SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY :: PUTTUR
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QUESTION BANK (DESCRIPTIVE)

Subject with Code :APPLIED PHYSICS (20HS0849)
Course & Branch: B.Tech – CSE, CAD,CCC,CSM,CIC,CIT & CAI (I –SEM), ECE & EEE (II SEM).
Year &Sem: I-B.Tech I & I/II -Sem. **Regulation:** R20

UNIT- I (WAVE OPTICS)

1	a	State and explain principle of superposition.	[CO1]	[6M]	[L2]
	b	Define interference and summarizing the importance conditions to get sustained interference.	[CO1]	[6M]	[L2]
2	a	Discuss the theory of interference of light due to thin films by reflection with suitable ray diagram.	[CO1]	[4M]	[L1]
	b	Derive the condition for bright and dark rings interference in the case of thin films by reflected light.	[CO1]	[8M]	[L4]
3	a	Describe the formation of Newton's ring with necessary theory with relevant diagram and derive the expressions for dark and bright fringes.	[CO1]	[9M]	[L3]
	b	In a Newton's rings experiment, the diameter of the 5^{th} ring is 0.30 cm and the diameter of the 15^{th} ring is 0.62 cm. Calculate the diameter of the 25^{th} ring.	[CO1]	[3M]	[L4]
4	a	How the wavelength of light sources is determined by using Newton's ring's concept.	[CO1]	[8M]	[L4]
	b	In a Newton's rings experiment the diameter of the 8^{th} ring was 0.35cm and the diameter of the 18^{th} ring was 0.65cm.If the wavelength of the light used is 6000A° then find the radius of curvature of the plano-convex lens.	[CO1]	[4M]	[L4]
5	a	What are engineering applications of interference?	[CO1]	[4M]	[L3]
	b	What are engineering applications of diffraction?	[CO1]	[4M]	[L3]
	c	A parallel beam of light of 6000 A° is incident on a thin glass plate of refractive index 1.5 such that the angle of refraction into the plate is 50^o.Calculate the least thickness of the glass plate which will appear dark by reflection.	[CO1]	[4M]	[L4]
6	a	Define diffraction? Distinguish between Fraunhofer and Fresnel's diffraction,	[CO1]	[6M]	[L4]
	b	Compare Interference and Diffraction.	[CO1]	[6M]	[L2]
7	a	In the study of Fraunhofer diffraction due to single slit how the diffraction fringes formed.	[CO1]	[8M]	[L4]
	b	Obtain conditions for bright and dark fringes in single slit diffraction pattern and draw intensity distribution.	[CO1]	[4M]	[L4]
8	a	Describe Fraunhofer diffraction due to double slit and derive the conditions for principal maxima, secondary maxima and minima.	[CO1]	[8M]	[L2]
	b	A plane transmission grating having 4250 lines per cm is illuminated with sodium light normally. In the second order spectrum, the spectral lines are deviated by 30^0. What is the wavelength of the spectral line?	[CO1]	[4M]	[L4]

9	a	Define diffraction grating and write about construction of diffraction grating.	[CO1]	[8M]	[L1]
	b	Find the highest order that can be seen with a grating having 15000 lines/inches. The wavelength of the light used is 600nm.	[CO1]	[4M]	[L3]
10	a	Define following terms i. Grating spectrum ii. Grating element	[CO1]	[6M]	[L1]
	b	How wavelength light is determined by diffraction grating.	[CO1]	[6M]	[L2]

UNIT – II (ELECTRON THEORY OF METALS & ELECTROMAGNETIC THEORY)

1	a	Define the following electrical properties of a material i) Drift Velocity (ii) Mean free path (iii) Relaxation time	[CO2]	[6M]	[L1]
	b	Derive an expression for electrical conductivity in a metal by using classical free electron theory.	[CO2]	[6M]	[L4]
2	a	What are the postulates, merits and drawbacks of classical free electron theory?	[CO2]	[6M]	[L1]
	b	Define electrical conductivity and resistivity of a material.	[CO2]	[2M]	[L1]
	c	Find relaxation time of conduction electron in metal if its resistivity is $1.54 \times 10^{-8}\Omega$-m and it has 5.8×10^{28} conduction electron/m^3.Given m= 9.1×10^{-31} kg, e= 1.6×10^{-19} C.	[CO2]	[4M]	[L1]
3	a	What are the advantages of quantum free electron theory over classical free electron theory?	[CO2]	[2M]	[L1]
	b	Derive an expression for electrical conductivity in a metal by quantum free electron theory.	[CO2]	[6M]	[L4]
	c	Write brief note on Fermi Dirac distribution. What is the effect of temperature on Fermi Dirac distribution function?	[CO2]	[4M]	[L1]
4	a	Evaluate Fermi Function for energy K_BT above Fermi level?	[CO2]	[4M]	[L4]
	b	Define effective mass and derive the expression for effective mass of an electron in periodic potential field.	[CO2]	[4M]	[L4]
	c	Describe the various sources of electrical resistance in metals.	[CO2]	[4M]	[L1]
5	a	Explain the formation of energy bands in solids.	[CO2]	[6M]	[L2]
	b	Classify the solids into conductor, semiconductor & insulators based on band theory of solids.	[CO2]	[6M]	[L2]
6	a	Write a significance of divergence and curl of a vector.	[CO2]	[4M]	[L1]
	b	If electric field $\vec{E} = x^2\hat{\imath} + 2y^2\hat{\jmath} + 3z^2\hat{k}$ then find the divergence of $\vec{E}$.	[CO2]	[4M]	[L3]
	c	If magnetic field $\vec{B} = x^2\hat{\imath} + 2y^2\hat{\jmath} + 3z^2\hat{k}$ then find the curl of $\vec{B}$.	[CO2]	[4M]	[L3]
7	a	State and Explain Gauss's Theorem for divergence.	[CO2]	[6M]	[L2]
	b	State and Explain Stoke's Theorem for curl.	[CO2]	[6M]	[L2]
8	a	Explain the Faraday's law and Ampere's law through the Maxwell equations.	[CO2]	[8M]	[L2]
	b	Write the applications of Faraday's law.	[CO2]	[4M]	[L1]
9		Derive the Maxwell's equations in differential and integral form.	[CO2]	[12M]	[L4]
10		Explain the propagation of electromagnetic wave in non-conducting media	[CO2]	[12M]	[L2]

UNIT – III (LASERS AND FIBER OPTICS)

1	a	Define laser and describe the important characteristic of laser beam?	[CO3]	[6M]	[L2]
	b	Distinguishes between spontaneous and stimulated emission of radiation.	[CO3]	[6M]	[L2]
2	a	Enumerate the relation between the various Einstein's coefficients of absorption and emission of radiation	[CO3]	[8M]	[L2]
	b	Explain population inversion.	[CO3]	[4M]	[L2]
3	a	Explain the different pumping mechanisms in laser.	[CO3]	[4M]	[L2]
	b	What are the important components of laser device.	[CO3]	[4M]	[L1]
	c	What are the application of laser.	[CO3]	[4M]	[L1]
4	a	Describe the construction and working principle of He-Ne Laser with the help of a neat diagram.	[CO3]	[8M]	[L2]
	b	What are the advantages of He-Ne laser.	[CO3]	[4M]	[L1]
5	a	Describe the construction and working principle of NdYAG Laser with the help of a neat diagram.	[CO3]	[8M]	[L2]
	b	Calculate the wavelength of emitted radiation from GaAs which has a band gap of 1.44ev	[CO3]	[4M]	[L4]
6	a	Define total internal reflection and derive the conditions for total internal reflection.	[CO3]	[8M]	[L4]
	b	Describe the construction of optical fiber.	[CO3]	[4M]	[L2]
7	a	What is the acceptance angle of an optical fiber and derive an expression for it.	[CO3]	[8M]	[L1]
	b	An optical fibre has a core refractive index of 1.44 and cladding refractive index of 1.40. Find its numerical aperture and θ_a.	[CO3]	[4M]	[L3]
8	a	What is the numerical aperture of an optical fibre and derive an expression for it.	[CO3]	[8M]	[L1]
	b	An optical fibre has a numerical aperture of 0.20 and cladding refractive index of 1.59. Determine the refractive index of core and the acceptance angle for the fiber in water has a refractive index of 1.33.	[CO3]	[4M]	[L3]
9	a	Write short note on classification of optical fibers.	[CO3]	[6M]	[L1]
	b	Distinguishes between step index and graded index optical fibers	[CO3]	[6M]	[L2]
10	a	Describe optical fiber communication system with block diagram.	[CO3]	[8M]	[L2]
	b	Mention the application of optical fiber in sensors	[CO3]	[4M]	[L1]

UNIT – IV (SEMICONDUCTORS)

1	a	Define the following terms (i) Carrier Concentration (ii) Fermi level (iii) Electrical Conductivity (iv) Energy band gap	[CO4]	[8M]	[L1]
	b	Enumerate the expression for intrinsic carrier concentration.	[CO4]	[4M]	[L2]
2	a	What is Fermi level? Prove that the Fermi level is lies exactly in between conduction band and valance band of intrinsic semiconductor.	[CO4]	[6M]	[L1]
	b	Determine the energy band gap of the intrinsic semiconductor	[CO4]	[6M]	[L3]

3	a	Find the conductivity of intrinsic semiconductor and energy band structure with relevantexpressions.	[CO4]	[8M]	[L3]
	b	The following data are given for an intrinsic Ge at 300K. Calculate the conductivity of the sample? (n_i= 2.4 x10 $^{19}m^{-3}$, μ_e = 0.39 m^2-$V^{-1}S^{-1}$, μ_p = 0.19 m^2-$V^{-1}S^{-1}$).	[CO4]	[4M]	[L4]
4	a	Define Doping? Explain the formation of n-type semiconductors with banddiagram	[CO4]	[8M]	[L1]
	b	The following data are given for an intrinsic Ge at 300K. Calculate the resistivity of the Sample? (n_i= 2.4 x10 $^{19}m^{-3}$, μ_e = 0.39 m^2-$V^{-1}S^{-1}$, μ_p = 0.19 m^2-$V^{-1}S^{-1}$).	[CO4]	[4M]	[L4]
5	a	Explain the formation of p-type semiconductors with band diagram .	[CO4]	[8M]	[L2]
	b	Mobilities of electrons and holes in an intrinsic germanium at 300K are 0.36 m^2/vs and 0.17 m^2/vs respectively. If the resistivity is 2.12 Ω m. Calculate the intrinsic concentration ?	[CO4]	[4M]	[L4]
6	a	Enumerate the expression for current generated due to drifting of charge carriers in semiconductors in the presence of electric field.	[CO4]	[6M]	[L2]
	b	Enumerate the expression for current generated due to diffusion of charge carriers in semiconductors in the absence of electric field.	[CO4]	[6M]	[L2]
7	a	Enumerate the expression for Einstein relation.	[CO4]	[8M]	[L2]
	b	Find the diffusion co-efficient of electron in Si at 300 K if μ_e = 0.19 m^2-$V^{-1}S^{-1}$.	[CO4]	[4M]	[L3]
8	a	Describe the Hall Effect in semiconductors.	[CO4]	[8M]	[L2]
	b	What are the applications of Hall Effect.	[CO4]	[4M]	[L1]
9	a	Explain the formation of p-n junction.	[CO4]	[4M]	[L2]
	b	Describe the construction and working mechanism of Photodiode.	[CO4]	[8M]	[L2]
10	a	Describe the construction and working mechanism of LED.	[CO4]	[8M]	[L2]
	b	Determine the wavelength of LED fabricated by the CdS material with band gap of 2.42ev.	[CO4]	[4M]	[L3]

UNIT-V (SUPERCONDUCTIVITY AND PHYSICS OF NANOMATERIALS)

1	a	Define Superconductivity? And Prove that super conductor is a very good diamagnetic material.	[CO5]	[8M]	[L5]
	b	Write the properties of Superconductors.	[CO5]	[4M]	[L1]
2	a	Explain the Type-I and Type-II superconductors.	[CO5]	[8M]	[L2]
	b	What is Meissner effect? Explain how Superconductors are behaving like a Diamagnetic material.	[CO5]	[4M]	[L2]
3	a	Explain BCS theory of superconductors.	[CO5]	[8M]	[L2]

	b	Calculate the critical current for a lead wire of 0.5mm radius at4.2K . Given for lead T_c = 7.18K, Ho=6.5 x 10^4A/m.	[CO5]	[4M]	[L3]
4	a	i) Define Flux Quantization?	[CO5]	[2M]	[L1]
		ii) Explain Flux quantization?	[CO5]	[6M]	[L2]
	b	i) Define Critical Temperature?	[CO5]	[2M]	[L1]
		ii) A superconducting material has a critical temperature of 3.7K and a magnetic field of 0.0306T at 0 K. Find the critical field at 2K.	[CO5]	[2M]	[L3]
5	a	Explain DC and AC Josephson effects in superconductors.	[CO5]	[8M]	[L2]
	b	What are the applications of superconductors.	[CO5]	[6M]	[L1]
6	a	i) What is nanomaterial?	[CO6]	[2M]	[L1]
		ii) Write the classification of nanomaterials.	[CO6]	[4M]	[L1]
	b	Explain the basic principle of nanomaterials.	[CO6]	[6M]	[L2]
7	a	i) Define Nano Science and Nano Technology?	[CO6]	[2M]	[L1]
		ii) Explain the concept of Quantum Confinement in nano materials.	[CO6]	[4M]	[L2]
	b	What are the applications of nanomaterials in different fields.	[CO6]	[6M]	[L1]
8	a	Explain why surface area to volume ratio very large for nano materials?	[CO6]	[6M]	[L2]
	b	What are the mechanical, magnetic and optical properties of nanomaterials.	[CO6]	[6M]	[L1]
9	a	What are the techniques available for synthesizing nanomaterials?	[CO6]	[4M]	[L1]
	b	Explain ball milling technique for synthesis of nanomaterial?	[CO6]	[8M]	[L2]
10	a	Explain Sol-Gel technique for synthesis of nanomaterial?	[CO6]	[8M]	[L2]
	b	What are the advantages of sol-gel process?	[CO6]	[4M]	[L1]

Prepared by: Dept. of Physics