Nirma University

Institute of Technology

Semester End Examination (IR), May 2022

B. Tech., Semester-VI

2CHOE01: CHEMICAL ANALYTICAL TECHNIQUES

Roll / Exam No. 19BCE245

Supervisor's initial with date

Time: 3 Hours **Max. Marks: 100**

Instructions:
1. Attempt all questions.
2. Figures to right indicate full marks.
3. Use section-wise separate answer book.
4. Draw neat sketches wherever necessary.

SECTION – I

Q-1. Answer the following questions: (CO1, BL1) **[16]**

A. Define standard solutions. Explain types of standard solutions with suitable examples. [08]

B. What is the range of infra-red radiations? Why the actual number of peaks shown by the molecule in IR graph is always less than the theoretical bands. [08]

Q-2. Answer the following questions: (CO3, BL3) **[14]**

i. Differentiate between TGA and DSC mode of thermal analysis. [07]

ii. Outline XRD technique and its working to calculate the percentage of crystallinity in the analyzed sample. [07]

Q-3. Answer the following questions: (CO4, BL3) **[20]**

A. Provide and justify the range of following functional groups on IR graph: OH, COOH, CH_3, C=C, NH_2, $CONH_2$, C=O, Finger print region [08]

B. Linear molecule has (3n-5) vibrational degrees of freedom whereas non-linear molecules have (3n-6) vibrational degrees of freedom. Explain with the examples of suitable molecules. [12]

OR

The force constant of CO molecule is 1840 Nm^{-1}. Calculate the vibrational frequency (in cm^{-1}). Given atomic masses are: C^{12}= 19.9×10^{-27} kg; ^{16}O= 26.6×10^{-27} kg.

SECTION – II

Q-4. Answer the following questions: (CO2, BL2) **[16]**

A. The wavelengths of first-order X-rays are 2.20A^0 at 27°8'. Find the distance between the adjacent Miller planes. [08]

B. State Bragg's law and Hook's law with their expression and application. [08]

Q-5. Answer the following questions: (CO3, BL2) **[14]**

i. Define Spectroscopy. Discuss its classification in detail. [07]

ii. Elaborate SEM in detail and sketch the diagram of instrument. [07]

Q-6. Answer the following questions. (CO4, BL4) **[20]**

A. Calculate the energy associated with a radiation having wavelength 300mμ. Report the results in kcalmole^{-1}, kJmole^{-1} and ev. [07]

B. State the Lambert Beer law and provide any two equations in which it can be expressed. [13]
The molar absorptivity of a substance is 2.0×10^4 cm^{-1} mol^{-1} dm^3. Calculate the transmittance through a cuvette of path length 5.0 cm containing 2.0×10^{-6} mol dm^3 solution of the substance.

OR

B. How is Fieser Kuhn rule different from Woodward Fieser rule? [13]
Utilise the Fieser Kuhn Rule [$\lambda_{max} = 114 + 5x + y\,(48.0 - 1.7\,y) - 16.5\,R_{endo} - 10\,R_{exo}$] to find out the wavelength of the lycopene shown below.