Code No: R201117 **R20** SET - 1

I B. Tech I Semester Regular Examinations, April-2022

APPLIED PHYSICS

(Common to CSE, CSE-CS&T, IT , CSE-CS, CSE-IOT&CS incl BCT, CSE-CS & BS, CSE-IOT)

Time: 3 hours Max. Marks: 70

Answer any five Questions one Question from Each Unit
All Questions Carry Equal Marks

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UNIT-I

1. a) Differentiate between interference and diffraction intensity patterns. How do you differentiate the Fresnel diffraction to that of Fraunhofer diffraction? (10M)

   b) A slit of width 1.5mm is illuminated by a light of wavelength 500nm, and diffraction pattern is observed on a screen 2m away. Calculate the width of the central maxima. (4M)

Or

2. a) What are the necessary conditions for obtaining interference fringes? Explain the colours in a thin film when exposed to sunlight. (10M)

   b) A parallel beam of light of wavelength 5890Å is allowed to incident on a thin glass plate with refractive index 1.5 and the angle of refraction is 60°. Calculate the smallest thickness of the glass plate which will appear dark in reflected system. (4M)

UNIT-II

3. a) What is laser? What are the important characteristics of lasers? (6M)

   b) Derive the expression for energy density of radiation in terms of Einstein coefficients. (8M)

Or

4. a) Explain the principle of Optical fiber. Describe different types of fibers by giving the refractive index profiles and propagation details. (10M)

   b) The numerical aperture of an optical fiber is 0.39. If the difference in refractive index of the material of its core and cladding is 0.05, calculate the refractive indexof material of the core. (4M)

UNIT-III

5. a) Explain the de Broglie hypothesis. (4M)

   b) Derive time dependent Schrodinger wave equation for a free particle. (10M)

Or

6. a) Explain with theory the formation of allowed and forbidden energy bands on the basis of the Kronig-Penny model. (10M)

   b) Explain the concept of hole. (4M)
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UNIT-IV

7. a) Obtain an expression for the internal field inside a crystalline (cubic) dielectric medium which is subjected to an external electric field of intensity E. (8M)

   b) Derive Clausius-Mosotti equation for the molar polarizability of a dielectric material with cubic crystalline structure. (6M)

Or

8. a) What is ferromagnetism? Explain the properties of ferromagnetic materials. (6M)

   b) Explain the Hysteresis curve in magnetism on the basis of domains. Distinguish between Soft and Hard magnetic materials. (8M)

UNIT-V

9. a) State and explain Hall effect. Show that for n-type semiconductor the Hall coefficient $R_H = -\frac{1}{n_e}$. (10M)

   b) Explain the applications of Hall effect. (4M)

Or

10. a) What are super conductors? Explain BCS theory. (8M)

    b) Explain Meissner effect. Distinguish between type I and type II superconductors. (6M)

Code No: R201117 **R20** SET - 2

I B. Tech I Semester Regular Examinations, April-2022

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Time: 3 hours Max. Marks: 70

Answer any five Questions one Question from Each Unit
All Questions Carry Equal Marks

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UNIT-I

1. a) Obtain the expressions for diameters of dark and bright rings in Newton's rings experiment and hence obtain the expression for wavelength of light used. (10M)

   b) Calculate the thickness of the thinnest film (μ=1.4) in which interference of violet component (λ=4000AU) of incident light can take place by reflection. (4M)

Or

2. a) With the help of neat diagrams, explain how Nicol's prism is used to produce and analyze plane polarized light. (10M)

   b) Define a quarter-wave plate and derive the expression for its thickness. (4M)

UNIT-II

3. a) Explain in detail the spontaneous and the stimulated Emissions of radiation? (6M)

   b) With neat diagram, describe the construction and working of Ruby laser. (8M)

Or

4. a) Explain the construction of optical fiber. Derive the expression for acceptance angle for an optical fiber. How is it related to numerical aperture? (10M)

   b) Calculate the angle of acceptance of a given optical fiber, if the refraction indices of the core and the cladding are 1.563 and 1.498 respectively. (4M)

UNIT-III

5. a) What are the drawbacks of classical free electron theory of metals? Explain Fermi–Dirac distribution function and also its variation with temperature. (10M)

   b) Find the relaxation time of conduction electrons in a metal of resistivity 1.54×10^{8} ohm- m. If the metal has 5.8×10^{28} conduction electrons m^{-3}. (4M)

Or

6. a) Explain with theory the formation of allowed and forbidden energy bands on the basis of the Kronig-Penny model. (10M)

   b) Derive the expression for effective mass of electron. (4M)
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UNIT-IV

7. a) Discuss in detail the electronic, ionic and orientational polarizations and their dependence on temperature. (6M)

   b) Deduce an expression for Lorentz field relating to a dielectric material. (8M)

Or

8. a) Explain magnetic flux density, B, magnetic field strength, H and Magnetisation M. Derive the relation between them. (7M)

   b) Describe dia, para and ferromagnetic materials. Explain their classification on the basis of permanent magnetic moment. (7M)

UNIT-V

9. a) Explain Hall effect. Derive the expression for Hall coefficient of p-type semiconductor. (9M)

   b) Explain the applications of Hall effect. (5M)

Or

10. a) Discuss the parameters that destruct the Superconductivity. (9M)

    b) Describe the BCS theory of Superconductivity. (5M)

Code No: R201117 **R20** SET - 3

I B. Tech I Semester Regular Examinations, April-2022

APPLIED PHYSICS

(Common to CSE, CSE-CS&T, IT , CSE-CS, CSE-IOT&CS incl BCT, CSE-CS & BS, CSE-IOT)

Time: 3 hours Max. Marks: 70

Answer any five Questions one Question from Each Unit
All Questions Carry Equal Marks

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UNIT-I

1. a) Obtain the conditions for central maximum, secondary maxima and minima in the case of Fraunhofer diffraction due to single slit. (10M)

   b) Calculate the thickness of a quarter wave plate of quartz for sodium light of wavelength 5893Å. The ordinary and extraordinary refractive indices for sodium light are 1.54425 and 1.5533 respectively. (4M)

Or

2. a) What is Interference of Light? What are the conditions for clear vision of interference fringes? (4M)

   b) With ray diagram discuss the theory of thin films and derive the condition for constructive and destructive interference in the case of reflected system. (10M)

UNIT-II

3. a) Explain the purpose of an active medium and cavity Resonator in a laser. (6M)

   b) With the help of suitable diagram, explain the principle, construction and working of a Ruby laser. (8M)

Or

4. a) Explain Acceptance angle and derive expression for it. Write notes on Step Index and Graded Index fibers. (10M)

   b) For an optical fiber fractional index change is 0.14 and refractive index of cladding is 1.3. Calculate refractive index of core. (4M)

UNIT-III

5. a) Derive the time independent Schrodinger's wave equation for a free particle. (10M)

   b) Find the second excited state energy of an electron confined in a box of length 0.1 nm. (4M)

Or

6. a) Discuss the origin of energy bands in solids. (7M)

   b) How does the band theory of solids lead to the classification of solids into conductors, semiconductors, and insulators? (7M)
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UNIT-IV

7. a) What is meant by polarization in dielectrics? Derive the relation between dielectric constant and atomic polarizability. (7M)

   b) Obtain an expression for electronic polarizability in terms of radius of the atoms. (7M)

Or

8. a) Discuss on the origin of magnetism in materials. Write the differences between diamagnetic, paramagnetic, and ferromagnetic substances. (10M)

   b) The magnetic field intensity in a place of ferric oxide is 10^6 amp/meter. If the susceptibility of the material is 1.5×10^{-3}, calculate the magnetization of the material and the flux density. (4M)

UNIT-V

9. a) Derive an expression for the number of electrons per unit volume in the conduction band of an N-type semiconductor. (8M)

   b) Explain the effect of temperature and dopant on Fermi level in N-type semiconductor. (6M)

Or

10. a) What is Meissner effect? Show that superconductors exhibit perfect diamagnetism. (7M)

    b) Describe Josephson effects. Explain the applications of Josephson effect. (7M)

Code No: R201117 **R20** SET - 4

I B. Tech I Semester Regular Examinations, April-2022

APPLIED PHYSICS

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Time: 3 hours Max. Marks: 70

Answer any five Questions one Question from Each Unit
All Questions Carry Equal Marks

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UNIT-I

1. a) Discuss various methods by which polarized light can be produced. (7M)

   b) What are Quarter and Half wave plates? Derive the expressions for thickness of quarter and half wave plates. (7M)

Or

2. a) Account for the circular shape of 'Newton's rings' in interference pattern. Obtain an expression for the diameter of the n^{th} dark ring in the case of Newton's rings. (10M)

   b) The diameter of 9th dark ring in newton's rings experiment is 0.28 cm. What is the diameter of 16th dark ring when $\lambda = 6000\text{Å}$. (4M)

UNIT-II

3. a) What is meant by population of an energy state? What is Population inversion? How can it be achieved? (6M)

   b) With neat diagram, describe the construction and working of Ruby laser. (8M)

Or

4. a) Show that the ratio of Einstein's coefficient of spontaneous emission to Einstein's coefficient of absorption is proportional to the cube of the frequency of the incident photon. (10M)

   b) Mention some important applications of lasers. (4M)

UNIT-III

5. a) Explain the de Broglie hypothesis. (4M)

   b) Derive time independent Schrodinger wave equation for a free particle. (10M)

Or

6. a) State and explain Bloch theorem. (4M)

   b) Discuss the Kronig Penny model for the motion of an electron in a periodic potential. (10M)

UNIT-IV

7. a) What do you understand by dielectric constant? Define dielectric susceptibility. Derive the relation between dielectric constant and dielectric susceptibility. (6M)
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b) Explain electronic polarisability and show that electronic polarisability for a mono atomic gas increases as the size of the atom becomes larger. (8M)

Or

8. a) Explain the origin of magnetic moment. Find the magnetic dipole moments due to orbital and spin motions of an electron. (10M)

b) A magnetic material has a magnetization of 3300A/m and flux density of 0.044 wb/m^2. Calculate the magnetizing force and relative permeability of the material. (4M)

UNIT-V

9. a) What do you understand by drift and diffusion currents in the case of a semiconductor? Deduce Einstein's relation relating to these currents. (9M)

b) Distinguish between n- and p-type semiconductors. (5M)

Or

10. a) What is superconductivity? Explain Meissner effect. Describe type-I and type-II superconductors. (10M)

b) Discuss the applications of superconductors. (4M)