Enrolment No......................................

Faculty of Engineering
End Sem. (Odd) Examination Dec-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.   Ruby laser comes under the category of: **1**
             (a) Semiconductor laser   (b) Liquid laser
             (c) Solid state laser   (d) Gas laser

       ii.   Optical fibers are basically   **1**
             (a) Insulators   (b) Conductors
             (c) Semiconductors   (d) Superconductors

       iii. In case of Newtons ring experiment, on insertion of liquid in the   **1**
             film, the diameter of ring:
             (a) Decreases
             (b) Increases
             (c) May decreases or increases
             (d) None of these

       iv.   For Fraunhofer diffraction, the first diffraction minima due to a   **1**
             single slit diffraction is at $\theta = 30^0$ for a light of $5000A^0$ wave
             length. What is the width of the slit?
             (a) 5×10^{-5}cm   (b) 10×10^{-5}cm (c) 2.5×10^{-5}cm (d) 1.25×10^{-5}cm

       v.   De-Broglie waves are associated with   **1**
             (a) Moving neutral particles only
             (b) Moving charged particles only
             (c) All moving particles
             (d) All particles whether in motion or at rest

       vi.   Which relation between radius of atom and lattice constant   **1**
             represents the FCC structure
             (a) r = a/2   (b) r = a $\sqrt{3}/4$ (c) a$\sqrt{2}/4$ (d) r=a

P.T.O.

vii. Which of the following statements is correct? **1**
For a particle executing simple harmonic motion about the origin
(a) The acceleration is maximum when the displacement is maximum.
(b) The acceleration is maximum at the origin.
(c) The velocity is maximum when the displacement is maximum.
(d) The force is maximum at the origin

viii. The magnetic susceptibility of a superconducting material is **1**
(a) -1 (b) Positive and very large
(c) Negative and very large (d) +1

ix. If two objects of 30kg and 10kg move with equal kinetic energy, **1**
then what is the ratio of magnitudes for linear momentum
(a) $\sqrt{3}:1$ (b) $1:\sqrt{3}$ (c) $1:3\sqrt{3}$ (d) 1:3

x. The reduced mass of a system consisting of two masses m_1 and **1**
m_2 is:
(a) Less than m_1 (b) Less than m_2
(c) Greater than m_1 and m_2 (d) Less than m_1 and m_2

Q.2 i. Why is four level lasers more efficient than three level laser? **2**
ii. A Ruby Laser has its metastable state at 1.79eV from which **3**
stimulated emission produces laser light. Calculate the
wavelength of light.
iii. Define Numerical Aperture of an optical fiber. Deduce suitable **5**
expression relating numerical aperture and acceptance angle.
OR iv. Explain with diagram any one type of Gas laser. **5**

Q.3 i. Explain Rayleigh criterion of resolution. **2**
ii. Explain the phenomenon of double refraction in a calcite crystal. **3**
iii. Explain the formation of rings in Newtons ring experiment and **5**
prove that diameter of dark ring is proportional to the square root
of natural numbers.
OR iv. Prove that in single slit diffraction pattern, intensity of first **5**
secondary maxima is 4.5% of the intensity of principal maxima.

Q.4 i. The De-Broglie wavelength of a proton is 0.8×10^{-10}m. Calculate **2**
the energy in eV if its mass is 1.67×10^{-27}kg.
ii. Explain Heisenberg's uncertainity principle with its elementary **3**
proof.
iii. Derive the expression for energy values and wave function for a **5**
particle in a box.
OR iv Write short note on: **5**
(a) Miller Indices (b) Matter waves

Q.5 i. Deduce suitable expression for reduced mass of a two particle **3**
system.
ii. Differentiate between elastic and inelastic collision. A car of **7**
500kg travelling at 30m/s rear ends another car of 600kg,
travelling at 20m/s in the same direction. The collision is great
enough that the two cars stick together after they collide. How
fast will both cars be going after the collision.
OR iii. What is gravitational law? Derive suitable expression for **7**
potential due to a spherical shell.

Q.6 i. At zero magnetic field a superconducting tin has a critical **3**
temperature of 3.7K. At 0 K, the critical magnetic field is
0.306T. Calculate critical magnetic field at 2.0K
ii. What is reverberation time? Explain clearly what causes **7**
reverberation in a hall and how it can be minimised. Derive
Sabine's expression for the reverberation time.
OR iii. Define superconducting state. Discuss Meissner effect in detail **7**
and prove that superconductors are perfectly diamagnetic in
nature.

******

<div align="center">

Marking Scheme

EN3BS05 Engineering Physics

</div>

Q.1 i. Ruby laser comes under the category of: **1**
(c) Solid state laser

ii. Optical fibers are basically **1**
(a) Insulators

iii. In case of Newtons ring experiment, on insertion of liquid in the film, the diameter of ring: **1**
(a) Decreases

iv. For Fraunhofer diffraction, the first diffraction minima due to a single slit diffraction is at $\theta = 30^0$ for a light of $5000A^0$ wave length. What is the width of the slit? **1**
(b) 10×10^{-5} cm

v. De-Broglie waves are associated with **1**
(c) All moving particles

vi. Which relation between radius of atom and lattice constant represents the FCC structure **1**
(c) $a\sqrt{2}/4$

vii. Which of the following statements is correct? **1**
For a particle executing simple harmonic motion about the origin
(a) The acceleration is maximum when the displacement is maximum.

viii. The magnetic susceptibility of a superconducting material is **1**
(a) -1

ix. If two objects of 30kg and 10kg move with equal kinetic energy, then what is the ratio of magnitudes for linear momentum **1**
(a) $\sqrt{3}:1$

x. The reduced mass of a system consisting of two masses m_1 and m_2 is: **1**
(d) Less than m_1 and m_2

Q.2 i. Why is four level lasers more efficient than three level laser? **2**
As per explanation

ii. A Ruby Laser has its metastable state at 1.79eV from which stimulated emission produces laser light. Calculate the wavelength of light. **3**
Formula   1 mark
Correct answer   2 marks

iii. Numerical Aperture of an optical fiber. Deduce suitable expression relating numerical aperture and acceptance angle. **5**
Definition   1 mark
Diagram   1 mark
Derivation   3 marks

OR iv. Any one type of Gas laser. **5**
Diagram   1 mark
Energy level diagram   1 mark
Description   3 marks

Q.3 i. Rayleigh criterion of resolution. **2**

ii. Phenomenon of double refraction in a calcite crystal. **3**

iii. Explain the formation of rings in Newtons ring experiment and prove that diameter of dark ring is proportional to the square root of natural numbers. **5**
Diagram   1 mark
Rest   4 marks

OR iv Prove that in single slit diffraction pattern, intensity of first secondary maxima is 4.5% of the intensity of principal maxima. **5**
Diagram   1 mark
Intensity Relation   2 marks
Complete Result   2 marks

Q.4 i. The De-Broglie wavelength of a proton is 0.8×10^{-10} m. Calculate the energy in eV if its mass is 1.67×10^{-27} kg. **2**
Formula   1 mark
Correct Answer   1 mark

ii. Explain Heisenberg's uncertainity principle with its elementary proof. **3**
Heisenberg's uncertainity principle   1 mark
Proof   2 marks

	iii.	Derive the expression for energy values and wave function for a particle in a box.		**5**
		Diagram & Equation	1 mark	
		Energy value	2 marks	
		Wavelength	2 marks	
OR	iv	Write short note on:		**5**
		(a) Miller Indices	2.5 marks	
		(b) Matter waves	2.5 marks	

Q.5	i.	Expression for reduced mass of a two particle system.		**3**
	ii.	Difference b/w elastic and inelastic collision.	3 marks	**7**
		How fast will both cars be going after the collision.	4 marks	
OR	iii.	Gravitational law	2 marks	**7**
		Diagram	1 mark	
		Rest	4 marks	

Q.6	i.	At zero magnetic field a superconducting tin has a critical temperature of 3.7K. At 0 K, the critical magnetic field is 0.306T. Calculate critical magnetic field at 2.0K.		**3**
		Formula	1 mark	
		Calculation	2 marks	
	ii.	Reverberation time	2 marks	**7**
		Causes reverberation in a hall and how it can be minimised	2 marks	
		Sabine's expression for the reverberation time	3 marks	
OR	iii.	Definition superconducting state	2 marks	**7**
		Meissner effect	2 marks	
		Proof	3 marks	

*****