Total No. of Questions: 6 *Total No. of Printed Pages:3*

Enrollment No.....

Faculty of Engineering

End Sem (Even) Examination May-2018

EN3BS05 Engineering Physics

Programme: B.Tech. Branch/Specialisation: All

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

Q.1 i. The Einstein's coefficients are **1**

(a) A for emission and B for absorption
(b) A for spontaneous emission and B_{12} and B_{21} for absorption and stimulated emission
(c) A for absorption and B_{12} and B_{21} for spontaneous and stimulated emission
(d) A for absorption and B_{12} and B_{21} for stimulated absorption and emission

ii. If n_1 and n_2 are the refractive index of core and cladding of an optical fiber respectively then the Numerical Aperture is given by **1**

(a) $(n_1^2 - n_2^2)$ (b) $(n_1^2 - n_2^2)^3$
(c) $(n_1^2 - n_2^2)^{1/2}$ (d) $1/(n_1^2 - n_2^2)$

iii. In Newton's ring arrangement the diameter of rings formed is proportional to **1**

(a) λ (b) $\sqrt{\lambda}$ (c) $1/\sqrt{\lambda}$ (d) $1/\lambda$

iv. Nicol prism is based on the phenomenon of **1**

(a) Refraction (b) Reflection
(c) Double refraction (d) Double reflection

v. Heisenberg Uncertainty principle holds for **1**

(a) Microscopic and macroscopic particles
(b) Only microscopic particles
(c) Only macroscopic particles
(d) All of these

vi. Matter waves were first experimentally observed by **1**

(a) De-Broglie (b) Schrodinger
(c) Davisson and Germer (d) Bohr

P.T.O.

vii. Divergence of a vector field is: **1**
(a) Scalar
(b) Vector
(c) Not defined
(d) None of these

viii. Required time for a sound to decay to 60 dB is called as **1**
(a) Echo time (b) Delay time
(c) Reverberation time (d) Transient time

ix. Force that produces an acceleration of 1 ms^{-2} in a body of mass of 1 kg is called **1**
(a) Slow Newton (b) Zero Newton
(c) One Newton (d) Two Newton

x. Elastic collision is collision in which kinetic energy is **1**
(a) Conserved (b) Not conserved
(c) Increases (d) Decreases

Q.2 i. Differentiate between Spontaneous emission and Stimulated emission **2**

ii. A glass clad fiber is made with core glass of refractive index 1.5 and the cadding is doped to give a index difference of 0.0005. Determine **3**
(a) The cladding refractive index
(b) The acceptance angle
(c) The numerical aperture

iii. Explain the construction and working of Ruby laser with neat diagram. **5**

OR iv. Explain the different types of Optical fibers with suitable diagram. **5**

Q.3 i. What is Malus law? **2**

ii. In a plane transmission grating the angle of diffraction for the second order principal maximum for the wavelength 5 x 10^{-5} cm is 30^0. Calculate the number of lines in one centimetre of grating surface. **3**

iii. Describe and explain the formation of Newton's ring in reflected monochromatic light. Prove that the diameters of bright rings are proportional to the square-roots of the odd natural numbers. **5**

OR iv. What is diffraction grating? Obtain an expression for maxima and minima due to fraunhofer diffraction at a single slit with intensity distribution curve. **5**

Q.4 i. Explain the concept of Miller indices. **2**

ii. Define wave packet and give any two properties of matter wave. **3**

OR iii. A particle is moving in one-dimensional box described by **5**
$V = 0$ for $0 < x < L$
$V = \infty$ for $0 \geq x$ and $x \geq L$
Write and solve its Schrodinger's wave equation and obtain Eigen value and Eigen function.

OR iv Write short note on: **5**
(a) Heisenberg's Uncertainty principle
(b) Compton's Effect

Q.5 i. Write short note on: **4**
(a) Electromagnetic Damping
(b) Sabines formula in accoustics

ii. Write Maxwells equation and derive electromagnetic wave equation in free space using it. **6**

OR iii. Give the physical significance of Curl and prove stokes theorem. **6**

Q.6 Attempt any two:

i. What are pseudo forces? Explain any one pseudo force by giving its application. **5**

ii. Derive gravitational potential due to a uniform spherical body at a point P on the surface of it and draw a graph showing the variation of potential with distance. **5**

iii. Differentiate between elastic collision and inelastic collision by giving one example each. **5**

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Marking Scheme
EN3BS05 Engineering Physics

Q.1 i. The Einstein's coefficients are **1**
(b) A for spontaneous emission and B_{12} and B_{21} for absorption and stimulated emission

ii. If n_1 and n_2 are the refractive index of core and cladding of an optical fiber respectively then the Numerical Aperture is given by **1**
(c) $(n_1^2 - n_2^2)^{1/2}$

iii. In Newton's ring arrangement the diameter of rings formed is proportional to **1**
(b) $\sqrt{\lambda}$

iv. Nicol prism is based on the phenomenon of **1**
(c) Double refraction

v. Heisenberg Uncertainty principle holds for **1**
(b) Only microscopic particles

vi. Matter waves were first experimentally observed by **1**
(c) Davisson and Germer

vii. Divergence of a vector field is a **1**
(a) Scalar

viii. Required time for a sound to decay to 60 db **1**
(c) Reverberation time

ix. Force that produces an acceleration of 1 ms^{-2} in a body of mass of 1 kg is called **1**
(c) One newton

x. Elastic collision is collision in which kinetic energy is **1**
(a) Conserved

Q.2 i. Differentiate between Spontaneous emission and Stimulated emission **2**
Spontaneous emission -1 mark
Stimulated emission - 1 mark

ii. A glass clad fiber is made with core glass of refractive index 1.5 and the cladding is doped to give a index difference of 0.0005. Determine **3**
a) The cladding refractive index
b) The acceptance angle
c) The numerical aperture

Solution:
Cladding index difference = (n1 – n2) /n1 - 1 mark
So n2 = 1.49925
Acceptance angle = $\sin^{-1}\left(\sqrt{(n_1^2 - n_2^2)}\right)$ - 1 mark
Acceptance angle = 2.72^0

Numerical aperture = $\sqrt{(n_1^2 - n_2^2)}$ - 1 mark
Numerical aperture = 0.0474

iii. Explain the construction and working of Ruby laser with neat diagram. **5**
Diagram - 1 mark
Energy level diagram - 1 mark
Description - 3 marks

OR iv. Explain with suitable diagram the different types of Optical fibers. **5**
Types of fibers- - 2 marks
Explanation of each three types -3 marks

Q.3 i. What is Malus law? **2**

ii. In a plane transmission grating the angle of diffraction for the second order principal maximum for the wavelength 5 x 10^{-5} cm is 30^0. Calculate the number of lines in one centimetre of grating surface. **3**
$(e + d)\sin\theta = n\lambda$ - 1 mark
n = 2 , $\lambda = 5\,x\,10^{-5}$ cm $\theta = 30^0$
(e + d) = 10^{-3} cm
Number of lines in one centimetre = $\frac{1}{e+d} = \frac{10000}{2} = 5000$ - 2 marks

iii. Describe and explain the formation of Newton's ring in reflected monochromatic light. Prove that the diameters of bright rings are proportional to the square-roots of the odd natural numbers. **5**
Diagram - 1 mark
Explanation of diagram - 1 mark
Proof - 3 marks

OR iv. What is diffraction grating? Obtain an expression for maxima and minima due to fraunhofer diffraction at a single slit with intensity distribution curve. **5**
What is diffraction grating - 1 mark

Expression for Intensity - 2 marks
Expression of maxima - 0.5 mark
Expression of minima - 0.5 marks
Intensity distribution curve - 1 mark

Q.4 i. Explain the concept of Miller indices. **2**

ii. Define wave packet and give any two properties of matter wave. **3**
Definition - 1 mark
Properties each 1 mark (1 mark * 2) - 2 Marks

OR iii. A particle is moving in one-dimensional box described by **5**
$V = 0$ for $0 < x < L$
$= \infty$ for $0 \geq x$ and $x \geq L$
Write and solve its Schrodinger's wave equation and obtain eigen value and eigen function.
Explanation of diagram - 1 mark
Wave function - 2 marks
Eigen value - 2 marks

OR iv Write short note on: **5**
a) Heisenberg's Uncertainty principle
Expression - 0.5 Marks
Statement -2 marks
b) Compton's Effect
Statement -2 marks
Diagram -0.5 marks

Q.5 i. Write short note on **4**
a) Electromagnetic Damping -2 marks
b) Sabines formula in acoustics -2 marks

ii. Write Maxwells equation and derive electromagnetic wave equation in free space using it. **6**
Maxwells equation - 2 marks
Derivation - 4 marks

OR iii. Give the physical significance of Curl and prove stokes theorem. **6**
physical significance of Curl - 2 marks
proof of stokes theorem - 4 marks

Q.6 Attempt any two:

i. What are pseudo forces? Explain any one pseudo force by giving its application. **5**
Pseudo forces - 2 marks
Explanation of any one pseudo force by giving its application - 3 marks

ii. Derive gravitational potential due to a uniform spherical body at a point P inside the body and draw a graph showing the variation of potential with distance. **5**
Diagram - 1mark
Derivation - 3 marks
Graph - 1 mark

iii. Differentiate between elastic collision and inelastic collision by giving one example each. **5**
Differentiation - 3 marks
Example each - 2 marks