SRM Institute of Science and Technology
College of Engineering and Technology

DEPARTMENT OF ECE
SRM Nagar, Kattankulathur – 603203, Chengalpattu District, Tamil Nadu
Academic Year: 2021-22 (Even)

SET- A

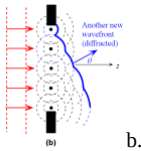
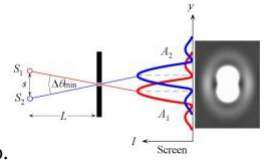
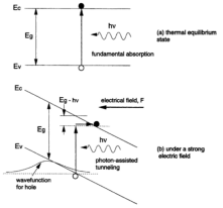
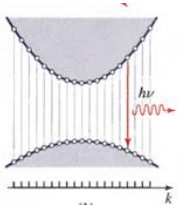
Test: CLAT-1 | Date: 08-04-2022
Course Code & Title: 18ECE322T Optoelectronics | Duration: 12:30 -1:30PM
Year & SEM: II year/ 4th SEM | Max. Marks: 25

Answer Key

Part – A (5 x 1 = 5 Marks)
Instructions: Answer all

Q. No	Question	Marks	BL	CO	PO	PI Code
1	Angular separation of wavevectors on a given wavefront is called A. Optical diffraction **B. <u>Optical divergence</u>** C. Dispersion D. Coherence	1	1	1	1	1.4.1
2	Calculate the rarer medium refractive index for a given 65 degree critical angel where the denser medium refractive index is 1.5 A. 1.90 B. 1.78 **C. <u>1.35</u>** D. 1.52	1	2	1	1	1.4.1
3	Group refractive index of pure silica is always _____ to the normal refractive index of the medium **A. <u>Greater</u>** B. Lower C. Equal D. Inversely proportional	1	1	1	1	1.4.1
4	For an intrinsic silica (Si) calculate carrier concentration (ni) when number of conduction band electrons are 1.61×10^{16} m^{-3} A. 1.68×10^{24} m^{-3} B. 3.21×10^{16} m^{-3} **C. <u>1.61×10^{16} m^{-3}</u>** D. 1.50×10^{9} m^{-3}	1	2	1	1	1.4.1
5	In case of energy bandgaps comparison which of the following is true **A. <u>AlSb > GaSb</u>** B. AlSb < GaSb C. AlSb = GaSb D. AlSb ≅ GaSb	1	2	1	1	1.4.1

Part – B (2 x 10 = 20 Marks)
Instructions: Answer any two Questions

6	(a).Discuss in detail the Huygens-Fresnel diffraction phenomenon and (b). Rayleigh criteria (c). Calculate the resolvable angle of two 600 nm light sources where the aperture size of a microscope is 1.5 mm. (3+3+4) a.  b.  c. $\Delta\theta = \sin^{-1}(1.22*600nm/1.5mm) = 0.0279°$	10	3	1	1	1.4.1
7	(a).Determine three factors influence the band to band transactions in semiconductors. (b). Illustrate and explain the effect of electric field on band structure of semiconductor and absorption process (5+5) a. Occupancy probabilities,Transition probabilities, Density of states b. 	10	3	1	1	1.4.1
8	(a).Elaborate spontaneous recombination process in semiconductors (b).Find the electron /hole recombination lifetime "t" and radiative recombination coefficient "B_r" when an optical beam irradiate an intrinsic semiconductor (GaAs) produces 0.8×10^{23} cm^{-3}/s electron-hole pairs. where steady state concentration of photoelectrons is $\Delta n = 1.6 \times 10^{14}$ cm^{-3} and intrinsic concentration of GaAs ~ 10^5 cm^{-3} (4+6) a.  b. t=2ns; $B_r = 3.125 \times 10^{-6}$ cm^{-3}/s	10	3	1	1	1.4.1

SRM Institute of Science and Technology
College of Engineering and Technology

DEPARTMENT OF ECE
SRM Nagar, Kattankulathur – 603203, Chengalpattu District, Tamil Nadu
Academic Year: 2021-22 (Even)

SET- B

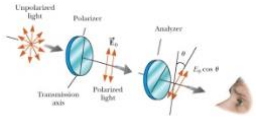
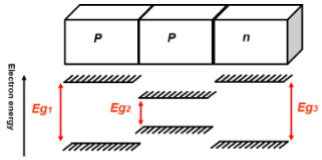
Test: CLAT-1 | Date: 08-04-2022
Course Code & Title: 18ECE322T Optoelectronics | Duration: 12:30 -1:30PM
Year & SEM: II year/ 4th SEM | Max. Marks: 25

Answer Key

Part – A (5 x 1 = 5 Marks)
Instructions: Answer all

Q. No	Question	Marks	BL	CO	PO	PI Code
1	Divergence of Planewaves **A. 0 Degree** B. 30 Degree C. 45 Degree D. 90 Degree	1	1	1	1	1.4.1
2	Find out the wavelength of light entering to a medium of refractive index 1.5 while its wavelength is 600nm in air A. 800nm B. 950nm C. 350nm **D. 400nm**	1	2	1	1	1.4.1
3	Brewster's angle is also known as_____ A. Refracted angle B. Snell's angle C. Diffracted angle D. **Polarisation angle**	1	1	1	1	1.4.1
4	Calculate the wavelength emission for GaP (Eg= 2.2 eV) A. 860nm B. **563nm** C. 1550nm D. 1310nm	1	2	1	1	1.4.1
5	In case of energy bandgaps comparison which of the following is true **A. AlAs > GaAs** B. AlAs < GaAs C. AlAs = GaAs D. AlAs ≅ GaAs	1	2	1	1	1.4.1

Part – B (2 x 10 = 20 Marks)
Instructions: Answer any two Questions

6	(a). Define refractive index and its relation with relative permittivity, (b).Give an expression for sellmeier empherical equation and (c). Find out the refractive index of SiO_2 at 530nm using sellmeier equation. Given SiO2(fused silica) A1:0.696749; A2: 0.408218; A3:0.890815 λ1: 0.0690660um; λ2: 0.115662; λ3:9.900559 (3+2+5) a. $n = \frac{c}{v} = \sqrt{\varepsilon}$ b. $n^2 = 1 + \frac{A_1\lambda^2}{\lambda^2-\lambda_1^2} + \frac{A_2\lambda^2}{\lambda^2-\lambda_2^2} + \frac{A_3\lambda^2}{\lambda^2-\lambda_3^2}$ c. 1.461	10	3	1	1	1.4.1
7	(a). Discuss in detail about the various types of electromagnetic wave polarization, (b).Explain the selective absorption method. Find out the tilt angle if the detector intensity is 1 µW through a polaroid and the source intensity is 4 µW. (5+5) a. Linear, circular, elliptical b.  , 60°	10	3	1	1	1.4.1
8	(a). List the Mechanisms leading to absorption and emission of photons in a semiconductor, (b). Illustrate Heterojunction and discuss the importance of quantum well in semiconductor devices (5+5) a. Band-to-Band (Inter-band) Transitions. Impurity-to-Band Transitions. Free-Carrier (Intraband) Transitions,Phonon Transitions, Excitonic Transitions b. 	10	3	1	1	1.4.1