

MALLA REDDY COLLEGE OF ENGINEERING & TECHNOLOGY
(Autonomous Institution – UGC, Govt. of India)
UG Model question paper
Engineering Physics

Time: 3 hours

Max Marks: 70

Note: This question paper contains of 5 sections. Answer five questions, choosing one question from each section and each question carries 14 marks.

SECTION-I

- 1 a) Discuss the theory of Newton's rings with necessary diagram [10M]
b) Write the difference between interference and diffraction. [4M]

OR

- 2 a) Derive the expression for bright and dark fringes when the interference pattern is form in thin films due to reflected light. [8M]
b) Explain the concept of double refraction. [6M]

SECTION-II

- 3 a) Explain the construction and working principle of He - Ne laser with neat diagram. [8M]
b) Write the applications of laser. [6M]

OR

- 4 a) Derive the expression for numerical aperture and acceptance angle. [10M]
b) Write the advantages of an optical fiber. [4M]

SECTION-III

- 5 a) Show that energy levels in 1D potential box are discrete. [10]
b) Define particle and wave nature of light. [4M]

OR

- 6 a) Explain the G.P. Thomson experiment that verify the wave nature of light. [10M]
b) An electron is moving under a potential field of 15 kV. Calculate the wavelength of electron waves. [4M]

SECTION-IV

- 7 a) Distinguish between Fermi dirac distribution and Bose Einstein distribution. [8M]
b) Explain the origin of energy bands in solids. [6M]

OR

- 8 a) Show that the Kronig Penny modes leads to energy band structure in solids. [10M]
b) Explain E – K diagram. [4M]

SECTION-V

- 9 a) Derive an expression for concentration of electrons in intrinsic semiconductor. [8M]
b) Write short notes on LED. [6M]

OR

- 10 a) Define hall effect and derive an expression for hall coefficient for P – type semiconductor. [8M]
b) Explain construction and working of solar cell. [6M]

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SECTION-I

- 1 a) Derive the expression for bright and dark fringes in thin film due to reflected ray [10M]
b) Define and explain the coherent sources [4M]

OR

- 2 a) Explain the formation of Newton's rings and write applications of newton's ring experiment. [10M]
b) In Newton's ring experiment the diameter of 7th dark ring is 3.3mm. Then calculate the diameter of 10th ring if the wavelength of monochromatic light used is $2000 \text{ \AA}$. [4M]

SECTION-II

- 3 a) Derive the relation between Einstein's coefficients [8M]
b) Write short notes on population inversion [6M]

OR

- 4 a) Define and Derive the expression for numerical aperture and acceptance angle of an optical fiber [10M]
b) For an optical fiber the refractive indices of core and clad are 1.50 and 1.41 then determine numerical aperture and acceptance angle of the optical fiber assuming that light is launched into optical fiber from air medium. [4M]

SECTION-III

- 5 a) Derive the time independent Schrödinger's wave equation. [8M]
b) Write a short notes on Heisenberg's uncertainty principle [6M]

OR

- 6 a) Show that the wavelength λ associated with a electron of mass m is given by $\lambda = \frac{h}{\sqrt{2mE}}$ [10M]
b) Electrons are accelerated by 340 V and reflected from a crystal in the first order diffraction when the angle of incidence is 60° . Then calculate inter planar distance. [4M]

SECTION-IV

- 7 a) Explain about MB & Fermi dirac distribution and Bose Einstein distribution. [8M]
b) Explain the origin of energy bands in solids. [6M]

OR

- 8 a) Write a short notes an Brillouin zones [10M]
b) Define and derive the expression for effective mass. [4M]

SECTION-V

- 9 a) Derive an expression for concentration of electrons in intrinsic semiconductor. [8M]
b) Distinguish direct and indirect band gap semiconductors [6M]

OR

- 10 a) What is hall effect ? And derive expression for hall coefficient? [10M]
b) The hall coefficient of a specimen is $7.35 \times 10^{-5} \text{ m}^3/\text{cm}$. Then find the nature of semiconductor and concentration of charge carriers. [6M]

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- 1 a) Derive the conditions for bright and dark fringes in thin film due to reflected ray. [10M]
- b) Write the difference between Fresnel and fraunhofer diffraction. [4M]

OR

- 2 a) Derive the conditions for bright and dark fringes in fraunhofer diffraction due to single slit. [8M]
- b) Explain the construction and working of Nicol prism. [6M]

SECTION-II

- 3 a) Explain the construction and working principle of Ruby laser with neat diagram. [8M]
- b) Explain the characteristics of laser. [6M]

OR

- 4 a) Explain the transmission of light in optical fiber communication system with a suitable block diagram [10M]
- b) Explain the working principle of optical fiber. [4M]

SECTION-III

- 5 a) Write the properties of matter waves. [4M]
- b) Derive the time independent schrodinger wave equation. [10M]

OR

- 6 a) Explain the Davisson and Germer experiment that verify the wave nature of light. [10M]
- b) Calculate the wavelength of an electron associated with an energy of 2000 e V. [4M]

SECTION-IV

- 7 a) Derive the expression for density of states. [8M]
- b) Write short notes on Brillouin zones. [6M]

OR

- 8 a) Explain about MB, BE statistics. [6M]
- b) Define and derive the expression for effective mass of an electron. [10M]

SECTION-V

- 9 a) Derive an expression for concentration of holes in intrinsic semiconductor. [10M]
- b) Write advantages of hall effect. [4M]

OR

- 10 a) Distinguish between direct and indirect band gap semiconductors. [6M]
- b) Explain construction and working of solar cell. [8M]

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SECTION-I

- 1 a) Explain in detail interference in thin films by reflected light? [7 M]
b) Derive an expression for wavelength of light by forming Newton rings? [7 M]

OR

- 2 a) Describe and explain the phenomenon of diffraction due to a single slit. Determine the positions of principle maxima and minima? [10 M]
b) In Newton's Rings experiment, diameter of 10th dark ring due to wavelength 6000Å in air is 0.5cm. Find the radius of curvature of lens? [4 M]

SECTION-II

- 3 a) Explain the terms:
i. Stimulated emission ii. Population Inversion
iii. Meta stable state iv. Optical Pumping [4 M]
b) Explain the construction and working of He- Ne laser with the help of energy level diagram? [10M]

OR

- 4 a) Write a note on types of optical fiber with propagation of light through it? [7 M]
b) Explain attenuation in fibers? [4 M]
c) Write any three advantages of optical fibers? [3 M]

SECTION-III

- 5 a) Explain De Broglie concept of matter waves? [5M]
b) What are matter waves? Describe the experiment that supports the existence of matter waves? [7M]
c) Write the statement of Heisenberg Uncertainty principle? [2M]

OR

- 6 a) Derive the Eigen value and Eigen function for a particle in a potential box? [7M]
b) Derive Schrodinger time independent wave equation? [7M]

SECTION-IV

- 7 a) Distinguish MB, BE, FD statistical distribution? [7M]
b) Derive an expression for the density of energy states? [7M]

OR

- 8 a) Explain the Kronig Penny model of solids and show that it leads to energy band structure of solids? [7M]
b) Obtain an expression for the Fermi energy in metals at T=0K? [7M]

SECTION-V

- 9 a) Calculate the carrier concentration in N-Type semiconductor? [7M]
b) What is Hall Effect and Derive an expressions for hall voltage and hall coefficient? [5M]
c) Mention important applications of Hall effect? [5M]

OR

- 10 a) Derive an expression for Fermi energy in intrinsic semi conductor. What is the effect of temperature on Fermi level in intrinsic semi conductor? [7M]
b) Write short notes on: solar cell and LED [7M]

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- 1 a) Show that fringe-width is same for bright fringe and dark fringes in interference of light? [7M]
- b) Derive an expressions for diameters of bright and dark rings in Newton's rings ? [7M]

OR

- 2 a) Describe Fraunhofer diffraction due to single slit & discuss intensity-curve of diffraction? [10M]
- b) In Newton's Rings experiment, diameter of 5th dark ring is 0.30 cm and the diameter of the 15th ring is 0.62 cm. Find the diameter of the 25th ring. [4M]

SECTION-II

- 3 a) Derive the relation between the probabilities of spontaneous and stimulated emission in terms of Einstein's coefficients. [7M]
- b) Explain the construction and working of GaAs laser?

OR

- 4 a) Derive expressions for the numerical aperture and the fractional change of an optical fiber [7M]
- b) Explain different types of fibers by giving the refractive index profiles and propagation details. [7M]

SECTION-III

- 5 a) Derive time-independent Schrodinger's wave equation for a free particle ? [7M]
- b) What are matter waves? Describe the experiment that supports the existence of matter waves? [7M]

OR

- 6 a) Show that the energy levels of the particle are quantized? [7M]
- b) State Heisenberg uncertainty principle? Explain the physical significance of the wave-function of the particle [7M]

SECTION-IV

- 7 a) Distinguish MB, BE, FD statistical distribution? [7M]
- b) Derive an expression for the density of energy states? [7M]

OR

- 8 a) Explain the Kronig Penny model of solids and show that it leads to energy band structure of solids? [7M]
- b) Obtain an expression for the Fermi energy in metals at T=0K? [7M]

SECTION-V

- 9 a) Calculate the carrier concentration in P-Type semiconductor? [7M]
- b) What is Hall Effect and Derive an expressions for hall voltage and hall coefficient? [5M]
- c) Mention important applications of Hall effect? [2M]

OR

- 10 a) Derive an expression for Fermi energy in intrinsic semi conductor. What is the effect of temperature on Fermi level in intrinsic semi conductor? [7M]
- b) Write short notes on: solar cell and LED? [7M]