

CHAUDHARY RANBIR SINGH UNIVERSITY, JIND

Scheme of Examination and Syllabus for Under-Graduate (Subject: Biotechnology)

**Under Multiple Entry-Exit, Internship and CBCS-
LOCF in accordance to NEP-2020 w.e.f. 2024-25
(in phased manner)**

CHAUDHARY RANBIR SINGH UNIVERSITY, JIND
Scheme of Examination for Under-Graduate Program
Under Multiple Entry-Exit, Internship and CBCS-LOCF in accordance to NEP-2020
w.e.f. 2024-25 (in phased manner), Subject: Biotechnology

FIRST YEAR: SEMESTER-1									
Remarks	Course	Paper(s)	Nomenclature of Paper	Credits	Hours/Week	Internal marks	External Marks	Total Marks	Exam Duration
Scheme A	CC-1 4 credit	B24-BTY-101	Introduction of Biotechnology	2	2	15	35	50	3 hrs.
			Practical	2	4	15	35	50	4 hrs.
Scheme A	CC-M1 2 credit	B24-BTY-103	Laboratory Techniques & Practices	1	1	10	20	30	3 hrs.
			Practical	1	2	5	15	20	4 hrs.
Scheme A	MDC-1 3 credits	B24-BTY-104	Biology-I	2	2	15	35	50	3 hrs.
			Practical	1	2	5	20	25	4 hrs.
Scheme A	AEC-1 2 credit	From Available AEC-1 of two credits as per NEP							
	SEC-1 3 credit	From Available SEC-1 of three credits as per NEP							
	VAC-1 2 credit	From Available VAC-1 of two credits as per NEP							
FIRST YEAR: SEMESTER-2									
Remarks	Course	Paper(s)	Nomenclature of Paper	Credits	Hours/Week	Internal marks	External Marks	Total Marks	Exam Duration
Scheme A	CC-2 4 credit	B24-BTY-201	General Microbiology	2	2	15	35	50	3 hrs.
			Practical	2	4	15	35	50	4 hrs.
Scheme A	CC-M2 2 credit	B24-BTY-203	Introduction of Biological Chemistry	1	1	10	20	30	3 hrs.
			Practical	1	2	5	15	20	4 hrs.
Scheme A	MDC-2 3 credits	B24-BTY-204	Biology-II	2	2	15	35	50	3 hrs.
			Practical	1	2	5	20	25	4 hrs.
Scheme A	AEC-2 2 credit	From Available AEC-2 of two credits as per NEP							
	SEC-2 3 credit	From Available SEC-2 of three credits as per NEP							
	VAC-2 2 credit	From Available VAC-2 of two credits as per NEP							
Internship of 4 credits of 4-6 weeks duration after 2nd Semester									

CC-1

Session: 2024-25			
Part A - Introduction			
Subject	Biotechnology		
Semester	I		
Name of the Course	Introduction of Biotechnology		
Course Code	B24-BTY-101		
Course Type: (CC/MCC/MDC/CC-M /DSEC/VOC/DSE/PC/AEC/VAC)	CC-1		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)	NA		
Course Learning Outcomes(CLO): (CLOs 1-4 of theory and 5 th of practical)	<p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"> 1. Understand the concepts in biotechnology 2. Gain the knowledge of scope and applications of plant biotechnology 3. Gain the knowledge of scope and applications of animal biotechnology 4. Get an insight of scope and applications of biotechnology in environment, food and chemical industries <p>5. Gain knowledge of structure, working, maintenance/calibration and safety measures during handling of biotech lab instruments and biochemicals. Also get insight of maintenance of hygiene/ aseptic conditions and proper disposal of biochemicals.</p>		
Credits	Theory	Practical	Total
	2	2	4
Contact Hours	2	4	6
Max. Marks:100		Time: 3h (theory), 4h (practical)	
Internal Assessment Marks: 30 (15 Theory + 15 Practical)			
End Term Exam Marks:70 (35 Theory + 35 Practical)			
Part B- Contents of the Course			

Instructions for Paper- Setter

Nine questions will be set in all. Question No.1 comprising of objective/short answer type questions from the entire syllabus, will be compulsory. The remaining eight questions will be set taking two questions from each unit. The candidates will be required to attempt Q.No.1 & four others selecting one question from each unit. All questions carry equal marks.

Unit	Topics	Contact Hours
I	Introduction to biotechnology an interdisciplinary pursuit; Main areas of application of biotechnology; Biotechnology research in India; Brief account of safety guidelines, risk assessment and ethics in biotechnology; Very brief account of intellectual property rights; In brief scope and techniques of preservation. Introduction of fermentation technology.	8
II	Introduction of animal tissue culture (brief of history, culture media, substrate surfaces, culture procedures, primary cultures, cell lines, organ culture and tissue engineering etc.). Introduction of plant tissue culture (in brief history, culture media, explants, totipotency, dedifferentiation and types of cell & tissue culture etc.). hybridoma technology and monoclonal antibodies. In vitro fertilization and embryo transfer technology in brief.	8
III	Genetics and Biotechnology: Introduction of genetic engineering, gene and genomes, proteins and proteome, history of genetic manipulations, DNA fingerprinting and forensic analysis. Industrial genetics, Potential laboratory biohazards of genetic engineering. Introduction of enzyme technology: nature of enzymes, application of enzymes and immobilized enzymes.	7
IV	Environmental Biotechnology: Brief account on bioremediation and waste treatment biotechnology, microbial insecticides, biofertilizers, microbes in oil recovery and bioleaching. Application of biotechnology in medicine (pharmaceutical industry, vaccines, antibiotics etc.), food industry and biofuels.	7
V*	List of Practical: 1. Personal and General laboratory safety rules 2. Study of structure and working of laminar air flow cabinets. 3. Study of structure and working of hot air oven. 4. Study of working, maintenance and safety measures during handling of autoclaves. 5. To study working, maintenance/calibration and precautions during handling of pH-meter, weighing balance, microscopes and other miscellaneous biotech lab instruments. 6. To study maintenance of hygiene/ aseptic conditions of biotech labs, instruments and glassware/plasticwares. 7. Precautions in handling of biochemicals and study of their proper disposal after use. 8. To prepare and sterilize MS media for the plant tissue culture. 9. Inoculation of explant to the MS media.	60

Suggested Evaluation Methods

Internal Assessment:

➤ Theory-15

- Class Participation: 4
- Seminar/presentation/assignment/quiz/class test etc.:4
- Mid-Term Exam: 7

➤ Practicum -15

- Class Participation: 4
- Seminar/Demonstration/Viva-voce/Lab records etc.:4
- Collection Report: 7

End Term

Examination:

35 (Theory);

35 (Practical) -

Evaluation of the practical skill will be done by an external examiner.

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Elements of Biotechnology - PK Gupta
2. Gene Biotechnology - S.N. Jogdand
3. Biotechnology 5th Edition (Cambridge) - John E. Smith
4. Biotechnology for beginners – Reinhard Renneberg Academic Press

CC-M1

Session: 2024-25			
Part A - Introduction			
Subject	Biotechnology		
Semester	I		
Name of the Course	Laboratory Techniques & Practices		
Course Code	B24-BTY-103		
Course Type: (CC/MCC/MDC/CC-M /DSEC/VOC/DSE/PC/AEC/VAC)	CC-M1		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)	NA		
Course Learning Outcomes(CLO): (CLOs 1-4 of theory and 5 th of practical)	<p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"> 1. Acquire knowledge of analytical tools and techniques of biotechnology & understanding of good laboratory practices. 2. Handle general & specific problems while processing of experimental material and learn to devise solution by choosing appropriate methodology/biotechnique for processing of biomaterials/products. 3. Exhibit the knowledge of testing the potency of antibiotics / disinfectants / antiseptics and learn aseptic conditions for working in Biotechnology Lab. 4. Understand the biochemical and microbiological techniques essential for working in a biotechnological laboratory. <hr/> <p>5*. Acquire knowledge of working and hands-on training of tools and techniques of biotechnology labs.</p>		
Credits	Theory	Practical	Total
	1	1	2
Contact Hours	1	2	3
Max. Marks: 50 Internal Assessment Marks: 15 (10 Theory + 5 Practical) End Term Exam Marks: 35 (20 Theory + 15 Practical)		Time: Theory- 3h; Practical-4h	
Part B- Contents of the Course			

Instructions for Paper- Setter

Nine questions will be set in all. Question No.1 comprising of objective/short answer type questions from the entire syllabus, will be compulsory. The remaining eight questions will be set taking two questions from each unit. The candidates will be required to attempt Q.No.1 & four others selecting one question from each unit. All questions carry equal marks.

Unit	Topics	Contact Hours
I	Lab rules and safety measures to be taken in Biotechnology Lab., Commonly used equipments for Biotechnological work- Laminar air-flow, Centrifuge, pH meter, Incubator, Fermenter, Colony-counter, Autoclave, Inoculating loop and needle, Use of bright-field microscope, Colorimeter and spectrophotometer.	4
II	Qualitative and quantitative estimation of various biomolecules- sugars, proteins; determination of various metabolites in given biological samples, Preparation of standard curve, Preparation of buffers, Preparation of normal, molar, percent solutions, buffer solutions and determination of their pH, Thin-layer, Paper and Two-dimensional Chromatography, Paper electrophoresis.	4
III	Sterilization techniques followed in biotechnology lab.-dry and wet sterilization techniques, Preferred method of sterilization for different materials, Biological indicators for checking the efficiency of sterilization process, Evaluation of different disinfectants and antiseptics and their usage.	4
IV	Microorganisms, Preparation of cotton plugs and different types of culture media for growth of microorganisms, animal and plant cell culture media, Preparation of dilutions and isolation of micro-organisms from air, water and soil, sub-culturing/ Picking off technique- streaking, pour-plate, spread plate methods.	3
V*	List of Practical: <ol style="list-style-type: none">1. Lab rules and safety measures to be taken in Biotechnology Lab.2. Sterilization techniques followed in biotechnology lab.3. Paper and Thin Layer Chromatography.4. Preparation of media for cultivation of bacteria.5. Preparation of dilutions and isolation of micro-organisms.6. Sub-culturing/ Picking off technique.7. Evaluation of different disinfectants and antiseptics.	30
Suggested Evaluation Methods		

<p>Internal Assessment:</p> <ul style="list-style-type: none"> ➤ Theory-10 <ul style="list-style-type: none"> • Class Participation: 4 • Seminar/presentation/assignment/quiz/class test etc.: NA • Mid-Term Exam: 6 ➤ Practicum -5 <ul style="list-style-type: none"> • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc.:5 • Mid-Term Exam: NA 	<p>End Term Examination: 20 (Theory); 15 (Practical) - Evaluation of the practical skill will be done by an external examiner.</p>
<p>Part C-Learning Resources</p>	
<p>Recommended Books/e-resources/LMS:</p> <ol style="list-style-type: none"> 1. Elements of Biotechnology; Gupta PK, Rastogi Publications, Meerut. 2. Gene Biotechnology - S.N. Jogdand 3. Berg, J. M., Tymoczko, J. L. and Stryer, L. (2006). Biochemistry. VI Edition. W.H Freeman and Co. 4. Buchanan, B., Grussem, W. and Jones, R. (2000) Biochemistry and Molecular Biology of Plants. American Society of Plant Biologists. 5. Nelson, D.L., Cox, M.M. (2004) Lehninger Principles of Biochemistry, 4th Edition, WH Freeman and Company, New York, USA 6. Mahajan, R., Sharma, J., Mahajan, R.K. (2010). Practical Manual of Biotechnology, Vayu Education of India. 	

MDC-1

Session: 2024-25			
Part A - Introduction			
Subject	Biotechnology		
Semester	I		
Name of the Course	Biology-I		
Course Code	B24-BTY-104		
Course Type: (CC/MCC/MDC/CC-M /DSEC/VOC/DSE/PC/AEC/VAC)	MDC-1		
Level of the course (As per Annexure-I)	100-199		
Pre-requisite for the course (if any)	NA		
Course Learning Outcomes(CLO): (CLOs 1-4 of theory and 5 th of practical)	<p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"> 1. Understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles. 2 Know about features of biodiversity in the living world and their biological classification describing the principal theories of taxonomy 3. Describe the unique characteristics of Kingdom Plantae and classify Kingdom Plantae into different groups. 4. Demonstrate knowledge of the principles of animal nomenclature and terminology by explaining the process, procedures, and purpose of the scientific classification of animals. <p>5*. Learn practical skills on basic Biology practical like parts of microscope, slide preparation.</p>		
Credits	Theory	Practical	Total
	2	1	3
Contact Hours	2	2	4
Max. Marks:75		Time: Theory- 3h; Practical-4h	
Internal Assessment Marks: 20 (15 Theory+ 5 Practical)			
End Term Exam Marks: 55 (35 Theory+ 20 Practical)			

Part B- Contents of the Course

Instructions for Paper- Setter

Nine questions will be set in all. Question No.1 comprising of objective/short answer type questions from the entire syllabus, will be compulsory. The remaining eight questions will be set taking two questions from each unit. The candidates will be required to attempt Q.No.1 & four others selecting one question from each unit. All questions carry equal marks.

Unit	Topics	Contact Hours
I	Cell: Structure and Function: Cell theory and cell as the basic unit of life, structure of prokaryotic and eukaryotic cells; Plant cell and animal cell; cell envelope; cell membrane, cell wall; cell organelles - structure and function; endomembrane system, endoplasmic reticulum, golgi bodies, lysosomes, vacuoles, mitochondria, ribosomes, plastids, microbodies; cytoskeleton, cilia, flagella, centrioles (ultrastructure and function); nucleus, Cell cycle, mitosis, meiosis and their significance.	8
II	Biological Classification: Five kingdom classification, salient features and classification of Monera, Protista and Fungi into major groups; Lichens, Viruses and Viroids.	8
III	Plant Kingdom: Classification of plants into major groups; Salient and distinguishing features and a few examples of Algae, Bryophyta, Pteridophyta, Gymnosperms, Angiosperms, Plant Life Cycle and Alternation of Generations.	7
IV	Animal Kingdom: Salient features and classification of animals, levels of organization (cellular/tissue/organ), symmetry (radial, bilateral), phylum, porifera, Coelenterata, Ctenophora, Platyhelminthes, Aschelminthes, Annelida, Arthropoda, Mollusca, Echinodermata, hemichordata, chordata.	7
V*	List of Practical: <ol style="list-style-type: none">1. Study and describe locally available common flowering plants, from family Solanaceae, Poaceae, Asteraceae or Brassicaceae.2. Dissection and display of floral whorls, anther and ovary to show number of chambers (floral formulae and floral diagrams),3. Study of types of roots (tap and adventitious).4. Study of types of stem (herbaceous and woody);5. Study of leaf (arrangement, shape, venation, simple and compound).6. Isolation of <i>Chlamydomonas</i>, <i>paramecium</i> and <i>spirogyra</i> from nearby pond and study its structure and movement under microscope.	30

	7. Study of structure of algae under microscope 8. Study of different part of fungi	
Suggested Evaluation Methods		
<p>Internal Assessment:</p> <p>➤ Theory-15</p> <ul style="list-style-type: none"> • Class Participation: 4 • Seminar/presentation/assignment/quiz/class test etc.:4 • Mid-Term Exam: 7 <p>➤ Practicum -5</p> <ul style="list-style-type: none"> • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc.:5 • Mid-Term Exam: NA 	<p>End Term Examination: 35 (Theory); 20 (Practical) - Evaluation of the practical skill will be done by an external examiner.</p>	
Part C-Learning Resources		
<p>Suggested Readings:</p> <ol style="list-style-type: none"> 1. Biology Text Book for class XI published by NCERT.https://ncert.nic.in/textbook.php?kebo1=0-19 2. Pradeep's A Text Book of Biology for Class 11 (Vol. 1 & 2) - Examination 2022/23 Paperback – by P.S. Dhama , G. Chopra, H.N. Srivastava. 3. S. Chand's Biology for XI by P.S. Verma and B.P. Pandey. 4. I.S.C. Practical Biology (Including Viva-Voce & Project Work) Class- XIby V.P. Aggarwal and S.C. Maheshwari 5. Fundamentals of Biology: CBSE Class 11 published by Wiley 		

CC-2

Session: 2024-25			
Part A - Introduction			
Subject	Biotechnology		
Semester	II		
Name of the Course	General Microbiology		
Course Code	B24-BTY-201		
Course Type: (CC/MCC/MDC/CC-M /DSEC/VOC/DSE/PC/AEC/VAC)	CC-2		
Level of the course (As per Annexure-I)	200-299		
Pre-requisite for the course (if any)	NA		
Course Learning Outcomes (CLO): CLOs 1-4 of theory and 5 th of practical)	<p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"> 1 Illustrate the knowledge of history, scope, classification and various approaches of study of microbes. Compare and characterize prokaryotic and eukaryotic cells based on morphology, different groups of microorganisms based on their structures. 2 Illustrate the knowledge of microbial growth, reproduction and exhibit skill of isolation, purification, and preservation of microbial cultures. 3 Gain the knowledge of characteristics of viruses, their types and mode of multiplication. Also understand the various control measures of microbes. 4 Understand the role of micro-organisms in the environment, for making industrially important fermented foods and also gain the knowledge of spoilage of food and food borne diseases. <hr style="width: 20%; margin-left: 0;"/> <ol style="list-style-type: none"> 5. Exhibit practical skills in preparation of media and staining of microbes, Isolate bacteria from different sources and determine their count and cell size. Testing of antibiotic sensitivity and MIC value. 		
Credits	Theory	Practical	Total
	2	2	4
Contact Hours	2	4	6

Max. Marks:100	Time: 3h (theory), 4h (practical)
Internal Assessment Marks: 30 (15 Theory + 15 Practical)	
End Term Exam Marks:70 (35 Theory + 35 Practical)	

Part B- Contents of the Course

Instructions for Paper- Setter

Nine questions will be set in all. Question No.1 comprising of objective/short answer type questions from the entire syllabus, will be compulsory. The remaining eight questions will be set taking two questions from each unit. The candidates will be required to attempt Q.No.1 & four others selecting one question from each unit. All questions carry equal marks.

Unit	Topics	Contact Hours
I	History and evolution of microbiology with special reference to the contribution of the scientists: A. V. Leeuwenhoek, Louis Pasteur, Robert Koch, Edward Jenner and Alexander Fleming. Introduction to current classification of bacteria. Stains and staining procedures: Acidic, basic and neutral stains, Gram staining, Acid fast staining, Flagella staining, Endospore staining. Morphology and cell structure of major groups of microorganisms eg. Bacteria, Algae, Fungi and Protozoa.	8
II	Cultivation and Maintenance of microorganisms: Nutritional requirements of microorganisms. Methods of isolation, purification and preservation of microorganisms. Microbial growth: Study of growth curve, generation time, Bacterial Reproduction: Transformation, Transduction and Conjugation.	8
III	Viruses: General characteristics of viruses, difference between virus and typical microbial cell, structure, different shapes and symmetries with one example of each type, classification of viruses on the basis of nucleic acids, Brief idea of lytic cycle and lysogeny. Control of microorganisms: By physical and chemical antimicrobial agents.	7
IV	Food and Water Microbiology: Bacterial pollutants of water, coliforms and non coliforms. Sewage composition and its disposal. Microbial spoilage of foods. Microbiology of fermented Foods. Soil microbiology: Types & functions of microorganisms in soil.	7
V*	List of Practical: 1. Lab rules and safety measures in microbiology lab. 2. Sterilization of glassware and chemicals. 3. Study structure and principle of compound microscope. 4. Preparation and sterilization of Nutrient Agar Media for Bacterial Culture. 5. Preparation of agar slants and agar plates. 6. Streaking and spreading techniques for isolation of bacteria. 7. Isolation of bacteria from different sources. 8. Study of simple staining method. 9. Study of differential staining method: Gram staining. 10. Determination of bacterial cell size by micrometry.	60

	<p>11. Enumeration of microorganism - total & viable count. 12. Preparation and sterilization of Nutrient Broth Media for Bacterial Culture. 13. Measurement of the growth of microbial culture. 14. Study of thermal death point and thermal death time of microbes. 15. Antibiotic sensitivity test and MIC value. 16. Pure culture of micro-organisms. 17. Study of growth curve of bacteria. 18. Effect of different pH on bacterial growth.</p>	
Suggested Evaluation Methods		
<p>Internal Assessment: ➤ Theory-15 • Class Participation: 4 • Seminar/presentation/assignment/quiz/class test etc.:4 • Mid-Term Exam: 7 ➤ Practicum -15 • Class Participation: 4 • Seminar/Demonstration/Viva-voce/Lab records etc.:4 • Collection Report: 7</p>	<p>End Term Examination: 35 (Theory); 35 (Practical) - Evaluation of the practical skill will be done by an external examiner.</p>	
Part C-Learning Resources		
<p>Recommended Books/e-resources/LMS:</p> <ol style="list-style-type: none"> 1. Alexopoulos CJ, Mims CW, and Blackwell M. (1996). Introductory Mycology. 4 th edition. John and Sons, Inc. 2. Jay JM, Loessner MJ and Golden DA.(2005). Modern Food Microbiology.7thedition, CBS Publishers and Distributors, Delhi, India. 3. Kumar HD. (1990). Introductory Phycology.2nd edition.Affiliated East Western Press. 4. Madigan MT, Martinko JM and Parker J. (2009). Brock Biology of Microorganisms.12th edition.Pearson/Benjamin Cummings. 5. Pelczar MJ, Chan ECS and Krieg NR.(1993). Microbiology.5th edition. McGraw Hill Book Company. 6. Stanier RY, Ingraham JL, Wheelis ML, and Painter PR. (2005). General Microbiology. 5th edition. McMillan. 7. Tortora, G. J., Funke, B. R. and Case, C. L. (2016) Microbiology: An introduction, PearsonEducation. 8. Willey, J., Sherwood, L. and Woolverton, C. J. (2017) Prescott's microbiology, McGraw-HillEducation 		

CC-M2

Session: 2024-25			
Part A - Introduction			
Subject	Biotechnology		
Semester	II		
Name of the Course	Introduction of Biological Chemistry		
Course Code	B24-BTY-203		
Course Type: (CC/MCC/MDC/CC-M /DSEC/VOC/DSE/PC/AEC/VAC)	CC-M2		
Level of the course (As per Annexure-I)	200-299		
Pre-requisite for the course (if any)	NA		
Course Learning Outcomes(CLO): CLOs 1-4 of theory and 5 th of practical)	<p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"> 1. Understand structure, function, and energy storage. 2. Know amino acids, peptide bonds, structure, and biological roles. 3. Understand nucleotides, DNA/RNA differences, and genetic information. 4. Know structure, function, energy storage, cell membranes, and fatty acids. <p>5 Students will master biomolecule testing, quantity estimation, component separation, and process analysis for a comprehensive understanding.</p>		
Credits	Theory	Practical	Total
	1	1	2
Contact Hours	1	2	3
Max. Marks: 50		Time: Theory- 3h; Practical-4h	
Internal Assessment Marks: 15 (10 Theory + 5 Practical)			
End Term Exam Marks: 35 (20 Theory + 15 Practical)			
Part B- Contents of the Course			
<u>Instructions for Paper- Setter</u>			
<p>Nine questions will be set in all. Question No.1 comprising of objective/short answer type questions from the entire syllabus, will be compulsory. The remaining eight questions will be set taking two questions from each unit. The candidates will be required to attempt Q.No.1 & four others selecting one question from each unit. All questions carry equal marks.</p>			

Unit	Topics	Contact Hours
I	<p>Carbohydrates:</p> <p>Define carbohydrates and classify them based on their structure.</p> <p>Explain the role of carbohydrates in energy storage and structural support.</p> <p>Understand the concept of glycosidic bonds and their importance in carbohydrate structures.</p>	4
II	<p>Proteins:</p> <p>Describe the structure and function of amino acids.</p> <p>Explain the concept of peptide bonds and protein primary, secondary, tertiary, and quaternary structures.</p> <p>Understand the role of proteins in various biological processes (e.g., enzymes, transport, signaling).</p>	4
III	<p>Nucleic Acids:</p> <p>Describe the structure and function of nucleotides.</p> <p>Explain the differences between DNA and RNA.</p> <p>Understand the role of nucleic acids in genetic information storage and transfer.</p>	4
IV	<p>Lipids:</p> <p>Define lipids and classify them based on their structure.</p> <p>Explain the role of lipids in energy storage, cell membranes, and signalling.</p> <p>Understand the concept of fatty acids and their saturation.</p>	3
V*	<p>List of Practical:</p> <ol style="list-style-type: none"> 1. Qualitative tests for Carbohydrates 2. Estimation of reducing and non-reducing sugars 3. Separation of sugars by Paper Chromatography 4. Qualitative tests for Proteins and Amino acids 5. Protein estimation by Lowry method 6. Separation of Lipids by TLC method\ 7. Determination of saponification and iodine value of Lipids 8. Starch hydrolysis by salivary amylase 	30
Suggested Evaluation Methods		
<p>Internal Assessment:</p> <p>➤ Theory-10</p> <ul style="list-style-type: none"> • Class Participation: 4 • Seminar/presentation/assignment/quiz/class test etc.: NA • Mid-Term Exam: 6 <p>➤ Practicum -5</p> <ul style="list-style-type: none"> • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc.:5 • Mid-Term Exam: NA 		<p>End Term Examination:</p> <p>20 (Theory);</p> <p>15 (Practical) -</p> <p>Evaluation of the practical skill will be done by an external examiner.</p>

Part C-Learning Resources

Recommended Books/e-resources/LMS:

1. Biochemistry by Lubert Stryer
2. Biochemistry by Jeremy M. Berg, John L. Tymoczko, and Lubert Stryer
3. Fundamentals of Biochemistry by Donald Voet and Judith G. Voet
4. Biochemistry by David L. Nelson and Michael M. Cox
5. Principles of Biochemistry by Albert L. Lehninger, David L. Nelson, and Michael M. Cox
6. Biochemistry by Robert H. Devlin
7. Biochemistry by John M. Ragan
8. Biochemistry by Thomas M. Devlin

MDC-2

Session: 2024-25			
Part A - Introduction			
Subject	Biotechnology		
Semester	II		
Name of the Course	Biology - II		
Course Code	B24-BTY-204		
Course Type: (CC/MCC/MDC/CC-M /DSEC/VOC/DSE/PC/AEC/VAC)	MDC-2		
Level of the course (As per Annexure-I)	200-299		
Pre-requisite for the course (if any)	NA		
Course Learning Outcomes(CLO): (CLOs 1-4 of theory and 5 th of practical)	<p>After completing this course, the learner will be able to:</p> <ol style="list-style-type: none"> 1. Students will understand the physiological processes taking place at the level of the cell, organ and the whole plant, will get knowledge of Interaction of light with green plant parts, preparation of food etc. 2. Students will describe how plants obtain the reactants needed for respiration, including the role of the roots and the stomata, functions of various plant hormones in plant development. 3. Students will learn the structure of major human organs surrounding respiratory explain their role in the maintenance of healthy individuals 4. Students will learn the structure of major human organs surrounding muscular and nervous system and explain their role in the maintenance of healthy individuals. <p>5*. Students will be able to learn practical skills on basic Biology practical like root slide preparation, chromatography, biochemical tests.</p>		
Credits	Theory	Practical	Total
	2	1	3
Contact Hours	2	2	4

Max. Marks:75

Internal Assessment Marks: 20 (15 Theory+ 5 Practical)

End Term Exam Marks: 55 (35 Theory+ 20 Practical)

Time: Theory- 3h; Practical-4h

Part B- Contents of the Course

Instructions for Paper- Setter

Nine questions will be set in all. Question No.1 comprising of objective/short answer type questions from the entire syllabus, will be compulsory. The remaining eight questions will be set taking two questions from each unit. The candidates will be required to attempt Q.No.1 & four others selecting one question from each unit. All questions carry equal marks.

Unit	Topics	Contact Hours
I	Plant Physiology: Plant water relations; osmosis, plasmolysis, imbibition, mineral nutrition; plant nutrients, micro and macro nutrients, role of nutrients. Photosynthesis in Higher Plants: Photosynthesis as a means of autotrophic nutrition; site of photosynthesis, pigments involved in photosynthesis.	8
II	Plant - Growth and Development : Seed germination; phases of plant growth and plant growth rate; conditions of growth; differentiation, dedifferentiation and redifferentiation; sequence of developmental processes in a plant cell; growth regulators - auxin, gibberellin, cytokinin, ethylene, ABA;	8
III	Human Physiology: Breathing and Exchange of Gases: Respiratory organs in animals (recall only); Respiratory system in humans; mechanism of breathing and its regulation in humans - exchange of gases, transport of gases and regulation of respiration, respiratory volume; disorders related to respiration - asthma, emphysema, occupational respiratory disorders.	7
IV	Locomotion and Movement Types of movement - ciliary, flagellar, muscular; skeletal muscle, contractile proteins and muscle contraction; skeletal system and its functions; joints; disorders of muscular and skeletal systems - myasthenia gravis, tetany, muscular dystrophy, arthritis, osteoporosis, gout. Neural Control and Coordination: Neuron and nerves; Nervous system in humans - central nervous system; peripheral nervous system and visceral nervous system; generation and conduction of nerve impulse.	7

V*	<p>PRACTICALS</p> <ol style="list-style-type: none"> 1. Preparation and study of T.S. of dicot and monocot roots and stems (primary). 2. Study of osmosis by potato osmometer. 3. Study of plasmolysis in epidermal peels (e.g. Rhoeo/lily leaves or flashy scale leaves of onion bulb). 4. Study of distribution of stomata on the upper and lower surfaces of leaves. 5. Comparative study of the rates of transpiration in the upper and lower surfaces of leaves. 6. Test for the presence of sugar, starch, proteins and fats in suitable plant and animal materials. 7. Separation of plant pigments through paper chromatography. 8. Study of the rate of respiration in flower buds/leaf tissue and germinating seeds. 9. Test for presence of urea in urine. 10. Test for presence of sugar in urine. 11. Test for presence of albumin in urine. 12. Test for presence of bile salts in urine. 	30
Suggested Evaluation Methods		
<p>Internal Assessment:</p> <ul style="list-style-type: none"> ➤ Theory-15 <ul style="list-style-type: none"> • Class Participation: 4 • Seminar/presentation/assignment/quiz/class test etc.:4 • Mid-Term Exam: 7 ➤ Practicum -5 <ul style="list-style-type: none"> • Class Participation: • Seminar/Demonstration/Viva-voce/Lab records etc.:5 • Mid-Term Exam: NA 	<p>End Term Examination: 35 (Theory); 20 (Practical) - Evaluation of the practical skill will be done by an external examiner.</p>	
Part C-Learning Resources		
<ol style="list-style-type: none"> 1. Biology Text Book for class XI published by NCERT. https://ncert.nic.in/textbook.php?kebo1=0-19 2. Pradeep's A Text Book of Biology for Class 11 (Vol. 1 & 2) Paperback – by P.S. Dhami , G. Chopra, H.N. Srivastava. 3. S. Chand's Biology for XI by P.S. Verma and B.P. Pandey. 4. I.S.C. Practical Biology (Including Viva-Voce & Project Work) Class- XI by V.P. Aggarwal and S.C. Maheshwari 5. Fundamentals of Biology: CBSE Class 11 published by Wiley 		

