

**Syllabus for Master of Science**
**Microbiology**
**Subject Code: 02MB0451**
**Subject Name: Bioanalytical techniques**
**M. Sc. Semester - II**

**Objective:** Exposure to principles and usage of analytical methods used routinely in microbiological laboratories.

**Credits Earned:** 6 Credits

**Course Outcomes:** After completion of this course, student will be able to

- Describe scientific concepts behind various instruments commonly used in microbial laboratories.
- Comprehend the knowledge of various assay procedures and formats in microbiology.
- Analysis and interpretation of data obtained from various microbiological experiments.
- Devise novel strategies using the knowledge in analytical techniques to assay various important molecules or phenomena in microbiology.
- Safely operate various microbiological instruments and understand the safety requirements while designing laboratory experiments.

**Teaching and Examination Scheme**

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	Mid Sem (M)	Internal(I)/(CSE)	Viva (V)	Termwork (TW) /Practicals (P)	
4	0	4	6	50	30	20	25	25	150

**Contents:**

<b>Unit</b>	<b>Topics</b>	<b>Contact Hours</b>
1	Centrifugation: Basic principles of sedimentation; centrifugal field and relative centrifugal force; types of centrifuges; types of rotors; differential centrifugation; density gradient centrifugation; preparative and analytical centrifugation. Safety aspects of centrifuges.	12
2	Properties of electromagnetic radiations and their interaction with matter; UV and visible light spectroscopy; Beer-Lambert law; spectrofluorimetry; CD spectroscopy; Mass spectrometry; components of mass spectrometer; methods of ionization and mass analysis including MALDI-TOF; IR spectroscopy; Raman spectroscopy; NMR spectroscopy. Radioisotope Techniques: Nature detection and measurements of radioactivity. GM counter; scintillation counter; pulse height analyser; isotope dilution analysis; autoradiography.	19
3	Chromatography: Principles of chromatography; distribution coefficient; retention time; capacity factor; plate height and resolution; peak broadening; TLC and column chromatography; matrix materials; HPLC; normal phase and reversed phase chromatography; ion exchange chromatography; gel exclusion chromatography; affinity chromatography; Gas chromatography.	17
4	Electrophoresis: General principle of electrophoresis; support media (agarose and polyacrylamide gels); electrophoresis by SDS-PAGE; native PAGE. Gradient gels; isoelectric focusing; two dimensional PAGE; Pulse Field Gel Electrophoresis (PFGE); capillary electrophoresis. Electrophoresis in Proteomics: Analysis of Cell Proteins; Free Flow Electrophoresis.	12
	<b>Total Hours</b>	<b>60</b>

**References:**

1. David Sheeham (2009). *Physical biochemistry: Principles and applications*, 2nd edition, John Wiley and Sons. New Jersey, USA.
2. Keith Wilson and John Walker (2002). *Principles and techniques of practical biochemistry*. Cambridge University Press, Cambridge.
3. Douglas Skoog, Donald West, James Holler, Stanley Crouch. (2007). *Fundamentals of Analytical Chemistry*. Saunders College Pub.
4. David Holm, Hazel Peck. (1998). *Analytical Biochemistry*. Prentice Hall. New Jersey, USA.
5. Donald Voet and Judith Voet. *Biochemistry*, 4th Edition. (2010). John Wiley and Sons. New Jersey, USA.
6. Abhilasha Shourie and Shilpa S Chapadgaonkar. *Bioanalytical Techniques*. (2004). Teri Press, New Delhi. India.
7. Rashmi A. Joshi. *A Textbook of Practical Biochemistry*. (2002). B. Jain Publishers. India.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
20%	20%	30%	15%	10%	5%

**Instructional Method:**

- a. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, etc.

- b. The internal evaluation will be done on the basis of continuous evaluation of students in the class-room in the form of attendance, assignments, verbal interactions etc.
- c. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.

#### List of Practicals

- Determination of absorption maxima of solution and determination of molar extinction coefficient.
- Isolation of Chloroplasts using differential centrifugation
- Separation of sugars by paper chromatography.
- Extraction and quantification of plant pigments by solvent-solvent chromatography.
- Analysis of extracted plant pigments by Spectrophotometer and Thin layer chromatography.
- Production and purification of Enzymes by Column chromatography.
- Determination of molecular weight by Electrophoresis.