

B.E (FTBE) FOURTH YEAR, SECOND SEMESTER EXAMINATION 2025

**ELECTIVE-II: ANALYTICAL INSTRUMENTS IN FOOD ANALYSIS:
PRINCIPLES AND PRACTICES**

ANSWER ANY TWO QUESTIONS

Time : Three hours

Full Marks: 100

(Use separate answer scripts for each Part.)

PART- I (50 MARKS)

Q1. You need to perform analyses of the given food products:

5 × 5 = 25

1. Textural features of a whole red apple
 2. Aroma of the fresh apple
 3. Cyanidin-3-O-galactoside (the primary anthocyanin) content in the apple skin
 4. Total Maillard reaction color products in cut apple pieces
 5. Acidity of the apple pomace
- a. Name the instruments and their essentials needed for each analysis with justification
 - a. Describe sample preparation needed for each analysis
 - b. Graphical/data outputs you would obtain post analyses in each case

Q2. Explain column dead volume. Prove that peak width (consider standard formula for total peak width) due to extra column effects is not more than 10%, considering a HPLC column of dimensions 25 cm × 4.6 mm packed with 5 µm C18 resin and assuming 70% of its volume to be filled by the mobile phase (solvent mixture) and having a plate count (N) of 12500.

5 + 20 = 25

OR

Explain diagrammatically the working principle of GC-FID. Explain determination of response factor, sample injection, column used, a tentative GC program, and the analysis output when 'linoleic acid' of soybean oil is quantified using the same.

15 + 10 = 25

Q3. Distinguish between (with explanations):

5 × 5 = 25

- a) Output from GC vs. HPLC for rice (stored) aldehydes
- b) Sampling mode vs. Injection mode in HPLC
- c) Procedure for estimation of a mixture of mango fruit carotenoids by UV-Vis spectrophotometer vs. HPTLC
- d) TA vs. TPA profile for non-creamy slice cake
- e) Flow behavior model equation for Chocolate liquor vs. RBD oil

[Turn over

Ref. No.: Ex/FTBE/PE/B/T/413B/2025

B.E. FOOD TECHNOLOGY AND BIOCHEMICAL ENGINEERING EXAMINATION 2025
(4th Year, 1st Semester)

Analytical Instruments in Food Analysis: Principles and Practices (FTBE/PE/B/T/413B)

Time: Three hours

PART II

Full Marks : 100

(50 Marks)

Answer Q.No 1(compulsory) and any two from the following:

5×2=10

- Q.1.** (i) How many NMR responses can be expected for cyclo-propane?
(ii) Which wavelength of radiation (in μm) is absorbed for wave number 2200 cm^{-1} ?
(iii) If $36 \times 10^{-24}\text{ kJ}$ is absorbed during FTIR analysis, which wave number is responsible for this?
(iv) In a NMR spectra, which parameter is represented along x-axis?
(v) At which wave number, -OH group and C-H(sp^3) is detected in FTIR?

- Q.2.** (i) Briefly discuss the sample preparation procedure for IR spectroscopy. (ii) A mixture of compounds were analyzed under FTIR and the peaks were found broadly intense at 3020 cm^{-1} while the other peaks are detected at 2720 cm^{-1} , 1725 cm^{-1} , 1695 cm^{-1} and at 1510 cm^{-1} , respectively. Justify the functional group associated with the probable compounds from these observations. (iii) If a mixture of Ethylene (A) and acetone (B) is analyzed using FTIR, then discuss about the different bond stretches along with their respective wave number and energy (kJ).

5+9+6=20

Q.3. Write short notes on

5×4=20

- (a) Wave number (b) Difference between FTIR and NMR (c) NMR response (d) Difference between functional group region and finger print region

- Q.4.** (i) Discuss the basic objective of NMR spectroscopy. (ii) What is ^1H NMR? How the NMR responses help to predict the molecular structure. Give one example to justify your view. (iii) How many NMR responses can be observed for the following compounds (a) Propane (b) Toluene (c) 1-4 di-methyl benzene (d) Nitro-benzene (e) Acetic acid

3+7+10=20