Registration No. :

Total number of printed pages – 2

B. Tech
PCMT 4401

Seventh Semester (Special) Examination – 2013
X-RAY AND ELECTRON MICROSCOPY
BRANCH : MME
QUESTION CODE : D 389
Full Marks – 70
Time : 3 Hours

*Answer Question No. 1 which is compulsory and any **five** from the rest.*

The figures in the right-hand margin indicate marks.

1. Answer the following questions :   2×10

    (a) Characterization radiation is independent of applied voltage. Why ?

    (b) Distinguish between Sealed and Demountable X-ray tube.

    (c) Why is Pb used for protection of personal in X-ray laboratory ?

    (d) What is Compton Effect ? Explain briefly the limitations of it.

    (e) What is atomic scattering factor ? How does it affect by angle of diffraction ?

    (f) What is mass absorption coefficient ?

    (g) What are the most common target used in X-ray tubes ?

    (h) What do you mean by Bremsstrahlung radiation ?

    (i) What type of lens does an electron microscope use ?

    (j) What are the two types of electron microscopes ?

2. (a) Discuss the mechanism of production of X-rays. What do you mean by filter ? How the filter materials are chosen for X-ray diffraction ?   5

    (b) What is Residual Stress ? Discuss the use of X-ray in Residual Stress Determination.   5

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3.　(a)　What is reciprocal lattice ? Give the relation between the direct lattice and the reciprocal lattice ? 　5

　　(b)　How the reciprocal lattice is used in different X-rays ? 　5

4.　(a)　What is Lorentz polarization factor ? Discuss. 　5

　　(b)　Explain the difference between camera method and diffraction method for X-ray diffraction for powder material. 　5

5.　(a)　Explain the principle of X-ray diffraction. Derive Bragg's law. 　5

　　(b)　Discuss some physicochemical properties of X-ray. Determine the wavelength of copper radiation for $K_{\alpha 1}$ line $\lambda_K = 0.61977$ Å, $\lambda_{111} = 4.9120$ Å. 　5

6.　(a)　Discuss the Fundamental Principles of Scanning Electron Microscopy (SEM). 　5

Or

What is the basis of SAD ? Discuss its utility and superiority over XRD.

　　(b)　Discuss the application of SEM in Metallurgy with special reference to failure analysis. 　5

7.　(a)　Discuss the Fundamental Principles of Electron probe micro-analyzer (EPMA). Discuss few applications of EPMA. 　5

　　(b)　A crystal has a cubic unit cell of 4.2 Å. Using a wavelength of 1.54 Å at what angle (2θ) would you expect to measure the (111) peak ? 　5

　　　　(i)　10.6°

　　　　(ii)　18.5°

　　　　(iii)　43.0°

　　　　(iv)　37°

8.　Write short notes on any **two** : 　5×2

　　(a)　Film loading in Debye Scherer Camera

　　(b)　White Radiation

　　(c)　Use of TEM in micro structural investigation of metallic materials

　　(d)　Laue method in diffraction

　　(e)　Sample preparation for TEM.