Code No: R161207 **R16** SET - 1

I B. Tech II Semester Regular/Supplementary Examinations, April/May - 2018
APPLIED PHYSICS
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

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

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PART –A

1. a) What are Newton's rings? (2M)
   b) Why intensity of light decreases with order in diffraction phenomenon? (2M)
   c) Define E and O-rays. (2M)
   d) Calculate the de Broglie wavelength associated with the proton moving with velocity 10^7 m/s. (2M)
   e) What is bound and free electron? (2M)
   f) What is a scalar field? (2M)
   g) How energy bands are formed in solids? (2M)

PART -B

2. a) What is a thin film? Deduce the conditions of maxima and minima in case of a thin parallel film. (10M)
   b) Light of wavelength 5893 Å is reflected is nearly normal incidence from a soap film of refractive index 1.42. What is the least thickness of the film that will appear i) Black and ii) Bright? (4M)

3. a) Discuss Fraunhofer diffraction of light at a circular aperture. (8M)
   b) Explain Rayleigh's criterion for resolution. (6M)

4. a) Describe the construction and working of Luarent's half-shade polarimeter. (10M)
   b) What are the characteristics of laser light? (4M)

5. a) Derive Maxwell's equations from the basic laws of electromagnetism. Explain physical meaning of each equation. (10M)
   b) What do you understand by the gradient of a scalar field? Explain its physical significance. (4M)

6. a) Obtain Schrodinger time independent wave equation. What is the physical significance of wave function (Ψ) used in this equation? (10M)
   b) What are the drawbacks of classical free electron theory? (4M)

7. a) Explain the determination of Hall co-efficient, carrier concentration and mobility of charge carriers of a semi conductor. (10M)
   b) An electric field of 100 V/m is applied to a sample of n-type semiconductor whose Hall coefficient is -0.0125 m^3/C. Determine the current density in the sample assuming μ_e 0.6 m^2 / V.s. (4M)
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Code No: R161207 **R16** SET - 2

I B. Tech II Semester Regular/Supplementary Examinations, April/May - 2018

APPLIED PHYSICS

(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

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

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PART –A

1.	a)	What is interference of light?	(2M)
	b)	Write conditions for principal maxima in the case of diffraction grating pattern.	(2M)
	c)	Define specific rotation.	(2M)
	d)	Give the mathematical form for 'effective mass of electron'.	(2M)
	e)	What is wave-particle duality?	(2M)
	f)	What is zero divergence, positive and negative divergence?	(2M)
	g)	Express conductivity of a semiconductor interms of mobility of charge carriers.	(2M)

PART -B

2.	a)	Describe Newton's rings method for measuring the wavelength of monochromatic light. Give the necessary theory.	(10M)
	b)	In Newton's rings experiment the diameter of the 15^{th} ring was found to be 0.590 cm and that of the 5^{th} ring 0.336 cm. If the radius of the plano convex lens is 100 cm, calculate the wavelength of the light used.	(4M)
3.	a)	Qualitatively analyze the diffraction pattern obtained when a plane diffraction grating is exposed to monochromatic light of wavelength, λ.	(10M)
	b)	A transmission grating has 8000 rulings per cm. The first order principal maximum due to a monochromatic source of light occurs at an angle of 30^0. Determine the wavelength of light.	(4M)
4.	a)	Deduce the relation between spontaneous and stimulated emission probabilities.	(10M)
	b)	Explain three energy level scheme.	(4M)
5.	a)	Stat and prove Stokes theorem.	(10M)
	b)	Discuss scalar and vector fields.	(4M)
6.	a)	Write down the Schrodinger's wave equation for a particle in a box. Solve it to obtain eigen function and show that eigen values are discrete.	(10M)
	b)	What are the postulates of a quantum free electron theory?	(4M)
7.	a)	How does the band theory of solids lead to the classification of solids into conductors, semiconductors and insulators?	(10M)
	b)	Establish Einstien's relation between diffusion coefficient and mobility of charge carriers.	(4M)

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Code No: R161207 **R16** SET - 3

I B. Tech II Semester Regular/Supplementary Examinations, April/May - 2018
APPLIED PHYSICS
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

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

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PART –A

1. a) What are coherent sources? (2M)
   b) Why the diffraction of light is not as evident in daily experience as that of sound waves? (2M)
   c) Define principal section and optic axis. (2M)
   d) Why laser action is called “inverted absorption”? (2M)
   e) Define Fermi level ‘EF’. (2M)
   f) What is a vector field? (2M)
   g) Locate the position of the Fermi level in the case of N-type semiconductor energy band diagram at 0˚K. (2M)

PART -B

2. a) Explain the construction and working of Michelson’s interferometer. (10M)
   b) Discuss any two applications of Michelson’s interferometer. (4M)

3. a) Discuss the Fraunhofer diffraction at a single slit. Obtain the condition for principal maximum and minimum. (10M)
   b) A plan wave of wavelength 5893 x 10^{-8} cm is incident normally on slit of width 0.5 mm and forms a diffraction pattern on a screen placed 1 m away from the slit. Calculate the separation of first dark band on either side of the central maximum. (4M)

4. a) Describe the construction and working of Nicol prism. How it can be used as a polarizer and an analyzer? (10M)
   b) Explain how a quarter wave plate could be constructed. (4M)

5. a) Stat and prove Gauss’s theorem. (8M)
   b) What is the curl of a vector? Show that it is related to net circulation integral. (6M)

6. a) Explain quantum free electron theory. Derive an expression for current density based on this theory. (10M)
   b) What are the properties of matter waves? (4M)

7. a) Derive an expression for the density of electrons in the conduction band of an N-type semiconductor. (10M)
   b) Explain effective mass of an electron. (4M)
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Code No: R161207 **R16** SET - 4

I B. Tech II Semester Regular/Supplementary Examinations, April/May - 2018
APPLIED PHYSICS
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

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

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PART –A

1.	a)	What is the role of beam splitter in Michelson's interferometer?	(2M)
	b)	How X-rays are made to diffract?	(2M)
	c)	What is an optical rotation?	(2M)
	d)	Define diffusion current of semiconductors.	(2M)
	e)	What is the basic assumption in Kronig-Penney model?	(2M)
	f)	State Ampere's circuital law and the modification made in the law.	(2M)
	g)	Define Fermi level in the case of semiconductors.	(2M)

PART -B

2.	a)	Explain the formation of Newton's rings with reflected monochromatic light. Discuss why Newton's rings are in circular.	(10M)
	b)	In Newton's rings experiment the diameter of the 15^{th} ring was found to be 0.590 cm and that of the 5^{th} ring 0.336 cm. If the radius of the plano convex lens is 100 cm, calculate the wavelength of the light used. What happens to ring diameter if air film is replaced with liquid of refractive index 1.5?	(4M)
3.	a)	Define the resolving power of microscope. Deduce an expression for it.	(10M)
	b)	A microscope is used to resolve to self luminous objects separated by distance of 4.0×10^{-5} cm. If the wavelength of light is 5461Å. Find the angle subtended at the eye by these objects when viewed at distance of distinct vision 25 cm.	(4M)
4.	a)	Explain construction and working of the He-Ne laser with the help of an energy level diagram.	(10M)
	b)	Why are four-level lasers more efficient than three level lasers?	(4M)
5.	a)	Discuss the propagation of electromagnetic waves in dielectrics.	(10M)
	b)	Discuss irrotational vector field. Show that it can be regarded as a field of the gradient of a scalar.	(4M)
6.	a)	What is Fermi energy function? Explain with the help of a diagram how it varies with change of temperature.	(10M)
	b)	What is the physical significance of the wave function?	(4M)
7.	a)	Derive an expression for the density of holes in the valence band of a P- type semiconductor.	(10M)
	b)	Explain effective mass of a hole.	(4M)
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