Birla Institute of Technology & Science, Pilani
Hyderabad Campus

SECOND SEMESTER : 2024-2025
Course Handout

06-01-2025

In addition to Part I (General Handout for all courses appended to the timetable), this portion gives further specific details regarding the course).

Course No.: BIO F244
Course Title: Instrumental Methods of Analysis (IMA)
INSTRUCTOR-IN-CHARGE: PRAGYA KOMAL
Lecture Instructor*: Prof. Sourav Chowdhury*
Team of Lab Instructors: **Prof. Pragya Komal, Prof. Kumar Pranav Narayan, Prof. Soumyananda Chakraborti**, Omalur Eshwari, Puja Das, Harshada Deshpande, Abhiram Kumar, Pankaj Garg, Srija Bhattacharya, Shubham Kumar Sinha, Priyanka Chakravarti, Nidhi O
Lecture Hour: 10th hour, Mon; 5-6p.m; G101
Lab Hours: B-108; 6-8 hour, 1-3p.m; Tuesday and Thursday

1. Scope & Objective of the Course:

The advent of dedicated bio-instruments and computers has facilitated explosive progress in the instrumental methods of analysis in biology. Many data points, whether physicochemical or biological, can be collected, stored, manipulated, and analyzed at high precision with the help of modern, sophisticated instruments with high sensitivity, selectivity, and extremely low detection limits. This course aims to provide a sufficient background of these instruments, their handling, and their application in molecular biology, structural biology, and biotechnology.

2. Text Book:

T1. "Instrumental Methods of Analysis", Sivasankar *et. al*., Oxford University Press, New Delhi, 1st ed., 2012.
T2. Lab Manual for PHA C391 IMA. Mahesh *et. al,*. 2008

Reference Book

R1. "Principles of Instrumental Analysis", Skoog *et. al*., Harcourt Asia, 5th ed., 2001.
R2 "Instrument Methods of Analysis. Williard *et al*., CBS Publication, New Delhi, 7th edition, 1998.
R3 "Handbook of Analytical instruments", R.S. Khandpur, Tata Mc Graw-Hill, 2nd edition, 2006.

3.a) Course Plan :

No	Learning Objectives	Topic to be covered	Ref. to the Book
1	Spectroscopy	Characteristic of atomic and molecular spectroscopy	T-1 (Ch. 6) R-1
2	Atomic Spectroscopy	Infrared Spectroscopy Atomic Absorption Spectroscopy	T-1 (Ch. 7) R-1, R-3
3	Molecular Spectroscopy	Visible and Ultraviolet Spectroscopy, Fluorescence Spectroscopy	T-1 (Ch. 8) R-1, R-3
4	Optical Spectroscopy	Polarimetry and Circular Dichroism	T-1 (Ch. 4)
5	Electrophoresis	SDS-PAGE	T-1 (Ch. 14) R-1
6	Chromatography	High-Performance Liquid Chromatography	T-1 (Ch. 13) R-1, R-3
7	Molecular Biology Techniques	ELISA, PCR	Class notes
8	Mass Spectrometry	Basic principles and applications	T-1 (Ch. 10)

3. b) Lab Components:

Experiments

Exp 1: Preparation of buffer solutions and measurement of pH using a pH meter
Exp 2: Qualitative and quantitative analysis of biomolecules using UV spectroscopy
Exp 3: Atomic absorption spectrophotometric analysis of elements
Exp 4: Fluorescent spectroscopy; total intensity and quenching measurements
Exp 5: Separation of molecules using HPLC
Exp 6: Polarimetric/ Circular Dichroic analysis of samples possessing optical activity
Exp 7: Measurement of molecular weight by mass spectrometry
Exp 8: Identification of amino acids using TLC
Exp 9: Detection of antigen using an ELISA reader
Exp 10: Amplification of DNA using PCR
Exp 11: Separation of proteins using SDS-polyacrylamide gel electrophoresis
Exp 12: Quantification of gene expression by real-time PCR

Note:

- Textbook 2 will be used for experimental details
- Extra reading material will be provided to the students, if required.
- Minor changes are possible subject to the availability of chemicals/ Instructors/Instruments

4. Evaluation Scheme:

No	Evaluation Component	Duration	Weightage	Date & Time	Nature of Component	Venue
1.	Continuous Laboratory Evaluation (3 components): Evaluation will be based on completion of a set of four experiments. Evaluation components – punctuality, records, and participation, **and lab exam**	-	20M+20M+ 20M (**30%**)	During Lab hours	OB	Lab
2	Midsem	1.5 h	30M (**15%**)	07/03 4.00 - 05.30 PM	CB	-----
3.	Lab Quiz (Announced)	60 min	20M, 20M, 20M (**30%**)	To be announced	CB	------
4.	Lecture (Continuous evaluation)	-----	10M (**5%**)	To be announced	OB	Every Lecture last 5 minutes (group-wise distribution)
5.	Compre	3 h	40M (**20%**)	13/05 AN	CB	------

Lab: OB- Open Book; CB-Closed Book; Continuous evaluation will consider IMA lab hours class + lecture class # Quizzes WILL BE ANNOUNCED and taken during THE LAB HOURS.

Award of NC report:

STUDENTS WHOSE TOTAL MARKS ARE LESS THAN 15% OF THE HIGHEST MARKS IN THE CLASS CAN BE AWARDED NC.

IF A STUDENT MISSES A SINGLE COMPONENT ENTIRELY OR IS FOUND ABSENT THROUGHOUT THE LECTURE/IMA LAB FOR THE ENTIRE SEMESTER (HE/SHE HAS NOT GIVEN US SUFFICIENT OPPORTUNITY TO BE ASSESSED), HE/SHE MAY BE AWARDED AN 'NC' REPORT REGARDLESS OF HIS/HER FINAL TOTAL SCORE IN THE COURSE.

5. Guide to Writing Lab Reports:

The report must be written in hardbound, practical files. It should include the following:

a. Objective of the experiments,
b. Theory on which the experiment is based,
c. Steps in the experimental procedure,
d. Results including all observations
e. Discussion and Conclusion.
f. Precautions

6. Chamber Consultation Hours: To be announced in the Class.

7. Make-up Policy: Make-ups will be granted for mid-semester or comprehensive examinations ONLY if the candidate is seriously sick. The student must provide a request letter for the same with the parent's signature on it, supplemented with an on-campus doctor's prescription.

NO MAKE-UP WILL BE GRANTED FOR QUIZZES UNDER ANY CIRCUMSTANCES.

THERE IS NO MAKEUP FOR LABORATORY EVALUATION.

8. Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester, and no academic dishonesty is acceptable.

IMPORTANT NOTE:

- **LAB COAT IS MANDATORY FOR PERFORMING EXPERIMENTS.**
- **YOU CANNOT DO THE EXPERIMENTS WITHOUT YOUR LAB RECORD.**
- **YOU MUST ENTER THE LAB ON TIME; IN CASE OF DELAY, YOU MAY LOSE YOUR EVALUATION AND MARKS.**

Instructor-in-charge
BIO-F244