20CB/DS/CM102/PH03

Hall Ticket Number:

I/IV B.Tech(Regular/Supplementary)DEGREE EXAMINATION

February, 2024 — **Common to CB, DS & CM Branches**

First Semester — **Semiconductor Physics &Nano materials**

Time: Three Hours — **Maximum:70 Marks**

*Answer **Question NO. 1** compulsorily.* (14X1 = 14 Marks)

*Answer **ONE** questions from each unit.* (4X14=56 Marks)

			CO	BL	M
1	a)	List out any two successive failures of Somerfield free electron theory	CO1	L1	1M
	b)	List any two differences between metals, semiconductors and insulators.	CO1	L3	1M
	c)	Explain the concept of hole?	CO1	L3	1M
	d)	Define Fermi level.	CO1	L4	1M
	e)	Mention any two materials of interest for opto-electronic devices.	CO2	L2	1M
	f)	How a P-type semiconductor is formed?	CO2	L4	1M
	g)	How does the resistance change with rise of temperature in an intrinsic semiconductor	CO2	L4	1M
	h)	What is a donor level?	CO2	L4	1M
	i)	Write the principle of photovoltaic cell	CO3	L4	1M
	j)	Write the full form of LED and LCD	CO3	L2	1M
	k)	Define Faraday effect?	CO3	L4	1M
	l)	Define nanotechnology	CO4	L4	1M
	m)	List out any two properties of carbon nano tubes	CO4	L1	1M
	n)	Write the principle of XRD	CO4	L3	1M
		Unit-I			
2	a)	Define and deduce the expression for the density of states.	CO1	L1	9M
	b)	Compare Direct and Indirect band gap semiconductors	CO1	L1	5M
		(OR)			
3	a)	Evaluate the expression for Effective Mass of an Electron moving in Energy bands of a solid.	CO1	L1	6M
	b)	Explain Somerfield free electron theory.	CO1	L3	8M
		Unit-II			
4	a)	Discuss the formation and working mechanism of p-n junction diode in forward and reverse bias with neat sketch?	CO2	L2	9M
	b)	Variation of Fermi energy level with temperature in N-type Extrinsic semiconductor.	CO2	L2	5M
		(OR)			
5	a)	Derive an expression for the density of holes in the valence band of an intrinsic semiconductor	CO2	L3	8M
	b)	Compare Schottky and Ohmic junctions	CO2	L1	6M
		Unit-III			
6	a)	Discuss the principle, construction and working mechanism of solar cell.	CO3	L1	9M
	b)	Examine Kerr effect and explain with neat diagram.	CO3	L2	5M
		(OR)			
7	a)	Explain the principle, construction, working of LED.	CO3	L2	9M
	b)	Distinguish PIN and APD	CO3	L1	5M
		Unit-IV			
8	a)	Explain briefly various types of carbon nano tubes	CO4	L2	8M
	b)	Write a short note on 1. Surface to volume ratio 2. Quantum confinement	CO4	L3	6M
		(OR)			
9	a)	Develop the preparation of nano materials by Chemical Vapour deposition Technique	CO4	L3	8M
	b)	Summarize the applications of nano materials.	CO4	L2	6M

20CS/IT/EE/EI202

Hall Ticket Number:

I/IV B.Tech(Supplementary)DEGREE EXAMINATION

February,2024 — **Common to CS, IT, EE & EI**

Second Semester — **Semiconductor Physics &Nano materials**

Time: Three Hours — **Maximum:70 Marks**

*Answer **Question NO. 1** compulsorily.* (14X1 = 14 Marks)

*Answer **ONE** question from each unit.* (4X14=56 Marks)

			CO	BL	M
1	a)	Define Fermi level.	CO1	L4	1M
	b)	What are indirect band gap semiconductors?	CO1	L4	1M
	c)	What do you mean by effective mass of an electron?	CO1	L3	1M
	d)	Define Density of states.	CO1	L4	1M
	e)	Explain about depletion region in pn junction diode	CO2	L3	1M
	f)	Which type of semiconductor materials (Direct / Indirect) are preferred for fabrication of LED.	CO2	L2	1M
	g)	How a N-type semiconductor is formed?	CO2	L4	1M
	h)	What are fullerenes?	CO3	L4	1M
	i)	Why APD's are more sensitive to light over other devices.	CO3	L3	1M
	j)	Give applications of solar cell	CO3	L3	1M
	k)	What is photovoltaic effect?	CO3	L4	1M
	l)	How many types of carbon nano tubes?	CO4	L4	1M
	m)	Write any two application of nano materials?	CO4	L3	1M
	n)	Define nanotechnology	CO4	L4	1M
		Unit-I			
2	a)	Explain the origin of energy bands in solids using Kronig-Penny model	CO1	L3	10M
	b)	Analyze the concept of hole	CO1	L1	4M
		(OR)			
3	a)	Explain Somerfield free electron theory and mention any two failures of free electron theory.	CO1	L3	8M
	b)	Classify solid materials based on energy bands.	CO1	L1	6M
		Unit-II			
4	a)	Estimate the Fermi energy level and carrier concentration of P-type Extrinsic semiconductor.	CO2	L2	8M
	b)	Distinguish between Intrinsic and Extrinsic Semiconductors with examples?	CO2	L1	6M
		(OR)			
5	a)	Derive an expression for the density of electrons in the conduction band of an intrinsic semiconductor.	CO2	L2	8M
	b)	Describe and deduce expressions for the drift and diffusion currents in a semiconductor	CO2	L2	6M
		Unit-III			
6	a)	Explain the principle, construction, working of Liquid crystal display	CO3	L3	10M
	b)	Define Faraday Effect? explain with neat diagram	CO3	L4	4M
		(OR)			
7	a)	Elaborate the principle, construction and working of LED.	CO3	L2	8M
	b)	Explain Kerr Effect with neat diagram	CO3	L3	6M
		Unit-IV			
8	a)	Examine the preparation of Nano materials by Laser Ablation method	CO4	L1	8M
	b)	Discuss physical and chemical properties nano materials	CO4	L1	6M
		(OR)			
9	a)	Examine how nano particles are analyzed by XRD technique	CO4	L1	8M
	b)	What are Carbon nano tubes? Mention their Properties	CO4	L4	6M

22CM102/20DS102/20CB102/ 20PH003

Hall Ticket Number:

I/IV B.Tech (Supplementary) DEGREE EXAMINATION

March, 2023 — **Common to A.I &ML,CB & DS**

First Semester — **Semiconductor Physics & Nano Materials**

Time: Three Hours — **Maximum:** 70 Marks

Answer Question No.1 compulsorily. (1X14 = 14 Marks)

1	Answer all questions		(1X14=14 Marks)	
	a)	What do you mean by band gap?	CO1,L1	
	b)	In Sommerfeld free electron theory, electronic distribution obey's Pauli's exclusion principle. (True/False)	CO1,L3	
	c)	The energy band gap for metals is ----------.	CO1,L1	
	d)	The electrical conductivity of semiconductor increases with increase in temperature. (True/False)	CO1,L1	
	e)	How do you prepare n-type semiconductor?	CO2,L1	
	f)	What is the symbol for PN Junction diode.	CO2,L1	
	g)	Working principle of LED is ----------.	CO2,L1	
	h)	Write the expression for fill factor.	CO3,L1	
	i)	What is Kerr effect.	CO3,L1	
	j)	In nanomaterials, with decrease of particle size surface area to volume ratio ----------.	CO3,L1	
	k)	Mention any two physical methods of synthesis of nanomaterials.	CO3,L2	
	l)	In nanomaterials, properties depend on size of the nanoparticle. (True/False)	CO4,L2	
	m)	Define mobility of charge carriers.	CO4,L1	
	n)	In $2d\sin\theta = n\lambda$, n stands for ----------.	CO4,L3	
		UNIT I		
2.	a)	Illustrate the important features of Sommerfeld free electron theory.	CO1,L1	7M
	b)	Derive an expression for density of states.	CO1,L1	7M
		(OR)		
3.	a)	Explain the formation of energy bands in solids on the basis of Kronig Penny model.	CO1,L1	7 M
	b)	How will you classify the materials into conductors, semiconductors and insulators based on energy band gap?	CO1,L1	7 M
		UNIT II		
4.	a)	Write the important properties of semiconductors and distinguish between intrinsic and extrinsic semiconductors.	CO2,L1	8M
	b)	Derive an expression for Fermi level using the expressions of concentration of electrons and holes and discuss the effect of temperature on Fermi level.	CO2,L2	6M
		(OR)		
5.	a)	Derive an expression for the concentration of electrons in an N-type semiconductor.	CO2,L1	7M
	b)	Obtain the expressions for drift and diffusion currents.	CO2,L3	7M
		UNIT III		
6.	a)	Illustrate the construction and working of LED.	CO3,L3	8M
	b)	Distinguish between PIN diode and APD.	CO3,L2	6M
		(OR)		
7.	a)	Discuss V-I characteristics of solar cell and their applications.	CO3,L1	8M
	b)	Explain the working of Photo diode and their applications.	CO3,L3	6M
		UNIT IV		
8.	a)	How will you prepare nanomaterials using Sol-Gel method?	CO4,L1	7M
	b)	Write the important applications of nanomaterials.	CO4,L3	7M
		(OR)		
9.	a)	Write a note on carbon nanotubes.	CO4,L2	7M
	b)	Derive Bragg's law of X-ray diffraction.	CO4,L1	7M

20CSE/EEE/EIE/IT202/PH03

Hall Ticket Number:

I/IV B.Tech(Regular/Supplementary) DEGREE EXAMINATION

September,2022 — **Common to CSE,EEE,EIE&IT Branches**

Second Semester — **Semiconductor Physics & Nano materials**

Time: Three Hours — **Maximum:70 Marks**

Answer question 1 compulsory. **(14X1 = 14 Marks)**

Answer one question from each unit. **(4X14=56 Marks)**

			M	CO	BL
1.	a)	Mention any two drawbacks of Sommerfeld free electron theory.		CO1	2
	b)	Explain the concept of hole in a semiconductor.		CO1	2
	c)	Define Fermi level.		CO1	2
	d)	How a p-type semiconductor is formed.		CO2	2
	e)	How does the resistance change with rise of temperature in an intrinsic semiconductor?		CO2	2
	f)	Illustrate the position of Fermi level in an N-type semiconductor.		CO2	2
	g)	Mention any two materials of interest for opto-electronic devices.		CO2	2
	h)	Give two examples for elemental and compound semiconductors.		CO2	2
	i)	Define dark current.		CO3	2
	j)	Compare LCD and LED.		CO3	2
	k)	Write the principle of photovoltaic cell.		CO3	2
	l)	Why nanomaterials exhibit different properties.		CO4	2
	m)	What is laser ablation?		CO4	2
	n)	Define nanotechnology.		CO4	2
		Unit –I			
2.	a)	Explain briefly the Sommerfeld free electron theory of metals.	7M	CO1	3
	b)	Write note on direct and indirect band gap semiconductors.	7M	CO1	4
		(OR)			
3.	a)	Explain the origin of energy bands in solids using Kronig-Penny model.	7M	CO1	3
	b)	Discuss the expression for the density of states.	7M	CO1	4
		Unit –II			
4.	a)	Derive an expression for the density of holes in the valence band of an intrinsic semiconductor.	7M	CO2	4
	b)	Describe and deduce expressions for the drift and diffusion currents in a semiconductor.	7M	CO2	3
		(OR)			
5.	a)	Explain the formation of potential barrier across the P-N junction diode.	7M	CO2	3
	b)	Compare Schottky and Ohmic junctions.	7M	CO2	4
		Unit –III			
6.	a)	Explain the working principle of Solar cell with neat diagram.	7M	CO3	3
	b)	Explain the principle and working of LED.	7M	CO3	4
		(OR)			
7.	a)	Differentiate between PIN and APD.	7M	CO3	4
	b)	Define Kerr effect and explain with neat diagram.	7M	CO3	3
		Unit –IV			
8.	a)	How do the various properties of nanomaterials vary with their size?	7M	CO4	4
	b)	Explain the synthesis of Nanomaterials by CVD method with neat diagram.	7M	CO4	3
		(OR)			
9.	a)	Describe briefly the various types of carbon nanotubes.	7M	CO4	4
	b)	Explain briefly the important applications of carbon nanotubes.	7M	CO4	3

(20DS102/20CB102) 20PH003

Hall Ticket Number:

I/IV B.Tech (Regular/Supplementary) DEGREE EXAMINATION

APRIL, 2022 — **Common to CB & DS**

First Semester — **Semiconductor Physics**

Time: Three Hours — **Maximum:70** Marks

*Answer **Question NO. 1** compulsorily.* (14X1 = 14 Marks)

*Answer **ONE** questions from each unit.* (4X14=56 Marks)

			M	CO	BL
1.	a)	What are direct band gap materials?		**CO1**	
	b)	State Fermi level.		**CO1**	
	c)	How Metals, Semiconductors and Insulators differ from one another. Justify		**CO1**	
	d)	Recall diffusion current.		**CO2**	
	e)	What are p-type semiconductors?		**CO2**	
	f)	What are the applications of semiconductors?		**CO2**	
	g)	Give the equation for continuity.		**CO2**	
	h)	Recall Faraday effect.		**CO3**	
	i)	Define the effect which converts light energy to electrical energy.		**CO3**	
	j)	How LED is different from LCD?		**CO3**	
	k)	What is meant by Graphene?		**CO3**	
	l)	What are two dimensional confinements.		**CO4**	
	m)	Mention any two applications of nanomaterials.		**CO4**	
	n)	What are the two factors that vary the properties of Nano materials with bulk materials?		**CO4**	
		UNIT I			
2.	a)	Define and derive an expression for density of energy states in metals.	**10M**	**CO1**	
	b)	Differentiate direct and in direct band gap materials.	**4 M**	**CO1**	
		(OR)			
3.	a)	Define effective mass of an electron and derive an expression for the effective mass of an electron	**10M**	**CO1**	
	b)	Explain in brief the concept of hole.	**4 M**	**CO1**	
		UNIT II			
4.	a)	What are extrinsic semiconductors derive an expression for carrier concentration for n-type semiconductors.	**10M**	**CO2**	
	b)	Differentiate n-type and p-type semiconductors.	**4M**	**CO2**	
		(OR)			
5.	a)	Explain in detail the principle, construction and working of P-N junction diode.	**10M**	**CO2**	
	b)	How semiconductors are used in opto electronic devices.	**4M**	**CO2**	
		UNIT III			
6.	a)	Explain the principle, construction and working of LED.	**10M**	**CO3**	
	b)	Calculate the band gap of the LED which emits blue and red colour of wavelength 4040 A^0(blue) and 6020 A^0(red).	**4M**	**CO3**	
		(OR)			
7.	a)	Working of PIN and APD diode.	**10M**	**CO3**	
	b)	Explain LCD.	**4M**	**CO3**	
		UNIT IV			
8.	a)	Mention the characteristics of the nanomaterials.	**6M**	**CO4**	
	b)	How nanoparticles are prepared by CVD method, Explain.	**8M**	**CO4**	
		(OR)			
9.	a)	Short notes on types, properties and applications of CNT's.	**6M**	**CO4**	
	b)	Explain principle, construction and working of Scanning Electon Microscope.	**8M**	**CO4**	

20CSE/EEE/EIE/IT202/PH03

Hall Ticket Number:

I/IV B.Tech (Regular) DEGREE EXAMINATION

OCTOBER, 2021 — **Common to CSE,EEE,EIE&IT Branches**

First Semester — **Semiconductor Physics & Nanomaterials**

Time: Three Hours — **Maximum:70** Marks

*Answer **Question NO. 1** compulsorily.* (14X1 = 14 Marks)

*Answer **ONE** questions from each unit.* (4X14=56 Marks)

			M	CO	BL
1.	a)	What are indirect band gap semiconductors?		**CO1**	
	b)	Define Fermi energy.		**CO1**	
	c)	How metals, semiconductors and insulators differ from one another? Justify.		**CO1**	
	d)	State drift current.		**CO2**	
	e)	Differentiate intrinsic and Extrinsic semiconductors.		**CO2**	
	f)	List any two applications of semiconductors.		**CO2**	
	g)	Give the expression for continuity equation.		**CO2**	
	h)	State Faraday Effect.		**CO3**	
	i)	Define photo voltaic effect.		**CO3**	
	j)	How LED is different from LASER?		**CO3**	
	k)	Define Bragg's law.		**CO4**	
	l)	What are zero and one dimensional confinements?		**CO4**	
	m)	Mention any two properties of nanomaterials.		**CO4**	
	n)	In what way carbon nano tubes are helpful?		**CO4**	
		UNIT I			
2.	a)	Derive an expression for density of energy states in metals using carrer concentration.	**10M**	**CO1**	
	b)	List out the failures of Sommerfeld free electron theory.	**4M**	**CO1**	
		OR			
3.	a)	Define effective mass of an electron and derive the expression for the same.	**10M**	**CO1**	
	b)	Explain in brief the concept of hole.	**4M**	**CO1**	
		UNIT II			
4.	a)	What are intrinsic semiconductors and derive expression for carrier concentration.	**10M**	**CO2**	
	b)	Differentiate n-type and p-type semiconductors	**4M**	**CO2**	
		OR			
5.	a)	Explain various biasing conditions and V-I characteristics of PN junction diode.	**10M**	**CO2**	
	b)	List few materials used in manufacturing of opto electronic devices.	**4M**	**CO2**	
		UNIT III			
6.	a)	Explain the principle, construction and working of LED.	**10M**	**CO3**	
	b)	List any four applications of Photo diode.	**4M**	**CO3**	
		OR			
7.	a)	Working of PIN and APD diode.	**10M**	**CO3**	
	b)	Explain Kerr effect with neat labeled sketch.	**4M**	**CO3**	
		UNIT IV			
8.	a)	List the properties of nanomaterials.	**6M**	**CO4**	
	b)	How the nano particles are produced by laser ablation method, Explain.	**8M**	**CO4**	
		OR			
9.	a)	Short notes on types, properties and applications of CNT's.	**6M**	**CO4**	
	b)	Explain principle, construction and working of Scanning Electon Microscope.	**8M**	**CO4**	

20PH003

Hall Ticket Number:

I/IV B.Tech (Regular) DEGREE EXAMINATION

JULY, 2021 — **Data Science and Cyber Security**

First Semester — **Semiconductor Physics & Nanomaterials**

Time: Three Hours — **Maximum:70** Marks

*Answer **Question NO. 1** compulsorily.* (14X1 = 14 Marks)

*Answer **ONE** questions from each unit.* (4X14=56 Marks)

			M	CO	BL
1.	a)	Define Fermi level.		**CO1**	
	b)	What is effective mass of an electron?		**CO1**	
	c)	Define a direct band gap semiconductor.		**CO1**	
	d)	How a p-type semiconductor is formed?		**CO2**	
	e)	What is a drift current?		**CO2**	
	f)	Give the expression for continuity equation for p-type semiconductor.		**CO2**	
	g)	What is a donar level?		**CO2**	
	h)	Define Faraday effect?		**CO3**	
	i)	Compare LED and LCD		**CO3**	
	j)	Give applications of photocell.		**CO3**	
	k)	Determine the colour of light that emitted when we use a material of energy gap 1.9 eV.		**CO3**	
	l)	What are the two factors that influence the properties of nano materials?		**CO4**	
	m)	Classify carbon nano tubes.		**CO4**	
	n)	Give expression for Bragg's law.		**CO4**	
		UNIT I			
2.	a)	Explain Sommerfeld free electron theory and mention any two failures of quantum free electron theory.	**9M**	**CO1**	
	b)	An electron is bound in one-dimensional infinite well of width of 10^{-10} m. Find the energy values in the ground state and first two excited states in eV.	**5M**	**CO1**	
		OR			
3.	a)	Define density of states and find the expression for density of states.	**9M**	**CO1**	
	b)	Classify solid materials based on energy bands.	**5M**	**CO1**	
		UNIT II			
4.	a)	Define n-type semiconductor and derive the expression for carrier concentration in n-type semiconductor.	**9M**	**CO2**	
	b)	Explain how Fermi level varies with temperature in p-type semiconductor with a neat diagram.	**5M**	**CO2**	
		OR			
5.	a)	Explain the construction, working of p-n junction diode and draw its V-I characteristics.	**9M**	**CO2**	
	b)	Compare Schottky and Ohmic junctions.	**5M**	**CO2**	
		UNIT III			
6.	a)	Explain the principle, symbol, construction and working of LED.	**9M**	**CO3**	
	b)	Differentiate between PIN and APD.	**5M**	**CO3**	
		OR			
7.	a)	Explain the principle, construction, working of solar cell.	**9M**	**CO3**	
	b)	Define Kerr effect and explain with neat diagram.	**5M**	**CO3**	
		UNIT IV			
8.	a)	Explain the synthesis of nano materials by sol-gel technique with neat diagram.	**8M**	**CO4**	
	b)	Explain briefly chemical and optical properties of nano materials.	**6M**	**CO4**	
		OR			
9.	a)	Explain briefly the properties of carbon nanotubes.	**8M**	**CO4**	
	b)	Discuss applications of nano materials	**6M**	**CO4**	