

Total No. of Questions: 6

Total No. of Printed Pages:3

Enrollment No.....



Faculty of Engineering
End Sem (Odd) Examination Dec-2017
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. In Ruby Laser which ions give rise to the laser action 1
(a) Al_2O_3 (b) Al^{3+} (c) Cr^{3+} (d) None of them
 - ii. Optical fiber communication is based on the phenomenon of 1
(a) Refraction (b) Total internal reflection
(c) Polarization (d) Diffraction
 - iii. In Newton's ring experiment which type of source is used: 1
(a) Mercury lamp (b) Sodium lamp
(c) Incandescent lamp (d) Fluorescent lamp
 - iv. In Fraunhofer diffraction, the incident wave front should be 1
(a) Elliptical (b) Plane (c) Spherical (d) Cylindrical
 - v. Compton effect supports: 1
(a) Wave nature of radiation
(b) Particle nature of radiation
(c) Both particle and wave nature of radiation
(d) None of these
 - vi. The wavelength of matter wave is independent of 1
(a) Mass (b) Velocity (c) Momentum (d) Charge
 - vii. What provides the restoring force for simple harmonic motion in 1
the simple pendulum
(a) Elasticity (b) Gravity (c) Weight (d) Friction
 - viii. Divergence of a vector field is: 1
(a) Vector Quantity (b) Scalar Quantity
(c) Not defined (d) Infinite

P.T.O.

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- ix. Can the centre of mass of a body lie where there is absolutely no mass **1**
(a) Yes (b) No
(c) Both (a) and (b) (d) None of these
- x. A body is moving with a uniform speed along a circle. The force acting on the body is **1**
(a) Centripetal force (b) Centrifugal force
(c) Coriolis force (d) Reaction force
- Q.2 i. A 3 mW laser beam ($\lambda_0 = 6328$) is incident on the eye. On the retina, it forms a circular spot of radius of about 20 μm . Calculate the appropriate intensity on the retina. **2**
- ii. Explain three quantum processes occurring when a light wave interacts with matter. Obtain the relationship between Einstein's A and B coefficient. Why it is difficult to prepare laser in X-ray region? **8**
- OR iii. Explain the propagation of light through an optical fibre with a neat diagram and obtain the expression of numerical aperture giving its physical significance. What is V-parameter? **8**
- Q.3 i. What is Brewster's Law? **2**
- ii. In Newton's ring experiment the diameter of 10th ring changes from 1.40 cm to 1.27 cm when a liquid is introduced between the lens and the plate. Calculate the refractive index of the liquid. **3**
- iii. Derive an expression for Intensity for the diffraction pattern due to a single slit and show that the intensity of first secondary maxima is about 4.5 % of that of principal maxima. **5**
- OR iv. Why two independent sources of light of same wavelength cannot produce observable interference pattern? Describe with full experimental details the method for determination of wavelength of light using Fresnel biprism. **5**

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- Q.4 i. Give the importance of Miller indices and symmetry of elements in crystal structure. **3**
- ii. What is a wave packet? Define phase, particle and group velocity. Explain the concept of Heisenberg uncertainty principle. **7**
- OR iii. Obtain the energy Eigen values and the normalized Eigen functions of a particle in an infinite square well. Draw the graph of Eigen functions and their absolute squares for the lowest four states. **7**
- Q.5 i. What is damped simple harmonic oscillations? Draw the graph of damped oscillation (displacement vs time). Write the examples of damped oscillations. **4**
- ii. Define reverberation time and absorption coefficient. What is Sabine's formula for reverberation time? Write applications for acoustics for designing of hall. **6**
- OR iii. What is the physical significance of Maxwell's equations? Given the concept of Displacement current. **6**
- Q.6 i. Heavier bodies need greater initial effort to put them in motion. Why? **2**
- ii. What is meant by a collision? Discuss two types of collision with their essential characteristics. **3**
- iii. Derive the expression for the gravitational potential due to a solid sphere at a point outside the sphere. **5**
- OR iv. Write short note on: **5**
(a) Coriolis Force
(b) Conservation of linear momentum

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Marking Scheme

Q.1	i.	(c) Cr^{3+}	1
	ii.	(b) total internal reflection	1
	iii.	(b) sodium lamp	1
	iv.	(b) plane	1
	v.	(b) particle nature of radiation	1
	vi.	(d) charge	1
	vii.	(b) gravity	1
	viii.	(b) scalar field	1
	ix.	(a) Yes	1
	x.	(b) centrifugal force	1
Q.2	i.	$P = 3 \text{ mW}$, $\lambda_0 = 6328 \text{ nm}$, $r = 20 \text{ }\mu\text{m}$. Area of focussed spot $A = \pi r^2 = 1.3 \times 10^{-9} \text{ m}^2$ Intensity on the retina $I = \frac{P}{A} = 2.36 \times 10^6 \text{ W/m}^2$	1 1
	ii.	Three quantum processes and its explanation with diagram Relationship between Einstein's A and B coefficient. Why it is difficult to prepare laser in X-ray region?	3 4 1
	OR iii.	Propagation of light through an optical fibre, Diagram Derivation of expression of numerical aperture. Physical Significance of numerical aperture What is V-parameter -	2 3 1 2
Q.3	i.	Brewster's Law: Statement and formula	1+1
	ii.	$(D_n^2)_{\text{liquid}} = \frac{4n\lambda R}{\mu} = 4 \times 10^4 \lambda R / 1.40$	1
		$(D_n^2)_{\text{air}} = \frac{4n\lambda R}{1.00} = 4 \times 10^4 \lambda R / 1.00$	1
		$\mu = \frac{(D_n^2)_{\text{air}}}{(D_n^2)_{\text{liquid}}} = \frac{(1.40)^2}{(1.27)^2} = 1.215$	1
iii.	Intensity Expression due to a single slit The intensity of first secondary maxima 4.5 % of I_0	4 1	
OR iv.	Two independent sources of light cannot produce sustained interference because they are not coherent. The atoms emitting light in the two sources are independent of each other.	1	

		Experimental details for Fresnel's Bi Prism	4
Q.4	i.	Importance of Miller indices and Symmetry of elements in crystal	1.5 each
	ii.	Wave Packet Phase, particle and Group Velocity Heisenberg's Uncertainty Principle	2 1+1+1 2
OR	iii.	Energy Eigen values and the normalized Eigen functions Draw the graph of Eigen functions and their absolute squares for the lowest four states.	5 2
Q.5	i.	Damped simple harmonic oscillations Draw the graph of damped oscillation (displacement vs time). The examples of damped oscillations.	1 1 2
	ii.	Definition of reverberation time and absorption coefficient. Sabine's formula for reverberation time? Applications for acoustics for designing of hall.	2 2 2
	OR iii.	Physical significance of Maxwell's equations Displacement current.	4 2
Q.6	i.	According to Newton's second law of motion, $F = ma$ i.e. For Heavier bodies (of large mass), initial effort (Force F) required is large.	2
	ii.	Meaning of collision Types of collision: Elastic and Inelastic collision essential characteristics	1 1 1
OR	ii.	Expression for Gravitational Potential	5
	iv.	(a) Coriolis force (b) Conservation of linear momentum	2.5 2.5