



Sanjay Ghodawat University, Kolhapur  
Established as State Private University under Govt. of Maharashtra.  
Act No XL, 2017

2019-20  
EXM/P/09/00

Year and Program:

School of Science

Department of Physics

2019-20, T.Y.B.Sc. (Physics)

Course Code – PHS303

Physics VI - Solid State Physics

Semester – V

Day and Date – Thursday  
21/11/19

End Semester Examination  
section A.

Time: 30 Min 10-30am to 11am  
Max Marks: 20

PRN number –

Seat no-

Answer Booklet No.-

Students' Signature -

Invigilator's Signature –

### Instructions:

- 1) All questions are compulsory.
- 2) Attempt Q.1 within first 30 minutes.
- 3) Each MCQ type question is followed by four plausible alternatives, Tick ( $\sqrt{\phantom{x}}$ ) the correct one.
- 4) Answer to question 1 should be written in the question paper and submit to the Jr. Supervisor.
- 5) If you tick more than one option it will not be evaluated.
- 6) Figures to the right indicate full marks.
- 7) Use Blue ball pen only.

Q.1	Select the correct alternative.	Marks	Bloom's Level	CO
a)	Relation between atomic radius $r$ and lattice constant $a$ in the case of BCC lattice is .... (i) $r = a/2$ (ii) $r = (\sqrt{2}/4).a$ (iii) $r = (\sqrt{3}/4).a$ (iv) $r = 4a$	01	L2	CO1
b)	The Miller index of the plane parallel to the $x$ -axis and $y$ -axis is..... i) (100) ii) (010) iii) (001) iv) (111)	01	L2	CO1
c)	Co-ordination number for FCC crystal is..... i) eight ii) six iii) twelve iv) four	01	L1	CO1
d)	Compton shift varies with..... i) angle of scattering ii) Plank constant iii) electron mass iv) velocity of light	01	L2	CO2

Q.1	Select the correct alternative.	Marks	Bloom's Level	CO
e)	In Bragg's spectrometer rotating arm is rotated through .... i) $0^\circ$ ii) $20^\circ$ iii) $30^\circ$ iv) $1.5^\circ$	01	L1	CO2
f)	Bragg used .....radiation to study diffraction by crystals. i) laser                  ii) uv                  iii) visible                  iv) X-ray	01	L1	CO2
g)	When the band gap is in the order of 1 eV in a solid , it behaves as a ... i) conductor                  ii) semiconductor iii) metal                  iv) insulator	01	L2	CO3
h)	Conductivity of semiconductor increases with .... i) increase in temperature                  ii) increase in band gap iii) decrease in carrier concentration                  iv) none of these	01	L2	CO3
i)	The periodicity of lattice is given by ... i) Bloch theorem                  ii) Plank theorem iii) Lorentz theorem                  iv) none of these	01	L1	CO3
j)	Hall Coefficient is given by formula.... i) $R = 1/\eta \cdot e$ ii) $R = 1/e$ iii) $R = 1/\eta \cdot e \mu$ iv) $R = 1/\eta \cdot \mu$	01	L2	CO3
k)	The critical magnetic field is that at which..... i) a material behaves as a normal conductor for last time. ii) a material maintains its superconductivity for the last time iii) a material has its mixed normal – superconducting state iv) a material transforms from superconducting state to normal state	01	L2	CO3
l)	The critical temperature is that temperature where..... i) resistivity of a superconducting material drops to zero ii) current flowing through a superconductor is minimum iii) magnetic field inside a superconductor becomes constant iv) none of these	01	L2	CO3



m)	Critical temperature of Mercury is.....	01	L1	CO3
	i) 98K                      ii) 9.4K                      iii) 0.01K                      iv) 4.15K			
n)	Hysteresis loop is the characteristics of which materials....	01	L2	CO4
	i) diamagnetic materials                      ii) paramagnetic materials iii) ferromagnetic materials                      iv) superconducting materials			
o)	In dielectric, the polarization is ....	01	L2	CO4
	i) linear function of the applied electric field ii) square function of the applied electric field iii) exponential function of the applied electric field iv) none of these			
p)	The relation between dielectric constant ( $\epsilon_r$ ) and electric susceptibility ( $\chi_e$ ) is .....	01	L1	CO4
	i) $\chi_e = (\epsilon_r - 1)$ ii) $\chi_e = \epsilon_r \epsilon_0$ iii) $\chi_e = \epsilon_r / \epsilon_0$ iv) $\chi_e = \epsilon_0 (\epsilon_r - 1) E$			
q)	Polarization is defined as ....	01	L1	CO4
	i) dipole moment per unit volume                      ii) surface charge density iii) dipole moment per unit area                      iv) none of these			
r)	Ferromagnetic substances have .....	01	L2	CO4
	i) high permeability and low susceptibility ii) low permeability and high susceptibility iii) low permeability and low susceptibility iv) high permeability and high susceptibility			
s)	The susceptibility of paramagnetic substance is ....	01	L2	CO4
	i) negative                      ii) positive                      iii) zero                      iv) none of these			
t)	Diamagnetic substances when placed in a magnetic field are....	01	L2	CO4
	i) strongly attracted                      ii) repelled iii) weakly attracted                      iv) neither attracted nor repelled			

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Course Code – PHS303

Physics VI - Solid State Physics

Semester – V

Day and Date – Thursday  
21/11/19.

End Semester Examination

Time: 2.30 hr 11am to 01.30pm

Section-B

Max Marks: 80

PRN number –

Seat no-

Answer Booklet No.-

Students' Signature -

Invigilator's Signature –

**Instructions:**

- 1) All questions are compulsory.
- 2) Use of scientific calculator is allowed.
- 3) Figures to the right indicate full marks.

Q.2	Answer the following questions: (12 Marks)	Marks	Bloom's Level	CO
a)	Derive the formula for density of SC, BCC and FCC crystals. Find the interplanar spacing for the planes (201) in cubic crystal of lattice constant 4.3 Å.	06	L5	CO1
b)	Define Miller index. Give the procedure to find Miller index of a plane. Give features of it.	06	L3	CO1
OR				
b)	i) Explain types of Unit cell.	03	L2	CO1
	ii) A substance with FCC lattice has density 6250 Kg/m <sup>3</sup> and molecular weight 60.2. Calculate lattice constant "a". (Avogadro's number = 6.02 x 10 <sup>26</sup> Kg/mole).	03	L5	CO1

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Q.3	Answer the following questions: (12 Marks)	Marks	Bloom's Level	CO
a)	With suitable diagram explain the construction and working of Bragg's X-ray spectrometer.	06	L4	CO2
b)	Define Compton effect and Compton shift. Show how Compton shift varies with angle of scattering of photon. OR	06	L5	CO2
b)	i) The Bragg's angle corresponding to the first order reflection from the plane of crystal is $30^\circ$ , when the X-rays of wavelength $1.78 \text{ \AA}$ are used. Calculate the interplanar spacing.	03	L3	CO2
	ii) Calculate the glancing angle for a cubic (100) crystal of rock salt ( $a=2.814 \text{ \AA}$ ) corresponding to second order diffraction maximum for X-rays of wavelength $0.710 \text{ \AA}$	03	L2	CO2
Q.4	Answer the following questions: (28 Marks)	Marks	Bloom's Level	CO
a)	Define superconductor. Explain Type – I superconductors.	06	L2	CO3
b)	On the basis of band theory how the crystalline solids are classified into conductors, semiconductors and insulators. OR	08	L6	CO3
b)	Describe Bloch Theorem.	08	L4	CO3
c)	Write any six applications of superconductors. OR	06	L1	CO3
c)	Explain Hall Effect.	06	L2	CO3
d)	i) The conductivity and the Hall Coefficient of an n- type silicon specimen are $112 \text{ /}\Omega\text{.m}$ , and $1.25 \times 10^{-4} \text{ m}^3 \text{ C}^{-1}$ , respectively. Calculate the charge carrier density and electron mobility.	04	L5	CO3
	ii) The transition temperature for Pb is $7.2^\circ\text{K}$ . However at $5^\circ\text{K}$ it loses the superconducting property if subjected to a magnetic field of $3.3 \times 10^4 \text{ A/m}$ . Find the maximum value of H which will allow the metal to retain its superconductivity at $0^\circ\text{K}$ .	04	L5	CO3

Q.5	Answer the following questions: (28 Marks)	Marks	Bloom's Level	CO
a)	Describe ferromagnetic materials? Explain hysteresis curve in case of these materials.	12	L4	CO4
b)	Obtain Clausius - Mossotti equation.	08	L5	CO4
OR				
b)	i) Write applications of dielectric materials.	04	L1	CO4
	ii) Differentiate between soft ferromagnetic materials and hard ferromagnetic materials.	04	L4	CO4
c)	i) The magnetic field in the interior of a certain solenoid has the value of $6.5 \times 10^{-4}$ T when solenoid is empty, When it is filled with iron the field becomes 1.4 T. Find the relative permeability of the material.	04	L5	CO4
	ii) The magnetic field intensity in the piece of ferric oxide is $10^6$ A/m. If the susceptibility of the material is $1.5 \times 10^{-3}$ . Calculate the magnetization produced.	04	L5	CO4

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