I B. Tech II Semester Regular Examinations, December - 2020
APPLIED PHYSICS
(Com. to EEE, ECE, CSE, EIE, IT)

Time: 3 hours Max. Marks: 75

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

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1. a) Explain the phenomenon of interference. What are the necessary conditions for obtaining sustained interference fringes? (7M)

   b) Explain the interference pattern in thin films and hence derive the conditions for maximum and minimum intensity. (8M)

Or

2. a) What is meant by diffraction of light? Explain. (3M)

   b) What is Rayleigh's Criterion for resolving power? Define Resolving power of a grating. Derive the expression for Resolving power of a grating based on Rayleigh's Criterion. (12M)

3. a) Discuss the de Broglie hypothesis of duality of matter. Obtain the expression for the wavelength of matter waves. (10M)

   b) If the kinetic energy of the neutron is 0.025ev, calculate its de Broglie wavelength. (5M)
   (Mass of neutron = $1.674 X 10^{-27}$ Kg).

Or

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

   b) Explain the physical significance of wave function. (5M)

5. a) Derive an expression for the density of energy states and carrier concentration in a metal by using Fermi distribution function. (10M)

   b) Find the mobility of electrons in copper if there are $9x10^{28}$ valance electrons/m^3 and the conductivity of copper is $6x10^7$ mho/m. (5M)

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? (8M)

7. a) What are Extrinsic semiconductors? Give examples. (3M)

   b) Derive an expression for the number of electrons per unit volume in the conduction band of an *n*-type semiconductor and explain the effect of temperature on Fermi level. (12M)

Or

8. a) Describe the drift and diffusion currents in a semiconductor and derive expressions for them. (10M)

   b) Deduce Einstein's relation in semiconductors. (5M)
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9. a) Define the terms dielectric constant and dielectric susceptibility. Derive the relation between them. (7M)

   b) Explain ionic polarizability in atoms and obtain an expression for ionic polarizability. (8M)

Or

10. a) Define the terms 'magnetic susceptibility' and 'magnetic induction'. What are the sources of permanent dipole moment in magnetic materials? (8M)

    b) Distinguish between dia, para and ferro magnetic materials. (7M)

Code No: R19BS1204 **R19** SET - 2

I B. Tech II Semester Regular Examinations, December - 2020
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Time: 3 hours Max. Marks: 75

Answer any five Questions one Question from Each Unit
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1. a) Explain in detail the Principle of Superposition of waves. (3M)

   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. (12M)

Or

2. a) What are the types of diffraction and give the differences between them. Obtain the condition for primary maxima in Fraunhoffer diffraction due to a single slit. (10M)

   b) Find the angular width of the central maxima in the Fraunhoffer diffraction using a slit of width 1 μm when the slit is illuminated by light of wavelength 600 nm. (5M)

3. a) What are Matter waves? Explain their properties. Show that the wavelength associated with an electron of mass 'm' and kinetic energy É' is given by $\lambda=\frac{h}{\sqrt{2mE}}$. (10M)

   b) Explain Heisenberg's uncertainty principle in detail. (5M)

Or

4. a) Deduce an expression for energy of an electron confined to a potential box of width á'. (10M)

   b) Explain the physical significance of wave function. (5M)

5. a) What are the drawbacks of the classical free electron theory? Derive an expression for electrical conductivity of a conducting material based on quantum mechanical treatment. (10M)

   b) Find the relaxation time of conduction electrons in a metal if its resistivity is 1.54×10^{-8} Ωm and it has 5.8×10^{28} conduction electrons/m^3. (5M)

Or

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

   b) Explain how the crystalline solids are classified into metals, semiconductors and insulators on the basis of band theory. (8M)

7. a) Distinguish between intrinsic and extrinsic semiconductors with suitable examples. (5M)

   b) Derive an expression for the density of electrons in the conduction band of an intrinsic semiconductor. (10M)

Or
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8. a) What do you understand by drift and diffusion currents in the case of a semiconductor? Deduce Einstein's relation relating to these currents. (10M)

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

9. a) Explain the origin of different kinds of polarization in dielectrics. (6M)

   b) Derive an expression for internal field in dielectrics. (9M)

Or

10. a) Draw and explain B-H curve for a ferromagnetic material placed in a magnetic field. (10M)

    b) Distinguish between soft and hard magnetic materials. (5M)

Code No: R19BS1204 **R19** SET - 3

I B. Tech II Semester Regular Examinations, December - 2020
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Time: 3 hours Max. Marks: 75

Answer any five Questions one Question from Each Unit
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1. 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) In Newton's rings experiment, the diameter of the 5^{th} and 25^{th} rings are 0.3cm and 0.8cm respectively. If the radius of curvature of the plano-convex lense is 10cm, find the wavelength of the incident light. (5M)

Or

2. a) What is meant by Diffraction of light? Explain it on the basis of Huygen's wave theory. (8M)

   b) Explain with necessary theory how wavelength of spectral line is determined using plane diffraction grating. (7M)

3. a) Explain the concept of matter waves. How are they different from Electromagnetic waves? (5M)

   b) Describe in detail, with a neat diagram, the Davisson and Germer experiment to show that particles behave like waves. (10M)

Or

4. a) State and explain uncertainty principle. (5M)

   b) Show that the energies of a particle in a potential box are quantized. (10M)

5. a) Derive the expression of electrical conductivity according to the quantum free electron theory. (8M)

   b) Explain the Fermi-Dirac distribution function of electrons. Illustrate graphically the effect of temperature on the distribution. (7M)

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 effective mass. (5M)

7. a) Distinguish between intrinsic and extrinsic semiconductors with suitable examples. (5M)

   b) Derive an expression for the density of holes in the valence band of an intrinsic semiconductor. (10M)

Or

8. a) Explain the experiment to determine the Hall coefficient. Explain the applications of Hall effect. (10M)

   b) The R_H of a specimen is $3.66 \times 10^{-4}\ m^3\ c^{-1}$. Its resistivity is $8.93 \times 10^{-3}\ \Omega m$. Find mobility and charge carrier concentration. (5M)
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9. 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. (9M)

Or

10. a) Explain ferromagnetism. (5M)

    b) Explain the Hysteresis of ferromagnetic materials. How is it used to classify magnets? (10M)

Code No: R19BS1204 **R19** SET - 4

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

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1. a) How do you obtain circular rings in Newton's rings experiment? With necessary theory explain the experimental procedure to determine the refractive index of transparent liquid by using Newton's rings method. (10M)

   b) In a Newton's rings experiment, the diameter of 10^{th} dark ring changes from 1.40cm to 1.27cm when a liquid is introduced between the lense and the plate. Calculate the refractive index of the liquid. (5M)

Or

2. a) Explain what is meant by diffraction of light. How diffraction is different from interference? (7M)

   b) Discuss Fraunhofer single slit diffraction. Draw intensity distribution curves and Obtain conditions for bright and dark fringes in single slit diffraction pattern. (8M)

3. a) What are matter waves? Mention their properties. (5M)

   b) Describe in detail, with a neat diagram, the G.P. Thomson experiment to show that particles behave like waves. (10M)

Or

4. a) Show that the particle trapped in a potential well possesses discrete energy values. (10M)

   b) Explain the consequences of uncertainty principle. (5M)

5. a) Explain the Fermi-Dirac distribution function of electrons. Explain the effect of temperature on the distribution. (8M)

   b) Derive the expression for the density of energy states in metals. (7M)

Or

6. a) State and explain Bloch theorem. (5M)

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

7. a) What are intrinsic semiconductors? Derive an expression for intrinsic carrier concentration in an intrinsic semiconductor. (9M)

   b) Show that Fermi energy level lies in the middle of the energy gap in intrinsic semiconductors. (6M)

Or

8. a) State and explain Hall effect. Derive expression for Hall coefficient. (10M)

   b) What are applications of Hall effect? (5M)
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9. 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. (8M)

Or

10. a) Distinguish between Dia, Para and Ferromagnetism. (6M)

    b) Explain the hysteresis loop observed in ferromagnetic materials. What are hysteresis losses? (9M)