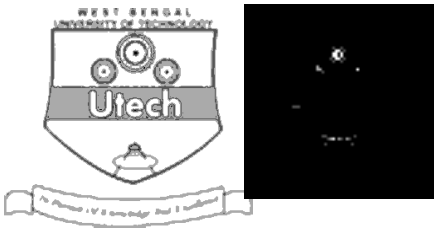
SPECTROSCOPY, CRYSTALLOGRAPHY, INSTRUMENTATION & MICROSCOPY
(SEMESTER - 2)

CS/MBT, MBIN, PHMB/SEM-2/MBT/MBIN/PHMB-202/09



1. .....
Signature of Invigilator

2. .....
Signature of the Officer-in-Charge

Reg. No.

Roll No. of the Candidate

– –

CS/MBT, MBIN, PHMB/SEM-2/MBT/MBIN/PHMB-202/09

ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE – 2009

SPECTROSCOPY, CRYSTALLOGRAPHY, INSTRUMENTATION & MICROSCOPY (SEMESTER - 2)

Time : 3 Hours] [Full Marks : 70

INSTRUCTIONS TO THE CANDIDATES :

1. This Booklet is a Question-cum-Answer Booklet. The Booklet consists of **32 pages**. The questions of this concerned subject commence from Page No. 3.
2. You have to answer the questions in the space provided marked 'Answer Sheet'. Write on both sides of the paper.
3. **Fill in your Roll No. in the box** provided as in your Admit Card before answering the questions.
4. Read the instructions given inside carefully before answering.
5. You should not forget to write the corresponding question numbers while answering.
6. Do not write your name or put any special mark in the booklet that may disclose your identity, which will render you liable to disqualification. Any candidate found copying will be subject to Disciplinary Action under the relevant rules.
7. **Use of Mobile Phone and Programmable Calculator is totally prohibited in the examination hall.**
8. You should return the booklet to the invigilator at the end of the examination and should not take any page of this booklet with you outside the examination hall, **which will lead to disqualification**.
9. Rough work, if necessary is to be done in this booklet only and cross it through.

No additional sheets are to be used and no loose paper will be provided

---

FOR OFFICE USE / EVALUATION ONLY

Marks Obtained

Question Number											***Total Marks***	***Examiner's Signature***
Marks Obtained												

.....
Head-Examiner/Co-Ordinator/Scrutineer

DO NOT WRITE ON THIS PAGE

ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE – 2009

SPECTROSCOPY, CRYSTALLOGRAPHY, INSTRUMENTATION & MICROSCOPY

SEMESTER - 2

Time : 3 Hours] [Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

Marks : 35

(SPECTROSCOPY & CRYSTALLOGRAPHY)

Answer Question 1 and any *three* from the rest.

1. Answer any *five* from the following : 5 ∞ 1

   a) What is Fourier transformation ?

   b) Write the relation between wave number and wavelength.

   c) Name one amino acid that can be used for concentration measurement of protein solution.

   d) State true / false

      By IR spectroscopy one can distinguish between intra-molecular and inter-molecular H-bond.

   e) Choose the correct answer :

      Which one may act as auxochrome ?

      i) $-NH_2$

      ii) NO_2

      iii) COOH

      iv) CH_3 .

f) Choose the correct answer :

The highest point group symmetry of a crystal is exploited so as to

i) reduce the volume of the asymmetric unit

ii) reduce the size of the cell

iii) reduce the number of molecules in the cell

iv) reduce the size of the lattice.

g) Choose the correct answer :

A crystal has point group symmetry 2 with equivalent positions (x, y, z) and ($-x$, y, $-z$). If there are 13 molecules of compound X in the asymmetric unit then there are

i) 13 molecules in the cell

ii) 2 molecules in the cell

iii) 15 molecules in the cell

iv) 26 molecules in the cell.

2. a) What is intrinsic fluorophore ? Why does Trp show higher fluorescence quantum yield in comparison to Phe ? How protein folding can be studied using Trp fluorescence ?

b) Elucidate how quantum yield in fluorescence is affected during quenching. 6 + 4

3. a) Why is the base value of homoannulan dienes higher than that of heteroannular dienes in UV spectra ?

b) A conjugated ene-one system in CCl_4 shows λ_{max} at 230 nm and 275 nm (with reduced intensity). Draw the UV spectral pattern of that sample if the solvent is changed to H_2O.

c) Justify that achiral system does not show any Cotton effect. How do you resolve plane polarized light into 'RCP' and 'LCP' ? 3 + 3 + 4

4. a) What changes do you expect for the stretching frequency of O-H in *IR* spectra if the solvent is changed from CCl_4 to C_6H_6 ?

b) How is intensity of an absorbence signal affected ? Why is phosphorescence a slower process ?

c) How do you distinguish an α-helix from random coil conformation using Circular Dichroism spectroscopy ? 3 + 4 + 3

5. a) Given the coordinates :

ATOM	6	N	PRO	A	23	– 5·366	12·844	64·670	1·00	49·30
ATOM	7	CA	PRO	A	23	– 6·657	13·539	64·701	1·00	46·45
ATOM	8	C	PRO	A	23	– 7·256	13·749	63·310	1·00	43·49

Calculate the bond angle N-CA-C (the bond angle subtended at CA)

b) Write down the steps in calculating the torsion angle about the *B – C* bond for the four bonded atoms *A-B-C-D*. 6 + 4

GROUP – B

Marks : 35

(INSTRUMENTATION & MICROSCOPY)

6. Answer any *five* from the following questions : 5 ∞ 1

a) Compared to light microscope why does greater resolution and magnification take place in an electron microscope ?

b) How are field strength, charge size and viscosity related to the velocity of moving particles in an electric field ?

c) What type of current is needed to conduct Polyacrylamide Gel Electrphoresis ?

d) Why is distilled or deionized water not used to preserve electrode of a pH meter for a longer time ?

e) Define Eastern Blot.

f) "Branched chain compounds elute more rapidly than their corresponding linear isomers when separated by Reversed Phase HPLC." Why ?

g) Why is protein hydrolysis by both acid and base needed to conduct amino acid analysis ?

h) How is "void volume" in the Size Exclusion Column Chromatography determined ?

7. Answer any *four* questions from the following :

a) Sketch a diagram to define how Gas Chromatography instrument works. 5

b) "Electrodes of a pH meter maintain a galvanic cell to measure pH of a buffer solution." Explain. 5

c) What are the basic steps to determine N-terminal amino acid sequence of a protein colorimetrically ? What is "Available Lysine" ? 4 + 1

d) Define "Western Blot" and explain the technique with a diagram. 5

e) What is the principle of Confocal microscopy ? Describe with an example. 2 + 3

f) Give examples of cation and anion exchange resins. What is gradient elution ? How are separated components eluted in the Affinity Chromatographic technique ? 2 + 2 + 1

8. Answer any *one* question from the following :

a) What are the roles of chloride ions and glycine present in different buffers used for SDS-PAGE ? What is the percentage of polyacrylamide gel used to prepare a "Stacking gel" ? "Potassium dodecyl sulphate cannot be used to denature proteins for SDS-PAGE." Why ? 6 + 2 + 2

b) Describe with a valid diagram how Transmission Electron microscopy of a biological sample is conducted. What is a Microtome ? 8 + 2

c) How are beta-particles produced ? Define specific activity of a radioactive component. Describe critically how a Scintillation Counter works. 3 + 1 + 6

END