

**M.TECH. FOOD TECHNOLOGY AND BIO-CHEMICAL ENGINEERING
FIRST YEAR SECOND SEMESTER EXAM 2025**

Advanced Food Quality Control And Analytical Methods

Time: 3 hrs.

Full Marks : 100

Part – I

Use separate answer script for each part

[Answer any four questions, $12.5 \times 4 = 50$]]

What is 'Beer Lambert Law' ? With a neat sketch show the basic configuration of UV-Vis spectrophotometer. What are the light sources used in UV-Vis spectrophotometer ? Mention the range of both 'UV' and 'Vis' band in EM spectrum. What is ' $\lambda_{\max}$ ' ? 'What is FWHM? 2.5 + 3+2+2+1+2

With the help of neat sketch show common electronic energy levels and various kinds of electronic transitions associated with organic molecules. What do you mean by 'chromophore'? give examples . What is 'auxochrome' ? give example. Why butadiene colourless but Lycopene is colourful? What is colour wheel ? What are 'blue shift' and 'hyperchromic effect' ? 2 + 2 +2+2+2+2.5

Mention some food applications of UV-Vis spectroscopy .

Identify which one will absorb at higher wavelength and why ?

(a)

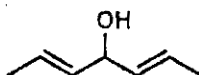


1,3 hexadiene

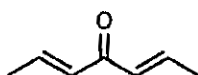


1,4 hexadiene

(b)

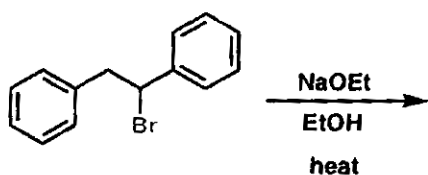


A

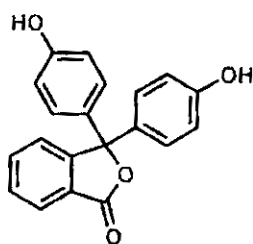


B

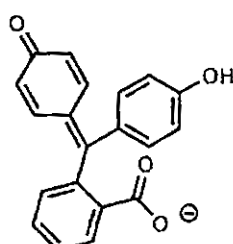
What will be the product ? Will the product absorb at longer wavelength ? why ?



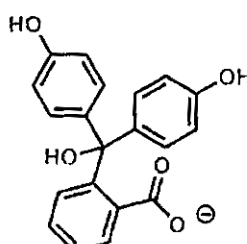
The following represents three forms of pH indicator phenolphthalein. Identify which one is responsible for pink colour and why?



A



B



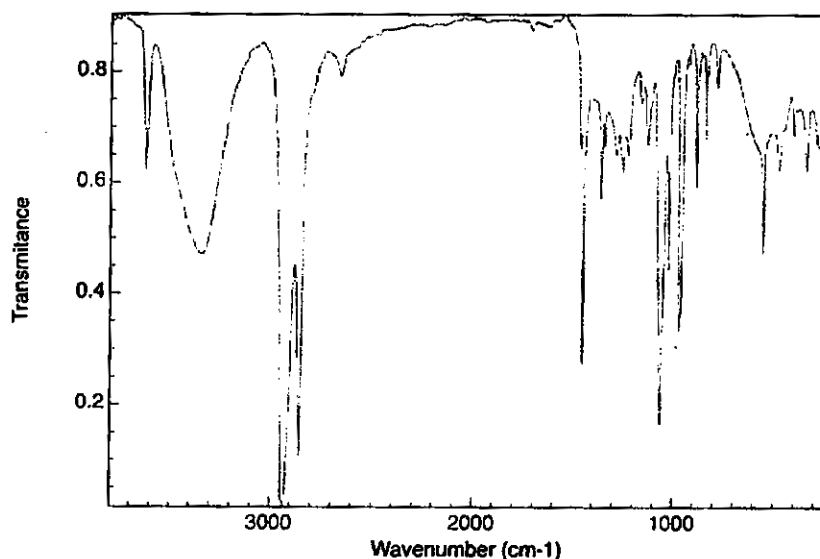
C

$2+(2 \times 2.5)+ 3+2.5$

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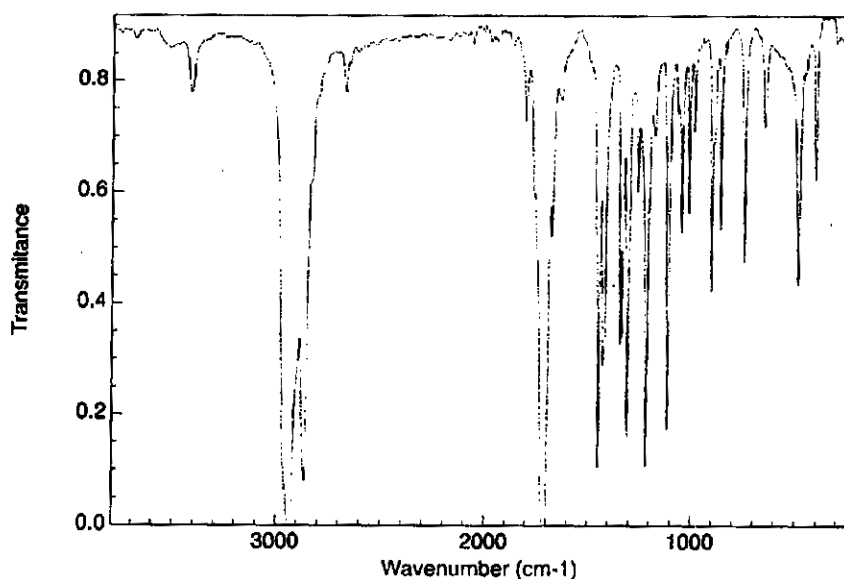
4. What is the basic difference between UV-Vis spectroscopy and IR spectroscopy ? Show different modes of vibrations of covalent bonds . With an example of covalent bonds in a molecule ,show how can one type of vibration may be IR active whereas another type of vibration may be IR inactive . Give examples of IR active bonds. Name the parameters plotted in X and Y axes for IR spectrum in transmission mode. 2.5 + 3.5+2.5 + 2+1
5. Citing proper example , mention two factors which affect peak location in IR spectrum. What do you mean by 'fingerprint region' ? Between 1-heptene and 3-heptene, which one will show higher intensity pic, why ?

(a) What functional group (types of bond) are present in the IR spectrum below?



- A) O—H B) C=O C) N—H D) C_{sp}—H

(b) What functional group (types of bond) are present in the IR spectrum below?



- A) O—H B) C=O C) N—H D) C_{sp}—H

M.TECH FIRST YEAR SECOND SEMESTER EXAM 2025

ADVANCED FOOD QUALITY CONTROL AND ANALYTICAL METHODS

PART- II (50 MARKS)

ANSWER Q1 AND ANY TWO FROM THE REST

Q1. Fill in the blanks (any five):

5 × 2 = 10

1. The content of *Anatoxin-a blue-green algal toxin* in our JU main campus pond water has to be analyzed by HPLC. The pond water has been collected in a 10 L capped plastic jar and brought to our Biochemical Engineering Laboratory for analysis. The DU is.....
2. For quantitative determination of MPL of *malachite-green* dye present in pickled-cucumber, the relationship between MPL and TMRL would be.....
3. The most reliable and rapid method you would employ to detect contamination in your breakfast egg would be.....
4. *Arah* 1 and 2 are associated withfood product.
5. In absence of data for NOAEL assessment.....serves as a substitute.
6. If you need to assess whether sodium benzoate can be administered at 200 ppm in apple jelly, the highest dose of the same for a rat-model trial would approximately be.....
7.mung beans have less allergenicity.

Q2. Describe the following (any two):

2 × 10 = 20

- a. Quantitative determination of MPL of a synthetic flavoring in a RTS beverage, considering TMRL
- b. Thermal and non-thermal processing methods in combating allergen protein superfamilies' in almonds
- c. HPP for manufacture of jam

Q3. Using flows sheets, diagrams and graphs, enumerate the following (any two):

2 × 10 = 20

- a. Procedures to quantify RDA and UL (show graphs) of acrylamide in bread.
- b. Explain diagrammatically the working principle of GC-FID. Explain determination of response factor, sample injection, column needed, a tentative GC program, and the analysis output when 'hexanal' is quantified in rancid soybean oil.

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- c. Principles that govern HPP and a dry bag-indirect compression HPP unit for prevention of browning in button mushrooms

Q4. Analyze the following (a or b and c):

- a. The content of cyanidine-3-O-galactoside anthocyanin has to be analyzed by HPLC in a spray dried sample of apple peels. One kg of the sample has arrived in the laboratory in a flexible laminate pouch.
1. What would be the DU? 1
 2. Identify the most important parameter that would contribute to analytical uncertainty. 1
 3. How can '2' be redressed? 1
 4. Would you prefer DNA extraction of the sample? Justify. 1 + 2
 5. If you are the manufacturer of the said sample, design the 'Quality Control' chart you would adopt in QC/QA department of your company for supply of the natural peel color to food industries having not more than 0.1 SD in percent content of the said pigment. 4

OR

- b. Sampling method needed in detail to perform analysis for the flavor-impact compound of *Basmati rice*, one sack (25 kg) of which has arrived in your factory, clearly stating the complete measurement process, uncertainties involved in each analysis step, the DU and the analytical sample. 10
- c. 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. 2 + 8 = 10