13/12/22 (E)

Exam.Code:1031
Sub. Code: 7551

2122

M. Tech. (Material Science and Technology)
Third Semester
MT-301: Advanced Material Characterization

Time allowed: 3 Hours Max. Marks: 50

***NOTE:*** *Attempt five questions in all, including Question No. I which is compulsory and selecting two questions from each Unit.*

*x-x-x*

I. Attempt the following:-

a) Working of non-contact mode atomic force microscope.

b) Explain why H and He cannot be detected by Auger electron spectroscopy.

c) What are the differences between electron energy analyzers of AES and XPS?

d) Why, in your opinion, people are more likely to use an AFM than an STM for topographic examinations?

e) Describe working principal of spectroscopic ellipsometery. (5x2)

## UNIT - I

II. a) Describe the ion channeling effect in materials.

b) Discuss the working principal of Rutherford backscattering (RBS) technique.

c) Derive Rutherford cross-section for backscattering in a given laboratory system. (3+4+3)

III. a) Explain the phenomena of surface relaxation and reconstruction and related mechanism.

b) How one can use LEED be used to determine surface structures quantitatively? Consider, e.g. a case to find the precise position of adsorbed atoms within the square surface unit cell. (5+5)

IV. Write short notes on:-

a) Secondary ion mass spectroscopy (SIMS)

b) Ion-matter interaction and ion channeling in solids

c) Reflection High energy electron Diffraction (RHEED)

d) Liquid metal ion sources (4x2½)

## UNIT - II

V. a) Describe the working principal, instrumentation involved and applications of x-ray photoelectron spectroscopy technique.

b) Suggest an appropriate technique to determine the composition of the following types of sample:

i) thin film of oxides

ii) polycrystailine metals

iii) nanometer-thick coatings of metal on a polymer. (7+3)

P.T.O.

VI. a) Describe the difference between dark field and bright field imaging modes of a transmission electron microscope.

b) What are the issues related to focusing electron beams in a TEM?

c) What information can be extracted from a selected area diffraction pattern? (4+3+3)

VII. Write short notes on:-

a) X-ray absorption spectroscopy

b) Imaging insulating samples with a SEM

c) Scanning tunneling spectroscopy

d) Density of states determination using STM (4x2½)

*x-x-x*