KONGUNADU ARTS AND SCIENCE COLLEGE

(AUTONOMOUS)

COIMBATORE – 641 029

DEPARTMENT OF BIOTECHNOLOGY (UG)

CURRICULUM AND SCHEME OF EXAMINATIONS (CBCS)

(2024 – 2025 onwards)

DEPARTMENT OF BIOTECHNOLOGY

Vision

1. To enable the students to comprehend the tool of Biotechnology so as to attain new vistasin core and applied areas of Biotechnology education and research; such that experiential learning and problem solving attribute shall continuously contribute to the nation building by maintaining high degree of ethical standard and integrity

Mission

1. Build comprehensive quest for scientific inquiry prove the basic and advanced courses
2. Provide a fundamental knowledge of the various application of Biotechnology andintegrate it with cutting edge research in niche areas
3. Pursue an integrative interdisciplinary and cross disciplinary approach in teaching,learning and research
4. Foster industrial national and international institutional collaboration for promotion of research, innovation and entrepreneurship in Biotechnology

Goal

1. Provide a holistic and self-reliant learning environment
2. Promote diversity in teaching, learning and research
3. Empower stakeholders through ample hands on studies, activity based learning method, Industry oriented case study and project work which shall make learning experience unique
4. Enrich the teaching and learning process through adequate industry/local community partnership
5. Inculcate high standards of ethic, professionalism and responsibility among the stakeholders

B.Sc. BIOTECHNOLOGY

Programme Outcomes (PO)

The Student will be able to:

PO1: Demonstrate their knowledge and technical skills in core and allied areas of Biotechnology

PO2: Possess adequate theoretical and practical knowledge, Skill and attitude to pursue higher studies/research in biotechnology and allied areas of Biological Science

PO3: Demonstrate application of knowledge through Critical thinking to decipher and devise potential solutions to existing issues in the industry/society

PO4: Employ the various tools of Biotechnology and Bioinformatics to arrive at viable solutions to address problems which require immediate action

PO5: Communicate appropriately and effectively to all stake holders in biotechnology education/industry/research

PO6: Contribute to the growth of Nation's GDP by establishing enterprise/startup/bio business ventures

PO7: Adopt high standards of ethics in all transactions in the field of biotechnology education, research, publication and dissemination of knowledge to all the stake holders

PO8: Develop and sustain Knowledge, Skills and Attitude for a continuous and lifelong learningand Continuous Professional Development

Programme Specific Outcomes (PSO)

PSO1: Apply the knowledge and skills gained through the study of basic and advanced courses like Cell Biology and Genetics, Molecular Biology, Recombinant DNA Technology, Immunology, Genomics and Proteomics, Plant and Animal Biotechnology alongside with the practical exposure to succeed in their career/ professional development and/or postgraduate education.

PSO2: Create, select and apply appropriate techniques, resources, and modern biotechnological tools along with computational and bioinformatics tools for solving several issues in myriad fields of science and technology

PSO3: Will be competent to outshine in various competitive examinations in Life Sciences, with emphasis on Biotechnology and applied sciences, for higher education and research

PSO4: Apply contextual knowledge to assess, comprehend and address societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to biotechnology education/research/ entrepreneurship.

PSO5: Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary niches like pharmaceutical, food, marine industries and other related areasof employment

KONGUNADU ARTS AND SCIENCE COLLEGE (AUTONOMOUS)

COIMBATORE – 641 029

Programme Name: BSc., Biotechnology Curriculum and Scheme of Examination under CBCS

(Applicable to the students admitted during the Academic Year 2024-2025)

Semester	Part	Subject Code	Title of the Paper	Instruction hours/cycle	Exam. Marks			Duration of Exam hours)	Credits
					CIA	ESE	TOTAL		
I	I	24TML101	Language I@	6	25	75	100	3	3
	II	24ENG101	English –I	6	25	75	100	3	3
	III	24UBT101	Core Paper 1 – Cell Biology andGenetics	5	25	75	100	3	4
	III		Core Practical 1 – Lab in Cell biology, Genetics and Microbiology	5	-	-	-	-	-
	III	24UCH1A1	Allied Paper 1 – Chemistry	4	20	55	75	3	4
	III		Allied Practical 1- Chemistry	2	-	-	-	-	-
	IV	24EVS101	Environmental Studies **	2	-	50	50	3	2
	Total			**30**	**-**	**-**	**425**	**-**	**16**
II	I	24TML202	Language II@	6	25	75	100	3	3
	II	24ENG202	English –II	6	25	75	100	3	3
	III	24UBT202	Core Paper 2 –Bioinstrumentation	4	25	75	100	3	4
	III	24UBT203	Core Paper 3 – Microbiology	4	25	75	100	3	4
	III	24UBT2CL	Core Practical 1 - Lab in Cell biology, Genetics and Microbiology	2	40	60	100	6	4
	III	24UCH2A2	Allied Paper 2 – Chemistry	4	20	55	75	3	4
	III	24UCH2AL	Allied Practical 1 – Chemistry	2	20	30	50	-	2
	IV	24VED201	Value Education- Moral andEthics**	2	-	50	50	3	2
	Total			**30**	**-**	**-**	**675**	**-**	**26**
III	I	24 TML303	Language III@	6	25	75	100	3	3
	II	24 ENG303	English –III	6	25	75	100	3	3
	III	24 UBT304	Core Paper 4 – Enzymology and Metabolism	3	25	75	100	3	4
	III	24 UBT305	Core Paper 5 – Molecular Biology	3	25	75	100	3	3
	III		Core Practical 2 - Lab in Enzymology, Molecular Biologyand rDNA Technology	3	-	-	-	-	-
	III	24UBT3A3	Allied Paper 3 – Fundamentals of Mathematics	5	20	55	75	3	4

	IV	24UGC3S1	Skill Based subject 1- Cyber Security	2	100	-	100	-	3
	IV	24TBT301/ 24TAT301/ 24UHR3N1	Basic Tamil* / Advanced Tamil**/Non-Major Elective- I**	2	-	75	75	3	2
	Total			**30**	-	-	**650**	-	**22**
IV	I	24TML404	Language IV@	6	25	75	100	3	3
	II	24ENG404	English –IV	6	25	75	100	3	3
	III	24UBT406	Core Paper 6 – rDNA Technology	4	25	75	100	3	3
	III	24UBT4CM	Core Practical 2 - Lab in Enzymology, Molecular Biologyand rDNA Technology	4	40	60	100	6	3
	III	24UBT4A4	Allied Paper 4 – Bio Statistics	4	20	55	75	3	4
		24UBT4AL	Allied Practical 2- Bio StatisticsPractical	2	20	30	50	3	2
	IV	24UBT4S2	Skill based Subject 2 - Traditional Indian Technology and Bio Business	2	25	75	100	3	3
	IV	24TBT402/ 24TAT402/ 24UWR4N2	Basic Tamil* / Advanced Tamil**/Non-Major Elective- II**	2	-	75	75	3	2
	Total			**30**	-	-	**700**	-	**23**
V	III	24UBT507	Core Paper 7 – Immunology	5	25	75	100	3	4
	III	24UBT508	Core Paper 8 – Plant and Animal Biotechnology	5	25	75	100	3	4
	III	24UBT509	Core Paper 9 – Genomics and Proteomics	4	25	75	100	3	4
	III	24UBT5CN	Core Practical 3 – Lab in Immunology, Plant and Animal Biotechnology	6	40	60	100	6	3
	III	24UBT5E1	Major Elective 1	5	25	75	100	3	5
	IV	-	EDC Paper	2	**100**	-	100	-	3
	III	-	Case Study analysis, Report and VivaVoce***	3#	-	-	-	-	-
	-	24UBT5IT	Internship Training ****	Grade					
	Total			**30**	-	-	**600**	-	**23**
	III	24 UBT610	Core Paper 10 – BioprocessTechnology	5	25	75	100	3	4
VI	III	24 UBT611	Core Paper 11 – Biopharmaceuticals	5	25	75	100	3	5
	III	24 UBT612	Core Paper 12 - Bioinformatics	5	100	-	100	3	4
	III	24U BT6E2	Major Elective 2	5	25	75	100	3	5
	III	24UBT6CO	Core Practical 4 - Lab in Bioprocess Technology & Biopharmaceuticals	6	40	60	100	6	3

	III	24UBT6Z1	Case Study analysis, Report and viva***	2#	20	80	100	-	5
	IV	24UBT6S3	Skill Based Subject 3 – Basics of Intellectual Property Rights	2	25	75	100	3	3
			Total	**30**	**-**	**-**	**700**	**-**	**29**
	V	24NCC$/NSS /YRC/PYE/ ECC/RRC/ WEC101#	Co-curricular Activities *	-	50	-	50	-	1
			Grand Total	**-**	**-**	**-**	**3800**	**-**	**140**

Note: CBCS – Choice Based Credit system CIA – Continuous Internal Assessment

ESE – End of Semester Examinations

@ Hindi/Malayalam/ French/ Sanskrit – 24HIN/MLM/FRN/SAN101 – 404

$ For those students who opt NCC under Co-curricular activities will be studying the prescribed syllabi of the UGC which will include Theory, Practical & Camp components. Such students who qualify the prescribed requirements will earn an additional 24 credits

* - No End-of-Semester Examinations. Only Continuous Internal Assessment (CIA)

**- No Continuous Internal Assessment (CIA). Only End-of-Semester Examinations (ESE)

*** Case study: Report- 35 marks, Viva voce-15 marks; Internal- 50 marks

**** The students shall undergo an Internship training /field work for a minimum period of 2 weeks at the end of the fourth semester during summer vacation and submit the report in the fifth semester. The report will be evaluated for 100 marks along with the internal viva voce by the respective faculty. According to their marks, the grades will be awarded as given below.

Not to be included in faculty workload

	Grade
85 – 100	O
70 – 84	D
60 – 69	A
50 – 59	B
40 – 49	C
< 40	U (Reappear)

Major Elective Papers (2 papers are to be chosen from the following 6 papers)

1. Stem cell and Neuroscience
2. Nanotechnology
3. IPR, Biosafety and Bioethics
4. Research Methodology
5. Molecular Diagnostics
6. Food and Dairy Technology

Non-Major Elective Papers

1. Human Rights
2. Women's Rights
3. Consumer Affairs

Skill Based Subjects

1. Cyber Security
2. Traditional Indian Technology and Bio Business
3. Basics of Intellectual Property Rights

Sub. Code & Title of the Extra Departmental Course (EDC) :

24UBT5X1 – Bioentrepreneurship

 # List of Cocurricular Activities:

1. National Cadet Corps (NCC)
2. National Service Scheme (NSS)
3. Youth Red Cross (YRC)
4. Physical Education (PYE)
5. Eco Club (ECC)
6. Red Ribbon Club (RRC)
7. Women Empowerment Cell (WEC)

Note: In core/ allied subjects, no. of papers both theory and practical are included wherever applicable. However, the total credits and marks for core/allied subjects remain the same as stated below

Job Oriented Courses (JOC)

1. Clinical Research and Medical Coding (24UBT0J1)
2. Agro Industrial biotechnology (24UBT0J2)

Note: JOC which are offered at present will be applicable for the students admitted during the academicyear 2024-2024 and will be considered as extra credit courses.

Tally Table:

S.No.	Part	Subject	Marks	Credits
1.	I	Language – Tamil/Hindi/Malayalam/ French/ Sanskrit	400	12
2.	II	English	400	12
3.	III	Core – Theory/Practical	1600	60
	III	Allied	400	20
		Electives/Project	300	15
4.	IV	Basic Tamil / Advanced Tamil (OR) Non-major electives	150	4
		Skill Based subject	300	9
		EDC	100	3
		Environmental Studies	50	2
		Value Education	50	2
5.	V	Cocurricular Activities	50	1
		Total	**3800**	**140**

- 25 % CIA is applicable to all subjects except JOC, COP and SWAYAM courses which are considered as extra credit courses.
- 100 % CIA for Bioinformatics ,Cyber Security and EDC paper.
- The students to complete any **MOOC On learning platforms like SWAYAM, NPTEL, Course era, IIT Bombay Spoken Tutorial etc.,** before the completion of the 5th semester and the course completion certificate should be submitted through the HOD to the Controller of Examinations. Extra credits will be given to the candidates who have successfully completed.
- An **Onsite Training** preferably relevant to the course may be undertaken as per the discretion of the HOD.
- Students who successfully complete **Naan Mudhalvan** courses in 3rd and 5th semester will be given 2 extra credits for each course. They are asked to submit the marks to Controller of Examinations through and undersigned by the HOD.

Semester	Naan Mudhalvan Course Title
III	Good Manufacturing Practices
V	PCR TECHNOLOGY INTERMEDIATE COURSE

Components of Continuous Internal Assessment

Components		Marks	Total
Theory			
CIA I	75	(75+75) Converted to 15	25
CIA II	75		
Assignment/Seminar		5	
Attendance		5	
Theory			
CIA I	75	(50+50) Converted to 15	25
CIA II	75		
Assignment/Seminar		5	
Attendance		5	
Theory (Allied)			
CIA I	55	(55+55) Converted to 10	20
CIA II	55		
Assignment/Seminar		5	
Attendance		5	
Practical			
CIA Practical		25	40
Observation Notebook		10	
Attendance		5	
Practical			
CIA Practical		10	25
Observation Notebook		10	
Attendance		5	
Practical (Allied)			
CIA Practical		10	20
Observation Notebook		5	
Attendance		5	
Project/Case study			
Review		15	20
Regularity		5	

Components of 100% Continuous Internal Assessment

Components		Marks	Total Mark
Theory			
CIAI	55	(55+55=110/2) 55	55
CIAII	55		
Assignment/Seminar*		5	10
Attendance		5	
Practical			
CIA Practical Breakup of Marks Protocol - 15 Result & viva - 15		30	35
Record Note book		5	
		TOTAL	**100**

BLOOM'S TAXONOMY BASED ASSESSMENT PATTERN

K1-Remembering; **K2**-Understanding; **K3**-Applying; **K4**-Analyzing; **K5**-Evaluating

1.Theory Examination:

(i) CIA I & II and ESE: 75 Marks

Knowledge Level	Section	Marks	Description	Total
K1 Q1 to 10	A (Answer all)	10 x 1 = 10	MCQ	75
K1 – K5 Q11 to 15	B (Either or pattern)	5 x 5 = 25	Short Answers	
K2 – K5 Q16 to 20	C (Either or pattern)	5 x 8 = 40	Descriptive / Detailed	

(ii) CIA I & II and ESE: 35 Marks (Allied)

Knowledge Level	Section	Marks	Description	Total
K1 Q1 to 10	A (Answer all)	10 x 1 = 10	MCQ	55
K1 – K5 Q11 to 15	B (Either or pattern)	5 x 3 = 15	Short Answers	
K2 – K5 Q16 to 20	C (Either or pattern)	5 x 6 = 30	Descriptive / Detailed	

(iii) CIA I & II and ESE: 50 Marks

Knowledge Level	Section	Marks	Description	Total
K1 Q1 to 10	A (Answer all)	10 x 1 = 10	MCQ	50**
K1 – K5 Q11 to 15	B (Either or pattern)	5 x 3 = 15	Short Answers	
K2 – K5 Q16 to 20	C (Either or pattern)	5 x 5 = 25	Descriptive / Detailed	

****For ESE 50 marks converted to 25 marks.**

2. ESE Practical Examination:

Knowledge Level	Section	Marks	Total
K3	Experiments	50	60
K4	Record Work	10	
K5			

(For Allied papers)			
Knowledge Level	**Section**	**Marks**	**Total**
K3	Experiments	25	30
K4	Record Work	05	
K5			

Knowledge Level	Section	Marks	Total
K3	Experiments	20	25
K4	Record Work	05	
K5			

3. ESE Project Viva Voce:

Knowledge Level	Section	Marks	Total
K3	Project Report	60	80
K4	Viva voce	20	
K5			

Practical Examination mark breakup:

Knowledge Level	Section	
K3 ↕ K5	**Major Experiments:**	
	Protocol -	15
	Perform -	5
	Result -	5
	Minor Experiments:	
	Protocol -	5
	Perform -	5
	Result -	5
	Q&A -	5
	Viva -	5
	Record work	10

Programme code: 08		**Programme name:** B. Sc. Biotechnology		
Course code: 24UBT101		**Core Paper 1** – Cell Biology and Genetics		
Batch: 2024-2025	**Semester** I	**Hours / Week** 5	**Total Hours** 75	**Credits** 4

Course Objectives

1. To introduce the basic concepts of cellular architecture and organelles
2. To familiarize with Cell division cycle and cancer
3. To provide an overview of the cellular environment outside the cell
4. To introduce the basic concepts of classical and population Genetics

Course Outcomes:

After Completion of the Course, the student will be able to:

K1 ↕ K5	CO1	Able to extend the learning on the cellular architecture to decipher complex cellular mechanisms
	CO2	Adaptable to a research environment to study the cell division cycles
	CO3	Able to comprehend and compare the cell signaling mechanisms and relate it to various diseases
	CO4	Able to provide a comprehensive overview of Classical genetics and its relevance in current day research
	CO5	Able to define and explain calculating genetic frequencies and allelic frequencies

Syllabus

UNIT I **(15 Hours)**

Cell organization: Origin and organization of prokaryote and eukaryotic cell - Primordial Soup, internal architecture of cell, ultra structure of plant and animal Cell, Nucleus, Cell membrane systems and transport- Active and Passive Transport- Na^+ K^+ Pump, Chloride ion pump, H^+ pump, ATpase. **Cytoskeleton**: Microtubules- Structure of Cilia and flagella, microfilaments: Actin and Myosin, Structure of Sarcomere, Muscle Contraction, and Intermediate filaments.

UNIT II **(15 Hours)**

Ribosomes, Chloroplast, lysosomes, peroxisomes, Golgi apparatus, mitochondria- Their structure and functions **Cell Growth and Division**: The cell Cycle (Eukaryotic) - G1, S, G2 and M phase molecular events. Mitosis and meiosis, Cell Cycle Check Points and Cancer, proto-oncogenes. Cell signaling; general principles, receptor ligand interactions- GPCR Signaling, Ras Raf pathway, Role of Calcium as Second messengers , Apoptosis- Mitochondrial pathway

UNIT III **(15 Hours)**

Cell-Cell Interaction: Glycocalyx, ECM, Collagen, fibronectin, lamin, proteoglycan, integrins, cell junctions, desmosomes, gap junctions, tight junctions, plasmodesmata, selectins, cadherins. Cellular differentiation. **Plant Cell structure and Cell wall ***

UNIT IV **(15 Hours)**

Classical genetics: Laws of inheritance: Mendel's Laws, concept of dominance, segregation, independent assortment- human traits; Chromosomal theory of inheritance. Allelic and non-allelic interactions: Concept of alleles, types of dominance, lethal alleles, multiple alleles, complementation; Epistasis. Sex-linked inheritance: Conceptual basis, sex influenced traits, mechanism of sex determination. penetrance and expressivity. Cytoplasmic inheritance and role of organellar genes. Linkage and linkage mapping

UNIT V **(15 Hours)**

Population genetics: Organization and measure of genetic variation: Random mating population, Hardy- Weinberg principle, non-random matting, Gene flow and genetic structure of Populations: Hierarchical populations, isolate breaking, inbreeding, assortative and non-assortative matings. Genotype Frequencies, Allele Frequencies, and Genetic Variation in Natural Populations. Genetic drift, migration, mutation and natural selection. **Quantitative traits and heritability***

Denotes self study

Teaching Methods

Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ video presentation /Podcast /materials from NDLI/class blended learning/ flipped class

Text book

1. Veera Bala Rastogi, (2020), A Text Book Of Cell Biology And Genetics.
2. Griffith, AF *et al.* (2015). Introduction to Genetic Analysis (11th Ed). W H Freeman and Company, USA.
3. Snustard, DP., Simmons, MJ. (2015). Principles of Genetics (7th Ed). John Wiley & Sons publisher.
4. Phillip Sheeler., Donald, E., Bianchi. (2014). Cell and Molecular Biology (3rd Ed). Wiley. UK.

Reference

1. Geoffery, M., Cooper, Hausman, RE. (2013). The Cell- A Molecular Approach (7th Ed). Oxford University Press, USA.
2. Lodhish, H. (2016). Molecular Cell Biology (8th Ed). W H Freeman and Company, USA
3. Klug, WS., Cummings, MR et.al. (2015). Concepts of Genetics (11th Ed). Pearson publisher.
4. Hartl, DL., Ruvolo, M. (2011).Genetics Analysis of Genes & Genomes (8th Ed). Jones and Bartlett publisher.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	S	L	L
CO2	H	S	M	M	L
CO3	S	S	S	H	M
CO4	S	M	H	S	M
CO5	M	S	S	L	M

S – Strong H – High M – Medium L – Low

Programme code: 08		**Programme name:** B. Sc. Biotechnology		
Course code:24UBT202		**Core Paper 2** –Bioinstrumentation		
Batch: 2024-2025	**Semester** II	**Hours / Week** 4	**Total Hours** 60	**Credits** 4

Course Objectives

1. To understand the usage of instruments in Experimentation
2. To seed knowledge about the principles of operation of analytical instruments
3. To equip students with the working and maintenance of instruments
4. To introduce the basics of analytical interpretation

Course Outcomes (CO)

After completion of the course, the students will be able to:

K1 ↕ K5	CO1	Appreciate the importance and application of analytical instruments
	CO2	Examine the troubleshoot methods for maintenance of instruments
	CO3	Solve the critical steps and biological calculations
	CO4	Analyze the data obtained from instruments
	CO5	Apply the principles in research process

Syllabus

UNIT 1 **(12 Hours)**

Introduction to analytical Instruments: Analytical balance: operational methods and maintenance; pH meter –Principle, Buffers, factors affecting pH measurement; Equipments to maintain laboratory sterility: Autoclave and Laminar Air flow Chamber. Photometry: Colorimetry, UV-Visible spectrophotometer, fluorimetry and flame photometry, Atomic absorption spectroscopy – working and applications

UNIT 2 **(12 Hours)**

Centrifuge: RPM, RCF and G conversions; Principle and types: Clinical, Ultracentrifugation, Refrigerator centrifugation; Distillation units – Single and double. Filtration units – Membrane and ultrafiltration; Particle size analyser; Geiger Muller and Scintillation counters; Chemilumiscence.

UNIT 3 **(12 Hours)**

Basic Microscope - Compound, Phase Contrast and Electron microscopy – TEM and SEM, Confocal and fluorescent microscopy; Electrophoresis: Agarose and Polyacrylamide gel electrophoresis; Iso electric focusing 2 D-gel electrophoresis, Pulsed Field Gel Electrophoresis (PFGE), Gel documentation System.

UNIT 4 **(12 Hours)**

Chromatography: Introduction; Types: **Paper***, Thin layer, Column, Ion exchange - Resins, Molecular exclusion, affinity, Gas chromatography, Liquid chromatography – working principle and applications; HPTLC and High performance Liquid chromatography – working principle and applications; Mass spectrometry - Principle and applications, Gas chromatography and Liquid chromatography coupled with Mass spectroscopy;

UNIT 5 **(12 Hours)**

Lyophilizer and cryopreservation; Sonicator; ELISA reader; Thermal cycler – Principle and applications; Structural analysis by X-ray crystallography; vacuum tray dryer, Speed Vacuum and **spray dryer***; Soxhlet apparatus and rotary vacuum evaporator. Calibration of instruments.

**** denotes Self study***

Teaching Methods

Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ video presentation /Podcast /materials from NDLI/class blended learning/ flipped class

Text Books

1. Veerakumari, L. (2009). Bioinstrumentation. MJP Publishers, New Delhi, India.
2. Sharma, BK. (2005). Instrumental Methods of Chemical analysis (24th Revised Ed). Goel Publishing House, Meerut.
3. Wilson, K.,Walker, J. (2000). Principles and Techniques of Practical Biochemistry (5th Ed). Cambridge University Press, Cambridge.

Reference Books

1. Holme and Peck. (1998). Analytical Biochemistry (3rd Ed). Pearson Education Ltd, Essex, England.
2. Skoog and Leary. (1992). Principles of Instrumental analysis(4thEd). Saunder's College Publishing, New York.

3. Khandpur, RS. (2003). Handbook of Biomedical Instrumentation, Tata McGraw Hill Education.
4. Rickwood, D., Hames, BD. (1986). Gel Electrophoresis of Nucleic acids-A Practical approach.IRL Press, Oxford.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	M	L	L
CO2	H	H	M	L	M
CO3	H	S	L	M	S
CO4	M	S	M	L	M
CO5	S	S	L	L	M

S – Strong H – High M – Medium L – Low

Programme code: 08		**Programme name:** B. Sc. Biotechnology		
Course code:24UBT203		**Core Paper 3** - Microbiology		
Batch: 2024-2025	**Semester** II	**Hours / Week** 4	**Total Hours** 60	**Credits** 4

Course Objectives

1. To understand the basic concepts of the biology of microorganisms
2. To learn the general principles of microbial classification, growth and evolution
3. To understand the role of microbes in human life
4. To study microbial pathogens, their pathogenesis and treatment.

Course Outcomes (CO)

After completion of the course, the students will be able to:

K1 ↑↓ K5	CO1	Correlate the early development, physiology and evolution of Microorganisms
	CO2	Employ various methods of studying and identification of microorganisms
	CO3	Decipher microbial interactions in soil, food, human and animals
	CO4	Contribute in understanding the mechanism of diseases caused by various Microorganisms
	CO5	Contribute to development of novel methods of microbial applications

Syllabus

UNIT I **(12 Hours)**

History of Microbiology: Discovery of Microscope, Principles, mechanisms of different types of microscopes, discovery of microorganisms. *Morphology of Prokaryotes* (Bacteria, Actinomycetes, fungi, bacteriophages and viruses); Size, shape and arrangement of bacterial cells, colony characteristics, bacterial structures and function, flagella and motility, bacterial extracellular structures, cell wall of Gram positive and negative cells, bacterial cell division, spore formation in bacteria. *Classification*: Bacteria (Bergey's and molecular taxonomy) Five kingdom and three kingdom classification of microorganisms. Baltimore Classification of virus, Classification of fungi. Fourclasses of Algae.

UNIT II **(12 Hours)**

Sterilization methods - Dry heat, moist heat, radiation, filtration and chemicals, asepsis; *Culture media* - Types and preparation. *Culture methods* - aerobic, anaerobic and microaerophilic cultures; Isolation and maintenance and of pure culture (spread plate, streak, and pour plate). **Type culture collections*.** *Bacterial stains and staining methods* - (Simple, Grams, negative, capsular, flagellar, acid-fast stain, spore staining, fluorescent staining) and fungal staining methods (Lactophenol cotton blue (LPCB), PAS (Periodic Acid Schiff) reaction and PAS and GMS (Periodic Acid Schiff and Gomari methenamine Silver staining).

UNIT III **(12 Hours)**

Microbial growth – Growth of bacteria - Nutrient types and requirements of bacteria, Bacterial cell elements and source of elements from media for bacterial growth. Modes of cell division, growth curve. Growth Kinetics *Measurement of microbial growth* – wet and dry weight, plate count method, Membrane filter count, electronic count, packed cell volume, turbidometry. Viral replication, plaque counting and titre calculation.

UNIT IV **(12 Hours)**

Microbial interactions: Symbiosis, asymbiosis, ammensalism, synergism, mutalism, neutralism Parasitism. *Modes of transmission of Microbial Diseases* – congenital, contact, fomites, food and water, airborne; reservoirs of infection (human, animal, and non-living reservoirs), animal and insect vectors. *Microbiology of water* –water borne diseases (Cholera, Typhoid, Hepatitis A); prevention measures for water borne diseases. *Bacteriological examination of water* – Pathogens that spread through water, Faecal coliforms and Membrane filtration technique; **MPN test***

UNIT V **(12 Hours)**

Microbial pathogenesis and Beneficial Microbes: Toxins and virulence factors and host immunity. Fungal replication, general information on fungal pathogenesis. *Nosocomial infections*: Etiology,incidence and predisposing factors of nosocomial infections. Viral Diseases – Dengue, SARS, SARS Cov, HIV Ebola. Industrially beneficial bacteria - Overview. **Importance of gut microbiome in human health and disease*,**

denotes self study

Teaching Methods

Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ video presentation /Podcast /materials from NDLI/class blended learning/ flipped class

Text book

1. Pelczar, Jr. (2004). Microbiology (5th Ed). Tata McGraw-Hill Publishing Co. Ltd, New Delhi.
2. Stainer *et al.* (1992). General Microbiology (5th Ed). Macmillan Education Ltd, London.

References

1. Prescott's. (2016). Microbiology (Joanne M Willey, Linda Sherwood, Christopher J Woolverton Eds.) (10th Ed). McGraw-Hill Education publisher.
2. Atlas, RM., Bartha, R. (1998). Microbial Ecology – Fundamentals and Applications, Pearson Education, Asia.
3. Madigan, MT., Bender, KS., Buckley, DH., Sattley, WM., David, A. (2015). Stahl Brock - Biology of Microorganisms (15th Ed), Pearson.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	S	S	L
CO2	S	L	H	L	M
CO3	H	H	S	L	H
CO4	S	L	M	M	M
CO5	H	S	M	H	S

S – Strong H – High M – Medium L – Low

Programme code: 08		**Programme name:** B. Sc. Biotechnology		
Course code:24UBT2CL		**Core Practical 1** – Lab in Cell biology, Genetics and Microbiology		
Batch: 2024-2025	**Semester** I &II	**Hours / Week** 5+2	**Total Hours** 75+30	**Credits** 4

Course Objective (CO)

1. To understand basic aspects of Cell structure and Genetics
2. To provide a hands on exposure in identification of cells and examine the stages of cell divisions.
3. To learn about the cell fractionation and basic Genetic experiments
4. To provide training on microbiological media preparation, isolation and characterization ofmicrobes.

Course Outcomes (CO)

After completion of the course, the students will be able to:

K3	CO1	Examine and appraise the cell types and different stages of cell divisions
↑	CO2	Examine the techniques involved in and molecular biology and genetics
↕	CO3	Distinguish the blood cells and obtaining the skill of blood cell counting and analyzing the amino acids pattern using chromatography techniques.
↓	CO4	Demonstrate the relationship between phenotype and genotype in human genetic traits.
K5	CO5	Apply the various microbiological techniques in an appropriate research and Industrial areas

Syllabus

CELLULAR BIOLOGY

General layout of a typical Biotechnology Laboratory

General Laboratory Instructions and Safety – Video /Power-point

1. Cell types – Microbial, Animal and Plant cells
2. Plant cell sectioning- Dicot and monocot sections of stem and root - TS and CS
3. Preparation of blood Smear- Identification of Blood cells
4. Cell Counting using Haemocytometer– RBC and WBC
5. Differential leukocyte count by Leishman's staining
6. Subcellular fractionation of Chloroplast
7. Preparations of onion peel and observations of cells

GENETICS

1. Punnet Square test in Pea plant- Mendelian Inheritance
2. Anatomy & sex linked inheritance of Drosophila
3. Barr body identification in Buccal cells
4. Mitotic Preparation in Onion root tip
5. Meiosis – flower buds of *Rhoeo discolor*
6. C-Banding techniques using maize
7. Pedigree chart for ABO blood group and hereditary analysis.
8. Polytene chromosome from Chironomus larvae

MICROBIOLOGY

Prelab Exercises

1. Safety guidelines
2. Types of Biosafety levels
3. Good microbiological Laboratory Practices
4. Sterilization Techniques

Experiments

1. Isolation of microbes (bacteria, fungi and actinomycetes) from soil, air and water
2. Pure culture techniques - Pour, Spread and Streak plate methods
3. Staining techniques - Simple, Negative, Gram, Spore and fungal staining
4. Growth curve and determination of generation time in *E. coli* by spectrophotometricmethod
5. Antibiotic sensitivity test by disc diffusion method (Kirby- Bauer method)
6. MBRT test for milk quality analysis
7. Biochemical Characteristics of Bacteria
   (i) Starch Hydrolysis Test
   (ii) Urease test
   (iii) Hydrogen sulphide production test
   (iv) Fermentation of Carbohydrates
   (v) IMVIC test
   (vi) Catalse Test
   (vii) Oxidase test
8. Motility of bacteria – hanging drop, soft agar methods

Text Book

1. Majumdar, R., Sisodia, R. (2018). Laboratory Manual of Cell Biology (1st Edition). Prestige Publishers.
2. Koliantz, G., Szymanski, DB. (2009). Genetics: A Laboratory Manual (2nd Edition). AmericanSociety of Agronomy.
3. Roy, AK., Prasad, MM. (2010). Laboratory Manual of Microbiology (2nd Edition). New IndiaPublishing Agency.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	L	M	L	M
CO2	S	L	H	L	M
CO3	S	L	H	M	M
CO4	S	H	H	H	H
CO5	S	L	H	M	H

S – Strong H – High M – Medium L – Low

Programme code: 08		**Programme name:** B. Sc. Biotechnology		
Course code:24UBT304		**Core Paper 4** - Enzymology and Metabolism		
Batch: 2024-2025	**Semester** III	**Hours / Week** 3	**Total Hours** 45	**Credits** 4

Course objectives

1. To provide a basic understanding of biological catalysis, and Mechanism of action of enzymes.
2. To describe the structure and functional relationship of enzyme
3. To understand the enzyme kinetics.
4. To Study the Metabolism of Carbohydrates, Amino acids and Lipids.

Course Outcomes

After completion of the course, the students will be able to:

K1	CO1	Distinguish the fundamentals of enzyme properties, nomenclatures characteristics and mechanisms.
↕	CO2	Describe the concepts of co-operative behavior, enzyme inhibition and allosteric regulation and the factors affecting enzymatic reactions
	CO3	Apply glucose homeostasis (pathways and hormonal regulation) and the pentose phosphate pathway
	CO4	Describe the metabolism, biosynthesis of fatty acids.
K5	CO5	Employ the concepts in deciphering metabolic defects and to study enzyme kinetics for novel systems

Syllabus

UNIT I **(9 Hours)**

Introduction, Classification of enzymes and nomenclature, Unit of enzyme: Katal and IU, Active site- Definition, investigations of 3D structure of active site, Fischer's lock & key and Koshland's induced fit hypothesis. Enzyme specificity. Enzyme kinetics- Michaelis-Menten equation, Lineweaver-Burk plot. Determination of Km, Vmax, Kcat. Factors affecting enzyme activity. Enzyme inhibition- Reversible (competitive, uncompetitive, non-competitive) and irreversible inhibition. Cofactor and prosthetic group, apo- and holo-enzymes. Restriction enzymes. **Isoenzymes*.**

UNIT II **(9 Hours)**

General mechanisms of action. Acid-base and covalent catalysis (chymotrypsin, lysozyme). Metal activated enzymes and metalloenzymes. Allosteric regulation and feedback inhibition (ATCase). Reversible covalent modification (glycogen phosphorylase). Proteolytic cleavage-

zymogen.Multienzyme complex. Coenzymes.

UNIT III **(9 Hours)**

Glycolysis, Citric acid cycle: establishment of the cyclic nature, individual reactions and enzymes of citric acid cycle. Amphibolic nature of the cycle. Pentose phosphate pathway of glucose oxidation. Biosynthesis: biosynthesis of glucose from non-carbohydrate precursors (gluconeogenesis).**Glycogensynthesis and its regulation*.**

UNIT I V **(9 Hours)**

Protein digestion and absorption. Overview of amino acid degradation: Transamination and the role of pyridoxal phosphate, oxidative deamination. Pathways of degradation of different amino acids (fates of carbon atoms of degraded amino acids) via pyruvate, acetoacetyl CoA leading to acetyl CoA- Ketoglutarate pathway, succinate pathway, fumarate pathway, oxaloacetate pathway. Formation of nitrogenous excretion products. The urea cycle linking of urea cycle to citric acid cycle. Industrial enzymes- amylase, lipase and protease. **Regulation of Urea cycle enzymes*.**

UNIT V **(9 Hours)**

Digestion and absorption of triglycerides, phospholipids, glycolipids and sterols. Biosynthesis of fatty acids. Oxidation of fatty acids. Sterol biosynthesis and conversion of cholesterol to various other biologically important compounds. Formation of prostaglandins, prostacyclins and thromboxanes from unsaturated fatty acids. Nucleic Acids: Synthesis of Purines and Pyrimidines by De novo and Salvage Pathways.

Denotes self study

Teaching Methods

Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ video presentation /Podcast /materials from NDLI/class blended learning/ flipped class

Text Books

1. Donald Voet, Judith G. Voet. (2011). Biochemistry (4th Ed). John Wiley & Sons Publisher.
2. Jain,JL., Sunjay Jain., Nithin Jain. (2016). Fundamentals of Biochemistry (7th Ed). S. Chand&Co Ltd). Publishers.
3. Nelson, DL., Lehninger, AL., Cox, MM. (2021). Principles of Biochemistry (8th Ed). W. H. Freeman and Company, New York, pp. 677-878.

Reference

1. Robert K. Murray., Daryl K. Granner., Peter A. Mayes., Victor W. Rodwell. (2012). Harper'sBiochemistry (29thRevised Ed). Appleton & Lange Publisher.
2. Jeremy M. Berg., John L. Tymoczko., Lubert Stryer. (2015). Biochemistry (8th Ed). W.H. Freeman Publisher.
3. Dixon,M., Webb E.C. (2014). Enzymes (2nd Ed). Elsevier.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	S	L	L
CO2	S	S	H	L	M
CO3	H	H	S	L	H
CO4	S	H	M	L	M

S – Strong H – High M – Medium L – Low

Programme code: 08		**Programme name:** B. Sc. Biotechnology		
Course code:24UBT305		**Core Paper 5** - Molecular Biology		
Batch: 2024-2025	**Semester** III	**Hours / Week** 3	**Total Hours** 45	**Credits** 3

Course Objectives

1. To provide basic information about DNA, RNA and Protein biology
2. To understand the role of regulatory elements and its mechanism of operation in prokaryotes
3. To study the repair mechanism to overcome DNA damage
4. To provide an outline on transposons and molecular biology of Lambda

Course Outcomes (CO)

After completion of the course, the students will be able to:

K1 ↑↓ K5	CO1	Describe the molecular aspects of cell function
	CO2	Discuss the molecular damage and its repair systems
	CO3	Investigate the gene regulation machinery in prokaryotes
	CO4	Compare and contrast the importance of recombination and genetics of lambda phage
	CO5	Define and execute experiments using transposons and phages

Syllabus

UNIT I **(9 Hours)**

Introduction to structure of nucleic acid and proteins: Physical and chemical structures and forms of DNA; Types of RNA; Replication: Mechanism in prokaryotes and eukaryotes, enzymes involved in replication.

UNIT II **(9 Hours)**

DNA methylation and methyl transferases in prokaryotes; DNA repair mechanism: Types of DNA damage and repair mechanism (Photoreactivation, Excision – Base and Nucleotide, Mismatch, Recombination and SOS).

UNIT III **(9 Hours)**

Gene, coding and Non coding genes, Cistron and its types (Mono and Poly); Gene regulation in prokaryotes**:** Operon concept – *lac* and *trp*; Signal sequences and protein export. Recombination: Homologous recombination - Holliday model and its enzymology; Recombinase – Cre-Lox system.

UNIT IV **(9 Hours)**

Gene expression in prokaryote: Transcription – enzymology and its mechanism; post transcriptional modification; Translation - enzymology and its mechanism. Universal genetic code and wobble hypothesis. Gene regulatory elements: *cis*-regulatory elements - promoter, enhancer, silencer and response elements and *Trans*-regulatory elements – transcription factors. **Reverse Transcriptase***

UNIT V **(9 Hours)**

Transposons and Insertion sequence; Prokaryotic and yeast transposons - Ty elements; Lambda phage: genome, (Theta and rolling circle model), **lytic and lysogeny cycle***; Transcriptional switch genetics in lambda phage (Cro gene, CI gene).

**** denotes Self study***

Teaching Methods

Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ video presentation /Podcast /materials from NDLI/class blended learning/ flipped class

Text Books

1. Malacinski, GM. (2008). Freidfelder's Essentials of Molecular Biology(4th Ed). Narosa Book Distributors Private Ltd.
2. Weaver, RF.(2012). Molecular Biology(5th Ed). The McGraw-Hill Companies, Inc., 1221 Avenue of the Americas, New York, NY 10020.
3. Gerald karp.(2010). Cell and Molecular Biology. John Wiley & Sons, Inc., 111 River Street, Hoboken, NJ 07030-5774.
4. Roger, LP., Adams and Roy H. Burdon.(1985). Molecular Biology of DNA Methylation.Springer-Verlag, New York, Inc.

Reference Books

1. Lodish et al. (2012). Molecular Cell Biology (7th Ed). W.H. Freeman and Co., New York.
2. Watson JD. et al. (2013). Molecular Biology of the gene (7th Ed). Person publisher.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	H	L	L
CO2	S	L	S	L	L
CO3	S	L	S	L	M
CO4	H	L	H	M	M
CO5	S	H	S	M	L

S – Strong H – High M – Medium L – Low

Programme code: 08		**Programme name:** B. Sc. Biotechnology		
Course code: 24UBT406		**Core Paper 6** – rDNA Technology		
Batch: 2024-2025	**Semester** IV	**Hours / Week** 4	**Total Hours** 60	**Credits** 3

Course Objectives:

1. To acquaint the students to versatile tools and techniques employed in Recombinant DNA technology
2. To provide theoretical base to properties and applications of DNA modifying enzymes and cloning strategies
3. To enable students to understand vector types, host genotype specificities for selection andscreening of recombinants and/or recombinant transformants
4. To help students comprehend the various strategies for studying recombinant DNA molecules and itsapplication in myriad fields
5. To sensitize on the various commercial recombinant Products

Course Outcomes (CO)

After completion of the course, the students will be able to:

K1	**CO1**	Have a technical knowhow on manipulating genes and genomes
↕	**CO2**	have knowledge to construct recombinant DNA and use them for cloning
↕	**CO3**	be competent in handling PCR and related molecular methods
↕	**CO4**	be proficient in conducting and interpreting genetic engineering experiments using various types of vectors and hosts
K5	**CO5**	be competent enough to handle recombinant strains at an industrial scale

Syllabus

UNIT I **(12 hours)**

Tools for the rDNA technology: Restriction endonucleases;Type I, II and III; Gene isolation strategies; Generalized cloning schemes, host genotypes specificities; markers for selection of recombinants; Ligases and Ligation strategies: End modifications, Nucleases, Polynucleotide kinase, Phosphatase, homopolymeric tailing, use of adapters and linkers.

UNIT II **(**12 **hours)**

Properties of vectors and Hosts: Bacterial Artificial Chromosomes as vectors, Yeast vectors- YIP, YEP, YCP, YRP BAC and YAC. Shuttle vectors, Artificial plasmids- pBR322- structure, construction and biology, pUC18, Phagemids, PGEM Series, Natural plasmids- types, properties. Hosts for cloning: *E.coli*, yeast, Plant, Insects and Animal Systems and their properties.

UNIT III **(**12 **hours)**

Lambda vectors - Insertion and replacement vectors, *In vitro* packaging, Selection strategies for screening of lambda recombinants, Cosmid construction protocol and cosmid cloning protocol. Construction of genomic DNA library and cDNA Library, Protein Expression Vectors (expression systems for high level protein expression in *E.coli*, Transcriptional and Translational fusion with examples of protein production).

UNIT IV **(**12 **hours)**

Nucleic acid sequencing methodologies: Maxam Gilbert Method, Sanger's Di-deoxy Chain termination method, Next Generation Sequencing, Pyrosequencing and illumina Polymerase Chain reaction- basic chemistry, types of PCR- nested PCR, Symmetric and asymmetric PCR, Inverse PCR, Real Time PCR. DNA Hybridization Techniques, Application of rDNA in Agriculture, **Application of PCR in forensic science***

UNIT V **(**12 **hours)**

Site Directed Mutagenesis: PCR based methods for site-directed mutagenesis, Oligo Nucletotide mediated mutagenesis, selection of mutant (dut/ung *E. coli* strains for SDM through uracil replacement), Application of recombinant DNA in production of pharmaceuticals- Insulin, glucagon, clotting factors, human growth hormone and interferons ****Denotes self study***

Teaching Methods

Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ video presentation /Podcast /materials from NDLI/class blended learning/ flipped class

Text Books:

1. Ernst Winnacker. (2003). From Genes to Clones- An Introduction to Gene Technology (4th Ed).Panima Publishing house, Bangalore.
2. Primrose, SB and Twyman R.(2016). Principles of Gene Manipulation and Genomics (8th

Ed).Wiley- Blackwell, UK.

Reference Books:

1. Brown, TA. (2016). Gene Cloning and DNA Analysis: An Introduction (7th Ed). John Wiley &Sons, UK.
2. Sambrook, J., Fritsch, EF., Maniatis, T. (1987). Molecular Cloning: A Laboratory Manual (2nd Ed). CSHL Press, USA.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	H	M	L
CO2	S	H	S	H	S
CO3	S	L	S	L	M
CO4	H	L	H	M	M
CO5	S	H	S	M	S

S – Strong H – High M – Medium L – Low

Programme code: 08		**Programme name:** B. Sc. Biotechnology		
Course code:24UBT4CM		**Core Practical 2 -** Lab in Enzymology, Molecular Biology and rDNA Technology		
Batch: 2024-2025	**Semester** III & IV	**Hours / Week** 3+4	**Total Hours** 45+60	**Credits** 3

Course Objectives

1. To Provide an opportunity to experimentally verify the theoretical principles of genetic Engineering in a more explicit and concentrated manner.
2. Students will gain a sound technical knowledge and have hands on exposure in various aspects of molecular biology and Biochemistry.
3. To provide knowledge about various isolation techniques and separation of Macromolecules

Course Outcomes (CO)

After completion of the course, the students will be able to:

K3	CO1	Isolate plasmid, clone genes and transformation to a suitable host
↕	CO2	Apply techniques like PCR for identification of genes
	CO3	Apply chromatographic techniques for several applications
	CO4	Be compatible in use of vectors and hosts
K5	CO5	Become competent in handling libraries and gene cassettes

Syllabus

ENZYMOLOGY

Pre lab experiments

1. Preparation of Molar , Normal and percent solutions
2. Preparation of Buffers
3. Notes on Chemical safety

Experiments

1. Cell rupture using a Sonicator
2. Estimation of Non reducing sugars and reducing sugars
3. Estimation of Amino acid- Arginine and Tyrosine
4. Estimation of total proteins – Lowry Method
5. Qualitative Tests for Catalase and Oxidase
6. Estimation of Fatty Acid – Tritrimetric method
7. Estimation of RNA using Orcinol method
8. Estimation of DNA using diphenylamine method.
9. Estimation of Ascorbic acid
10. Separation of Natural Pigments by Paper and Thin layer Chromatography

MOLECULAR BIOLOGY

Prelab Experiments

1. General chemical safety procedures
2. Calculations for molecular biology

Experiments

1. Extraction of Genomic DNA (Bacteria and Phage).
2. Extraction of Plasmid DNA.
3. Agarose gel electrophoresis
4. Quality and Quantity check of DNA/ RNA/ Protein by UV spectrophotometer
5. Polyacrylamide Gel Electrophoresis (Demo)
6. Bacterial Transformation by calcium chloride method and electroporation

RECOMBINANTDNA TECHNOLOGY

Prelab Experiments

1. Calculation for vector: Insert cloning
2. Genotypes of cloning hosts - Bacteria - *E.coli*. DH5 alpha, JM109and CSH strains

Experiments

1. Restriction Digestion of vector DNA and lambda DNA
2. Ligation of Restricted fragments
3. Competent cell preparation and plate count method
4. Amplification of a gene by Polymerase Chain Reaction
5. Southern Blotting and Hybridization (Demo)
6. Western blotting (Demo)

Text Book

1. Wilson, K., Walker, J. (2010). Principles and techniques of biochemistry and molecular biology (7^{th} edition). Cambridge University Press. 759 pages.
2. Ruhi Dixit, KartikayBisen, Ashwani Kumar, Ashim Borah, Chetan Keswani. (2016). Lab manual on molecular biology (1^{st} Edition). Media Associates, Delhi.
3. Kurnaz, IA. (2015). Techniques in genetic engineering.CRC Press, Boca Raton.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	L	H	L	M
CO2	S	L	H	L	M
CO3	S	L	H	M	M
CO4	S	H	H	H	H
CO5	S	L	H	M	S

S – Strong H – High M – Medium L – Low

Programme code: 08		**Programme name:** B. Sc. Biotechnology		
Course code: 24UBT507		Core Paper 7 - Immunology		
Batch: 2024-2025	**Semester** V	**Hours / Week** 5	**Total Hours** 75	**Credits** 4

Course Objectives

1. To understand the definition and concepts of immunity
2. To familiarize about the structural features and components of the immunesystem as well as their functions
3. To comprehend how the immune system recognizes self from non-self
4. To provide insights into Monoclonal antibody and its Applications

Course Outcomes:

After completion of the course, students should be able to:

K1 ↕ K5	**CO1**	Recall the innate and adaptive immune responses and to understand their role in protection against invading pathogens
	CO2	Demonstrate the strategies used to enhance immune responses
	CO3	Investigate hypersensitivity reactions, transplantations or autoimmune diseases.
	CO4	Apply key immunological concepts and methods to diagnose immune disorders
	CO5	Analyze the strategies to improve existing vaccines

Syllabus

UNIT I **(17 hours)**

Organization and classification of immune system – Immunity – *Hematopoiesis:* Development, maturation, activation, regulation, differentiation and classification of T- cells and B-cells and organs (Primary lymphoid organ- Bone marrow, secondary lymphoid organ-lymph node); *Innate immunity* - Complement pathway: Definition, Nomenclature, Activation pathways (classical and alternate). *Antigens:* Essential features, classification of antigens, Epitopes, Haptens, Adjuvants, Cross reactivity, Synthetic antigens. *Antibodies:* Structure, Types, properties and their biological functions; genes and generation of diversity; antigen-antibody reactions,

UNIT II **(16 hours)**

Antigen recognition by Pattern Recognition Receptors – Toll like receptors (TLR) and responses. Primary and Secondary immune responses, Antigen presenting cells; major histocompatibility complex structure and function - antigen processing and presentation, HLA typing, theory of clonal selection, production of plasma and memory cells, production of antibodies. *Cytokines:* Interleukins and interferons, production and their biological functions. Cytokine Strom

UNIT III **(14 hours)**

Immune tolerance, Immunosuppression, Transplantation – genetics of transplantation; laws of transplantation; *Allergy and hypersensitivity* – Types of hypersensitivity. Autoimmunity, Auto immune disorders and **Immunodeficiency diseases and types***.

UNIT IV **(14 hours)**

Inflammation and disease: cause for inflammation. Immune responses to virus, bacteria, fungi and parasites; *Tumor Immunology*: Tumor antigens and its regulation, tumor immune response, tumor diagnosis, tumor immunotherapy *Transplantation Immunology:* Types of grafts, transplantation reactions (graft versus host)

UNIT V **(14 hours)**

Monoclonal antibodies - antibodies production and applications, Engineering of antibodies; *Classification of Vaccines* - (Attenuated, sub-unit vaccine, DNA and RNA vaccines and anti-idiotype vaccines) methods of vaccine development, *Immunodiagnostic methods* (Immunodiffusion, **agglutination, precipitation*,** Immunofluorescence, Immunoblotting ELISA, FACS), **Immuno-modulatory drugs***

Denotes self study

Teaching Methods

Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ video presentation /Podcast /materials from NDLI/class blended learning/ flipped class

Text Books

1. Owen, J., Punt, J., Stranford, S. (2013). Kuby's Immunology (7th Ed). W. H. Freeman and company, New York.
2. Peter J. Delves., Seamus J. Martin., Dennis R. Burton., Ivan M. Roitt. (2016). Roitt's Essential Immunology (13th Ed). Wiley-Blackwell.

References

1. Ashim, K. Chakravarthy. (2006). Immunology and Immunotechnology. Oxford University Press,India.
2. Tizard, IR. (1995). Immunology: An Introduction (4th Ed). Prentice Hall, International.
3. Abbas, A K., Lichtman, AH., Pillai S. (2016). Basic Immunology –Functions and Disorders of theImmune System (5th Ed). Elsevier.
4. Khan, Fahim Halim. (2009). The elements of Immunology, Pearson Education Pvt. Ltd.India.
5. Ballarin, L., Cammarata, M. (2016). Lessons in Immunity (1stEd). Academic Press, Elsevier.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	L	H	L	M
CO2	H	L	H	H	L
CO3	H	M	H	L	M
CO4	H	S	S	H	L
CO5	H	L	L	L	H

S – Strong H – High M – Medium L – Low

Programme code: 08		**Programme name:** B. Sc. Biotechnology		
Course code: 24UBT508		Core Paper 8 – Plant and Animal Biotechnology		
Batch: 2024-2025	**Semester** V	**Hours / Week** 5	**Total Hours** 75	**Credits** 4

Course Objectives

1. To equip students with plant tissue culture techniques
2. To provide knowledge on genetic engineering in the improvement of plants for human welfare
3. To educate about basic embryogenesis techniques in mammalian cells
4. To gain an insight on transgenic animal production and its applications in human welfare

Course Outcomes (CO)

After completion of the course, the students will be able to:

K1 ↕ K5	CO1	List the *in vitro* techniques for propagating plant and its applications
	CO2	Creating the scope of biotechnology tools in plant science
	CO3	Evaluate and discuss public and ethical concerns over the use of Animal Biotechnology
	CO4	Understand the mechanism and Principles of Embryogenesis
	CO5	Relate the importance of CRISPR technology in the relevant fields.

Syllabus

UNIT I **(15 Hours)**

Nucleus, Chloroplast and Mitochondria; Plant breeding: Heterosis and Male sterility. Tissue culture: Laboratory organization; Media components; Types of media; Growth regulators: Biosynthesis, physiological effects and mechanism of action of Auxin, Cytokinin and Gibberellic acid.

UNIT II **(14 Hours)**

Propagation techniques: Micropropagation; Callus culture; Cell culture: Single cell culture and Suspension culture; Protoplast - Isolation, Culture and fusion; Somatic embryogenesis and Synthetic seed preparation; Anther/pollen and embryo culture; Somaclonal variation. Production of secondary metabolites through plant cell/tissue culture, ***Invitro*** **Germ plasm Conservation***

UNIT III **(15 Hours)**

Introduction - Scope of Animal Biotechnology, Cell culture media-physical and chemical constituents and reagents, culture of mammalian cells- tissues and organs, primary culture, secondary culture, continuous cell lines, suspension cultures. Various bio-reactors used for animal cell culture-Roller bottle culture, stirred animal cell culture; Contamination- Sources, types, monitoring and eradication.

UNIT IV **(15 Hours)**

Embryogenesis–Basis principles of Human Embryogenesis, Embryo culture and transfer technology, somatic cell nuclear transfer, embryonic stem cells, Artificial insemination, IVF and embryo transfer, cryopreservation. Cloning – Therapeutic and Reproductive cloning its applications, Gene silencing and antisense therapy in the treatment of disease. Ethical Issues

Case Study: Increasing trend of IVF : Deliberate or Disease Centric?

UNIT V **(16 Hours)**

Gene Transformation: Plant viral vector: CaMV; *Agrobacterium* mediated transformation; Model plant for transformation: Tobacco. Applications of plant transformation: Nutraceuticals - Golden rice and Flavr Savr; Chitinase gene mediated fungal resistant; Edible vaccines: Interleukins and interferons; GM foods and **Biosafety issues*.** Gene targeting - **knockout Mouse model for human genetic disorder***, Monoclonal antibodies and their use for mankind, CRISPR - transgenic animals Production

**** denotes Self* study**

Teaching Methods

Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ video presentation /Podcast /materials from NDLI/class blended learning/ flipped class

Text books

1. Chawla, H. S. (2002). Introduction to Plant Biotechnology. 2nd Edition, Science Publishers, Inc., Enfield, NH, USA.
2. Kalyan Kumar De. 2004. An Introduction to Plant Tissue Culture.2008. New Central Book Agency, Kolkata.
3. Singh B (2005). Textbook of Animal Biotechnology. The Energy and Resources Institute.
4. Brown T. A. (2002). Gene Cloning

Reference Books

1. Slater, Scott and Fowler, 2008. Plant Biotechnology, 2nd Edition, Oxford University Press.
2. Buchanan, Gruissem and Jones.2000. Biochemistry and Molecular Biology of Plants. John Wiley & Sons, UK.
3. Ralf Poetner, 2018. Animal Cell Biotechnology, Springer, Human Press, 4th Edition.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	H	L	M
CO2	H	L	H	L	M
CO3	S	H	H	L	L
CO4	H	L	H	H	L
CO5	H	L	L	H	L

S – Strong H – High M – Medium L – Low

Programme code: 08		**Programme name:** B. Sc. Biotechnology		
Course code: 24UBT509		Core Paper 9 – Genomics and Proteomics		
Batch: 2024-2025	**Semester** V	**Hours / Week** 4	**Total Hours** 60	**Credits** 4

Course Objectives

1. To acquaint the genome organization, gene identification, expression and applications of genomics analysis
2. To disseminate the fundamentals of proteomics, analysis and its applications
3. To interpret the data obtained from high through-put technologies
4. To classify the complexity of genome/ proteome structural and functional organization

Course Outcomes (CO)

After completion of the course, the students will be able to:

K1 ↕ K5	CO1	Discern the crucial concepts and techniques applied in genomics, and Proteomics
	CO2	Communicate on the recent developments in the genomics and proteomics, and its application in human disease biology
	CO3	Apply the tools available in the open source to specific research problems and Projects
	CO4	Apply functional genomics techniques to analyze data for biological system
	CO5	Apply proteomic tools in structure - function predictions

Syllabus

UNIT I **(12 Hours)**

Introduction – Organization and structure of genomes, Genome size, Sequence complexity, Introns and Exons, Genome structure in viruses and prokaryotes, Eukaryotic Gemone. Molecular markers for genome analysis – RAPD, RFLP and SNP

UNIT II **(12 Hours)**

Mapping and Sequencing: Restriction mapping, Genome mapping, Chromosome landmarks, Genetic variations, Physical maps. Genetic and physical mapping- Pedigree analysis, STS mapping with radiation hybrid panels; DNA and Whole Genome Sequencing; Contig assembly.

UNIT III **(12 Hours)**

Human Genome project, Ethical, legal, social implications of HGP, Hap Map Project, The 1000 genome project, and The ENCODE Project, Genome annotation, traditional routes of gene identification, detecting open-reading Frames, software programs for finding genes, **Identifying the function of a new gene*.**

UNIT IV **(12 Hours)**

Proteomics: Structural proteomics- X-ray crystallography and Mass spectroscopy-MALDI-TOF, ESI, SELDI-TOF. Functional Proteomics - 2D analysis of cellular proteins, Yeast two hybrid system for protein-protein interaction, Protein micro arrays.

UNIT V **(12Hours)**

Protein secondary structure prediction - for globular proteins and for transmembrane proteins. Coiled coil prediction. Protein tertiary structure prediction – methods – homology modeling, threading and fold recognition; ab initio protein structural prediction. **CASP***. Applications of Proteomics.

Denotes self study

Teaching Methods

Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ video presentation /Podcast /materials from NDLI/class blended learning/ flipped class

Text Books:

1. Arthur M. Lesk. **(**2007). Introduction to Genomics (2nd Ed). Oxford University Press.
2. Primrose, SB., Twyman, R.M.(2013).Principles of Genome analysis and Genomics (7th Ed). Blackwell publishing.
3. Tymann, R. (2013). Principles of Proteomics (2nd Ed). Garland Science Publisher.

Reference Books:

1. Brown, TA. (2007). Genomes 3. Garland Science Publishing, New York.
2. Dunham, I. (2003). Genome Mapping and sequencing. Horizon Scientific.
3. Andrezej, K., Konopka and James C. Crabbe. (2004). Compact Hand Book – ComputationalBiology. Marcel Dekker, USA,.
4. Pennington, Dunn.(1996). Proteomics from Protein Sequence to Function (1st Ed). AcademicPress, San Diego.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	H	M	L
CO2	M	S	H	L	H
CO3	M	S	H	L	M
CO4	H	H	M	M	M
CO5	M	S	H	L	M

S – Strong H – High M – Medium L – Low

Programme code: 08		**Programme name:** B. Sc. Biotechnology		
Course code:24UBT5CN		Core Practical 3 – Lab in Immunology, Plant and Animal Biotechnology		
Batch: 2024-2025	**Semester** V	**Hours / Week** 6	**Total Hours** 90	**Credits** 3

Course Objectives

1. To provide hands on experience and to learn the principles behind immunologicaltechniques
2. To make the students skilled in plant tissue culture techniques
3. To teach students the latest techniques and principles in animal biotechnology
4. To provide hands on training on animal cell culture techniques

Course Outcomes

After completion of the course, the students will be able to:

K3 ↑	CO1	Apply basic techniques for identifying antigen and antibody molecules
	CO2	Devise conservation methods important plant species through *in vitro* Tissue culture
	CO3	Analyze the bioactive natural compounds from plants
	CO4	Conduct experimental studies relating to animal biotechnology
↓ K5	CO5	Devise and execute experiments using cell lines

IMMUNOLOGY

Prelab Exercises

1. Safety and precautionary measures in handling as and also samples
2. Introduction to automate detection systems

Experiments

1. ELISA
2. Immunoelectrophoresis
3. ABO blood grouping.
4. Radial immunodiffusion.

5. Ouchterlony Double immunodiffusion.
6. Preparation of serum and plasma from blood.
7. Immunoassay of particulate antigen.
8. WIDAL test

PLANT BIOTECHNOLOGY

Prelab Exercise

1. Laboratory organization for a typical plant tissue culture lab
2. Stocks of media components and their role

Experiments

1. Media preparation and sterilization
2. *In vitro* seed germination
3. Embyo Culture
4. Callus Induction and Cell Culture
5. Micropropagation – Nodal
6. Artificial seed preparation and culture
7. Isolation of protoplast and viability check
8. Phytochemical screening and estimation of plant secondary metabolites – Alkaloids, flavonoids and phenols

ANIMAL BIOTECHNOLOGY

Pre lab Exercises

1. Safety guidelines and laboratory design of a typical animal cell culture lab
2. Good Laboratory Practices in handling cell lines
3. Sterilization Technique
4. Media types and components

Experiments

1. Different types of Media preparation
2. Study of Zebra fish cell structure
3. Primary cell culture preparation from embryonated egg
4. Preparation of Established Cell Lines from primary culture
5. Cell counting and viability by Trypan blue dye exclusion test
6. Trypsinization method and Preservation of cells and thawing

Text Book

1. Hay, CF., Westwood, OMR. (2008). Practical Immunology (4th Ed.). Wiley Blackwell
2. Giri, CC., Giri, A. (2013). Plant Biotechnology: Practical Manual (1st Ed). LK International
3. Portner. (2020). Animal Cell Biotechnology –Methods and Protocols Ralf (Ed), (1st Ed). Humana Press.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	L	H	L	M
CO2	S	L	H	L	M
CO3	S	L	H	M	M
CO4	S	H	H	H	H
CO5	M	L	H	M	S

S – Strong H – High M – Medium L – Low

Programme code: 08		**Programme name:** B. Sc. Biotechnology		
Course code: 24UBT610		Core Paper 10 – Bioprocess Technology		
Batch: 2024-2025	**Semester** VI	**Hours / Week** 5	**Total Hours** 75	**Credits** 4

Course Objectives

1. To introduce the principles and techniques of bioprocess engineering and downstream processing.
2. To understand the basics of fermentation techniques
3. To enable the students to learn about the design of fermentors.
4. To decipher techniques for genetic improvements of micro-organisms to improve yield of bioproducts.

Course Outcomes (CO)

After completion of the course, the students will be able to:

K1	CO1	Recognize and apply the basic principles of bioprocess technology and differenttypes of bioreactors.
↕	CO2	Design and use selectable and optimized media for maximum production of microbial metabolites
	CO3	Explain designing of protocols for strain improvement and separation of moleculesafter fermentation process.
	CO4	Apply the process for commercial production of metabolites
K5	CO5	Apply the principles of bioprocessing in product development and products

Syllabus

UNIT I **(15 Hours)**

Introduction: Basic principles of fermentation, **scope and application of bioprocess technology***, Commercial significance of enzymes, metabolites and recombinant products. *Selection of Industrially important microorganism*: Isolation, screening- primary and secondary screening methods; Strain improvement- Selection of natural variants; Selection of induced mutants - Auxotroph mutant; Use of recombination system; Pure culture maintenance.

UNIT II **(15 Hours)**

Bioreactor configuration: Body construction; Construction material; Aeration and agitation system, Stirrer glands and bearings, Baffles, Valves and stream traps, Pressure-control valves.

Bioreactors Types: Trickling bed, CSTR, Bubble column, Air lift bioreactor, Packed bed, Tower bioreactor, Fluidized bed and Photobioreactor and Hallow fiber Bioreactor and Upflow Aerobic Sludge Bioreactor (UASBR); Solid substrateoperation of bioreactor,

UNIT III **(15 Hours)**

Upstream processing: Introduction, Raw material and media formulation for fermentation process: Fermentation media - Natural media, Synthetic media; Sources of carbon; Nitrogen and vitamins; antifoams; *Media designing* - Submerged and solid state processes; Media optimization.

Sterilization: Methods of sterilization- Batch and continuous sterilization; Air sterilization-air filters design and mechanism of air sterilization; Inoculum source – Seed culture; Innocula Development; Scale up and scale down.

UNIT IV **(15 Hours)**

Culture System: Batch, Fed batch, Continuous culture. Phases of cell growth, Factors affecting cell growth. Microbial Growth kinetics: Specific growth rate, substrate utilization and product development, Monod's model and yield coefficients.

Transport phenomena: Mass and heat transfer mechanism. *Bioprocess monitoring and control:* Monitoring variables: pH, temperature, pressure, agitation, Computer aided control.

UNIT V **(15 Hours)**

Downstream processing: Introduction, Solid-liquid separation - Floatation, Flocculation and Filtration (Rotary Drum Vacuum filter); Centrifugation- Tubular Bowl, Disc Dowl, Multichamber, Decanter Centrifuge; Cell disruptions (Mechanical, enzymatic and chemical). Concentration – Methods of protein precipitations. Membrane filtration - Ultrafiltration, Nanofiltration, Reverse Osmosis. Chromatography – Gel permeation Chromatography; Product polishing: drying - spray driers, drum driers and freeze driers and crystallization.

Industrial Biotechnology**:** Alcoholic beverages (**beer and wine***), organic acids (Lactic acid), enzymes (Protease), 4th generation antibiotics (Cephalosporin) and amino acids (glutamic acid).

**** denotes Self study***

Teaching Methods

Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ video presentation /Podcast /materials from NDLI/class blended learning/ flipped class

Text books

1. Pauline and Doran M., 2003. A Textbook of Industrial Microbiology, Panima Publishing corporation. New Delhi.
2. Sathyanarayana U., *et al.*, 2005. Biotechnology, Books and Allied (P) Ltd. India
3. Bernard R, Glick and Jack J, Pasternak, Molecular Biotechnology- Principles & application ofRecombinant DNA, 4th edition, ASM press, Washington, DC.

References

1. Stanbury, PF., Whitaker, A., Hall, SJ.(2016). Principles of Fermentation Technology (3rdEd). Butterworth-Heinemann Elsevier Ltd, Oxford, United Kingdom.
2. Shuler, ML., Kargi, F.(2017). Bioprocess engineering, Basic Concepts (3rd Ed).Prentice Hall, Engelwood Cliffs.
3. Casida, LE. (2002). Industrial Microbiology. John Wiley & Sons Inc., United States.
4. Lancini, G., Lorenzetti, R.(2014). Biotechnology of Antibiotics and other Bioactive Microbial Metabolites, Springer publications, Germany.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	L	S	L	H
CO2	L	L	H	L	H
CO3	S	H	S	M	M
CO4	H	L	S	H	S
CO5	M	L	M	L	M

S – Strong H – High M – Medium L – Low

Programme code: 08		**Programme name:** B. Sc. Biotechnology		
Course code: 24UBT611		Core Paper 11 – Biopharmaceuticals		
Batch: 2024-2025	**Semester** VI	**Hours / Week** 5	**Total Hours** 75	**Credits** 5

Course Objectives:

1. To enable the students to learn Indian system of medicine.
2. To understand the basic facts in pharmaceutical technology
3. To give them the knowledge on drug development process
4. To teach them to evaluate on the biological-efficacy of drugs.
5. To provide students a foundation on clinical research.

Course Outcomes:

After completion of the course, students should be able to:

K1	CO1	Apply the knowledge on drug use, dose and dosage
↕	CO2	Prepare the drug and test the same
	CO3	Use classical treatment processes and relate it to the novel methods of drug Development
	CO4	Integrate the use of past and present drug treatment regimes for health benefits
K5	CO5	Distinguish conventional lab and proficient lab with good GLP

Syllabus

UNIT I **(16 hours)**

Introduction Biopharmaceuticals: current status and future prospects, generic and branded biopharmaceuticals, overview of life history for development of biopharmaceuticals. **Introduction to Indian system of medicine-** Ayurvedic, siddha , Unani and Allopathy. Sources of drug and preparation. Need for pharmaco economics. Classification of drugs based on ATC system and pharmacotherapy. NSAID drug and mode of action of NSAID drug. Basic principle in drug formulation and drug dosage forms.

1. Case study on some drugs ayurveda and allopathy for dose and dosage.

Routes of drug administration and adverse drug effects in collaboration with Arya Vaidya Pharmacy, Coimbatore

2. Observational study for symptoms of adverse drug effects with known allopathic drugs

UNIT II **(15 hours)**

Pharmacokinetics and Pharmacodynamics of Biopharmaceuticals: Definition, rationales, absorption, distribution and metabolism pathway. Factors governing absorption of drug. Pharmacokinetics and Pharmacodynamics of therapeutic peptides. Dose response relationship, interspecies scaling, heterogeneity of therapeutic proteins. Chemical modification of therapeutic protein, ADMET-biotransformation of drugs

UNIT III **(15 hours)**

Drug discovery and development : Drug development cycle-Source identification , separation - extraction (Solvent extraction , Steam distillation) identification of bioactive constituents, quality management and its clinical chemistry, formulation (**study one formulation for each student-capsule, tablet cream *etc*. of any chemical entity)** (Demo on GCMS /HPTLC/FTIR)*** Clinical research : preclinical study for toxicity testing, clinical trial , FDA review , ANDA (Abbreviated New Drug Application Review) and **pharmacovigilance***

UNIT IV **(14 hours)**

Drug Manufacturing Processes: Good Manufacturing practice: Industrial plant design, quality control, maintenance of manufacturing standards, validation. rDNA technology in manufacturing processes. Production of biopharmaceutical ingredients like curcumin, vincristine, omega -3- Fatty acid.

(A Case study on drug manufacturing process/ visit to a factory)

UNIT V **(15 hours)**

Formulation of Biopharmaceuticals: Rational for formulation of biotherapeutics, formulation recipients: solubility enhancers, anti aggregating agents, buffers, cryoprotectants, antioxidants and preservatives etc significance with relevant examples. Methods to enhance shelf life protein based therapeutics. Packaging techniques and quality analysis of product. Oils used in aroma therapy **Compliance/Adherence and acceptability of Product*. Genesis of Biopharmaceuticals from traditional medicine* as per AYUSH.**

****denotes self study **case study***

Teaching Methods

Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ video presentation /Podcast /materials from NDLI/class blended learning/ flipped class

Text Books:

1. Guyton, C., John E. Hall. (2000). Hall Textbook of Medical Physiology (13th Ed).Oxford University Press.
2. Gary Walsh. (2004). Biopharmaceuticals: Biochemistry and Biotechnology, John Wiley & Sons.

Reference Books:

1. Mahato, RI. (2012). Pharmaceutical Dosage Forms and Drug Delivery (10^{th} Ed).https://doi.org/10.1201/9781315156941.
2. Tripathy KD. (2017). Essentials of Pharmacology for medicine, (3^{rd} Ed) Jaypee brothers medicalPublishers.
3. Brahmankar, BM., Sunil B jaiswal. (2015). Concepts is Biopharmaceutics and PharmacokineticsA treatise (3^{rd} Ed). Vallabh Prakashan Publishers, Delhi.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	L	L	M	L
CO2	H	S	M	M	M
CO3	M	S	H	S	M
CO4	H	L	M	H	M
CO5	M	L	M	S	H

S – Strong H – High M – Medium L – Low

Programme code: 08		**Programme name:** B. Sc. Biotechnology		
Course code: 24UBT612		Core Paper 12 - Bioinformatics		
Batch: 2024-2025	**Semester** VI	**Hours / Week** 5	**Total Hours** 75	**Credits** 4

Course Objectives

1. To impart the challenges and importance of bioinformatics in the biological research field
2. To describe the different sequence types and the specific databases available for biological data.
3. To outline the usage of specialized database and their significance
4. To explain the various applications of bioinformatics in the field of biological sciences

Course Outcomes (CO)

After completion of the course, the students will be able to:

K1	CO1	Outline the importance and basics of bioinformatics as a tool in biological sciences
↕	CO2	Use knowledge on different types of biological databases for solving real time Problems
	CO3	Employ the nucleotide and protein sequences using specialized databases
	CO4	Analyze the different applications of bioinformatics in biological research field
K5	CO5	Apply computational tools in myriad areas of research

Syllabus

UNIT I: (15 Hours)

Bioinformatics- Definition, Background, Aim, Scope, Challenges and Applications- Sequence analysis, Protein structure prediction, Genome annotation, Health and Drug discovery; Opportunities in Bioinformatics. **Emerging areas of Bioinformatics***

Exercise: 1.Retrieve information from NCBI, PubMed databases

2.Retrieve information from primary nucleotide sequence databases: EMBL, DDBJ,

UNIT II: (15 Hours)

Genome, Gene, Nucleotides, DNA sequence, Nucleotide Database- National Center for Biotechnology Information (NCBI), GenBank, European Molecular Biology Laboratory (EMBL), DNA Databank of Japan (DDBJ), The Human Genome Project- Sangers and shot gun method of genome sequencing; Prokaryotic and Eukaryotic gene structure, gene prediction rules and software.

Exercise: 1. Perform similarity search for protein sequence using (BLAST)

2. Perform Multiple Sequence Alignment SA using ClustalW

UNIT III: (15 Hours)

Protein structure- importance, Primary structure of proteins- amino acid sequence, Peptide bond; Protein sequence databases: Uniprot-KB: SWISS-PROT, TrEMBL; Secondary structure of proteins- α- helix, β-sheets; Domains and Motifs, Secondary Structure database-PROSITE, Tertiary structures- Side chains and protein folding, PFam database, Quaternary structure, Protein Data Bank (PDB).

Exercise: 1. Retrieve 3D structure information from PDB

2.Perform protein structure visualization using Pymol, SPDBViewer, Rasmol

UNIT IV: (15 Hours)

Sequence retrieval system - Entrez, SRS; Sequence submission system- BankIt, Sequin; Metabolic pathway database- KEGG (Kyoto Encyclopedia of Genes and Genomes), Meta Cyc (Metabolic Pathway Database), Eco Cyc (*Escherichia coli* genes and metabolism); OMIM (Online Mendelian Inheritance in Man); Species specific database- ACeDB (A *Caenorhabditis elegans* database), SGD (*Saccharomyces* Genome Database)

Exercise: 1.Design primer from sequence information

2. Retrieve structure information of small molecules from PubChem

UNIT V: (15 Hours)

Genomics- Comparative genomics and Structural genomics; Proteomics- Structural and functional proteomics; Transcriptomics, Metabolomics, Metagenomics, Pharmacogenomics, Pharmacogenetics, Rational Drug Designing, **CADD***.

Exercise: 1. Perform Structure drawing of small molecules using Chem sketch

2. Predict the biological activity for small molecules using Pass prediction

3. Perform Docking analysis using Argus Lab

denotes self study

Teaching Methods

Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ video presentation /Podcast /materials from NDLI/class blended learning/ flipped class/hands on demo and exercise

Text books

1. Teresa K.Attwood and David J.Parry Smith.(1999). Introduction to Bioinformatics (1999) Addison Wesley Longman Limited.
2. Rastogi S. C. Namita Mendiratta; Parag Rastogi (2008) Bioinformatics Concepts Skills and Application (3rd Ed). New Delhi : PHI Learning Publishers
3. Jenny Gu ,Philip E. Bourne (2011). Structural Bioinformatics. (2nd Ed). Wiley-Blackwell
4. Jin Xiong (2012). Essentials of Bioinformatics. Cambridge University Press
5. Richard Twyman (2013). Principles of Proteomics, (2nd Ed). Garland Science Publishers.
6. Curran BG and Walker RJ,(2017) Bioinformatics, CBS Publishers & Distributors Pvt Ltd, India

Reference book

1. Bryan Bergeron (2002).Bioinformatics Computing- Bergeron- Prentice Hall India Learning Private Limited
2. Murthy, CSV (2016). Bioinformatics, Himalaya Publishing House publishers.
3. Arthur M. Lesk (2019). Introduction to Bioinformatics, Oxford University Press.
4. Malcolm Campbell A. and Laurie J. Heyer (2003), Discovering Genomics Proteomics and Bioinformatics- Campbell, Heyer, Cold Spring Harbor Laboratory Press.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	S	M	L	L
CO2	H	S	H	L	L
CO3	H	S	M	M	L
CO4	H	S	H	M	M
CO5	H	S	M	M	H

S – Strong H – High M – Medium L – Low

Programme code: 08		**Programme name:** B. Sc. Biotechnology		
Course code:24UBT6CO		Core Practical 4 - Lab in Bioprocess Technology & Biopharmaceuticals		
Batch: 2024-2025	**Semester** VI	**Hours / Week** 6	**Total Hours** 90	**Credits** 3

Course Objectives

1. To provide an opportunity to experimentally verify the theoretical concepts already studied.
2. To provide an exposure to design and run batch fermentation experiments for production of microbialenzymes
3. To introduce basics of herbal drug preparation and testing.

Course Outcomes (CO)

After completion of the course, the students will be able to:

K3	CO1	Apply the principles of industrially important microorganisms for large yield of Products
↑	CO2	Explain the basic design and types of bioreactors and its working principles
↕	CO3	Demonstrate various techniques like media formulation, strain improvement andinocula development and product recovery to improve processing
↕	CO4	Use various bioseparation processes such as cell disruption techniques, product enrichment techniques and product purification methods
K5	CO5	Able to design and execute modules for drug preparation and testing

Syllabus

BIOPROCESS TECHNOLOGY

Prelab Exercise

1. Bioprocess engineering lab
2. Working model of Bioreactor
3. Design of a bioreactor

Experiments

1. Isolation of alpha amylase producing bacteria
2. Optimization of medium conditions for bacterial growth and amylase production (Substrates, pH & temperature)

3. Concentration of bacterial amylase - Ammonium sulfate precipitation
4. Dialysis
5. Purification - size-exclusion chromatography
6. Wine production and analysis
7. Sauerkraut preparation for lactic acid fermentation and analysis.
8. Immobilization of Enzyme – Gel entrapment

BIOPHARMACEUTICALS

1. Determination of antibacterial spectrum of Drugs/antagonist
2. Preparation of a Herbal Hydrogel
3. Conversion of Herbal oil to Gel
4. Testing Hemagglutination and Hemolytic activity of a drug formulations

Text book:

1. Kulandaivel, S., Janarthanan, S. (2012). Practical Manual on Fermentation Technology Paperback edition. I K International Publishing House Pvt. Ltd.
2. Baltz, RH., Davies, JE., Demain, AL. Manual of industrial Microbiology and Biotechnology (3rd Edition). ASM publications. ASM press, Washington, DC.
3. ReshmaFathima, K. Biopharmaceutics and Pharmacokinetics Practical Manual. Trinity Publishing House.

MAPPING

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	S	S	S
CO2	H	H	H	H	S
CO3	H	L	H	S	H
CO4	H	L	M	H	M
CO5	M	L	H	H	H

S – Strong H – High M – Medium L – Low

Programme code: 08		**Programme name:** B. Sc. Biotechnology		
Course code:24UBT5IT		Internship Training		
Batch: 2024-2025	**Semester** -	**Hours / Week** -	**Total Hours** -	**Grade**

Course objective

- To provide an opportunity to work in industry/institute under the mentorship of an industrial personnel
- To develop key skill sets that are industry relevant for future placements
- To have a flavor of corporate life in an industry sector
- To built strength, sprit of team work and self confidence
- To prepare the students to comprehend industrial problem

Working Instructions

- The tutor of the respective class shall identify a list of industries/institutes at the beginningof the fourth semester and the same shall be approved by the HoD
- The tutor shall prepare a letter of request with the name of the student who will be placed in a particular industry and send the same or concurrence from the industry
- The class tutor shall ensure not more than four students allotted to a particular industry or institute
- The class tutor shall ensure that a daily log book provided to all the students while they leave for the internship during the summer vacation (The format of the log book will be available with the HoD)
- The tutor shall also ensure that the following documents are received from the studentsbefore they leave for the internship
    i. The letter of undertaking from the concerned student
    ii. A letter of undertaking from a parent/guardian indicating the willingness for permitting for his/her ward to the internship either in Coimbatore or other places
    iii. During the internship the student must be in contact with the tutor and shall send weekly report

iv. After the internship is completed the log books have to be submitted to the tutor which has to be verified

The tutor shall arrange for an evaluation in consultation with the HoD and grades be allotted

Mark breakup for Evaluation

Component	Marks
Log book submission	15
Report	50
Attendance	15
Review & Evaluation	20
Total	**100**

Programme code: 08		**Programme name:** B. Sc. Biotechnology		
Course code:24UBT6Z1		Case Study analysis, Report and Viva Voce		
Batch: 2024-2025	**Semester** V &VI	**Hours / Week** 3+2	**Total Hours** 45+30	**Credits** 5

Course objectives

- To comprehend the problem that needs a viable solution
- To describe an individual/collective situation in industry/society
- To identify the key issues/factors that govern the problem
- Analyze the problem using extensive review and theory
- Recommend an action plan to alleviate the problem

Work Instructions

- Each student will be allotted to the teaching faculty in a Department based on random lot
- The topic of the case study work will be finalized by the respective guide either solelyor inconsultation with an industrial personnel provided a memorandum of understanding exist
- Monitoring of the progression of the case study will be done by the respective guides on a continuous basis
- Every student will subject himself or herself to a mid-review on case study progressionon adate fixed by the Department
- The student shall submit the consolidated case study report in the format prescribed bythe Department by the end of the sixth semester or a date intimated by the authorities
- The guide and the student shall ensure maximum integrity and shall not go astray in anyform
- The case study report will be subjected to the end semester examination and will bejointly evaluated by internal examiner and industrial personnel
- Plagiarism in any form shall not be entertained in the dissertation and if found shall invite

necessary disciplinary action on grounds of mal practice

Evaluation scheme for case study analysis

Knowledge Level	Section	Marks	Total
K3	Case study Viva voce	35	50
K4		15	
K5			

Case study mark breakup

Knowledge Level	Section
K3 ↕ K5	**Case study Report:** Issue identification - 10 Review - 10 Analysis - 5 Recommendation - 5 Report - 5 **Viva Voce:** Layout of presentation - 5 Clarity - 5 Defense - 5

Programme code: 08		**Programme name:** B. Sc. Biotechnology		
Course code: 24UBT5E1		Major Elective 1 -Stem cell and Neuroscience		
Batch: 2024-2025	**Semester** VI	**Hours / Week** 5	**Total Hours** 75	**Credits** 5

Course Objectives

1. To familiarize the students with stem cell technology and basics of neuroscience
2. To discuss various chemical and biological neural signals and its types.
3. To explain the importance of artificial intelligence in neural network
4. To familiarize the use of stem cells in the treatment of genetic and human diseases

Course Outcomes (CO)

After completion of the course, the students will be able to:

K1	CO1	Relate various stem cells and their characteristic features.
↕	CO2	Explain neuronal signaling pathways and neurotransmitters in action potential
	CO3	Investigate the role of Artificial intelligence in neural network.
	CO4	Investigate the applications of stem cell and neuroscience in the treatment of various diseases.
K5	CO5	Use stem cells in design of therapeutic regimes

Syllabus

UNIT I **(15 Hours)**

Introduction to stem cell Biology**:** Properties, proliferation, Identification, characterization and differentiation; overview of different stem cell types (embryonic, adult, and induced pluripotent stem cell), adult stem cell from amniotic fluid and cord blood; Ethical and legal issues of stem cell.

UNIT II **(15 Hours)**

Stem cell culture and Aging: Growth factor and serum free culture of stem cells, Feeder free culture, Trophoblast stem cells – Identification and lineage specificity, Role of Yamanaka factor in iPSC; aging theory; cell cycle; senescence of stem cell; Role of stem cell in aging; regeneration of adult stem cell.

Case Study I: Potential impact of CRISPR and iPS cells over the coming decades

UNIT III **(15 Hours)**

Neuron: Neural membrane, classification, nerve fibre, neural growth, nervous system, Blood Brain Barrier, Cerebrospinal fluid, Neuronal signaling- ion channel, recording neural signal, propagation of action potential, **Role of Artificial intelligence in neural network***.

UNIT IV **(15 Hours)**

Synapse and Neurotransmitters**:** Synapse, Electrical synapse transmission, Synaptic transmitter release, Myoneural junction, neurotransmitters – synthesis, storage, release and functions – acetyl choline,catecholamine, histamine, serotonin, nitric oxide.

Case Study II: The Amalgamation of Human Brain and Artificial Intelligence

UNIT V **(15Hours)**

Applications:Current stencell therapy for type 1 diabetes, **cancer***. Clinical outcomes of stem cell therapy, pluripotent stem cell in cell replacement therapy. Neurodegenerative disorders – Hearing and Memory, Parkinson's disorder, **Alzheimer's disorder***.

Group discussion on Neuropsychology and well being

**** denotes Self study***

Teaching Methods

Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ video presentation /Podcast /materials from NDLI/class blended learning/ flipped class

Textbooks

1. Deb, KD., and Totey, SM. (2017). Stem cell basics and Applications. Tata McGraw Hill Pvt.Ltd.
2. Kiessling, AA. (2006). Human Embryonic stem cells. Jones and Barlett Publications.
3. Kandel, E., Schwarts, J., Jessell, T., Siegelbaum, S. (2013). Principles of Neurosciences (5^{th} Ed). McGraw hill Medicals.
4. Kuldhip S Sindhu. (2018). Frontiers in Pluripotent stem cells research and therapeutic potentials. Bench to Bedside.

References

1. Quesenberry, PJ., Stein, GS, Wiley, ED. (2001). Stem Cell Biology and Gene therapy. Springer.
2. Bear, MF., Connors,BW., Paradiso, MA. (2015). Neuroscience: Exploring the Brain (4th Edition). Wolters Kluwer.

MAPPING

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CO1	S	S	L	L	H
CO2	S	H	L	L	H
CO3	M	L	M	M	H
CO4	M	M	L	H	M
CO5	H	H	L	H	H

S – Strong H – High M – Medium L – Low

Programme code: 08		**Programme name:** B. Sc., Biotechnology		
Course code: 24UBT5E1		Major Elective 1 -Nanotechnology		
Batch: 2024-2025	**Semester** VI	**Hours / Week** 5	**Total Hours** 75	**Credits** 5

Course objective

1. To familiarize the influence of dimensionality of the object at Nanotechnology on their properties.
2. To discuss various classification of Nano materials and its different approaches
3. To comprehend the principle behind nanoparticle synthesized methods
4. To understand the concepts of nanomaterials in different characterization techniques
5. To acquaint with Nanotechnology and its medical applications

Course out comes:

After completion of the course, the students will be able to:

K1 ↑	CO1	Distinguish between the functional aspects of various Nanomaterials
	CO2	Explain different classification methods and approaches
	CO3	Utilization of significant role of synthesis
	CO4	Use the appropriate method of characterization
K5	CO5	Employ nanoparticles in diagnosis and therapy

Syllabus

UNIT I **(15 Hours)**

Concepts of Nanomaterials – Definition of nanoscale, surfaces and particle size, surface energy and surface tension and relation to size, phase transformation in nanomaterials, specific heat and heat capacity of nanomaterials, mechanical properties of nanomaterials, optical properties of nanomaterials, electrical and magnetic properties of nanomaterials.

UNIT II **(15Hours)**

Classifications of Nanomaterials: Fullerenes and carbon nanotubes (CNTs) classes of carbon-based Nanoparticles, Metal based nanoparticles – Ag Au Cu Pt Zn Fe Ni, Metal sulfide, Metal Oxide and Metal organic Nanoparticles, Semi-conductor Nanoparticles, Polymorphic Nanoparticles, Lipid based Nanoparticles.

UNIT III **(15 Hours)**

Synthesis Methods of Nanomaterials: Top down : Milling; Bottom up approaches – Synthesis of zero dimensional metal, metal oxides, Physical and chemical methods; Superlattices; Self Assembly; Langmuir-Blodgett Films; Electrochemical Deposition; Special Nanomaterials – Core/shell structures, Carbon-based Nanomaterials, Micro and Mesoporous Materials, Organic-Inorganic Hybrids, Green synthesis method –Plants, Biosynthesis method – Fungi, Bacteria, Viruses and algae.

UNIT IV **(15 Hours)**

Characterization: X-ray diffraction - nanolayers effects of nanosize and shape of nanostructures, SEM, SEM/EDX - scattering of electrons, secondary and backscattered electrons, electron sources, imaging for nanomaterials size and shape analysis, TEM - imaging and diffraction modes of operation HRTEM - Energy dispersive analysis of x-rays, Nanomaterials size and shape structural analysis, AFM - dynamic force microscopy, and various other modes, FTIR - single and group frequencies, advantages of surface enhanced.

UNIT V **(15 Hours)**

Nanomedicine and Drug Delivery: Basic concepts in the design of nanomedicine,Nanomedicines for various disease conditions: infectious diseases, neurological diseases: (challenges of blood brain barrier), pulmonary disorders, cardiovascular diseases, cancer: nano-chemotherapy, -radiation therapy, -immunotherapy, -nuclear medicine therapy, -photodynamic therapy, -photothermal and RF hyperthermia therapy, -scintillation therapy, gene-therapy: DNA, RNA delivery.

denotesSelfstudy

TeachingMethods

Powerpointpresentation/GoogleClassRooms/SmartClassRooms/Seminar/Quiz/Discussion/ Assignment/Demonstration/videopresentation/Podcast/materialsfromNDLI/classblendedlearni ng/flippedclass

TextBooks

1. Materials Science and Engineering – An Introduction, William D Callister, 12th Edition, John Wiley (Available in Amazon India, Rs. 287)
2. G. Cao, Nanostructures and Nanomaterials – Synthesis, Properties and Applications, Imperial College Press 2006.
3. Understanding Nanomedicine: An Introductory Textbook Rob Burgess, CRC Press, 2012.

Reference Books

1. Nanostructured materials: Processing, Properties and Potential Applications, Edited by Carl. C. Koch, Noyes Publications, 2002.
2. N. Yao and Z. L. Wang, Handbook of Microscopy for Nanotechnology, Springer Science and Business Medi (2005).
3. Nanomedicine for Cancer Therapy: From Chemotherapeutic to Hyperthermia-Based Therapy , Springer, Piyush Kumar, RohitSrivastava, 2017

MAPPING

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	M	H
CO2	M	M	M	M	H
CO3	M	M	H	H	H
CO4	H	L	H	H	M

S–Strong H–High M–Medium L–Low

Programme code: 08		**Programme name:** B. Sc. Biotechnology		
Course code: 24UBT5E1		Major Elective 1 - IPR, Biosafety and Bioethics		
Batch: 2024-2025	**Semester** VI	**Hours / Week** 5	**Total Hours** 75	**Credits** 5

Course Objectives

1. To disseminate fundamentals of Intellectual Property Rights to students
2. To impart the importance of IPR laws and to encourage students in the novel creation to meet the biotechnological demands.
3. To educate students about the principles and conflicts in bioethics
4. To understand the basics of bioethics in biotechnology research and biosafety measures to protectthe ecology and human health

Course Outcomes (CO)

After completion of the course, the students will be able to:

K1 ↕ K5	CO1	Apply intellectual property law principles (including copyright, patents, designs and trademarks) to real problems and analyze the social impact of intellectual
	CO2	Identify and analyze Patent law, the legislative provisions regulating patents, principles and procedure for obtaining patent
	CO3	Demonstrate and develop awareness of relevance and impact of intellectual property law on academic and professional live
	CO4	Demonstrate knowledge and understanding of the specific aspect(s) of intellectual property law that is/are relevant to their legal careers
	CO5	Draft and apply Design/Process/Product patent

Syllabus

UNIT I **(15 Hours)**

Intellectual property rights: Types of IP: Patents, Trademarks, Copyright & Related Rights, Industrial Design, Traditional Knowledge, Geographical Indications: Traditional knowledge-indigenous, medicinal, bioprospecting knowledge, need for protection, positive protection, defensive and legal protection, Protection of GMOs IP as a factor in R&D; IPs of relevance to Biotechnology.

Case Studies- Neem, Turmeric, Basmati, *Bt* Brinjal, *Bt* Cotton*

Activity: List and identify the various products in India which has got G.I tags

UNIT II **(15 Hours)**

Patents; Types of patent applications: Ordinary, PCT, Conventional, Divisional and Patent of Addition; Specifications: Provisional and complete; Forms and fees Invention in context of "prior art"; Patent databases; legal requirements for patents- Granting of patent- Rights of a patent, exclusive right. Searching International Databases; Country-wise patent searches (USPTO, esp@cenet(EPO), PATENTScope (WIPO), IPO, etc.)

UNIT III **(15 Hours)**

Patents and patent processing: International scenario of patents, patenting of biological materials, significance of patents in India, Patent application types- Patent document, Specification and claims, protection of biotechnological inventions, Patent Act (1970), Patent (Amendments) Act (2002), Infringement, The different layers of the international patent system: National, Regional and International options.

Activity: Drafting for an application for Design patent

UNIT IV **(15Hours)**

Bioethics: Introduction, Ethical issues related to biotechnology, legal and socioeconomic impacts of biotechnology, health and safety issues, possible benefits of successful cloning, Ethical concerns of gene cloning, hazards of environmental engineering, Ethical issues in Human Cloning and stem cell research, Ethical implications of biotechnological products and techniques. **Social and ethical implications of biological weapons*.**

UNIT V **(15 Hours)**

Biological Safety Cabinets; Primary Containment for Biohazards; Biosafety Levels; Biosafety Levels of Specific Microorganisms; Recommended Biosafety Levels for Infectious Agents and Infected Animals, Government of India; Definition of GMOs & LMOs; Roles of Institutional Biosafety Committee, RCGM, GEAC etc. for GMO applications in food and agriculture; Environmental release of GMOs; Risk Analysis; Risk Assessment; Risk management and communication; Overview of National Regulations and relevant International Agreements including; **Cartegana Protocol*.**

Case study: Regulation in India with reference to use of GM foods/crops

denotes self study

Teaching Methods

Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ video presentation /Podcast /materials from NDLI/class blended learning/ flipped class

Text Books:

1. Deepa Goel and Shomini Parasha. (2013). IPR, Bio safety and Bioethics. (1st Edition). Pearson.
2. Reddy, SVD. (2019). Intellectual property rights. (1st Edition). Asia Law House.

Reference Books:

1. Vaughn, L.(2016). Bioethics: Principles, Issues and Cases. (3rdEdition). Oxford University Press.
2. Sree Krishna, V. (2007). Bioethics and Biosafety in Biotechnology. (1st Edition). New AgeInternational Publishers.
3. Sibley, D. (2007). The Law and Strategy of biotechnological patents. (1st Edition). Butterworthpublication.
4. Ganguli, P. (2001). Intellectual property rights. (1st Edition). McGrawhill.
5. Wattal, V. (1997). Intellectual Property Right. (1st Edition). Oxford Publication House.

MAPPING

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	H	S	S
CO2	M	L	M	S	S
CO3	M	M	H	H	S
CO4	M	L	H	H	H
CO5	M	L	M	S	H

S – Strong H – High M – Medium L – Low

Programme code: 08		**Programme name:** B. Sc. Biotechnology		
Course code: 24UBT6E2		Major Elective 2 - Research Methodology		
Batch: 2024-2025	**Semester** VI	**Hours / Week** 5	**Total Hours** 75	**Credits** 5

Course Objectives

1) To inculcate the basic framework of a typical research process
2) To understand a general definition of research design and experimentation
3) To disseminate the various information for literature review and data collection
4) To identify the primary characteristics of quantitative research and qualitative research.

Course Outcomes (CO)

After completion of the course, the students will be able to:

K1 ↑	CO1	Design a good quantitative purpose statement and good quantitative research questions and hypotheses
	CO2	Identify various types of quantitative sampling and which presents the most rigorous approach to use.
	CO3	Distinguish and apply methods for a population and a sample, design
	CO4	Analyze the link between quantitative research questions and data collection and how research questions are operation
↓ K5	CO5	Present the findings of research in an organised and non-plagiarized forms

Syllabus

UNIT I: **(15 Hours)**

Research Methodology –Characteristics and Criteria of Good research, Types of research, Research Problem- Scientific thinking, Selection and evaluation of research problem, Review of Literature- Need of review of literature, Sources, functions and hints for the review of literature. Research Approach- Qualitative, quantitative, mixed-methods approach, Criteria for selecting a research approach, Research Strategies- Case studies, Experiments, **Action research***

Activity: Collect at least 10 literatures on the given topic and make a concept note.

UNIT II: **(15 Hours)**

Writing a Article; Essay, Research Paper, Research Project, Legislation Drafting, Judgment Writing, Thesis, Dissertation, Book, Reviews - Book Review; Case Review- Criteria of Good Research, Research Ethics; Citation Methods- Foot Note, Text Note, End Note, Bibliography; Citation Rules- Blue Book, OSCOLA, MLA, APA, Chicago, Oral Presentations using usual aids such as handouts, overhead transparencies and presentation software such as PowerPoint.

Activity: Calculate citation index, h-index and impact factor

UNIT III: **(15 Hours)**

Sampling techniques- Concepts of statistical population, sampling error, sample size, methods of sampling, characteristics of good sample, Data collection- Questionnaires, Interviews, Focus Groups, Observation, Research Hypotheses- nature, importance and kinds of hypothesis, Variables, formulating, hypothesis testing, data processing and analysis strategies and tools, data analysis with statically package (Sigma STAT,SPSS for student t-test, ANOVA, etc.)

Activity: Frame and validate a survey questionnaire for health data

UNIT IV: **(15 Hours)**

Organizing and writing a rough draft – searching and reviewing scientific literature – publishing in scientific journals – ethical and legal issues – scientific presentations – oral presentation – poster presentation. Preparation of research report - steps involved in writing a good report - concepts of bibliography and references. Developing a Research Proposal: Format of research proposal - Individual research proposal - Institutional proposal.

Activity: Develop a research proposal concept note in given area

UNIT V: **(15 Hours)**

Application of Computer for Research Work: Application of Computer packages - Educational and Research resources on the Internet - Data Analysis and Display using software. Use of encyclopedias, Research guides, Handbook, Internet, Academic databases. Use of tools- Reference management, Zotero/Mendeley, **Paper formatting MS Office***, Plagiarism- Types, penalty, software and tools for the detection of plagiarism.

Case study: Compare and report the features of Academic Database

denotes self study

Teaching Methods

Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ video presentation /Podcast /materials from NDLI/class blended learning/ flipped class

Text Books

1) Kothari, CR. (1990). Research Methodology. (1st Edition).
2) Kerlinger, FN. (2017). Foundation of Research. (1st Edition). Surjeet Publications

Reference books

1. Cohen, L., Lawrence, M., and Morrison, K. (2005). Research Methods in Education (5th edition). Oxford: Oxford University Press.
2. Denscombes, M. (2010). The Good Research Guide: For small-scale social research projects.Maiden-Read: Open University Press
3. Singh, YK. (2006). Fundamental of Research Methodology and Statistics. New International

   (P) Limited, Publishers

MAPPING

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	M	H	M
CO2	H	L	M	S	S
CO3	M	M	H	M	S
CO4	L	L	M	H	H
CO5	M	M	M	S	H

S – Strong H – High M – Medium L – Low

Programme code: 08		**Programme name:** B. Sc. Biotechnology		
Course code: 24UBT6E2		Major Elective 2 -Molecular Diagnostics		
Batch: 2024-2025	**Semester** VI	**Hours / Week** 5	**Total Hours** 75	**Credits** 5

Course Objectives

1. To State the fundamental principles of clinical molecular diagnostics and explores theuse of molecular techniques in the diagnosis of disease
2. To explain the required quality assurance and quality control measures required in a molecular laboratory.
3. To sensitize on the application of monoclonal antibodies
4. To introduce basic of Neonatal and Prenatal diagnostics

Course Outcomes (CO)

After completion of the course, the students will be able to:

K1 ↑ ↓ K5	CO1	Clarity about the molecular diagnostic aspects, its significance and goal
	CO2	Categorize various techniques used in the clinical diagnostic laboratory for the diagnosis of various pathogenic situations
	CO3	Explain how these methods are applied in current research and diagnostics
	CO4	Asses the need of quality assurance that needs to be followed in the molecular diagnostic lab.
	CO5	Apply basic diagnostic principles for design of novel tools for diagnosis

Syllabus

UNIT I **(15 Hours)**

Traditional disease diagnosis methods and tools: Diagnosis of infection caused by Coliforms, Vibrio and Mycobacterium, Candidiosis and Aspergillosis. Diagnosis of DNA and RNA viruses- Pox virus, Adenovirus, Hepatitis Virus and · Retrovirus. Protozoan diseases: Amoebiosis, Malaria - Study of helminthic diseases- *Fasciola hepatica* and *Ascaris lumbricoides*

UNIT II **(15 Hours)**

DNA sequencing methods in molecular diagnosis: Automated DNA sequencing- Principles, Methods and Instrumentation- Advances in DNA sequencing- New Generation sequencing Methods, Pyrosequencing, Microarrays- Personalized Medicine- Pharmacogenomics (ADMET), RT-PCR - Diagnosis of Sars-CoV-2

UNIT III **(15 Hours)**

Neonatal and Prenatal disease diagnostics: Gender identification using amelogenin gene locus. Amplification of Y chromosome specific Short Tandem Repeats (Y-STR). Analysis of mitochondrial DNA for maternal inheritance. Molecular diagnosis for early detection of cerebral palsy and cancer.

UNIT IV **(15 Hours)**

Therapeutic monoclonal antibodies: Human monoclonal and Humanized monoclonal. Uses – unconjugated antibodies for treatment of kidney rejection, HIV treatment, treatment of multidrug resistant cancer cells, Herceptin in breast cancer therapy, toxin delivery, Sars-CoV-2.

UNIT V **(15 Hours)**

Recombinant Vaccine therapy**:** Protein based vaccine for Sars-CoV-2, DNA vaccine for Ebola virus, Gene vaccine-the vaccinia virus approach, Edible vaccine from transgenic plants, Role and properties of adjuvants, reverse vaccinology, Vaccine safety and quality assurance

**** denotes Self study***

Teaching Methods

Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ video presentation /Podcast /materials from NDLI/class blended learning/ flipped class

Text books

1. Pamela Greenwell and McCulley, M. (2008). Molecular Therapeutics: 21st century medicine. (1st Ed).Springer.
2. Coleman, WB. (2006). Molecular Diagnostics for the Clinical Laboratorian. (2nd Edition). Humana Press.

References

1. Buckingham, M and Flaw, S. (2019). Molecular Diagnostics: Fundamentals, Methods and Clinical Applications. (3rd Ed). FA Davis Company Publication.
2. Burtis, C., Bruns, D. (2014). Tietz Fundamentals of Clinical Chemistry and Molecular Diagnostics.(7th Ed). Elsevier- Saunders.

MAPPING

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	H	H	S
CO2	H	M	M	S	S
CO3	H	M	H	S	M
CO4	H	L	M	H	H
CO5	M	M	M	S	S

S – Strong H – High M – Medium L – Low

Programme code: 08		**Programme name:** B. Sc. Biotechnology		
Course code: 24UBT6E2		Major Elective 2 - Food and Dairy Technology		
Batch: 2024-2025	**Semester** VI	**Hours / Week** 5	**Total Hours** 75	**Credits** 5

Course Objectives

1. To familiarize students with advances in food processing techniques
2. To acquaint students with the industrial techniques
3. To introduce the various methods to preserve and process foods and extend their shelf-life
4. To sensitize the methods to improve their palatability characteristics.

Course Outcomes (CO)

After completion of the course, the students will be able to:

K1 ↑	CO1	To provide an overview of basic principles and methods of food processing, preservation and quality.
	CO2	To predict processing and to standardize methods of preservation in relation to food composition.
	CO3	To review quality standards and ethics in processed foods.
	CO4	To invent and develop novel food processing and preservation technologies to manufacture and preserve food in an effective manner
↓ K5	CO5	To design smart packaging systems from local resources

Syllabus

UNIT I **(15 Hours)**

Introduction to food processing, preservation and quality, Basic principles and methods. Emerging Technologies in food processing. Food additives and preservatives. Food laws and standards. Effect of processing on acceptability and nutritive value of food, Conventional foods and indigenous food.

Activity: Prepare a nutritive chart on Indian conventional snacks

UNIT II **(16 Hours)**

Milk Products: Physico-chemical properties and structure of milk and milk constituents. Chemical and microbial spoilage of milk and milk products; Fluid milk processing, packaging and distribution.

Dairy products- cream, Butter, Ghee, Evaporated milk, Condensed milk, Whole and skim milk powder, Butter oil, Ice cream. Fermented milk-Yoghurt, Acidophilus milk, butter milk, Paneer and similar products. *Cheese*- Classification, Cottage cheese, Cheddor cheese, processed cheese-manufacturing methods.

UNIT III **(14 Hours)**

Dairy plant sanitation- Selection and use of dairy cleaner and sanitizer in plant cleaning system, Waste disposal methods. Common dairy processes – cream separation (standardization), pasteurization, sterilization and Homogenization. Grading and Quality- Specifications and standards in milk processing industry Judging and grading of milk

Activity: Visit to a local dairy unit

UNIT IV **(15 Hours)**

Food products: Technological processes for industrially manufactured foods of commercial importance, from plant and animal origin. Functional foods and Nutraceuticals. Ready to eat therapeutic food, micronutrient fortified high energy bar, gluten free bread, lactose free milk, carbonated cereal beverage. Cereals, vegetables, fruits, meats, poultry and egg products; Bakery, pasta and confectionary products, ready to eat foods, fermented foods, **alcoholic and non-alcoholic Beverages, tea, coffee and cocoa, fabricated foods*.**

Activity: Reading and comprehending food labels

UNIT V **(15 Hours)**

Packaging materials: Characteristics, properties and their design. Packaging requirement for different processed and unprocessed foods. Working Principles of various types of fillers: form-fill-seal machine. Gas packaging and modified atmosphere Package design. Shelf life prediction of foods in packages. Quality control in Food packaging. **Product safety and packaging regulations***.

Case study: Compare the conventional methods of food package with the latest ones

**** denotes Self study***

Teaching Methods

Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ video presentation /Podcast /materials from NDLI/class blended learning/ flipped class

Text books

1. Shakuntalamany, V and Shadakshara Swamy, M. (1987). Foods: Facts and Principles. NewAge International Pub. (P) Limited.
2. Srilakshmi B, (2007). Food Science. New Age International Pub. (P) Limited.
3. Eckles, E., Comb, B and Macy, S. (1972).Technology of Indian Milk products.Tata McGraw Hill.
4. Vijaya Khade. (1999). Text Book on Foods Storage and Preservation.(1st Ed).Kalyani Publ.

References

1. Goldberg I. (1994). Functional foods. Chapman & Hall.
2. Gutierrez-Lopez, GF. and Barbosa-Conovas, GV. (2003). Food Science and Food Biotechnology. CRC Press.
3. Lee Byong H. (1996). Fundamentals of food Biotechnology. VCH Publ.
4. Sukumar, D. (2001). Outline of Dairy technology. (1st Edition). Oxford University Press

MAPPING

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	H	S
CO2	H	M	H	S	H
CO3	H	M	H	S	M
CO4	M	L	M	H	H
CO5	M	M	H	S	H

S – Strong H – High M – Medium L – Low

Programme code: 08		**Programme name:** B. Sc. Biotechnology		
Course code: 24UGC3S1		**Skill Based Subject 1 – Cyber Security**		
Batch: 2024-2025	**Semester** IV	**Hours / Week** 2	**Total Hours** 30	**Credits** 3

COURSE OBJECTIVES

- The course introduces the basic concepts of Cyber Security
- To develop an ability to understand about various modes of Cyber Crimes and Preventive measures
- To understand about the Cyber Legal laws and Punishments

COURSE OUTCOMES

On successful completion of the course, the students will be able to

K1	CO1	To Understand the Concepts of Cybercrime and Cyber Frauds
↑	CO2	To Know about Cyber Terrorism and its preventive measures
↕	CO3	To Analyze about the Internet, Mobile Phone and E-commerce security issues
↓	CO4	To Understand about E-mail and Social Media Issues
K5	CO5	To Describe about various legal responses to Cybercrime

SYLLABUS

UNIT I **6 Hours**

Introduction to Cyber Security: Definition of Cyber Security- Why is Cyber Security important? Layers of Cyber Security- Evolution of Cyber Security. Cyber hacking - Cyber fraud: Definition- Different modes of cyber fraud - Cyber fraud in India. Cyber pornography.

UNIT II **6 Hours**

Cyber Terrorism: Modes of cyber terrorism. Cybercrime: What is Cybercrime? Cybercrime preventive methods - Preventive steps for individuals & organizations - Kinds of cybercrime - Malware and its types – Cyber attacks.

UNIT III **5 Hours**

Internet Mobile Phone and E-commerce Security issues: Data theft - Punishment of data theft- Theft of internet hours - Internet safety tips for children & parents. Mobile phone privacy- E-Commerce security issues.

UNIT IV **6 Hours**

Email and Social media issues: Aspects of Social Media - The Vicious Cycle of unhealthy social media use- Modifying social media use to improve mental health. Computer Virus - Antivirus – Firewalls.

UNIT V **7 Hours**

Cyber Forensics and Digital Evidence: What does Digital Footprint Mean? - Web Browsing and Digital Footprints- Digital Footprint examples – How to Protect Your Digital Footprints? - How to

erase your Footprints? - Browser Extensions and Search Engine Deletion - Cyber Crime and Cyber Laws - Common Cyber Crimes and Applicable Legal Provisions: A Snapshot - Cyber Law (IT Law) in India – The Information Technology Act of India 2000 - Cyber Law and Punishments in India - Cyber Crime Prevention guide to users – Regulatory Authorities.

Teaching Methods:

- Chalk and Talk, Presentation, Seminar, Quiz, Discussion & Assignment

Text Book:

1. **"Cyber Security", Text Book** prepared by "Kongunadu Arts and Science College", Coimbatore - 29, 2022.

Reference Books:

1. Mayank Bhushan, Rajkumar Singh Rathore, Aatif Jamshed, **"Fundamental of Cyber Security",** BPB Publications, 1st Edition, 2017.
2. Anand Shinde, "**Introduction to Cyber Security-Guide to the world of Cyber Security**",Notion Press,2021.
3. Paul Grishman, "**Cyber Terrorism- The use of the Internet for Terrorist Purpose**",Axis Publication,1st Edition 2010.
4. Shilpa Bhatnagar, **"Encyclopaedia of Cyber and Computer Hacking**", Anmol Publications, 1st Edition 2009.

Web References:

1. http://deity.gov.in/ - Department of Electronics and Information Technology,
2. Govt. of India
3. http://cybercellmumbai.gov.in/ - Cybercrime investigation cell
4. http://ncrb.gov.in/ - National Crime Records Bureau
5. http://catindia.gov.in/Default.aspx - Cyber Appellate Tribunal
6. http://www.cert-in.org.in/ - Indian Computer Emergency Response Team
7. http://cca.gov.in/rw/pages/index.en.do - Controller of Certifying Authorities
8. www.safescrypt.com - Safescrypt
9. www.nic.in – National Informatics Centre
10. https://www.kaspersky.com/resource-center/definitions/what-is-a-digital-footprint
11. https://geekflare.com/digital-footprint/

Mapping

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	M	S	H
CO2	H	S	S	H	S
CO3	M	H	M	S	H
CO4	S	H	H	M	H

S – Strong **H** – High **M** – Medium **L** – Low

Question Paper Pattern

Duration: 3 hrs **Max: 75 marks**

Section - A (10x1=10)

Choose the correct answer

Section - B (5x5=25)

Short answer questions, either or type, one question from each unit.

Section - C (5x8=40)

Essay answer questions, either or type, one question from each unit.

CIA EXAMINATION MARK BREAKUP

S. NO	DISTRIBUTION COMPONENT	MARKS
1.	CIA I – 75 Marks Converted to 30	**30**
2.	CIA II – 75 Marks Converted to 30	**30**
3.	Assignment I	**10**
4.	Assignment II	**10**
5.	Attendance	**05**
6.	Any Case Study related to Cyber Security	**15**
	Total	**100**

Programme code: 08		**Programme name:** B. Sc. Biotechnology		
Course code: 24UBT4S2		Skill based Subject 2 - Traditional Indian Technology and Bio Business		
Batch: 2024-2025	**Semester** IV	**Hours / Week** 2	**Total Hours** 30	**Credits** 3

Course Objectives

1. To educate students about our Indian systems of medicine and explain methods for identification and authentication of herbal drugs.
2. To make the students to be skilled in hydroponics and to use the technology in developing commercial ornamental species.
3. To impart the knowledge of various aspects of Creativity, Innovation and New Product Development
4. To develop knowledge and skills to master the future challenges of the biotechnology industries
5. To educate students about concepts of traditional knowledge and trade system

Course Outcomes (CO)

After completion of the course, the students will be able to:

K1 ↕ K5	CO1	Recognize the basic principles of Identification, authentication and Validation of herbs.
	CO2	Explore and offer services with regard to hydroponics
	CO3	Be a responsible biotechnologists who can work in an interdisciplinary framework of related fields
	CO4	Imbibe self-management, interpersonal and team work skills and Set up a rewarding business ventures
	CO5	Understand the concepts of traditional knowledge in different sectors.

Syllabus

UNIT I:

Indian System of Medicine: Ayurveda, Yoga, Unani, Siddha, Homeopathy, Naturopathy, "Sowa-Rig- Pa" (Amchi Medicine), Prospects for the twenty first century in herbal medicine. Phytopharmaceuticals: Selection of suitable extraction processes – Infusion, Decoction, Digestion, Maceration, Percolation, Solvent extraction, steam distillation, Sepbox, Headspace techniques,

WHO and ICH Standardization of single and compound formulations*,Shelf life determination and stability testing of herbal formulation.

UNIT II **(6 Hours)**

Principles of Hydroponics: Substrates; Hydroponic systems. Plant anatomy, physiology and growth requirements. Plant varieties: Crop selection, **Crop selection for different systems*,** Crop scheduling; Monitoring plants. Nutrient Supply: Plant requirements, Monitoring of the nutrient solution, Advantages and Disadvantages.

UNIT III **(6 Hours)**

Introduction to bio-business from the Indian context, SWOT analysis of bio-business. Development of Entrepreneurship; Stages in entrepreneurial process; Project Planning– Business opportunity, Essential requirement for Commercial biotech / bioproducts. Entrepreneurial ventures in biotechnology – scope, sectors and avenues.Quality control and strategies for future developmentof products, IT for business administration, use of IT in business performance, e-business setup

UNIT IV:

Value addition to Biotechnology products, Marine biotechnology products–biomedical applications, Functional nutraceuticals.Microbial consortia in Environmental Biotechnology industry. Design of proto type - testing - quality standards - marketing research –introducing new products.

UNIT V :

Indigenous Traditional Knowledge (ITK): Production of Bijamrut, Sanjivak, Jivamrut, Amritpani, Panchagavya enriched, Anda-Arkh, Fish –Arkh, Brahmastra (broad spectrum botanical pesticides), Kunapajala, Panchagavya, Cow horn manure production, compost tea production using suitable Agricultural resources and Indian Trade System.

**** denotes Self study***

Teaching Methods

Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ video presentation /Podcast /materials from NDLI/class blended learning/ flipped class

Textbooks

1. Peter Kolchensky.(2011).The Entrepreneurship Guide to a Biotech startup. Evelexa.
2. Tripathi,PC.and Reddy,PN. (2012). Principles of Management.(6thEdition).TataMc Graw Hill.
3. Khanka,S S.(2006).Entrepreneurship Development. S.Chand & Co.
4. Agarwal, SS., Paridhavi M. (2012). Herbal Drug Technology (2nd Ed). Orient Blackswan.
5. Afsar. Z. (2019). Essentials of Herbal Drug technology. (1st Ed). S Vikas and Company.

Reference Books:

1. Damian Hine and John Kapeleris.(2008).Innovation and Entrepreneurship in Biotechnology, Concepts, Theories and Case. Edward Elgar Publishing.
2. Yali Friedman.(2008). Best practices in biotechnology business Development.Logos Press.
3. NeeleshMalviya.,SapnaMalvia.(2019).Herbal Drug Technology.CBS Publishers

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	L	L	S	L
CO2	L	M	H	L	L
CO3	S	M	M	H	M
CO4	M	L	L	M	M
CO5	M	L	M	S	L

S – Strong H – High M – Medium L – Low

Programme code: 08		**Title: All Bachelor Degree Courses**		
Course code: 24UBT6S3		Skill Based Subject III: BASICS OF INTELLECTUAL PROPERTY RIGHTS		
Batch: 2024-2025	**Semester**	**Hours / Week**	**Total Hours**	**Credits**
	VI	2	30	3

COURSE OBJECTIVES

- To create awareness about recent trends in IPR and Innovation
- To explore the basic concepts IPR
- To focus upon trademarks, copyrights, patents, industrial designs and traditionalknowledge.
- To learn more about managing IP rights and legal aspects.

COURSE OUTCOMES

On successful completion of the course, the students will be able to

K1 ↕ K5	CO1	Know about basic concepts of IPR and patent
	CO2	Understand copyrights, industrial designs and geographical indication of goods.
	CO3	Differentiate between trademarks and trade secrets
	CO4	Acquire knowledge on parotection of traditional knowledge and plant varieties.
	CO5	Manage and protect IP Rights

UNIT – I **6 hours**

Introduction -origin and development of Intellectual Property Rights (IPR), need for protecting IP, **Patents:** Foundation of patent law, patent searching process, basic criteria of patentability. Patentable and non - patentable subject matters in India. Patent prior art search, drafting the patent specification and filing procedure

UNIT – II **6 hours**

Copyrights: Fundamentals of copyright law, originality of material, right of reproduction, right to perform the work publicly, copyright ownership issues, notice of copyright. **Industrial Designs:** Kind of protection provided in Industrial design. **Geographical Indication of Goods:** Basic aspects and need for the registration.

UNIT – III **6 hours**

Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights,transfer of rights, selecting and evaluating trademark, registration of trademarks,

claims. **Trade Secrets:** Trade secret law, determination of trade secret status, liabilityform is appropriation of trade secrets, trade secret litigation.

UNIT – IV **6 hours**

Protection of traditional knowledge - Objectives, concept of traditional knowledge, issues concerning, bioprospecting and biopiracy. **Protection of Plant Varieties -** Objectives, international position, plant varieties protection in India. Rights of farmers, breeders and researchers.

UNIT- V **6 hours**

Managing IP Rights: Acquiring IP Rights: letters of instruction, joint collaboration agreement, protecting IP Rights: non-disclosure agreement, cease and desist letter, settlement memorandum. **Transferring IP Rights:** Assignment contract, license agreement, deed of assignment. Infringement and enforcement.

Teaching Methods

Smart Class Room/PowerPoint presentation/Seminar/Quiz/Discussion

TEXT BOOKS

1. Ramakrishna Chintakunta and M. Geethavani (2022). A Textbook of IntellectualProperty Rights. Blue Hills publications.
2. N.K Acharya (2021).Intellectual property rights(8th Edn). Asia Law House.
3. Craig Allen Nard, Michael J. Madison, and Mark P. McKenna. (2017). Law ofIntellectual Property (5th Edn). New York Aspen publishers.
4. Barrett and Margreth (2009). Intellectual Property. New York Aspen publishers.

5. Deborah E.Bouchoux(2013). Intellectual property:The Law of Trademarks, Copyrights, Patents, and Trade Secrets. Publisher: Cengage India

REFERENCES

1. B.Ramakrishna and H.S.Anil Kumar (2017). Fundamentals of Intellectual Property Rights: For Students, Industrialist and Patent Lawyers.Notion Press.

2. V. K. Ahuja (2013). Law relating to Intellectual Property rights (2nd Edn). LexisNexis.

3. R. Radhakrishnan and S. Balasubramanian(2008).Intellectual property rights: Text and Cases.Excel Books India.

4. D. Goeland S. Parashar (2013). IPR Biosafety and Bioethics. Pearson Education India.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	H	H	M	S
CO2	H	S	H	M	S
CO3	H	H	M	S	H
CO4	S	M	S	M	H
CO5	S	M	S	S	H

S-Strong **H** -High **M**-Medium **L** - Low

Programme code: 08		**Programme name:** B. Sc. Biotechnology		
Course code:24UBT5X1		EDC -Bio-Entrepreneurship		
Batch: 2024-2025	**Semester** VI	**Hours / Week** 2	**Total Hours** 30	**Credits** 3

Course Objectives:

1. To provide an insight into the field of Bioentrepreneurship, i.e. innovation and entrepreneurshipin the life sciences
2. To motivate students for entrepreneurship and the need for technological innovation
3. To familiarize students with the scope of issues and decisions that managers in biotechnologyface as their company progresses from its earliest stages to self-sustainability
4. To give students the vocabulary to participate and contribute to the business side of scientificenterprises

Course Outcomes:

After completion of the course, the students will be able to:

K1 ↑ ↓ K5	CO1	Develop an understanding of Bio entrepreneurship
	CO2	Apply basic Business tools
	CO3	Compose and write a business plan offering a convincing presentation of a biotech venture
	CO4	Setup enterprise for new biotechnology product
	CO4	Assess the national and international market for product launch
	CO5	Apply for funding from Government/non Government agencies

Syllabus

UNIT I **(6 Hours)**

Introduction to Bioentrepreneurship: translational biotechnology industry overview (include the commercialization pathways for drug, medical device, diagnostic companies), Skills needed for a bioentrepreneur, identify and market need, Biotechnology startups in India,

Case Study: Prepare a list of Biotechnology start ups and their contribution to the National GDP

UNIT II **(6 Hours)**

New product development, IP/Licensing strategy, Value innovation and market creation Market scanning, data collection, and market selection, The strategic triangle: segmentation, targeting and positioning, The business plan and financial projections,

Case Study: Identify local resources from Coimbatore District which can fit in to a new product development.

UNIT III **(6 Hours)**

Starting a Company: Issues and methods of starting a monopoly biotech company/start up, Business Model Canvas, Biotechnology Business Models, Role of Venture capitalist, Angle Investors, Government Funding agencies like NSTEDB, MSME, TBI etc.. Problems of entrepreneurship, The Art of Negotiation, Workable marketing and the strength of distribution. Opportunities and lessons in international marketing.

Case Study: Prepare a 5 minute presentation based on Business Model Canvas to be presented to a Venture Capitalist

UNIT IV **(6 Hours)**

How to Start a Start up: corporate structure (LLC, LLP, C-Corp, S-Corp, etc.), ownership/vesting, LLP check in (customer development), Test Marketing Strategies, Choosing a business location, Hiring and managing staff

Case Study: Prepare a present a Customer interview and a test marketing survey for a product that will be launched

UNIT V: **(6 Hours)**

Problem and Solution of Entrepreneurship: Risk and benefit, Steps involved in commercialization of a biotechnological product, Introduction to IPR and Patenting of a Biological product

Case Study: Real time experiences from Start up CEO/CTO's on establishment of a Start up.

****denotes self study***

Teaching Methods

Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ video presentation /Podcast /materials from NDLI/class blended learning/ flipped class

Text books:

1. Vasant Desai. (2011). Dynamics of Entrepreneurial development & management. (6th Edition)Himalaya Publications.
2. Bisht, MS. and Mishra, RC. (2000). Entrepreneurship reflection and investigation. Chugh Publication.
3. Samiuddin, M. (1992). Entrepreneurship development in India. Mittal Publication.
4. Roth, CR. (2001). From Alchemy to IPO: The Business of Biotechnology. (1st Edition). BasicBook Publisher.

References:

2. Dorf, RC. and Byers, TH. (2007). Technology Ventures: From Idea to Enterpris. (2nd Edition).McGraw-Hill.
3. Hisrich, RD., Peters, MP and Shepherd, DA. (2007). Entrepreneurship. (7th Edition). McGraw-Hill.
4. Shimasaki, C. (2014). Biotechnology Entrepreneurship: Starting, Managing, and Leading Biotech Companies. (2nd Edition). Elsevier.

MAPPING

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	S	S	S	S
CO2	S	S	M	S	H
CO3	L	L	L	S	S
CO4	M	L	L	H	S
CO5	H	H	L	H	H

S – Strong H – High M – Medium L – Low

Question Paper Pattern

Duration: 3 hrs **Max: 75 marks**

Section - A (10x1=10)
Choose the correct answer

Section - B (5x5=25)
Short answer questions, either or type, one question from each unit.

Section - C (5x8=40)
Essay answer questions, either or type, one question from each unit.

CIA EXAMINATION MARK BREAKUP

(For Theory Only)

S. NO	DISTRIBUTION COMPONENT	MARKS
1.	CIA I – 75 Marks Converted to 40	**40**
2.	CIA II – 75 Marks Converted to 40	**40**
3.	Assignment I	**05**
4.	Assignment II	**05**
5.	Attendance	**05**
6.	Others (Seminar, Group Discussion, Flipped Class room, etc.,)	**05**
	Total	**100**

CIA EXAMINATION MARK BREAKUP

(For Practical Only)

S. NO	DISTRIBUTION COMPONENT	MARKS
1.	CIA Practical I – 60 Marks Converted to 30	**30**
2.	CIA Practical I – 60 Marks Converted to 30	**30**
3.	Continuous Assessment of Practical (Observation to be Submitted*) (15 Experiments/Programs × 2 = 30Marks)	**30**
4.	Record	**05**
5.	Attendance	**05**
	Total	**100**

* In case a student is absent for an Experiment/Program conducted on a particular day, the Student will not be allowed to compensate that Experiment/Program and will be awarded zero for that particular Experiment/Program and shall be marked absent. In case any students has an attendance lack; the concerned faculty handling the course in consultation with HoD may permit the student who has an attendance lack to compensate one or two Experiments/Programs as the case may be to enable them to become eligible with mandate of 75% attendance to appear for the Continuous Internal Practical Examinations. However the compensated Experiments/Programs will not be awarded any marks whatsoever.

Programme code: 08		**Programme name:** B. Sc. Biotechnology		
Course code: 24EVS101		**PART IV – ENVIRONMENTAL STUDIES**		
Batch: 2024-2025	**Semester** I	**Hours / Week** 2	**Total Hours** 30	**Credits** 2

COURSE OBJECTIVES

- The course will provide students with an understanding and appreciation of the complex interactions of man, health and the environment. It will expose students to the multi-disciplinary nature of environmental health sciences
- To inculcate knowledge and create awareness about ecological and environmental concepts, issues and solutions to environmental problems.

- To shape students into good "Ecocitizens" thereby catering to global environmental needs.
- This course is designed to study about the types of pollutants including gases, chemicals petroleum, noise, light, global warming and radiation as well as pollutant flow and recycling and principles of environmental pollution such as air, water and soil
- The course will address environmental stress and pollution, their sources in natural and workplace environments, their modes of transport and transformation, their ecological and public health effects, and existing methods for environmental disease prevention and remediation.

COURSE OUTCOMES

On successful completion of the course, the students will be able to

K1 ↑	CO 1	Understand how interactions between organisms and their environments drive the dynamics of individuals, populations, communities and ecosystems
	CO2	Develop an in depth knowledge on the interdisciplinary relationship of cultural, ethical and social aspects of global environmental issues
	CO3	Acquiring values and attitudes towards complex environmental socio-economic challenges and providing participatory role in solving current environmental problems and preventing the future ones
↓	CO4	To gain inherent knowledge on basic concepts of biodiversity in an ecological context and about the current threats of biodiversity
K5	CO5	To appraise the major concepts and terminology in the field of environmental pollutants, its interconnections and direct damage to the wildlife, in addition to human communities and ecosystems

UNIT I MULTIDISCIPLINARY NATURE OF ENVIRONMEN (4 HOURS)

Definition : scope and importance – Need for public awareness - Natural resources – Types of resources – Forest Resources – Water Resources – Mineral Resources – Food Resources – Energy Resources – Land Resources.

UNIT II ECOSYSTEMS (4 HOURS)

Concept of an ecosystem – Structure and functions of an ecosystem – Procedures, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food web and ecological pyramids – Structure and function of the following ecosystem – Forest Ecosystem – Grassland Ecosystem – Desert
Ecosystem – Aquatic Ecosystem.

UNIT III BIODIVERSITY AND ITS CONSERVATION (5 HOURS)

Introduction – Definition – Genetic – Species and ecosystem diversity- Bio geographical classification of India – Value of biodiversity – Biodiversity at global, national and local levels – India as a mega - diversity Nation - Hot spot of biodiversity – Threats to biodiversity - Endangered and endemic species of India – Conservation of Biodiversity – *In situ* Conservation of Biodiversity – *Ex situ* Conservation of Biodiversity

UNIT IV ENVIRONMENTAL POLLUTION (8 HOURS)

Definition - Causes, effects and control measures of : Air Pollution – Water Pollution – Soil Pollution – Marine Pollution – Noise Pollution – Thermal Pollution – Nuclear Pollution – Solid Waste Management: Causes, effects, control measures of urban and industrial wastes – Role of individual in prevention of pollution – Pollution case studies – domestic waste water, effluent from paper mill and dyeing, cement pollution – Disaster Management – Food, Drought, Earthquake, Tsunami, Cyclone and Landslide.

UNIT V SOCIAL ISSUES AND THE ENVIRONMENT (9 HOURS)

Sustainable Development – Smart City, Urban planning, Town Planning , Urban problems related to energy – Water Conservation: Rain Water Harvesting and Watershed Management – Resettlement and rehabilitation of people, its problems and concerns, case studies Narmatha Valley Project – Environmental ethics, issues and possible solutions – Climate change, global warming, ozone layer

depletion, acid rain, nuclear accidents and holocaust, case studies – Hiroshima and Nagasaki, Chernobyl – Consumerism and waste products – Environmental Protection Act – Air Pollution Act (Prevention and Control) – Water Pollution Act (Prevention and control) – Wild Life Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness – Human Population and the environment – Population Growth andDistribution – Population Explosion – Family Welfare Programme – Environment and Human Health – Human Rights – Value Education – HIV/ AIDS – Women and Child Welfare – Role of Information Technology in Environment and Human Health.

Teaching Methods

Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ video presentation /Podcast /materials from NDLI/class blended learning/ flipped class

Text Book

1.P.Arul, A Text Book of Environmental Studies, Environmental Agency, No 27, Nattar street, Velacherry mainroad, Velachery, Chennai – 42, First Edition, Nov.2004.

References

1. Purohit Shammi Agarwal, A text Book of Environmental Sciences, Publisher Mrs.Saraswati Prohit, Student Education , Behind Naswan Cinema Chopansi Road, Jodhpur.
2. Dr.Suresh and K.Dhameja, Environmental Sciences and Engineering , Publisher S.K.Kataria & Sons, 424/6, Guru Nanak Street, Vaisarak, Delhi -110 006.

3.J.Glynn Henry and Gary W Heinke, Environmental Science and Engineering, Prentice Hall of India PrivateLtd., New Delhi – 110 001

Question Paper Pattern for General papers

Environmental Studies

Question Paper Pattern
(External only)

Duration: 3 hours Total Marks: 50

Answer all Questions (5 x 10 = 50 Marks)

Essay type, either or type questions from each unit.

Programme code: 08		**Programme name:** B. Sc. Biotechnology		
Course code: 24VEV201		**PART IV – MORAL AND ETHICS**		
Batch: 2024-2025	**Semester** II	**Hours / Week** 2	**Total Hours** 30	**Credits** 2

Course Objectives

1. To impart Value Education in every walk of life.
2. To help the students to reach excellence and reap success.
3. To impart the right attitude by practicing self introspection.
4. To portray the life and messages of Great Leaders.
5. To insist the need for universal brotherhood, patience and tolerance.
6. To help the students to keep them fit.
7. To educate the importance of Yoga and Meditation.

Course Outcomes (CO)

After completing the course the students:

K1 ↕ K5	CO1	will be able to recognize Moral values, Ethics, contribution of leaders, Yoga and its practice
	CO2	will be able to differentiate and relate the day to day applications of Yoga and Ethics in real life situations
	CO3	can emulate the principled life of great warriors and take it forward as a message to self and the society
	CO4	will be able to Analyse the Practical outcome of practicing Moral values in real life situation
	CO5	could Evaluate and Rank the outcome of the pragmatic approach to further develop the skills

Syllabus

UNIT I: (4 Hours)

Moral and Ethics: Introduction – Meaning of Moral and Ethics – Social Ethics – Ethics and Culture – Aim of Education.

UNIT II: (6 Hours)

Life and Teachings of Swami Vivekananda: Birth and Childhood days of Swami Vivekananda – At the Parliament of Religions – Teachings of Swami Vivekananda

UNIT III: (4 Hours)

Warriors of our Nation: Subhas Chandra Bose – Sardhar Vallabhbhai Patel – Udham Singh – V. O. Chidambaram Pillai – Bhagat Singh – Tiruppur Kumaran – Dheeran Chinnamalai – Thillaiaadi Valliammai – Velu Nachiyar – Vanchinathan

UNIT IV: **(8 Hours)**

Introduction -yoga and its benefits - Ardhasiddhasana- Yoga for peace- Yoga for health - Yoga for wellbeing - Yoga for success - Brain yoga benefits - The science of Yoga.

UNIT V:

(8 Hours)

Isha kriya -Surya Shakthi and it's benefits.

Teaching Methods

Smart Class Room/PowerPoint presentation/Seminar/Quiz/Discussion

Text Books:

- Value Based Education – Moral and Ethics – compiled by Kongunadu Arts and Science College (Autonomous), 3rd Edition (2024).

Reference Books:

1. Swami Vivekananda - A Biography, Swami Nikhilananda, Advaita Ashrama, India, 24th Reprint Edition (2010).
2. Gandhi, Nehru, Tagore and other eminent personalities of Modern India, Kalpana Rajaram, Spectrum Books Pvt. Ltd., revised and enlarged edition(2004).
3. Freedom Fighters of India, Lion M.G. Agrawal, Isha Books Publisher, First Edition (2008).
4. Easy steps to Yoga by Swami Vivekananda, A Divine Life Society Publication (2000).

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Question Paper Pattern

Duration: 3 hours **Total Marks: 50**

Answer all Questions (5 x 10 = 50 Marks)

Essay type, either or type questions from each unit.

Programme code: 08		**Programme name:** B. Sc. Biotechnology		
Course code: 24UHR3N1		PART IV -Non Major Elective –Human Rights		
Batch: 2024-2025	**Semester** III	**Hours / Week** 2	**Total Hours** 30	**Credits** 2

COURSE OBJECTIVES

- To prepare for responsible citizenship with awareness of the relationship between Human Rights, democracy and development.
- To impart education on national and international regime on Human Rights.
- To sensitive students to human suffering and promotion of human life with dignity.
- To develop skills on human rights advocacy
- To appreciate the relationship between rights and duties
- To foster respect for tolerance and compassion for all living creature.

COURSE OUTCOMES

After Completion of the Course the student will be able to

K1	CO1	To understand the hidden truth of Human Rights by studying various provisions in the Constitution of India.
↕	CO2	To acquire overall knowledge regarding the Feminist perspectives in the Liberative Empowerment of Women.
↕	CO3	To gain knowledge about various gender roles and stereotypes involved in the comprehension of gender equality and women's rights.
↕	CO4	To comprehend the legal provisions and policies that foreground the safety of children in the society and to promote awareness.
K5	CO5	To gain enhanced knowledge about sexual and gender minorities to recognize, celebrate and acknowledge the diversified forms of gender expressions and rights.

SYLLABUS

UNIT I **(6 Hours)**

HUMAN RIGHTS HUMANS RIGHTS CONSTITUTION OF INDIA: Humans Rights - Constitution Of India

UNIT II **(6 Hours)**

WOMEN EMPOWERMENT IN INDIA: Feminism And Sexual Violence - Women And Liberation

UNIT III **(6 Hours)**

GENDER EQUALITY AND WOMEN'S RIGHTS: Stereotype Gender Roles - Women's Education, Power And Science

UNIT IV **(6 Hours)**

RIGHTS OF THE CHILD IN INDIA: Status of child in contemporary Indian society - Special Laws and Policies for protection of children

UNIT V **(6 Hours)**

SOGIESC RIGHTS: Understanding SOGIESC- basic Definitions- inclusivity of SOGIESC- importance of studying SOGIESC- presence of SOGIESC in Indian Traditions- temples and cultural practices that exemplify SOGIESC in India- Genetics of Sex determination- Genetics of Intersex community- Successful SOGIESC Personalities and achievers – Alan Turing- Sally Ride- Leonardo da vinci- Alan Hart- Virginia -Woolf- Bayard Rustin- Padmini Prakash- Akkai Padmashali- K Prithika Yashini- Laxmi Narayan Tripati- Madhu Bai Kinnar-Manabi Bandhopadhyay- SOGIESC Rights and laws

Teaching Methods

Smart Class Room/PowerPoint presentation/Seminar/Quiz/Discussion

Books for Study:

1. Human Rights (2024) Compiled by Kongunadu Arts and Science College, Coimbatore –29.

REFERENCES:

1. Human Rights, (2018) by Jaganathan, MA.,MBA.,MMM.,ML.,ML., (Humanitarian Law) and J.P. Arjun
Proprietor: Usha Jaganathan, Refugee Law
Law series, 1st floor, Narmatha Nanthi Street, Magathma Gandhi Nagar, Madurai – 625014.
2. Country Report on SOGIESC Rights In India: An Unfinished Agenda.
Weblink: https://www.ilgaasia.org/publications/india-country-report-an-unfinished-agenda
3. Intersex.

Weblink: https://my.clevelandclinic.org/health/articles/16324-intersex

4. SOGIESC Personalities:

https://www.bbc.com/news/world-asia-india-29357630

https://en.wikipedia.org/wiki/Laxmi_Narayan_Tripathi

https://en.wikipedia.org/wiki/Akkai_Padmashali

https://www.indiatoday.in/india/story/prithika-yashini-india-first-transgender-police-officer-tamil-nadu-969389-2017-04-04

https://yourstory.com/2018/03/first-transgendre-college-principal-west-bengal

5. SOGIESC Rights and laws

https://www.openglobalrights.org/lgbtqia-to-sogiesc-reframing-sexuality-gender-human-rights/

https://static1.squarespace.com/static/5a84777f64b05fa9644483fe/t/625ead0484f9005d75b92 dd0/1650371887436/ILGA+Asia+India+Report+2021.pdf

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Question Paper Pattern

Duration: 3 hrs **Max: 75 marks**

Section - A (10x1=10)

Choose the correct answer

Section - B (5x5=25)

Short answer questions, either or type, one question from each unit.

Section - C (5x8=40)

Essay answer questions, either or type, one question from each unit.

Programme code: 08		**Programme name:** B. Sc. Biotechnology		
Course code: 24UWR4N2		Part IV -Non- Major Elective – Women's Rights		
Batch: 2024-2025	**Semester** IV	**Hours / Week** 2	**Total Hours** 30	**Credits** 2

Objectives

1. To know about the laws enacted to protect Women against violence.
2. To impart awareness about the hurdles faced by Women.
3. To develop a knowledge about the status of all forms of Women to access to justice.
4. To create awareness about Women's rights.
5. To know about laws and norms pertaining to protection of Women.
6. To understand the articles which enables the Women's rights.
7. To understand the Special Women Welfare laws.
8. To realize how the violence against Women puts an undue burden on healthcare services.

Course Outcomes (CO)

After Completion of the Course the student will be able to

K1 ↑	CO1	Appraise the importance of Women's Studies and incorporate Women's Studies with other fields.
	CO2	Analyze the realities of Women Empowerment, Portrayal of Women in Media, Development and Communication.
	CO3	Interpret the laws pertaining to violence against Women and legal consequences.
	CO4	Contribute to the study of the important elements in the Indian Constitution, Indian Laws for Protection of Women.
↓ K5	CO5	Spell out and implement Government Developmental schemes for women and create awareness on modernization and impact of technology on Women.

Syllabus

Unit I **(6 Hours)**

Women's Studies:

Basic concepts of Women's studies in Higher education, Women's studies perspectives- Socialization- Patriarchy- Women's studies as an academic discipline- Growth and development of Women's studies as a discipline internationally and in India

Unit II **(6 Hours)**

Socio-Economic Development of Women:

Family welfare measures, role of Women in economic development, representation of Women in

media, statusof Women land rights, Women Entrepreneurs, National policy for the empowerment of women.

Unit III **(6 Hours)**

Women's Rights – Access to Justice:

Crime against Women, domestic violence – physical abuse- verbal abuse – emotional abuse - economic abuse – minorities, dowry- harassment and death, code of conduct for work place, abetment of suicide.

Unit IV **(6 Hours)**

Women Protective acts:

Protective legislation for Women in the Indian constitution- Anti dowry, SITA, PNDT, and Prevention Sexual Harassment at Workplace (Visaka case), Domestic violence (Prevention) Act.

Unit V **(6 Hours)**

Women and Child welfare:

Safety provisions - various forms of mass media, radio, visual, internet, cyber space, texting, SMS and smart phone usage. Healing measures for the affected Women and child society by private and public sector, NGO and society.

Teaching Methods

Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ video presentation /Podcast /materials from NDLI/class blended learning/ flipped class

Text Book:

1. Women's Rights (2021), Published by Kongunadu Arts & Science College, Coimbatore – 641029.

Reference Books:

1. "Rights of Indian Women" by Vipul Srivatsava. Publisher: Corporate Law Advisor, 2014.
2. "Women's security and Indian law" by Harsharam Singh. Publisher: Aabha Publishers and Distributors,2015.
3. "Women's Property Rights in India" by Kalpaz publications, 2016

QUESTION PAPER PATTERN

Duration: 3 Hours **Max. Marks: 75**

SECTION A (5 x 5 = 25 marks)
Short answers, either or type, one question from each unit.

SECTION B (5 x 10 = 50 marks)
Essay type questions, either or type, one question from each unit.

Programme code: 08		**Programme name:** B. Sc. Biotechnology		
		PART IV -Non- Major Elective – Consumer Affairs		
Batch: 2024-2025	**Semester** VI	**Hours / Week** 2	**Total Hours** 30	**Credits** 2

Course Objectives

1. To familiarize the students with their rights and responsibilities as a consumer.
2. To understand the procedure of redress of consumer complaints.
3. To know more about decisions on Leading Cases by Consumer Protection Act.
4. To get more knowledge about Organizational set-up under the Consumer Protection Act
5. To impart awareness about the Role of Industry Regulators in Consumer Protection
6. To understand Contemporary Issues in Consumer Affairs

Course Outcomes (CO)

K1	CO1	Able to know the rights and responsibility of consumers.
↑	CO2	Understand the importance and benefits of Consumer Protection Act.
↕	CO3	Applying the role of different agencies in establishing product and service standards.
↕	CO4	Analyse to handle the business firms' interface with consumers.
K5	CO5	Assess Quality and Standardization of consumer affairs

SYLLABUS

UNIT I **(6 Hours)**

Conceptual Framework - Consumer and Markets: Concept of Consumer, Nature of markets: Liberalization and Globalization of markets with special reference to Indian Consumer Markets, E-Commerce with reference to Indian Market, Concept of Price in Retail and Wholesale, Maximum Retail Price (MRP), Fair Price, GST, labeling and packaging along with relevant laws, Legal Metrology. Experiencing and Voicing Dissatisfaction: Consumer buying process, Consumer Satisfaction/dissatisfaction-Grievances-complaint, Consumer Complaining

Behaviour: Alternatives available to Dissatisfied Consumers; Complaint Handling Process: ISO 10000 suite

UNIT II **(6 Hours)**

The Consumer Protection Law in India - Objectives and Basic Concepts: Consumer rights and UN Guidelines on consumer protection, Consumer goods, defect in goods, spurious goods and services, service, deficiency in service, unfair trade practice, restrictive trade practice.

Organizational set-up under the Consumer Protection Act: Advisory Bodies: Consumer Protection Councils at the Central, State and District Levels; Adjudicatory Bodies: District Forums, State Commissions, National Commission: Their Composition, Powers, and Jurisdiction (Pecuniary and Territorial), Role of Supreme Court under the CPA with important case law.

UNIT III **(6 Hours)**

Grievance Redressal Mechanism under the Indian Consumer Protection Law - Who can file a complaint? Grounds of filing a complaint; Limitation period; Procedure for filing and hearing of a complaint; Disposal of cases, Relief/Remedy available; Temporary Injunction, Enforcement of order, Appeal, frivolous and vexatious complaints; Offences and penalties.

Leading Cases decided under Consumer Protection law by Supreme Court/National Commission: Medical Negligence; Banking; Insurance; Housing & Real Estate; Electricity and Telecom Services; Education; Defective Products; Unfair Trade Practices.

UNIT IV **(6 Hours)**

Role of Industry Regulators in Consumer Protection

i. Banking: RBI and Banking Ombudsman
ii. Insurance: IRDA and Insurance Ombudsman
iii. Telecommunication: TRAI
iv. Food Products: FSSAI
v. Electricity Supply: Electricity Regulatory Commission
vi. Real Estate Regulatory Authority

UNIT V **(6 Hours)**

Contemporary Issues in Consumer Affairs - Consumer Movement in India: Evolution of Consumer Movement in India, Formation of consumer organizations and their role in consumer protection, Misleading Advertisements and sustainable consumption, National Consumer Helpline, Comparative Product testing, Sustainable consumption and energy ratings.

Quality and Standardization: Voluntary and Mandatory standards; Role of BIS, Indian Standards

Mark (ISI), Ag-mark, Hallmarking, Licensing and Surveillance; Role of International Standards: ISO an Overview.

Note: Unit 2 and 3 refers to the Consumer Protection Act, 2086. Any change in law would be added appropriately after the new law is notified.

Teaching Methods:

Smart Class rooms /Power Point Presentations / Seminars/Quiz /Discussion /Flipped Classrooms

SUGGESTED READINGS:

2. Khanna, Sri Ram, Savita Hanspal, Sheetal Kapoor, and H.K. Awasthi. (2007) Consumer Affairs, UniversitiesPress.
3. Choudhary, Ram Naresh Prasad (2005). Consumer Protection Law Provisions and Procedure, Deep and Deep Publications PvtLtd.
4. G. Ganesan and M. Sumathy. (2012). Globalisation and Consumerism: Issues and Challenges, RegalPublications
5. Suresh Misra and Sapna Chadah (2012). Consumer Protection in India: Issues and Concerns, IIPA, NewDelhi
6. Rajyalaxmi Rao (2012), Consumer is King, Universal Law Publishing Company
7. Girimaji, Pushpa (2002). Consumer Right for Everyone Penguin Books.
8. E-books :-www.consumereducation.in
9. Empowering Consumers e-book,www.consumeraffairs.nic.in
10. ebook,www.bis.org
11. The Consumer Protection Act, 2086 and its later versions.

Question paper pattern (External Only)

Duration: 3 hrs Max: 75 Marks

Section A (5 x 5=25)

Short notes

Either – or / type – question from each unit.

Section B (5 x 10=50)

Essay type

Either – or / type – question from each unit.

Programme code: 08	**Programme name:** B. Sc. Biotechnology		
Course code: 24UBT0J1	JOC1 – Clinical Research & Medical Coding		
Batch	Hours / Week	Total Hours	Credits
2024-2025	2	30	2

Course Objectives

1. To understand the concepts of human anatomy and physiology
2. To learn the various medical terminology of organs and treatment strategies for medical coding
3. To Interpret and understand healthcare documentation and billing
4. To understand diagnostic procedure codes using ICD coding systems

Course Outcomes (CO)

After completion of the course, the students will be able to:

K1 ↕ K4	CO1	Explaining anatomy and physiology concepts of organs with medical terminology.
	CO2	Understanding the different procedures involved in medical documentation
	CO3	Applying the standard coding resources for medical billing
	CO4	Understanding the pharmaceutical codes for identifying medications

Syllabus

UNIT I **(**6 Hours**)**

Anatomy and Physiology I: Introduction to Integumentary System – thermoregulation, types, functions. Musculoskeletal System - Concepts, types, Structural and functional features. Cardiovascular System – Systemic circulation, Function and diseases.

UNIT II (6 Hours)

Anatomy and Physiology II: Respiratory System – Physiology of respiration, Parts and functions. Gastrointetinal system- Basic Medical Science, Clinical assessment and investigation. Gentinourinary System – Urinary tract structure and infection, **Regulation of osmolality and infection***

UNIT III (6 Hours)

Anatomy and Physiology III: Eye, Ear, Nose and throat - Anatomy and clinical correlates. Nervous System – Neurophysiology and function

UNIT IV (6 Hours)

Endocrine System – Introduction and hormonal functions. Exocrine system – Physiology and Biological importance. Lymphatic system – Anatomy, functions and disorders

UNIT V (6 Hours)

ICD: ICD 10 CM Overview, CPT Overview, HCPCS and Modifiers, Pharmaceutical codes for identifying medications, **The Systematized Nomenclature of Medicine (SNOMED)***

Denotes self-study

Teaching Methods

Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz /Discussion / Assignment/ Demonstration/ video presentation /Podcast /materials fromNDLI/class blended learning/ flipped class

Text Books

1. Zahoor ul Haq Bhat, 2018. Khel Sahithya Kendra Publisher, First Edition, Pages 137.
2. Medical Coding Training: Practical Application ICD 10CM CPC®- AAPC; AAPC publisher; 2022; ISBN-13:978-1-626880-924

References

1. Ross and Wilson, 2018. Anatomy and Physiology in Health and Illness , 13th Edition, Elsevier Health Science.
2. http://www.icd10data.com/

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	S	H	S	M
CO2	M	M	S	M	H
CO3	H	H	M	S	H
CO4	H	S	M	H	S

S – Strong H – High M – Medium L – Low

Programme code: 08	**Programme name:** B. Sc. Biotechnology		
Course code : 24UBT0J2	JOC 2 – Agro industrial biotechnology		
Batch 2024-2025	Hours / Week 2	Total Hours 30	Credits 2

Course Objectives

1. To provide knowledge on Indian agriculture, biomass, biofertilizer and biocontrol agents
2. To develop students technical skills on bio fertilizer and Biocontrol agents production
3. To encourage natural ways of crop disease management

Course Outcomes (CO)

After completion of the course, the students will be able to:

K1	CO1	Defining and to impart training of ecofriendly agricultural inputs so as to nullify the ill effects of chemical fertilizers.
↕	CO2	Illustrating the production and use of biopesticides, bio-control agents etc as alternative inputs in organic farming
	CO3	Demonstrating the effectiveness of biofertilizer cultural practices in the farmers fields for enhanced crop productivity through bioreclamation of waste land
K4	CO4	Analyzing and promoting disease management in the country

Syllabus

UNIT I **(**6 Hours**)**

History of Indian Agriculture, Green Revolution in India, Cropping patterns in India, Soil, Rainfall Patterns in India. Agroindustries.

UNIT II **(6 Hours)**

Biofertilizers: Isolation, purification and characterization of *Rhizobium, Azospirillum, Blue green algae*, *Azolla* and *Frankia*. Screening for their activity and strain improvement, Spirulina, biogas, biodiesel, SCP, mushroom.

UNIT III **(6 Hours)**

Biocontrol agents: Types: parasites, parasitoids, predators and entomopathogenic nematodes. and mass production strategies of Biocontrol agents, Field application methods.

UNIT IV **(6 Hours)**

Biopesticides: Definition and significance, mass production and formulation of microbial control agents: Bt and NPV. Economics of production of biocontrol agents and biopesticides: cost of production, capital cost and profit.

UNIT V **(6 Hours)**

Disease Management: Major crops and major diseases in India. Emerging diseases, Alternate approaches of disease management. Drought, Salinity, Cold tolerant crops in India and its economic importance. Post harvest and storage of grains. Economic importance. Post harvest and storage of grains.

Teaching Methods

Power point presentation/ Google Class Rooms/Smart Class Rooms /Seminar /Quiz/Discussion / Assignment/ Demonstration/ video presentation /Podcast /materials from NDLI/class blended learning/flipped class

Text book

1. Ahindra Nag, (2009). Textbook of Agricultural Biotechnology, PHI LearningPrivate Ltd., NewDelhi,
2. Dubey, R.C., (1996). A Textbook of Biotechnology, S. Chand and Co. Ltd., New Delhi.

References

1. Subba Rao. N.S., (1982). Biofertilizers, In: Advances in Agricultural Science. Oxford and IBHPub. Co., New Delhi.
2. Tanuja S. (2008). Biofertilizer Technology. Agrobios (India).
3. Mahendra Rai. (2006). Handbook of Microbial Biofertilizers, CRC Press.

MAPPING

PSO / CO	PSO1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	S	M	S	M	M
CO2	H	S	M	H	S
CO3	M	H	S	S	S
CO4	S	H	H	H	H

S – Strong H – High M – Medium L – Low