(A)

Instructions:
1) All Questions are compulsory.
2) Mark √ to the correct option. Do not circle.
3) More than one options marked will not be considered for assessment.
4) Rough calculations on paper are not allowed.
5) Use of non-programmable calculator is allowed.

Q.1		Solve the following questions.	Marks	Bloom's Level	CO
a)		**Select the correct alternative.**			
	i)	Sample strain can be determined by …...	01	L_1	606.1

    1) Thomson method   2) Williamson Hall method
    3) Joule method   4) Scherer's method

| | ii) | XRD pattern of amorphous material will show …. | 01 | L_2 | 606.1 |

    1) sharp peak   2) hump
    3) doublet peak   4) none of these

| | iii) | Einstein's photoelectric equation is given by formula….. | 01 | L_2 | 606.2 |

    1) $1/mv^2 = P$ 2) $\frac{1}{2} mv^2 = h(v - v_0)$

    3) $\frac{1}{2} mv^2 = hc$ 4) non of above

| | iv) | Minimum wavelength of X-ray is given by formula….. | 01 | L_2 | 606.2 |

    1) $\lambda = h/mv$ 2) $\lambda = 12400/V$ Å
    3) $\lambda = mv$ 4) none of these

| | v) | Contact mode and non contact mode is present in which technique. | 01 | L_4 | 606.3 |

    1) SEM   2) XPS
    3) TEM   4) AFM

ESE

vi)	AFM tip is made up of	01	L_2	606.3
	1) Cu 2) Ni 3) Fe 4) tungsten carbide			
vii)	............scanners are used in STM.	01	L_4	606.3
	1) metal 2) piezoelectric scanners 3) semiconductor 4) dielectric			
viii)	STM is used to study only	01	L_2	606.3
	1) soft superconductors 2) hard superconductor 3) conducting samples 4) non conducting samples			
ix)	In TEM generally sample grids are made up of	01	L_1	606.4
	1) Copper 2) Lead 3) Gold 4) Silver			
x)	In case of SEM.....is used to produce electrons.	01	L_1	606.4
	1) anode 2) electron gun 3) condenser lens 4) cathode			
xi)	In case of TEM .... emitted from the specimen are studied.	01	L_2	606.4
	1) X-rays 2) ions 3) secondary electrons 4) transmitted electrons			
xii)	SEM gives...........image. 1) 1D 2) 2D 3) 3D 4) All of these	01	L_1	606.4

b) **State whether the given statement is true or false.**

i)	The minimum frequency of the incident light at which emission just begins is called as threshold frequency.	01	L_1	606.1
ii)	XPS can not detect easily Helium element.	01	L_1	606.2

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iii)	STM is used to study all types of samples such as conducting, non conducting, biological.	01	L_2	606.?
iv)	Imaging system in a TEM consists of graphene screen.	01	L_1	606.?

c) **Fill in the blank.**

i)	Powder diffraction is specially made to study.... (single /poly) crystals.	01	L_1	606.1
ii)	The velocity of photoelectron is directly proportional to frequency of light.	01	L_1	606.2
iii)	In STM interaction between substrate and............. is studied.	01	L_2	606.3
iv)	For smaller monitor screen the magnification of the displayed SEM image becomes ....(smaller / larger).	01	L_2	606.4

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SGU	Sanjay Ghodawat University, Kolhapur		2018-19
	Established as State Private University under Govt. of Maharashtra. Act No XL, 2017		EXM/P/09/01
Year and Program: 2018-19 S.Y.M.Sc.	School of Science		Department of Physics
Course Code: PHN606	Course Title: Physical and Chemical Characterization Techniques		Semester – IV
Day and Date: Saturday, 25th May 2019	End Semester Examination (ESE)		Time: Max Marks: 80 3.00 to 5.30 pm

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Instructions:

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

			Marks	Bloom's Level	CO
Q.2		**Solve the following questions.**			
	a)	Elaborate with diagrams, how does uniform and non-uniform strain affect the XRD peak? Also explain how to measure strain in the sample. Calculate the interplanar spacing for (321) plane in a simple cubic lattice where lattice constant is 4.2 Å.	12	L_2, L_5	606.1
	b)	Explain the information that can be obtained from typical XRD patterns. OR	04	L_5	606.1
	b)	The peak position and FWHM for (200) peak is $2\theta = 65.045°$ and FWHM $= 1.50079°$, calculate the average particle size of the material. (Given: $\lambda = 1.54$ Å)	04	L_3	606.1
Q.3		**Solve the following questions.**			
	a)	Derive Einstein's photoelectric equation and explain the principle of working of X-ray Photoelectron Spectroscopy (XPS). The threshold frequency of a metal is 1.2×10^{15} Hz. If a light of frequency 1.5×10^{15} Hz is made to incident on the metal plate, calculate the maximum K.E. of the ejected photoelectron. ($h = 6.62 \times 10^{-34}$ J.s).	12	L_3, L_5	606.2
	b)	State any four advantages of Energy Dispersive X-ray Analysis Technique (EDAX). OR	04	L_2	606.2
	b)	The energy of photon is 5.28×10^{-19} J. Calculate frequency and	04	L_3	606.2

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wavelength. (Given: $C = 3 \times 10^8$ m/s and h = 6.625×10^{-34} J.s).

Q.4   **Solve the following questions.**

a) Describe the construction of Atomic Force Microscopy (AFM) and discuss   12 L_5 606.3
how surface topography can be studied by using this technique. Enlist any
two advantages and two disadvantages of AFM.

b) Describe the construction of Scanning Tunneling Microscopy (STM) and   08 L_6 606.3
elaborate in brief how STM can be used to showcase the surface
morphology of the sample.
OR

b) State any four applications of each of AFM and STM.   08 L_2 606.3

c) Distinguish between AFM and STM.   04 L_4 606.3

Q.5   **Solve the following questions.**

a) Explain the construction and working of Transmission Electron   12 L_2 606.4
Microscopy (TEM). Enlist any two advantages of the TEM.

b) Explain how Gatan software can be used to analyze the TEM data for   08 L_5 606.4
interplanar distance calculation.

OR

b) Discuss the role of the components/ parts of Scanning Electron   08 L_6 606.4
Microscopy (SEM).

c) State any two applications of TEM and SEM each.   04 L_2 606.4

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