

Enrollment No.....



## Faculty of Science

End Semester (Even) Examination May-2022

BC3EP08 Solid State Physics &amp; Devices

Programme: B.Sc.(CS)

Branch/Specialisation: Computer Science

Duration: 3 Hrs.

Maximum Marks: 60

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

- Q.1 i. Which one is the smallest and fundamental unit of any crystal system: **1**  
 (a) Unit cell (b) Lattice  
 (c) Miller Indices (d) Basis
- ii. Bragg's equation is: **1**  
 (a)  $d \sin \theta = n \lambda$  (b)  $2d \sin \theta = n \lambda$   
 (c)  $d \cos \theta = n \lambda$  (d)  $2d \cos \theta = n \lambda$
- iii. Magnetic susceptibility ( $\chi$ ) is negative for: **1**  
 (a) Paramagnetic (b) Diamagnetic  
 (c) Ferromagnetic (d) Vacuum
- iv. The unit of specific heat of solids is: **1**  
 (a)  $^{\circ}\text{C}$  (b) J/kg mol (c) K (d) J mole /Kg
- v. The number of terminals in transistors are: **1**  
 (a) Three (b) Four (c) Five (d) Two
- vi. Which device is used as a voltage regulator in electronic circuit: **1**  
 (a) Half wave rectifier (b) Transistor  
 (c) Zener Diode (d) LED
- vii. In a CE amplifier, the input and output signals are: **1**  
 (a) Positive (b) In opposite phase  
 (c) In same phase (d) Negative
- viii. In a transistor configuration value of  $\beta$  is about: **1**  
 (a) Less than 1 (b) More than 100  
 (c) Between 20 to 100 (d) Zero
- ix. Surface morphology of nanomaterials can be determined by: **1**  
 (a) SEM (b) TEM (c) XRD (d) Both (a) and (b)

- x. The structure of a spherical particle of radius 10 nm will be: **1**  
 (a) 0 D (b) 1 D (c) 2 D (d) 3 D

- Q.2 i. What do you mean by Miller indices? **2**  
 ii. Write three differences between crystalline and non-crystalline solids. **3**  
 iii. What is packing fraction? Determine the packing efficiency in Body Centred Cubic Crystal (BCC). **5**
- OR iv. What is X-ray diffraction? Explain the working of X-ray diffraction setup with its important part. **5**
- Q.3 i. What is Kronig-Penney model? Explain with suitable diagram. **2**  
 ii. Write any three limitations of the Einstein's theory of specific heat. **3**  
 iii. How we classify magnetic materials? Compare the properties of magnetic materials. **5**
- OR iv. What is Hall effect? How it works? Explain its working with neat and clean diagram. **5**
- Q.4 i. With the help of energy band diagram explain the difference between conductor, insulator and semiconductor. **3**  
 ii. What is a transistor? Explain the construction and operation of NPN transistor with the help of proper diagrams. **7**
- OR iii. What is Solar cell? Explain its construction and working. **7**
- Q.5 i. Write any four differences between oscillator and amplifier. **4**  
 ii. How does transistor work as an amplifier? Draw the circuit diagram and obtain expression for efficiency of an amplifier. **6**
- OR iii. What is feedback mechanism? Explain the principle of feedback and hence obtain the expression for voltage gain. **6**
- Q.6 Attempt any two:  
 i. What do you mean by Bottom-up and Top-down approach? Differentiate between them. **5**  
 ii. Write a brief note on the characterization method of nano materials which provides the information regarding the crystal structure. **5**  
 iii. What are the major differences between the measurement taken from SEM and TEM methods? **5**

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**Marking Scheme**  
**BC3EP08 Solid State Physics & Devices**

Q.1	i.	(a) Unit cell		<b>1</b>
	ii.	(b) $2d \sin \theta = n \lambda$		<b>1</b>
	iii.	(b) Diamagnetic		<b>1</b>
	iv.	(b) J/kg mol		<b>1</b>
	v.	(a) Three		<b>1</b>
	vi.	(c) Zener Diode		<b>1</b>
	vii.	(b) In opposite phase		<b>1</b>
	viii.	(c) Between 20 to 100		<b>1</b>
	ix.	(a) SEM		<b>1</b>
	x.	(a) 0 D		<b>1</b>
Q.2	i.	Definition/explanation by example	2 Marks	<b>2</b>
	ii.	Each difference 1 mark for each	(1 Mark*3)	<b>3</b>
	iii.	Packing fraction	2 Marks	<b>5</b>
		Determination of formula and value of packing efficiency	3 Marks	
OR	iv.	X- ray diffraction definition	2 Marks	<b>5</b>
		Explain of X-ray diffraction with part.	3 Marks	
Q.3	i.	Kronig-Penney model and its diagram.	1 Mark for each (1 Mark*2)	<b>2</b>
	ii.	Three limitations.	1 Mark for each (1 Mark*3)	<b>3</b>
	iii.	Types of magnetic materials	2 Marks	<b>5</b>
		Comparison	3 Marks	
OR	iv.	Hall effect	2 Marks	<b>5</b>
		Working with diagram.	3 Marks	
Q.4	i.	Each diagram	1 Mark for each (1 Mark*3)	<b>3</b>
	ii.	Definition of transistor	2 Marks	<b>7</b>
		Construction	2 Marks	
		Operation.	3 Marks	
OR	iii.	Solar cell definition	2 Marks	<b>7</b>
		Construction	2 Marks	
		Working	3 Marks	
Q.5	i.	Each difference	1 Mark for each (1 Mark*4)	<b>4</b>
	ii.	Transistor work as an amplifier	2 Marks	<b>6</b>

		Circuit diagram	2 Marks	
		Expression	2 Marks	
OR	iii.	Feedback mechanism	2 Marks	<b>6</b>
		Principle	2 Marks	
		Expression	2 Marks	
Q.6		Attempt any two:		
	i.	Each difference	1 Mark for each (1 Mark*5)	<b>5</b>
	ii.	Figure	2 Marks	<b>5</b>
		Explanation	3 Marks	
	iii.	Each difference	1 Mark for each (1 Mark*5)	<b>5</b>

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