



**DHH-003-010406**

Seat No. \_\_\_\_\_

**M. Sc. (Sem. IV) (CBCS) Examination**

**May / June - 2015**

**Advanced Instrumental Techniques :**

**C (PM) - 402 & C (PA) - 402**

**Faculty Code : 003**

**Subject Code : 010406**

Time :  $2\frac{1}{2}$  Hours]

[Total Marks : 70

- Instructions :** (1) All questions are compulsory.  
(2) All questions carry equal marks.

**1. Answer the following (Any Seven):**

- Define: Polarized light, Optical activity, Dextro rotation, Unit cell
- What is the principle of thermogravimetry? What information one can get from TG thermograms.
- What is automated method of chemical analysis? How it differ from automatic method. Give advantages of it.
- Give the function of running buffer and buffer additives in electrophoresis.
- Explain briefly capillary gel electrophoresis.
- Draw a hypothetical DSC curve and label various types of transitions.
- Mention the steps of unit operation of chemical analysis.
- Differentiate between X-ray absorption and X-ray fluorescence.
- State the Freeman- Carrol equation and write the significance of all the terms involved in it.
- How x-rays are generated? Explain emission of K and L lines X-rays.

**2. Answer the following (Any Three):**

- (a) (i) Define specific rotation.

A solution of 2.0 g of (+) lactic acid in 10.0 ml of water was placed in 100 mm polarimeter tube using the sodium D line. A rotation of  $1.74^{\circ}$  was observed at  $25^{\circ}\text{C}$ . Calculate the specific rotation of (+) lactic acid.

(ii) Explain the term racemic mixture.

Calculate the relative proportions of (+) 2-butanol and

(-) 2-butanol required to give a specific rotation of  $+0.45^\circ$ .

- (b) Define and explain ORD, CD and Cotton effect.
- (c) Draw and explain the functioning of ORD spectroscopy.
- (d) Write note on electrophoresis.

**3. Answer the following:**

(a) Derive the Bragg's law.

Calculate the separation of the (123), (246), (133) and (399) planes of an orthorhombic unit cell with  $a=0.82\text{nm}$ ,  $b=0.94\text{nm}$  and  $c=0.75\text{nm}$ .

(b) Discuss the rotating crystal X-ray diffraction method.

**OR**

(c) A substance known to have a cubic unit cell gives reflections with  $\text{CuK}\alpha$  X-rays of wavelength  $154\text{ pm}$  at glancing angles  $19.4^\circ$ ,  $22.5^\circ$ ,  $32.6^\circ$  and  $39.4^\circ$ . The reflection at  $32.6^\circ$  is known to be due to the (220) planes. Index the other reflections.

**4. Answer the following:**

(a) Discuss the principle and working of DTA technique.

Following are the TGA data for a sample at  $10^\circ\text{C/min}$ :

$1/T$	% W	$dW/dt$
$1.49 \times 10^{-3}$	20.09	11.50
$1.50 \times 10^{-3}$	25.42	12.93
$1.51 \times 10^{-3}$	31.06	13.97
$1.52 \times 10^{-3}$	36.89	14.54
$1.53 \times 10^{-3}$	42.78	14.61
$1.54 \times 10^{-3}$	48.59	14.18
$1.55 \times 10^{-3}$	54.20	13.27
$1.56 \times 10^{-3}$	59.48	11.95

Determine order of reaction, energy of activation, frequency factor and entropy for the reaction. ( $R=8.314\text{JK}^{-1}\text{mol}^{-1}$ ).

(b) Discuss the various physical and chemical properties evaluated by DSC and TGA methods. State the various fields of chemistry in which these techniques are used.

**5. Answer the following (Any two):**

- (a) Write note on flow injection analysis.
  - (b) Discuss the principle and experimental technique of Gel chromatography.
  - (c) Describe the principle and instrumental of osmotic elemental analyser.
  - (d) Give an account of electro osmosis.
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