *Calculate E & H*

- (c) A clock keeps correct time. With what speed should it be moved relative to an observer so that it may appear to lose 4 minutes in 24 hours.

- (d) A sugar solution in a tube of 20 cm produces optical rotation of 13° . The solution is then diluted to one-third of its previous concentration. Find the optical rotation produced by 30 cm long tube containing the diluted solution.

SECTION - C

3. Attempt any two parts from each question. Each part carry equal marks. $8 \times 5 = 40$
- (a) Describe the formation of Newton's ring in reflected light. Prove that in reflected light the diameter of dark rings are proportional to the square root of natural numbers.
- (b) Describe Fraunhofer diffraction due to a single slit and deduce the positions of the maxima and minima. Show that the relative intensities of the successive maxima are nearly $1 : \frac{4}{9} \pi^2 : \frac{4}{2} \pi^2 : \frac{4}{49} \pi^2$.
- (c) What is polarised light? How will you produce and detect plane, elliptically and circularly polarised light?
4. (a) Describe the Rayleigh's criterion for resolution. Derive an expression for the resolving power of grating.
- (b) Define Einstein's coefficient of absorption, spontaneous emission and induced emission. Obtain relationship between them.

Define ν_g & ν_g & show that
& $\nu_p \times \nu_g = c^2$

[P. T. O.]

- (c) What do you understand by the modes of an optical fibre? Discuss the merit and demerits of single mode fibres over multimode fibre.
5. (a) Derive Lorentz transformations and use them to find out the expression for length contraction.
- (b) ~~X~~ *Poynting vector & theorem* Draw a neat diagram of He-Ne laser and describe its method of working. What are the characteristics of laser beam?
- (c) Describe the construction and working of a Nicol prism. How it can be used as a polariser and analyser?
6. (a) ~~X~~ *Time indep. Schrodinger eq.* Explain the principle of holography using construction and reconstruction of images.
- (b) Deduce Einstein's mass-energy relation $E = mc^2$ and discuss it. Give some evidence showing its validity.
- (c) Discuss the effect of introducing a thin plate in the path of one of the two interfering beams in biprism experiment. Deduce the expression for displacement of fringes.

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NBS 4202

No. of Printed Pages : 04

Following Paper ID and Roll No. to be filled in your Answer Book.

PAPER ID : 49906

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B. Tech. Examination 2023-24

(Even Semester)

ENGINEERING PHYSICS

Time : Three Hours]

[Maximum Marks : 60

Note :- Attempt all questions.

SECTION - A

1. Attempt all parts of the following : $8 \times 1 = 8$

- (a) What are coherent sources?
- (b) What do you mean by grating element?
- (c) What are the characteristics of a wave function?
- (d) What is Bragg's law?
- (e) Define specific rotation.
- (f) Show that velocity of matter wave is greater than velocity of light.

[P. T. O.]

- (g) What are inertial and non-inertial frames?
(h) Show that rest mass of photon is zero.

3.

SECTION – B

2. Attempt any two parts of the following : $2 \times 6 = 12$

- (a) In Newton's ring experiment, the diameter of 15th dark ring was found to be 0.590 cm and that of 5th ring is 0.336 cm. If the radius of plano-convex lens is 100 cm, calculate the wavelength of light used.
- (b) An electron has speed $4 \times 10^5 \text{ ms}^{-1}$ within the accuracy of 0.01%. Calculate the uncertainty in the position of electron.
- (c) If earth receives $2 \text{ cal min}^{-1} \text{ cm}^{-2}$ solar energy, what are the amplitudes of electric and magnetic field of radiation?
- (d) If the kinetic energy of a body is twice the rest energy, find the velocity of body.

4.

SECTION – C

Note :- Attempt all questions. Attempt any two parts from each questions. $8 \times 5 = 40$

3. (a) Discuss the formation of Newton's ring in reflected light. Prove that in reflected light, the diameter of dark ring is proportional to the square root of natural number.
- (b) Describe the Rayleigh's criterion for resolution. Derive an expression for resolving power of grating.
- (c) Explain the construction and working of Nicol prism.
4. (a) Derive time independent Schrodinger wave equation.
- (b) Show that group velocity is equal to the velocity of particle.
- (c) What are matter waves? Show that De-broglie wavelength associated with a particle of mass 'm' and kinetic energy 'E' is given by :

$$\lambda = \frac{h}{\sqrt{2mE}}$$

5. (a) What is Poynting vector? Derive and explain Poynting theorem.

[P. T. O.]

- (b) Show that velocity of plane electromagnetic wave in free space is given by :

$$C = \frac{1}{\sqrt{\mu_0 \epsilon_0}}$$

- (c) Explain the basic principle of optical fibre. Discuss fibre classification.

6. (a) What was the objectives of Michelson-Morley experiment? Describe the experiment. How is the negative result of experiment interpreted?
- (b) Establish mass-energy relation.
- (c) Derive relativistic formula for the variation of mass with velocity.

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NBS 4202/4102

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B.Tech. Examination, September 2024

(Special Carry Over Paper)

ENGINEERING PHYSICS

Time : Three Hours]

[Maximum Marks : 60

Note :- Attempt all questions.

SECTION-A

1. Attempt all parts of the following : $8 \times 1 = 8$

- (a) Two independent sources could not produce interference, why?
- (b) What do you mean by grating element?
- (c) What is optic axis?
- (d) What are the outcomes of Lave's experiment?
- (e) What is Photon?

[P. T. O.

- (f) Write equation of continuity.
- (g) What is the basic principle of optical fibre?
- (h) What are inertial and non-inertial frame of references?

SECTION - B

2. Attempt any two parts of the following : $2 \times 6 = 12$

- (a) Calculate the minimum number of lines in a grating which will just resolve the lines of wavelength 5890 \AA and 5896 \AA in the second order.
- (b) Calculate De-Broglie wavelength of neutron of energy 12.8 MeV .
- (c) Assuming that all the energy from a 1000 watt lamp is radiated uniformly, calculate the average values of intensities of electric and magnetic fields of radiation at a distance of 2m from the lamp.
- (d) A particle of rest mass m_0 moves with speed $\frac{C}{\sqrt{2}}$. Calculate its mass, momentum and kinetic energy.

SECTION - C

Note :- Attempt all questions. Attempt any two parts from each questions. $8 \times 5 = 40$

3. (a) What are Newton's rings? Prove that in reflected light, diameter of the dark ring is proportional to the square root of natural numbers.
- (b) Define resolving power. Derive an expression for the resolving power of grating.
- (c) Describe construction and working of Laurent's half shade polarimeter.
4. (a) Derive time independent Schrodinger wave equation.
- (b) What is Heisenberg uncertainty principle? Apply this to calculate binding energy of electron in an atom.
- (c) What is Bragg's law? Describe Bragg's spectrometer.
5. (a) What is Poynting vector? Derive Poynting theorem.

[P. T. O.]

- (b) Explain the concept of displacement current. How it led to the modification of Ampere's law?
 - (c) Discuss fibre classification.
6. (a) Derive mass-energy relation. Give some evidence showing its validity.
- (b) Obtain the relativistic formula for addition of velocities. Also show that it is consistent with Einstein's second postulate.
 - (c) Explain why a moving clock appears to go slow to a stationary observer?
