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**MSS 553**

**IV Semester M.Sc. Examination, September/October 2022**  
**MATERIALS SCIENCE**  
**Materials Testing and Characterization**

Time : 3 Hours

Max. Marks : 70

**Instructions :** i) *Scientific calculator may be allowed.*  
ii) *Answer all questions.*

1. a) Describe the construction and working of oil diffusion pumps. How can back streaming be minimized in these pumps ?
- b) Obtain the fundamental equation of vacuum technology and state its significance in designing vacuum systems. **(12+08)**

OR

2. a) Describe construction and working of a cryogenic pump and mention its merits.
- b) Explain the construction and working of hot cathode ionisation gauge. Discuss its working range and suggest how the range can be extended. **(08+12)**
3. a) Compare the usefulness of destructive testing and non-destructive testing in ensuring the quality of materials and mention the various NDT techniques generally employed.
- b) Explain the factors affecting the resolution in the case of X-ray radiography. **(08+12)**

OR

4. a) Discuss various factors affecting the contrast in X-ray radiography.
- b) Describe the neutron radiography method of flaw detection in materials. **(12+08)**

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5. a) Describe the working principle of SEM with a neat diagram. Discuss the factors which determine the backscattered and secondary yields.

b) Discuss some applications of SEM. **(14+06)**

OR

6. Explain how composition of a material can be analyzed using X-ray emission spectroscopy. Compare the working principle and the sensitivities of EDAX and EPMA. **20**

7. Answer the following. **Each** question carries **two** marks. **(2×5=10)**

a) Calculate the mean free path of air molecules at 298 K and a pressure of 0.5 microns.

b) What are the functions of oil in oil sealed rotary vacuum pump ?

c) Distinguish between Rayleigh wave and Lamb wave.

d) Calculate the de Broglie wavelength of an electron subjected to an accelerating potential of 50 kV.

e) Why is Dysprosium preferred for use as an intermediate detector in neutron radiography ?

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