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

I B. Tech I Semester Supplementary Examinations, January - 2020
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. 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 an advantage of interferometer? (2M)
   b) Define resolving power of a microscope. (2M)
   c) What are the basic components of a laser system? (2M)
   d) Define scalar field with example. (2M)
   e) Show that the de Broglie wavelength for an electron is found to be $\frac{12.26}{\sqrt{V}}$ Å (2M)
   f) Write any two drawbacks of classical free electron theory. (2M)
   g) Express conductivity of a semiconductor in terms of mobilities of charge carriers. (2M)

PART -B

2. a) Explain the phenomena of interference in parallel thin film due to reflected light and discuss the condition of maximum and minimum intensity of the film. (10M)
   b) Blue light of wavelength 480 nanometers is most strongly reflected off a thin film of oil on a glass slide when viewed near normal incidence. Assuming that the index of refraction of the oil is 1.2 and that of the glass is 1.6, what is the minimum thickness of the oil film. (4M)

3. a) Describe Fraunhofer diffraction at a circular aperture with relevant theory. (10M)
   b) The Fraunhofer diffraction pattern of a circular aperture of radius 0.5 mm is observed on the focal plane of a convex lens of focal length 20 cm. Calculate the radii of the first dark rings. Assume λ=5.5 x 10^{-5} cm. (4M)

4. a) With the help of suitable diagram, explain the construction and working of He – Ne laser. (10M)
   b) "Stimulated emission is must for laser transitions". Comment and justify your answer. (4M)

5. a) Write the Maxwell electromagnetic wave equations in differential and integral form. Prove that electromagnetic waves are transverse in nature. (10M)
   b) What do you understand by the gradient of a scalar field? Explain with one example. (4M)
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6. a) Obtain an expression for electrical conductivity on the basis of free electron theory. (10M)

   b) Using the Fermi function, evaluate the temperature at which there is 1% probability that an electron in a solid will have energy 0.5 eV above E_F of 5 eV. (4M)

7. a) What is Hall effect? Derive the expression for Hall coefficient. (10M)

   b) Find the Hall coefficient and electron mobility of Ge for a given sample (length 1 cm, breadth 5 mm, and thickness 1 mm). A current of 5 mA flows from a 1.35 V supply and develops a Hall voltage of 20 mV across the specimen in a magnetic field of 0.45 Wb/m^2. (4M)

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

I B. Tech I Semester Supplementary Examinations, May/June - 2019
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. Answering the question in **Part-A** is Compulsory
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1. a) State the superposition theorem. (2M)
   b) When slit width increases, what will happen to central maximum? Why? (2M)
   c) What do you mean by optical pumping? (2M)
   d) Give the probability interpretation of wave function. (2M)
   e) Define vector field with example. (2M)
   f) Write one assumption in quantum free electron theory. (2M)
   g) What is an N-type semiconductor? Explain with one example. (2M)

PART –B

2. a) Explain how Newton's rings are formed in the reflected light. Derive an expression for diameter of bright ring. (10M)
   b) Newton's rings are observed in the reflected light of wavelength 5900 Å. The diameter of 10^{th} dark ring is 0.5 cm. Find the radius of curvature of lens used. (4M)

3. a) What is grating? Explain formation of spectra by a plane transmission grating when monochromatic light is incident normally on it. (10M)
   b) A plane transmission grating having 5500 lines per cm is used to produce a spectrum of mercury light. What will be the angular separation between two yellow lines 5770 Å and 5790 Å in a second order? (4M)

4. a) Describe the construction and working of Laurent's half shade polarimeter. (10M)
   b) 80 gm of impure sugar when dissolved in one litre of water, gives an optical rotation of 9.9°, when placed in a tube of length 200 mm. If the specific rotation of sugar is 66 degree/dm / (gm/cc), find the percentage purity of sugar sample. (4M)

5. a) State and prove the Stoke's theorem. (10M)
   b) Write down the physical significance of Maxwell equations. (4M)
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6. a) Write down Schrodinger's equation for a particle confined in a one dimensional box and solve it to obtain its wave function. (10M)

   b) A particle is moving in one-dimensional potential box of infinite height of width 25 Å. Calculate the probability of finding the particle within an interval of 5 Å at the centres of the box when it is in its state of least energy. (4M)

7. a) Explain the 'Kronig-Penney' model of solids and show that it leads to energy band structure of solids. (10M)

   b) What is a drift and diffusion current in semiconductors? Obtain Einstein's equations. (4M)

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

I B. Tech I Semester Supplementary Examinations, May - 2018
APPLIED PHYSICS
(Com. to ECE,CSE,IT,EIE,ECom E)

Time: 3 hours Max. Marks: 70

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

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PART –A

1.	a)	Why two independent sources of light of the same wavelength cannot produce interference fringes?	(2M)
	b)	Why central fringe in diffraction pattern is always bright with maximum intensity?	(2M)
	c)	What is lasing action?	(2M)
	d)	Discuss the physical significance of curl of a vector.	(2M)
	e)	When do you say that wave function is said to be normalized?	(2M)
	f)	Define plane of vibration and plane of polarization.	(2M)
	g)	What is a hole in the valence band?	(2M)

PART -B

2.	a)	With a neat ray diagram describe construction and working of Michelson's interferometer.	(10M)
	b)	Explain how you determine the refractive index of a material using Michelson's interferometer.	(4M)
3.	a)	Explain Rayleigh's criterion for resolving power.	(5M)
	b)	Derive an expression for resolving power of a telescope.	(5M)
	c)	Calculate the linear separation between two points at a distance of 10 km from a telescope objective of width 0.5 m if the wavelength of light used is 600 nm.	(4M)
4.	a)	Discuss various methods to produce plane polarized light.	(10M)
	b)	Calculate the thickness of a quarter wave plate for monochromatic light of wavelength 600nm if the refractive indices of ordinary and extraordinary rays in the medium are 1.5442 and 1.5533 respectively.	(4M)
5.	a)	State and prove Stoke's theorem.	(10M)
	b)	Show that curl of a vector field is a vector quantity.	(4M)
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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) Find the lowest energy of an electron confined in one dimensional box of width 0.1nm. (4M)

7. a) Explain Hall effect and derive an expression for Hall coefficient in semiconductors. (10M)

   b) Discuss applications of Hall effect. (4M)

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

I B. Tech I Semester Regular/Supplementary Examinations, Oct/Nov - 2018
APPLIED PHYSICS
(Com. to ECE, CSE, IT, EIE, ECom E)

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 an interferometer? (2M)
   b) How can you accomplish Fraunhofer diffraction in laboratory environment? (2M)
   c) A 15 cm tube containing cane sugar solution shows optical rotation of 7^0. The specific rotation of the solution is 66^0. Calculate the strength of the solution. (2M)
   d) What is a scalar and scalar field? Give two examples. (2M)
   e) Why the de-Broglie wave associated with a moving car is not observable? (2M)
   f) What is Fermi energy? (2M)
   g) Depict the position of Fermi level in Intrinsic semiconductor at temperature T = 0 K and T > 0 K. (2M)

PART -B

2. a) Describe and explain the formation of Newton's rings in reflected monochromatic light. Prove that in reflected light, diameters of bright rings are proportional to the square-roots of odd natural numbers. (10M)
   b) Find the minimum thickness of a film with refractive index 1.33 for which light with wavelength 0.64 μm experiences maximum reflection while light with wavelength 0.40 μm is not reflected at all. The angle of incidence is equal to 30^0. (4M)
3. a) Explain what is a plane transmission grating? With a neat diagram explain how diffraction pattern is obtained in the case of a plane transmission grating illuminated with monochromatic light. (10M)
   b) The first order maximum for light of wavelength 6×10^{-5} cm occurs at an angle of 20^o when the light is incident normally on the grating. Calculate the number of lines / cm. (4M)
4. a) Explain the principle, construction and working of Helium-Neon laser with the help of energy level diagram. (10M)
   b) Differentiate laser light from the ordinary light. (4M)
5. a) State and prove Gauss' theorem. (10M)
   b) State the basic laws of electromagnetism in their integral form. (4M)
6. a) Discuss de Broglie's hypothesis of duality for material particles. Enumerate properties of matter waves. (10M)
   b) Explain any four assumptions of quantum free electron theory. (4M)
7. a) Show that for intrinsic semiconductors the Fermi level lies midway between the conduction band and valence band. (10M)
   b) What is effective mass? Why is the effective mass of holes more than the effective mass of electrons? (4M)
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Code No: R161104 **R16** SET - 2

I B. Tech I Semester Regular/Supplementary Examinations, Oct/Nov - 2018
APPLIED PHYSICS
(Com. to ECE,CSE,IT,EIE,ECom E)

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) State the superposition theorem. (2M)
   b) Explain Rayleigh's criterion for resolving power (2M)
   c) Define the terms (i) Population Inversion (ii) Pumping (2M)
   d) What is the difference between light waves and matter waves? (2M)
   e) Define the gradient. What is the physical meaning of gradient? (2M)
   f) What is the normalization condition for a wave function? (2M)
   g) What is Fermi level? Describe its importance. (2M)

PART -B

2. a) With a neat diagram explain the working principle of Michelson's interferometer and discuss how it can be used to determine the Wave length. (10M)
   b) In Michelson's interferometer, when a transparent thin glass plate of refractive index 1.52 is introduced in the path of one of the beams, 100 fringes cross the field of view at a given point. The wavelength of light used is 5000Å. Find the thickness of the plate. (4M)
3. a) Obtain conditions for maxima and minima in Fraunhofer diffraction due to a single slit. Calculate width of the central maxima. (10M)
   b) A plane wave of light with wavelength 500 nm falls on a slit of width 10^{-5} cm at an angle 30^0 to its normal. Find the angular position of first minima located on both sides of central maximum. (4M)
4. a) What is the principle of working of a Nicol prism? Describe the construction of a Nicol prism. (10M)
   b) Calculate the minimum thickness of a double refracting crystal required to introduce a phase difference of 60^0 between the ordinary and extraordinary rays. Given that the wavelength of light used is 600 nm and refractive indices of the crystal for ordinary and extra ordinary rays are 1.54 and 1.55 respectively. (4M)
5. a) State and prove Stokes theorem. (10M)
   b) What do you mean by irrotational vector field? Explain with an example. (4M)
6. a) What is Fermi funtion? Discuss its variation with temperature. (10M)
   b) Explain the drawbacks of classical free electron theory. (4M)
7. a) What is Hall effect? Deduce an expression for Hall coefficient. How mobility can be determined by using Hall effect? (10M)
   b) A 2 cm wide and 0.2 cm thick semiconductor strip with Hall coefficient 145 cm^3/C and carrying a current of 150 mA is subjected to a magnetic field induction of 2T along its smaller dimension. Calculate the current density and Hall voltage. (4M)

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Code No: R161104 **R16** SET - 3

I B. Tech I Semester Regular/Supplementary Examinations, Oct/Nov - 2018
APPLIED PHYSICS
(Com. to ECE,CSE,IT,EIE,ECom E)

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) Write the conditions for which two light waves interfere constructively and destructively. (2M)
   b) How can diffraction be explained on the basis of wave theory? (2M)
   c) Define the phenomenon of optical activity in polarization (2M)
   d) What is a vector and vector field? Give two examples. (2M)
   e) What is a wave function? (2M)
   f) Define an energy band. (2M)
   g) Depict the position of Fermi level in P-type semiconductor at temperature T = 0 K and T > 0 K. (2M)

PART -B

2. a) Obtain the conditions for a thin film to appear bright and dark in reflected light. (10M)
   b) A parallel beam of light with wavelengh 5896Å, is incident on a glass plate of refractive index 1.5 such that angle of refraction into the plate is 60^0. Calculate the smallest thickness of the plate which will make it appear dark by reflection. (4M)
3. a) Define resolving power of a microscope. Obtain an expression for the same with necessary ray diagrams. (10M)
   b) The smallest object detail that can be resolved with a certain microscope with light of 589 nm wavelength is 3.5 x 10^{-7} m. Calculate the resolving power of the microscope. (4M)
4. a) What are the essential requirements for producing laser? Explain how population inversion is achieved in a four level energy scheme. (10M)
   b) Explain spontaneous and stimulated emission processes. (4M)
5. a) Obtain an expression for speed of propagation of EM waves through dielectric medium. (10M)
   b) Discuss the physical meaning of divergence. (4M)
6. a) Solve the Schrodinger equation for a particle confined in a one-dimensional box of width (L). Draw the first few energy levels and the corresponding eigen functions. (10M)
   b) Find the lowest energy of a neutron confined to a nucleus of size 10^{-14} m. Given mass of the neutron is 1.67 x 10^{-27} kg. (4M)
7. a) With the help of energy band diagram classify solids on the basis of band theory. (10M)
   b) Explain the concepts of drift and diffusion currents in the case of semiconductors. (4M)
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Code No: R161104 **R16** SET - 4

I B. Tech I Semester Regular/Supplementary Examinations, Oct/Nov - 2018
APPLIED PHYSICS
(Com. to ECE,CSE,IT,EIE,ECom E)

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 **A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1.	a)	Show that the spacing between the Newton's rings decreases with increase in order.	(2M)
	b)	What is Fraunhofer diffraction?	(2M)
	c)	How do you achieve lasing action to produce laser beam?	(2M)
	d)	State the stokes theorem.	(2M)
	e)	Calculate the wave length associated with an electron accelerated by a potential of 150V.	(2M)
	f)	Describe any two failures of classical free electron theory.	(2M)
	g)	Depict the position of Fermi level in N-type semiconductor at temperature T = 0 K and T > 0 K.	(2M)

PART -B

2.	a)	Derive an expression for the radius of curvature of a plano convex lens by using newton's rings experiment.	(10M)
	b)	For Michelson's interferometer, calculate the distance between two successive positions of the movable mirror giving well defined fringes in the case of sodium source of wavelength of 589.0 nm and 589.6 nm.	(4M)
3.	a)	Derive an expression for the resolving power of a grating and explain how the resolving power depends on the wavelength of the light used.	(10M)
	b)	In a Fraunhofer diffraction pattern due to a circular aperture, the screen is at a distance of 1 m from the aperture and the aperture is illuminated by monochromatic light of 589.3 nm wavelength. The diameter of the aperture is 0.1×10^{-3} m. Calculate the width of the central maximum.	(4M)
4.	a)	With a neat diagram explain the principle and working of a half shade polarimeter used for finding the specific rotation of sugar solution.	(10M)
	b)	Explain the construction of a quarter wave plate.	(4M)
5.	a)	State and explain basic laws of electromagnetism in their differential form.	(10M)
	b)	Define electric potential. Derive it from electric field.	(4M)
6.	a)	What are matter waves? Obtain an expression for Schrodinger's time independent wave equation.	(10M)
	b)	Define Fermi energy. Write down the expression for Fermi-Dirac distribution law.	(4M)
7.	a)	Obtain an expression for the concentration of holes in valence band of an intrinsic semiconductor.	(10M)
	b)	Distinguish between intrinsic and extrinsic semiconductors.	(4M)
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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 $22x10^{-5}$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
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) 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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