Code No: R161104 **R16** SET - 1

I B. Tech I Semester Supplementary Examinations, Nov/Dec - 2017
APPLIED PHYSICS
(Com. to ECE, CSE, IT, EIE, E Com E)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1.	a)	What is interference of light? Can interference be observed with independent sources of light?	(2M)
	b)	Distinguish between the phenomena of interference and diffraction.	(2M)
	c)	Define Plane of polarisation and Plane of vibration.	(2M)
	d)	What are the characteristics of laser light?	(2M)
	e)	How population inversion is achieved in Ruby laser?	(2M)
	f)	What are the limitations of quantum free electron theory?	(2M)
	g)	State Bloch's theorem.	(2M)

PART -B

2.	a)	What is an interferometer? Explain principle and working of Michelson's interferometer.	(10M)
	b)	Fringes of equal inclination are observed in a Michelson interferometer. As one of the mirrors is moved back by 1mm, 3663 fringes move out from the centre of the pattern. Calculate the wavelength of light used.	(4M)
3.	a)	Describe the theory of Fraunhofer diffraction at a single slit. Explain Rayleigh's criterion for resolution.	(10M)
	b)	Light of wavelength 550nm falls normally on a slit of width $22\text{x}10^{-5}$cm. Calculate the angular position of the first two minima on either side of the central maximum.	(4M)
4.	a)	With necessary theory explain the production of plane, circularly and elliptically polarized lights.	(10M)
	b)	Distinguish between spontaneous emission and stimulated emission.	(4M)
5.	a)	State and prove Gauss divergence theorem.	(10M)
	b)	Show that curl of a vector field is a vector quantity.	(4M)
6.	a)	Derive the time dependent Schrodinger wave equation. Give the physical significance of wave function.	(10M)
	b)	Find the lowest energy of an electron confined in one dimensional box of side 0.1nm.	(4M)
7.	a)	Describe different types of semiconductors. Derive the expression for the intrinsic carrier concentration.	(10M)
	b)	Explain applications of Hall effect.	(4M)
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Code No: R161104 **R16** SET - 2

I B. Tech. I Semester Supplementary Examinations, Nov/Dec - 2017
APPLIED PHYSICS
(Com. to ECE, CSE, IT, EIE, E Com E)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1. a) What are coherent sources? (2M)
   b) Define limit of resolution. (2M)
   c) What is the role of an optical resonator in a laser device? (2M)
   d) Define Divergence of vector field. Give one example. (2M)
   e) What is matter wave and give expression for de Broglie's wavelength. (2M)
   f) Define Fermi energy. Write expression for it. (2M)
   g) Explain conductivity of a semiconductor. (2M)

PART -B

2. a) Derive cosine law. Write down the conditions for brightness and darkness in the reflected system. (10M)
   b) The diameter of the 5^{th} bright ring in Newton's ring experiment is $4x10^{-3}$m. Find the radius of curvature of the lens used, if the wavelength of light is 589nm. (4M)

3. a) Explain diffraction of light through a plane transmission grating. Obtain the grating equation. (10M)
   b) Light of wavelength 500nm is incident normally on a slit. The first minimum of the diffraction pattern is observed to lie at a distance of 5mm from the central maximum on a screen placed at a distance of 2m from the slit. Calculate the width of the slit. (4M)

4. a) Describe ruby laser source with relevant energy level diagram. (10M)
   b) What is plane polarized light? Discuss any two methods to produce plane polarized light. (4M)

5. a) Describe the propagation of electromagnetic waves in dielectric medium. Derive expressions for field vectors and Phase velocity. (10M)
   b) Prove that div curl A = 0. (4M)

6. a) Derive an expression for the wave function and energy of a particle confined to one dimensional potential box using Schrodinger's wave equation. (10M)
   b) Calculate the energy difference between the ground state and first excited state of an electron in a one dimensional rigid box of length 10^{-8}cm. (4M)

7. a) What is an energy band? Classify solids into conductors, semiconductors and insulators on the basis of band theory of solids. (10M)
   b) Define effective mass of an electron and derive an expression for it. (4M)
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Code No: R161104 **R16** SET - 3

I B. Tech. I Semester Supplementary Examinations, Nov/Dec - 2017
APPLIED PHYSICS
(Com. to ECE, CSE, IT, EIE, E Com E)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1. a) State the principle of superposition. (2M)
   b) What is diffraction of light and grating? (2M)
   c) How do you distinguish polarized light from un polarized light? (2M)
   d) Discuss pumping scheme of He-Ne laser. (2M)
   e) Why is the wave nature of matter not noticeable in our daily observations? (2M)
   f) What is Rayleigh's criterion for resolution? (2M)
   g) Discuss any two applications of Hall effect. (2M)

PART -B

2. a) What is interference of light? Prove that the diameter of the n^{th} dark ring in a Newton's ring set-up is directly proportional to the square root of the ring number. (10M)
   b) In Newton's rings experiment, the diameter of 4^{th} and 12^{th} dark rings is 0.4cm and 0.7cm respectively. Find the diameter of 20^{th} dark ring. (4M)

3. a) Define resolving power of an optical instrument. Obtain an expression for resolving power of a telescope. (10M)
   b) The telescope of a certain objective has diameter of 100 inches. Estimate the smallest angle between two stars that can be just resolved by it. The mean wavelength is 500 nm. (4M)

4. a) Derive the relationship between Einstein's coefficients and discuss their physical significance. (10M)
   b) Explain the construction of a Nicol prism. (4M)

5. a) State and prove Stoke's theorem. (10M)
   b) Define the terms scalar field and vector field. Give two examples of each. (4M)

6. a) Derive the expression for electrical conductivity according to the quantum free electron theory. (10M)
   b) Discuss drawbacks of classical free electron theory. (4M)

7. a) Discuss the formation of energy bands in solids using Kronig-Penney model. (10M)
   b) Distinguish drift and diffusion currents. (4M)
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Code No: R161104 **R16** SET - 4

I B. Tech. I Semester Supplementary Examinations, Nov/Dec - 2017
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Time: 3 hours Max. Marks: 70

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2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1. a) Explain why Newton rings are circular. (2M)
   b) Differentiate between Fraunhofer and Fresnel's diffraction. (2M)
   c) With energy level diagram explain the term population inversion. (2M)
   d) Define rotational vector field. (2M)
   e) State condition for normalization of the wave function. (2M)
   f) How energy band is formed in solids? (2M)
   g) Give expression for conductivity of an intrinsic semiconductor. (2M)

PART -B

2. a) Explain formation of Newton's rings. Describe how Newton's rings are used to determine the wavelength of Sodium light. (10M)
   b) In Newton's ring experiment the diameter of the 15^{th} dark ring was found to be 0.590cm and that of the 5^{th} dark ring 0.336cm. If the radius of the plano convex lens is 100cm, calculate the wavelength of the light used. (4M)

3. a) Describe the theory of Fraunhofer diffraction due to double slit and draw the intensity distribution curve. (10M)
   b) In double slit Fraunhofer diffraction calculate the fringe spacing on a screen 50cm away from the slits, if they are illuminated with blue light of wave length 480nm. Given slit separation is 0.1mm and slit width is 0.020mm. (4M)

4. a) How can Nicol's prism be used as polarizer and analyzer? Explain in detail with the help of a diagram. (10M)
   b) Distinguish between spontaneous and stimulated emission. (4M)

5. a) Derive electromagnetic wave equation in dielectric medium. (8M)
   b) Explain the terms electric potential, curl and divergence of field. (6M)

6. a) Explain Fermic-Dirac distribution function. Plot this function for various temperatures including 0K. (10M)
   b) Explain the physical significance of the wave function 'Ψ'(psi). (4M)

7. a) Explain Hall effect and derive an expression for Hall coefficient in semiconductors. (10M)
   b) Define effective mass of a hole and derive an expression for it. (4M)

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