BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: BE **SEMESTER : III**
BRANCH: BIOTECHNOLOGY **SESSION : MO/18**

SUBJECT: BT3025-BIO-ANALYTICAL TECHNIQUES

TIME: 03:00 **FULL MARKS: 60**

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a) Calculate relative centrifugal force of a fixed angle type rotor with rpm of 160,000 and r_{min} of 20 mm and r_{max} of 80 mm. [2]

(b) Derive Svedberg equation for an un-hydrated molecule in terms of molecular weight of the macromolecule, density of solvent and partial volume particle. Illustrate $CsCl_2$ and sucrose gradient analytical centrifuge? [4]

(c) A protein has a sedimentation coefficient of 7.2 S, a diffusion coefficient D = 8.8 x $10^{-7}$$cm^2$ sec^{-1} and v_p = 0.92 cm^3 g^{-1} (all measured at 22^{o}C). (a) How long will it require to migrate from r = 11.0 cm to r = 11.8 cm in a rotor spinning at 72,000 rpm? (Assume constant velocity throughout this time). (b) What is the molecular weight of the DNA? [6]

Q.2(a) Compare the Van-Deemeter and Halasz Equation related to chromatography? [2]

(b) Consider for a LC chromatogram consisting of two peaks with following details, first peak with height of 18,000 au, retention time of 20 mins and FWHM of 2 msec, for second peak height 40,000 au, retention time 30 mins and FWHM 8 msec, calculate (a) number of Theoretical Plates (N), (b) Resolution (RS) and (c) Separation factor. [4]

(c) Illustrate, sketch, and interpret mechanism of Affinity Chromatography (principle, elution process, ligand immobilization and ligand design) [6]

Q.3(a) Compare packed columns, WCOT, SCOT and FSOT used for Gas Chromatography. [2]

(b) In a thin layer choromatography (TLC), if a compound travels 3.4 cm and the and solvent front travels 2.6 cm, calculate the retention factor. Calculate distribution Constant (K_c), column's Phase Ratio (ß) and retention constant for a HPLC system. [data given: solute concentration in mobile phase = 110 mg/l; solute concentration in stationery phase = 25 mg/l; column radius = 142 micrometer, film thickness = 8 micrometer]. [4]

(c) Compose and illustrate different components (inlet, column, separation conditions) of Gas Chromatography system with proper diagram including different detectors. [6]

Q.4(a) Demonstrate electrophoresis and electro-osmosis process. [2]

(b) Hypothesize and evaluate the mechanism of one-dimensional, two-dimensional gel electrophoresis and isoelectric focusing with proper diagram. [4]

(c) Design, label and demonstrate SDS-PAGE system for protein separation (different components, constituents of loading and stacking gel, protein identification with marker lane). [6]

Q.5(a) Illustrate the differences between fluorescence and phosphorescence. [2]

(b) Sketch and organize the basic system for dual beam UV-VIS spectrometer. [4]

(c) Write and explain Beers-Lambert law. Design and explain the instrumentation of Spectroflourimeter. [6]

Q.6(a) Compare principle of mechanism of Atomic Absorption Spectroscopy (AAS), Flame emission Spectroscopy (FES) and Atomic Fluorescence Spectroscopy (AFS) [2]

(b) Write the role of a nebulizer in flame spectroscopy? Dramatize and sketch a double beam flame atomic absorption spectrometer with atomizing unit. [4]

(c) Compose the working principle of MALDI, ESI, Quadra-pole and TOF technique related to Mass spectroscopy. [6]

Q.7(a) Compare the principle of DTA, DSC and TGA system. [2]

(b) Sketch and label different components of a Thermal Gravimetric Analysis (TGA) system. Briefly correlate the chemical dynamics of calcium oxalate [$Ca(C_20_4)*xH_2O$] molecule with TGA graph. [4]

(c) Illustrate, sketch and explain Differential Scanning Calorimetric (DSC) system with a representative DSC graph of a polymer sample (point different phase transition state). [6]

********26.11.18******E**