Dr. N.G.P. ARTS AND SCIENCE COLLEGE

(An Autonomous Institution, Affiliated to Bharathiar University, Coimbatore)
Approved by Government of Tamil Nadu and Accredited by NAAC with 'A++' Grade (3rd Cycle-3.64 CGPA)
Dr. N.G.P. - Kalapatti Road, Coimbatore-641048, Tamil Nadu, India
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2025-26 for Post Graduate Programme

(Outcome Based Education model with Choice Based Credit System)

M.Sc. Biotechnology Degree

(For the students admitted during the academic year 2025-26)

Programme: Biotechnology

Eligibility:

A candidate who has passed in Higher Secondary Examination with any Academic Stream or Vocational Stream as one of the subjects under Higher Secondary Board of Examination and as per the norms set by the Government of Tamil Nadu or an Examination accepted as equivalent thereto by the Academic Council, subject to such conditions as may be prescribed thereto are permitted to appear and qualify for the **M.Sc. Biotechnology Examination** of this College after a programme of study of three academic years.

Programme Educational Objectives:

The Curriculum is designed to attain the following learning goals which students shall accomplish by the time of their graduation:

1. This programme will enable students to acquire knowledge on the fundamentals of Biochemistry, Cell biology, Microbiology and Molecular biology. It helps them to understand emerging and advanced concept in modern biology and guide them to take up their carrier in this field.

2. This programme will facilitate the students to acquire knowledge in fields such as Genetic Engineering, Protein Engineering and Molecular Therapeutics.

3. The programme will aid the students to learn the recent developments in the field of Genomics, Proteomics, Stem cell biology and Tissue Engineering approach.

PROGRAMME OUTCOMES:

On the successful completion of the program, the following are the expected outcomes.

PO Number	PO Statement
PO1	Impart quality biotechnology education to students and to develop young minds as outstanding scholars/teachers/entrepreneurs and responsible citizens.
PO2	Apply their understanding of the commercialization processes to biotechnology products or services in future.
PO3	Graduates of the course will have strong background in the interface of biotechnology and be able to use the tools in industry and/or institutes wherever necessary.
PO4	Ability to design and carry out experiments (safely) and to interpret experimental data and apply the scientific method by developing valid hypotheses, designing experiments, gathering relevant data using current technology, and interpreting quantitative and qualitative data.
PO5	Develop an awareness of ethical issues in biochemical research and careers options along with understanding of the area of biotechnology chosen.

TOTAL CREDIT DISTRIBUTION

Courses	Credits	Total Marks		Credits	Cumulative Total credits
Core Theory	4	13 X 100 =	1300	52	78
Core Theory	3	1 X 100 =	100	03	
Core Lab	3	3 X 100 =	300	09	
Core Lab	2	3 x100 =	300	06	
Project and Viva Voce	8	1 X 200=	200	08	
Elective	4	4X 100 =	400	12	12
Internship	2	1X100	100	02	2
		Total	**2700**	**92**	**92**

PG CURRICULUM

BIOTECHNOLOGY
AY 2025- 2026

Course Code	Course Category	Course Name	L	T	P	Instruction Hours		Exam (h)	Max Marks			Credits
						Week	Total		CIA	ESE	Total	
First Semester												
25BTP1CA	Core -I	Molecular Biology and Genetics	4	-	-	4	48	3	25	75	100	4
25BTP1CB	Core -II	Biochemistry	4	-	-	4	48	3	25	75	100	4
25BTP1CC	Core -III	Microbiology	4	-	-	4	48	3	25	75	100	4
25BTP1CD	Core - IV	Biodiversity and Bioprospecting	4	-	-	4	48	3	25	75	100	4
25BTP1CP	Core Practical- I	Molecular Biology, Genetics and Biochemistry	-	-	5	5	60	6	40	60	100	2
25BTP1CQ	Core Practical - II	Microbiology, Biodiversity and Bioprospecting	-	-	5	5	60	6	40	60	100	2
25BTP1DA	DSE-I	Applied Biotechnology	3	1	-	4	48	3	25	75	100	3
25MBP1DA		Microbial Technology										
25BCP1DA		Cancer Biology, Diagnosis and Therapy										
Total			**19**	**1**	**10**	**30**	**360**				**700**	**23**

Course Code	Course Category	Course Name	L	T	P	Instruction Hours		Exam (h)	Max Marks			Credits
						Week	Total		CIA	ESE	Total	
Second Semester												
25BTP2CA	Core - V	Immunotechnology	4	-	-	4	48	3	25	75	100	4
25BTP2CB	Core -VI	Genetic Engineering	4	-	-	4	48	3	25	75	100	4
25BTP2CC	Core -VII	Environmental Biotechnology	4	-	-	4	48	3	25	75	100	4
25BTP2CD	Core -VIII	Bioprocess Technology	4	-	-	4	48	3	25	75	100	4
25BTP2CP	Core Practical – III	Immunotechnology and Bioprocess Technology	-	-	4	4	48	6	40	60	100	2
25BTP2CQ	Core Practical –IV	Genetic Engineering and Environmental Biotechnology	-	-	6	6	72	6	40	60	100	3
25BTP2DA	DSE- II	Forensic Biotechnology	3	1	-	4	48	3	25	75	100	3
25MBP2DA		Bionanotechnology										
25BCP2DA		Biochemistry of Toxicology										
		Total	**19**	**1**	**10**	**30**	**360**	-	-	-	**700**	**24**

Course Code	Course Category	Course Name	L	T	P	Instruction Hours		Exam (h)	Max Marks			Credits
						Week	Total		CIA	ESE	Total	
Third Semester												
25BTP3CA	Core - IX	Research Methodology andIPR	4	-	-	4	48	3	25	75	100	4
25BTP3CB	Core - X	Genomics and Proteomics	4	-	-	4	48	3	25	75	100	4
25BTP3CC	Core -XI	Marine Biotechnology	4	-	-	4	48	3	25	75	100	3
25BTP3CD	Core -XII	Plant Biotechnology	4	-	-	4	48	3	25	75	100	4
25BTP3CE	Core -XIII	Animal Biotechnology	4	-	-	4	48	3	25	75	100	4
25BTP3CP	Core Practical - V	Plant, Animal, Marine Biotechnology, Genomics and Proteomics	-	-	6	6	72	6	40	60	100	3
25BTP3DA	DSE -III	Molecular Therapeutics	3	1	-	4	48	3	25	75	100	3
25MBP3DA		Medical Laboratory Techniques										
25BCP3DA		Free Radicals and Antioxidant System										
25BTP3CT	Internship		-	-	-	-	-	3	40	60	100	2
		Total	**23**	**1**	**6**	**30**	**360**	-	-	-	**800**	**27**

Course Code	Course Category	Course Name	L	T	P	Instruction Hours		Exam (h)	Max Marks			Credits
						Week	Total		CIA	ESE	Total	
Fourth Semester												
25BTP4CA	Core - XIV	Pharmaceutical Biotechnology	4	-	-	4	48	3	25	75	100	4
25BTP4CP	Core Practical - VI	Pharmaceutical Biotechnology	-	-	6	6	72	6	40	60	100	3
25BTP4CV	Project	Project and Viva Voce	-	-	16	16	192	-	80	120	200	8
25BTP4DA	DSE - IV	Stem Cell Technology	3	1	-	4	48	3	25	75	100	3
25MBP4DA		Molecular Diagnostics and Bioinformatics										
25BCP4DA		Neurobiology										
		Total	**7**	**1**	**22**	**30**	**360**	-	-	-	**500**	**18**
		Grand Total									**2700**	**92**

DISCIPLINE SPECIFIC ELECTIVE

Students shall select the desired course of their choice in the listed elective course during Semesters I - IV

Semester I (Elective I) List of Elective Courses

S. No.	Course Code	Name of the Course
1.	25BTP1DA	Applied Biotechnology
2.	25MBP1DA	Microbial Technology
3.	25BCP1DA	Cancer Biology,Diagnosis and Therapy

Semester II (Elective II)

List of Elective Courses

S. No.	Course Code	Name of the Course
1.	25BTP2DA	Forensic Biotechnology
2.	25MBP2DA	Bionanotechnology
3.	25BCP2DA	Biochemistry of Toxicology

Semester III (Elective III) List of Elective Courses

S. No.	Course Code	Name of the Course
1.	25BTP3DA	Molecular Therapeutics
2.	25MBP3DA	Molecular Diagnostics in Microbiology
3.	25BCP3DA	Free Radicals and Antioxidant System

Semester IV (Elective IV)

List of Elective Courses

S. No.	Course Code	Name of the Course
1.	25BTP4DA	Stem Cell Technology
2.	25MBP4DA	Molecular Diagnostics and Bioinformatics
3.	25BCP4DA	Neurobiology

EXTRA CREDIT COURSES

The following are the courses offered under self study to earn extra credits:

S. No.	Course Code	Course Title
1.	25BTPSSA	Food Biotechnology
2.	25BTPSSB	Developmental Biology

Semester - I
CORE: MOLECULAR BIOLOGY AND GENETICS

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	25BTP1CA	MOLECULAR BIOLOGY AND GENETICS	CORE	48	-	-	4

Preamble	This course has been designed for students to learn and understand • The replication and repair mechanism in prokaryotic and eukaryotic cells • The Transcription, translation and Translational inhibitors. • The concept of human genetics, disorders and inheritance pattern
Prerequisite	Knowledge on Basic Molecular biology and Genetics

Course Outcomes (COs)

CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Understand the mode of DNA replication and repair mechanisms	K2
CO2	Study the mechanism of transcription	K2
CO3	Infer translational events and its role in gene expression.	K3
CO4	Integrate the human genetics and various genetic disorders	K4
CO5	Generalize the inheritance pattern and population genetics	K4

Mapping with Program Outcomes:

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓		✓
CO2	✓	✓	✓		
CO3		✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	

25BTP1CA	CORE: MOLECULAR BIOLOGY AND GENETICS

Syllabus

Unit	Content	Hours	E-Contents / Resources
I	Introduction and history of molecular biology, Central Dogma, Replication & experimental proof for semiconservative method. Enzymes & accessory proteins involved in DNA replication. DNA replication and regulation mechanism in prokaryotes & eukaryotes. DNA Repair mechanism - Nucleotide excision, Base excision, Mismatch repair, Double-strand breakage repair, Photo-reactivation, SOS and Recombination repair. Recombination: Homologous and site-specific recombination.	12	Text Book
II	Importance of DNA binding proteins, RNA polymerase. Mechanism of transcription in prokaryotes & eukaryotes. Transcriptional and post- transcriptional gene silencing. mRNA stability and localization. RNA processing - r-RNA & t- RNA processing, mRNA 5' capping, 3'-end processing and polyadenylation, RNA splicing, RNA Editing, Nuclear export of mRNA and mRNA-based therapeutics.	09	Reference Book
III	Overview of Genetic code, codon, anticodon and wobble hypothesis. The translation machinery, role of tRNA & ribosome. Mechanism of translation in Prokaryotes & Eukaryotes. Post translational modifications of proteins- Phosphorylation, Deformylation, Glycosylation, Acetylation, Amidation, Lipid attachment, S - Nitrosylation and Disulfide bond formation. Translation Regulation- Translational inhibitors, Control of gene expression at translational level.	08	Reference book
IV	Overview on mendelian and non-mendelian inheritance. Human Genetics - Introduction to human genetics. Chromosomal changes resulting in abnormal phenotype: Numerical (Aneuploidy) changes resulting in genetic syndromes eg: Turner, Down & Klinefelter Syndromes. Structural changes resulting in genetic diseases: eg: Cri-du-chat syndrome. Genetic Diseases and Inheritance Pattern: Autosomal inheritance – Dominant (Eg: Adult polycystic kidney, Achondroplasia); Autosomal inheritance – Recessive (Eg: Albinism, Sickle Cell Anemia, Phenyl Ketonuria); X-linked: Recessive (Eg: Duchenne muscular dystrophy – DMD); X-linked: Dominant (eg. Xg blood group); Y-linked inheritance (Holandric – eg. Testes determining factor); Mitochondria disorders like LHON, DAD, MERRF and MELAS. Cancer genetics.	09	Reference Book
V	Pedigree analysis; Diagnosis of disease: Molecular cytogenetics, DNA markers - VNTR, STR, microsatellite, SNP and their	10	Reference

	detection techniques - RFLP genotyping, RAPD, AFLP. Prevention of disease: Prenatal diagnosis; Genetic counseling. Population genetics: Organization and measure of genetic variation: Random mating population, Hardy-Weinberg principle. Sources responsible for changes in gene frequencies: Mutation, selection, migration and isolation; random genetic drift; insights into human migration, natural selection and evolution.		Book
	Total	**48**	

Text Book	1.	George M Malacinski, 2015, "Freifelders Essentials of Molecular Biology", 4th Edition, Jones & Bartlett Publisher. USA.
Reference Books	1.	Harvey Lodish, Arnold Berk, Chris A Kaiser, Monty Krieger, Anthony Bretscher, 2021, "Molecular Cell Biology", 9th Edition, W H Freeman & Co. USA.
	2.	David L Nelson and Michael Cox, 2021, "Lehninger Principles of Biochemistry", 8th Edition, W.H. Freeman & Co Ltd., USA
	3.	Eldon John Gardner, Peter Sunstad D and Michael J Simmons,1991, "Principles of Genetics", 8th Edition, Johnn Wiley & Sons Inc, USA.
	4.	Tamarin Robert H, 2002, " Principles of Genetics", 7th Edition, Tata McGraw- Hill Publishing Company Limited, New Delhi.

Journal and Magazines	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3883366/ https://ncert.nic.in/textbook/pdf/kebt108.pdf
E-Resources and Website	https://learn.genetics.utah.edu https://www.cdc.gov/genomics/about/basics.htm https://www.dnaftb.org/#organization

Learning Methods	Chalk and Talk/Assignment/Seminar/Video presentation

Focus of the Course	Skill Development/Employability

Semester - I
CORE: BIOCHEMISTRY

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	25BTP1CB	BIOCHEMISTRY	CORE	48	-	-	4

Preamble	This course has been designed for students to learn and understand • The Structure of Biomolecules. • The Function and Biosynthesis of the Biomolecules. • Metabolism and their regulatory pathways.
Prerequisite	Knowledge on Biomolecules and its functions

Course Outcomes (COs)

CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Experiment the physical properties, classification, metabolism and disorders of carbohydrates	K4
CO2	Interpret the concepts of structure and functions, metabolism and disorders of lipids and fatty acids	K4
CO3	Summarize the biosynthesis of amino acids and disorders related to amino acids	K4
CO4	Integrate the mechanism, kinetics and inhibition of enzymes and coenzymes	K5
CO5	Appraise the regulatory mechanism of different metabolism activities and their disorders of nucleic acid	K5

Mapping with Program Outcomes:

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓		✓		✓
CO2	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓

25BTP1CB | CORE: BIOCHEMISTRY

Syllabus

Unit	Content	Hours	E-Contents / Resources
I	Classification and reactions: occurrence, properties and biological reactions. Structural features of carbohydrates and Conjugated carbohydrates (Glycoproteins and Glycolipids), Glycolysis and TCA cycle; Glycogen breakdown and synthesis; Gluconeogenesis; interconversion of hexoses and pentoses. Carbohydrate metabolic disorders. Glycogen storage diseases. Lectins – characteristics and functions in biological system.	10	Text Book
II	Classification, Structure, functions and reactions of Lipids, Biosynthesis of fatty acids, Triglycerides, phospholipids and Sterols, Catabolism of Fatty acids - Oxidation (α, β and ω), Catabolism of triglycerides and phospholipids, Essential fatty acids and their physiological functions. Disorders associated with lipid metabolism and its therapeutic intervention - ketone bodies and ketosis; fatty liver, atherosclerosis.	10	Text Book
III	Classification and Biosynthesis. Peptides, Classification of Protein, Primary structure of proteins, structural comparison at secondary and tertiary levels (Ramachandran Plot), quaternary and domain structure and architecture. Motifs, functional relationship between domains and function of protein. Regulation of Protein metabolism. Protein metabolism in prolonged fasting. Disease related to protein folding – Alzheimer's and mad cow disease.	8	Reference Book
IV	IUBMB classification of enzymes, active site, Lock and key Model and induced fit hypothesis. Factors affecting enzyme activity, Mechanism of enzyme catalysis: Lysozyme, Enzyme kinetics- Michaelis – Menten (MM) equations, Transformations of MM equation and their significance, Enzyme inhibition: Reversible – Competitive, Noncompetitive, Uncompetitive, Irreversible inhibition, Kinetics of Enzyme inhibition. Isoenzymes, allosteric enzymes, ribozymes, abzymes and artificial enzymes. Diseases Caused By Deficiency Of Digestive Enzymes-Obesity, Galactosemia, Maple Syrup Urine Disease.	10	Reference Book
V	Nucleic acids: Structural characteristics of A, B and Z-DNA. 3D structure of t-RNA, ribozymes and riboswitches. Biosynthesis of Nucleotides –De nova and Salvage pathway, Regulations of Purines and Pyrimidine, Metabolism of Purine and Pyrimidine. Disorders of nucleic acids metabolism- Gout, Lesch-Nyhan syndrome, oroticaciduria, and xanthinuria.	10	Text Book
	Total	**48**	

Semester - I
CORE : MICRO BIOLOGY

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	25BTP1CC	MICROBIOLOGY	CORE	48	-	-	4

Preamble	This course has been designed for students to learn and understand • The applications of biotechnology in plant , animal and Environmental field the basic concept of sequence and series • The applications of biotechnology in health care sector • The interaction of microbes with host and the control measures
Prerequisite	Knowledge on Basic Microbiology

Course Outcomes (COs)

CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Interpret the Microbial classification and their preservation	K4
CO2	Infer the techniques used in Microbial identification	K4
CO3	Relate the role of microbes in agricultural field	K5
CO4	Analyze the causes for various infections	K5
CO5	Find the solutions to control the spread of infections	K5

Mapping with Program Outcomes:

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	
CO2	✓	✓	✓	✓	
CO3	✓	✓	✓	✓	✓
CO4	✓	✓		✓	✓
CO5	✓	✓	✓	✓	✓

Text Book	1.	Lehninger AL and Cox M M, 2013, "Principles of Biochemistry", 6th edition, W. H. Freeman and Company, New York.
Reference Books	1.	Rodwell VW, Bender DA, Botham KM, Kennelly PJ, and Weil PA, 2018, "Harper's Illustrated Biochemistry", 31st edition, McGraw Hill publications, New Delhi.
	2.	Voet D and Voet J G, 2011, "Biochemistry". 4th edition. John Wiley and Sons Inc. USA.
	3.	Ramadevi K, 2016, "Ambika Shanmgam's Fundamentals of Biochemistry for Medical Students". 8th edition, Wolters Kluwer (India) Pvt, Ltd., New Delhi.
	4.	Fromm HJ and Hargrovem, 2012, "Essentials of Biochemistry", Springer publisher.

Journal and Magazines	Journal of Applied Biochemistry and Microbiology https://link.springer.com/journal/10438
E-Resources and Website	https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=MNhNzp1RQlU+6LM40KjY1Q==

Learning Methods	Chalk and Talk/Assignment/Seminar

Focus of the Course	Skill Development/Employability

25BTP1CC	CORE: MICROBIOLOGY

Syllabus

Unit	Content	Hours	E-Contents / Resources
I	Concepts of species and hierarchical taxa – Bacterial nomenclature– Bergey's system of Classification, Classification of Fungi and Viruses, Polyphasic taxonomy, Preservation and maintenance of microbes, Microbial Culture Collection centers – India and International organizations, Modern methods to study microbial diversity: NGS.	08	Text Book
II	Microbial Identification through physiological and biochemical methods (BIOLOG, Vitex). Techniques used in diversity analysis – Fatty Acid Methyl Ester (FAME), 16S rRNA & 18s rRNA gene sequencing. Mol % G+C analysis, DNA-DNA hybridization, Molecular methods to study complex microbial communities: DGGE, SSCP, T-RFLP and FISH.	10	Text Book
III	Spoilage of food – Principles and types; Food preservation: physical and chemical- Food sanitation – Food poisoning – Food borne pathogens – Quality control and Food laws. Role of microorganisms in soil fertility – Role of nif gene in Biological nitrogen fixation, Plant microbe interaction: Biopesticides (*B. thuringiensis* and NPV) - Biofertilizers - PGPR –mycorrhiza	10	Reference Book
IV	Bacterial Diseases: Host-parasite relationship, epidemiology, pathogenesis, prevention and treatment – Mycobacterium, Salmonella and Yersinia. Viral Diseases: Epidemiology, pathogenesis, prevention and Treatment - H1N1, HIV, SARS-COV-2. Fungal Diseases: Infections caused by yeast: Candida. Filamentous Fungi: *Aspergillus* sp. Protozoan Diseases: Malaria, Leishmaniasis.	10	Reference Book
V	Concept of sterilization and disinfection. Physical and chemical methods of microbial control. Chemotherapeutics, susceptibility test (broth procedures and diffusion methods), mode of action of antibiotics, narrow and broad spectrum (Penicillin, ampicillin, sulfonamide, vancomycin, tetracycline, chloramphenicol), antifungals (clotrimazole, fluconazole), antiretroviral (tenofovir, AZT).	10	Text Book
	Total	**48**	

Text Book	1.	Pelczar MJ Jr., Chan ECS and Kreig NR., 1993, "Microbiology", 5th Edition, Tata McGraw Hill, New Delhi.
	2.	Vijaya Ramesh, K, 2020, "Food Microbiology"1st Edition, MJP Publishers, Chennai
Reference Books	1.	Joanne Willey, Kathleen Sandman, Dorothy Wood, 2020, "Prescott's Microbiology", 11th Edition, McGraw Hill Education, New York.
	2.	David H. Persing, Fred C. Tenover, James Versalovic, Yi-Wei Tang, Elizabeth R. Unger, David A. Relman, Thomas J. White, 2004, "Molecular Microbiology-Diagnostic Principles and Practice, 1st Edition, ASM Press, Washington, DC.
	3.	William C. Frazier, Dennis C. Westhoff, 2021, "Food Microbiology", 1st Edition, McGraw Hill Education, India.
	4.	David Greenwood, Richard C.B. Slack, John F Peutherer, 2002, "Medical Microbiology – A Guide to Microbial Interactions: Pathogenesis, Immunity, Laboratory Diagnosis and Control", 16th Edition, Churchill Livingstone, Edinburgh.

Journal and Magazines	International Journal of Microbiology
E-Resources and Website	American Society for Microbiology https://youtu.be/5iz6Ar2nTVU

Learning Methods	Chalk and Talk/Assignment/Seminar

Focus of the Course	Entrepreneurial Development /Employability

Semester - I
CORE: BIODIVERSITY AND BIOPROSPECTING

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	25BTP1CD	BIODIVERSITY AND BIOPROSPECTING	CORE	48	-	-	4

Preamble	This course has been designed for students to learn and understand • The importance of biodiversity and various methods of conservation • The Bioprospecting potentials of available natural resources • The regulations related with biodiversity and Bioprospecting
Prerequisite	Knowledge on Different types of Biodiversity

Course Outcomes (COs)

CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Articulate the types of biodiversity, the threats to the biodiversity and Biodiversity hotspots	K2
CO2	Illustrate the discovery of medicinal compounds from natural products and their significance	K2
CO3	Infer the sustainable utilization of microbial resources and benefit sharing	K3
CO4	Report the screening and purification process of various bioactive substances	K4
CO5	Formulate regulations and laws for Bioprospecting	K3

Mapping with Program Outcomes:

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2		✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓		
CO5	✓	✓	✓		✓

25BTP1CD	CORE: BIODIVERSITY AND BIOPROSPECTING

Syllabus

Unit	Content	Hours	E-Contents / Resources
I	Biodiversity- Facts about global & Indian biodiversity- Hot spots of Indian Biodiversity- Types of Biodiversity- Measures of Biodiversity (alpha, beta & gamma)-Threats to Biodiversity, Endemic, threatened, Red List of IUCN- National biodiversity strategy and action plan (Initiatives to conservation (international & national)- Organization involved in Biodiversity conservation and research (NBA, BSI, and ZSI)- The biological diversity act 2002	10	Text Book
II	Drugs derived from plants, Antitumor agent - Etoposide, Colchicine, Taxol, Vinblastine, Vincristine. Cardiotonic – Convallatoxin, Acetyldigoxin, Adoniside. Antiinflammatory – Aescin, Bromelain. Choleretic – Curcumin. Laxatives, Antimalarial Quinine- Cinchona. Morphine-Opium plant-analgesic. Volatile, pigments and terpenes, Phenols, flavonoids.	10	Reference Book
III	Screening for bioactivity, antimicrobials, pharmacologically active agents of microbial origin, Bioprospecting for industrial enzymes, plant growth promoting agents, antifoulants and anti-biofilm agents from microbes. Bioprospecting of marine organisms. Bio piracy issues	10	Text Book
IV	Drug discovery and product development: Discovery from traditional medicine. Modern tools in drug discovery. Role of chromatography in drug analysis including HPLC, GC and LC and GC Mass spectrometry, FTIR, -NMR their principles and merits. Product development procedures and policies	10	Text Book
V	Regulations on bio-prospecting, access and benefit-sharing (National Environmental Management: Biodiversity act, 2004)- Rules and regulations in patenting and Intellectual Property Rights of Bio-Prospecting products in India	08	Text Book
	Total	**48**	

Text Book	1.	Russell Paterson, Nelson Lima, 2016, "Bioprospecting: Success, Potential and Constraints", 1st Edition, Springer International Publications.
Reference Books	1.	Santosh Kumar Upadhyay, Sudhir P. Singh, 2021, "Bioprospecting of Plant Biodiversity for Industrial Molecules", 1st Edition, John Wiley & Sons Ltd, USA.
	2.	Jeffries MJ, 2006, "Biodiversity and Conservation", 2nd Edition, Routledge, USA.
	3.	Vanesha S, 2010, "Marine Bioprospecting and Natural Product Research", 1st Edition, LAP Lambert Academic Publishing, Germany.
	4.	Dubey KN and Yadav GP, 2011, "Biodiversity - Threats to Conservation", 1st Edition, Axis Publication, India.

Journal and Magazines	Home | Biodiversity and Conservation (springer.com) https://link.springer.com/journal/13659
E-Resources and Website	Microsoft Word - Frisvold FINAL.doc (arizonalawreview.org) https://portals.iucn.org/library/sites/library/files/documents/2003-025.pdf

Learning Methods	Chalk and Talk/Power Point Presentation/Assignment/Seminar

Focus of the Course	Skill Development/Employability/ Intellectual Property Rights/ Social Awareness/ Environment

Semester – I CORE PRACTICAL: MOLECULAR BIOLOGY, GENETICS AND BIOCHEMISTRY							
Semester	**Course Code**	**Course Name**	**Category**	**L**	**T**	**P**	**Credits**
I	**25BTP1CP**	**MOLECULAR BIOLOGY, GENETICS AND BIOCHEMISTRY**	**CORE**		**-**	**60**	**2**

Preamble	This course has been designed for students to learn and understand • Genetic material and its transfer • Various Biomolecules and its analysis • Separation of Biomolecules
Prerequisite	Knowledge of Genetic material and Biomolecules

Course Outcomes (Cos)		
CO Number	**Course Outcomes (COs) Statement**	**Bloom's Taxonomy Knowledge Level**
CO1	Purify Genetic Material from Human Blood.	K3
CO2	Perform various gene transfer techniques.	K3
CO3	Assess the amount of carbohydrates in various samples and interpret the results.	K4
CO4	Quantify the aminoacids and proteins in various samples and interpret the results.	K4
CO5	Measure the amount of nucleic acids and interpret the results.	K4

Mapping with Program Outcomes:					
Cos / POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	
CO3	✓	✓	✓	✓	
CO4	✓	✓	✓	✓	
CO5	✓	✓	✓	✓	✓

25BTP1CP	CORE PRACTICAL: MOLECULAR BIOLOGY, GENETICS AND BIOCHEMISTRY

S.No	List of Programs
1	Isolation of genomic DNA from human blood sample.
2	Bacterial conjugation.
3	Bacterial Transformation.
4	Molecular analysis using RAPD.
5	RFLP analysis.
6	Estimation of total Protein and albumin from serum.
7	Estimation of glucose from serum.
8	Estimation of Vitamin C from Citrus fruit.
9	Estimation of total amino acids from serum.
10	Estimation of DNA & RNA.
11	Determination of blood cholesterol.
12	Separation of amino acids from serum Paper Chromatography.

Texk Books	1.	Sambrook, J. and Green, M.R., 2012, "Molecular Cloning: A Laboratory Manual", 4th Edition, Cold Spring Harbor, USA.
	2.	Sadasivam, S. and Manickam, A, 1996, "Biochemical Methods", 4th edition, New Age International, India.

Learning Method	Demonstration/ Hands on Experiments

Focus of the Course	Skill Development/ Employability

Semester – I CORE PRACTICAL: MICROBIOLOGY, BIODIVERSITY AND BIOPROSPECTING							
Semester	**Course Code**	**Course Name**	**Category**	**L**	**T**	**P**	**Credits**
I	**25BTP1CQ**	**MICROBIOLOGY, BIODIVERSITY AND BIOPROSPECTING**	**CORE**		**-**	**60**	**2**

Preamble	This course has been designed for students to learn and understand • Microbial isolation techniques • Observation of Microbes and other substances under microscope • Separation of Phytochemicals and its analysis
Prerequisite	Knowledge of Microbes and Biodiversity

Course Outcomes (Cos)		
CO Number	**Course Outcomes (COs) Statement**	**Bloom's Taxonomy Knowledge Level**
CO1	Isolate and Purify enzyme and antibiotic producing microbes.	K3
CO2	Isolate microbes from food materials.	K3
CO3	Analyze the microbial and pollen structures.	K4
CO4	Identify various phytochemicals in plants.	K4
CO5	Separate and purify the phytochemicals.	K4

Mapping with Program Outcomes:					
Cos / POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	
CO3	✓	✓	✓	✓	
CO4	✓	✓	✓	✓	
CO5	✓	✓	✓	✓	✓

25BTP1CQ	CORE PRACTICAL: MICROBIOLOGY, BIODIVERSITY AND BIOPROSPECTING

S.No	List of Programs
1	Isolation of enzyme producing Bacteria from soil.
2	Isolation of Antibiotic producing microorganisms against pathogen.
3	Isolation of Fungi from spoiled food.
4	Sampling and analysis of microbial load on food contact surfaces.
5	Morphological Analysis of Microbes using stereomicroscope.
6	Observation of fungal morphology using Phase contrast microscopy.
7	Methylene blue reductase test for milk.
8	To identify and classify 5 different types of pollen and note the observation under stereomicroscope.
9	Observation of bacterial growth curve.
10	Phytochemical Analysis of same plant species grown in different geographic locations
11	TLC analysis of the secondary metabolites of same plant species grown in different geographic locations
12	To run column chromatography of a single phytochemical (alkaloid, flavonoid, tannin) obtained from different sources (fruits, vegetables, leaves etc).

Texk Books	1.	Demain AL and Davies JE, 1999, "Manual of Industrial Microbiology and Biotechnology", ASM Press, Washington, D.C., USA.
	2.	Paterson Russell and Lima Nelson, 2017, "Bioprospecting: Success, Potential and Constraints", Springer Publications.

Learning Method	Demonstration/ Hands on Experiments

Focus of the Course	Skill Development/ Employability

Semester - I
DSE- I: APPLIED BIOTECHNOLOGY

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	25BTP1DA	APPLIED BIOTECHNOLOGY	DSE	36	12	-	3

Preamble	This course has been designed for students to learn and understand • The applications of biotechnology in plant, animal and Environmental field the basic concept of sequence and series • The applications of biotechnology in health care sector • The products obtained from fermentation and its applications
Prerequisite	Knowledge on Applied Biotechnology

Course Outcomes (COs)

CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Understand the fundamental applications of Biotechnology	K2
CO2	Know the basics and fundamentals of biotechnology applications in environment	K2
CO3	Discuss about the disease and disease prevention	K3
CO4	Discuss the applications of Enzymes in various fields	K4
CO5	Discuss the production and application of products obtained from fermentation technology	K2

Mapping with Program Outcomes:

COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓		✓	
CO2	✓		✓	✓	✓
CO3			✓	✓	✓
CO4	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓

25BTP1DA	DSE: APPLIED BIOTECHNOLOGY

Syllabus

Unit	Content	Hours	E-Contents / Resources
I	**Agricultural, Plant Biotechnology and Animal Biotechnology:** Applications of transgenic crop technology: Herbicide resistance (Glyphosate Resistance plants), Pest resistance (Bt Cotton) and Virus Resistance. Enhancement of micro-nutrients (Vitamin A). Delayed Fruit Ripening. Molecular pharming in plants. Transgenic animals (Transgenic mice and Transgenic cattle). Production and recovery of products from animal tissue cultures (Blood clotting factors, Growth hormones, insulin)	10	Text Book - 1
II	**Environmental Biotechnology:** Bioremediation- (Bioaugmentation and Biostimulation). Biodegradation of Xenobiotic componds. Bioleaching. Microbially Enhanced Oil Recovery. Biotechnological methods for hazardous waste management. Bioindicators –Biomarkers –Biosensors – Management of effluent toxicity, heavy metal pollution, thermal and radioactive pollution	08	Reference Book - 2
III	**Health Care Biotechnology:** Disease prevention – vaccines: conventional vaccines, purified antigen vaccines, recombinant vaccines, DNA vaccines, synthetic vaccines. Disease Diagnosis – Probes, monoclonal antibodies and detection of genetic diseases. Disease treatment – interferons, monoclonal antibodies. Gene therapy, enzyme therapy and replacement. Forensic medicine.	10	Reference Book -3
IV	**Enzyme Biotechnology:** Enzymes used for diagnostic purpose- (acid phosphatase, alanine aminotransferase and alkaline phosphatase). Cardiac Biomarkers. Enzymes used for screening liver and kidney diseases. Enzymes used in food industry, leather industry, wool industry, dairy industry and textile industry.	10	Referece Book – 2 and NPTEL
V	**Fermentation Biotechnology:** Production, harvest, recovery and uses – enzymes, antibiotics (Tetracycline), vitamins (B2), aminoacids (glutamic acid), organic solvents (ethanol); organic acids (lactic acid). Single cell protein (algae), beverages (Wine). Formulation of Biofertilizer (Rhizobium), Biopesticides.	10	You Tube Videos and Reference Book - 4
	Total	**48**	

Text Book	1.	Bernard R Glick and Jack J Pasternak, 2010, "Molecular Biotechnology: Principles and Applications of recombinant DNA", 4th Edition, ASM Press
Reference Books	1.	Marwaha S S & Arora K, 2000, "Food processing: Biotechnological application", Asiatech Publishers INC, New Delhi.
	2.	Palmer T, Bonner PLR, 2014, "Enzymes: Biochemistry, Biotechnology and Clinical Chemistry", 2nd Edition, Woodhead Publishing Limited, Oxford..
	3.	Owen, Jenni Punt and Sharon A Stranford, 2013, "Kuby Immunology",7th Edition, W.H. Freeman and Company, New York.
	4.	Stanbury PF and Whitaker A, 2007, "Fermentation microbiology and Biotechnology", 2nd Edition, Taylor and Francis.

Journal and Magazines	https://www.macrothink.org/journal/index.php/jab, https://link.springer.com/journal/12010
E-Resources and Website	https://www.keaipublishing.com/en/journals/biotechnology-notes/ https://www.drishtiias.com/to-the-points/paper3/biotechnology-and-its-applications https://nptel.ac.in

Learning Methods	Chalk and Talk/Assignment/Seminar

Focus of the Course	Entrepreneurial Development /Employability

Semester – I

DSE - I: MICROBIAL TECHNOLOGY

Semester	Course Code	Course Name	Category	L	T	p	Credits
I	25MBP1DA	MICROBIAL TECHNOLOGY	DSE	36	12	-	3

Preamble	This course has been designed for students to learn and understand • The production of Sustainable products using Microorganisms. • The importance of Microorganisms in Pharmaceutical sector. • How to explore the ideas in commercial level
Prerequisite	Knowledge on microbial products and their mass production

Course Outcomes (Cos)

CO Number	Course Outcomes (Cos) Statement	Bloom's Taxonomy Knowledge Level
CO1	Inculcate about microbial products and its scale up production through establishing a small scale industry	K2
CO2	Exemplify the ideas about the production and uses of Biofuel and Biofertilizer.	K3
CO3	Demonstrate the commercial production of Biopolymers using Microorganisms.	K4
CO4	Understand the way of cells and enzymes were immobilized for industrial uses.	K3
CO5	Explore the pharmaceutical products and possibilities of converting it to a commercial product.	K4

Mapping with Programme Outcomes

Cos/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓		✓	✓	✓
CO2	✓	✓		✓	✓
CO3	✓		✓	✓	✓
CO4	✓		✓		✓
CO5	✓	✓		✓	✓

25MBP1DA: DSE: MICROBIAL TECHNOLOGY
Syllabus

Unit	Content	Hours	E-Contents / Resources
I	**Single Cell Protein and its Economic Aspects:** Bacterial, Yeast, Fungal and Algal Proteins –Brewer's and Baker's yeast – Food and Fodder yeast – Mushroom (Agaricus, Oyster) and Products from Higher fungi (*Ganoderma lucidum*).	9	Text book Reference Book Journals
II	**Production of Biofuel & Biofertilizer:** Production, Methods and Uses of Bioethanol (*S. cerevisiae*) – Biodiesel (*Chlorella*) – Biohydrogen (*Chlamydomonas*) – Biogas (Methanobacteria). Biofertilizer - N_2 fixing, Phosphate Solubilizing, Phosphate Mobilizing, Plant Growth Promoting Rhizobacteria - Mass production and Applications.	9	Text book Reference Book
III	**Biopolymer production:** Production and Uses of Polyhydroxybutyrate (PHB) – Xanthan – Alginate – Cellulose –Cyanophycin – Levan - Melanin - Welan - Succinoglucan- Curdlan- Chitosan -Polyhydroxyalkanoates - Hyaluronic acid.	9	Text book Reference Book
IV	**Immobilization of Cells & Enzymes:** Cells – Surface attachment of cells – Entrapment - Hydrogel method, Preformed support materials – Containment behind a barrier: Microencapsulation, Immobilization using membranes – Self aggregation of cells –Methods for Enzyme immobilization – Carrier binding method, Intermolecular cross linking – Applications of Immobilized cells and Enzymes.	10	Text book Reference Book
V	**Microbial products with pharmaceutical importance**: Vaccines – Steps of Manufacturing – Growing the microbes and separation – Preparation of Live and killed vaccine – Preparation of Toxoid and uses – BCG Vaccine – Cholera vaccine – Rabies vaccine – Diptheria toxoid. Pharmaceutical industry - certification & accreditation required. Bioentreprenurship opportunities and Funding sources - Government funds, Venture capital, NGOs, Crowd funding and Incubation centers. Antimicrobial compounds from soil microbes -Case study	11	Text book Reference Book Journals
	Total	**48**	

Text Book	1.	Patel A H, 2012, Industrial Microbiology, 2nd Edition, Trinity Press, New Delhi
Reference Books	1.	El-Mansi E M T, Bryce C F A, Dahhou B, Sanchez S, Demain A L and Allman A R, 2012, Fermentation Microbiology and Biotechnology, 3rd Edition, CRC Press, USA
	2.	Bernard R Glick, Jack J Pasternek and Cheryl L Patten, 2010, Molecular Biotechnology -Principles and Applications of Recombianant DNA, 4th Edition, ASM Publishers, USA]
	3.	Nidhi Goel, 2013, Pharmaceutical Microbiology, 1st Edition, Narosa Publishing House, New Delhi.
	4.	Puvanakrishnan R, Sivasubramanian S and Hemalatha T, 2012, Microbial Technology -Concepts and Applications, 1st Edition, MJP Publishers, New Delhi

Journal and Magazines	https://link.springer.com/ https://aem.asm.org/
E-Resource and Websites	https://www.microbialbiotechnology.com/ https://www.asmscience.org/content

Learning Methods	Chalk and Talk/ Seminar/ Assignment

Focus of the Course	Skill Development/Employability/Entrepreneurial Development/Innovations/Intellectual Property Rights

Semester – I DSE I: CANCER BIOLOGY, DIAGNOSIS AND THERAPY							
Semester	**Course Code**	**Course Name**	**Category**	**L**	**T**	**P**	**Credits**
I	**25BCP1DA**	**CANCER BIOLOGY, DIAGNOSIS AND THERAPY**	**DSE**	**36**	**12**	**-**	**3**

Preamble	This course has been designed for students to learn and understand • Molecular basis of cancer, mutations causing cancer, and repair mechanisms • The basic principles of cancer development and available therapeutic options • The different diagnostic and treatment methods for cancer.
Prerequisite	Basic Knowledge on Cell Biology

Course Outcomes (Cos)		
CO Number	**Course Outcomes (COs) Statement**	**Bloom's Taxonomy Knowledge Level**
CO1	Compare and contrast benign and malignant tumors and the morphological characteristics of cancer cells.	K4
CO2	Justify the molecular basis of cancer. Distinguish interdisciplinary areas in cancer biology.	K5
CO3	Evaluate the molecular mechanism of oncogenesis, tumor biology and the role of cell cycle in cancer	K5
CO4	Validate the role of tumor suppressor genes and apoptosis. Explain about epigenetics.	K5
CO5	Summarize on the choice of diagnosis and therapy available for cancer patients.	K6

Mapping with Program Outcomes:					
Cos / POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓

25BCP1DA	DSE: CANCER BIOLOGY, DIAGNOSIS AND THERAPY

Syllabus

Unit	Content	Hrs	Resources
I	**Introduction** Cancer cell-morphology and growth characteristics. Metastasis and cytoskeleton. Apoptosis. Types and prevalence of cancer. Nomenclature of neoplasms, classification based on origin/organ. Differences between benign and malignant tumors.	9	Text Book
II	**Carcinogenesis** Cancer epidemiology and endocrinology. Cancer causing agents- radiation, viruses, chemicals. Multistep carcinogenesis: Initiation, Promotion, Progression. Para-neoplastic syndromes. Mutation- definition, significance, rates and frequency. Mutagenic agents. Molecular basis of mutagenesis: induced and spontaneous mutations, crossing over and segregation. Cancer genetics. Chemical carcinogenesis- genetic and epigenetic carcinogens, pro-carcinogens and co- carcinogens, promoters and initiators, testing for carcinogenecity, Ames test. Aberrant metabolism during cancer development.	9	Reference Book
III	**Tumor Markers and Signal Transduction** Oncogenes - RNA and DNA tumor viruses, retroviruses and viral oncogenes and abrupt activation. Src and Ras gene, mechanism and characteristic of cell transformation. Molecular mechanism of oncogenesis- protooncogenesis, oncoproteins, tumor suppressor genes involved in cancer. Radiation- effect of ionizing radiations on DNA, chromosomal aberrations. Cancer Markers: Genetic basis of cancer, use of tumor markers in detection and monitoring of cancer. Signal transduction in cancer: cell-cell interactions, cell adhesion, invasion and metastasis, VEGF signalling and angiogenesis; role of transcription factors. Growth factors- EGF, TNF-α and TGF-β and growth factor receptors. Free radicals and antioxidants in cancer. Diet and cancer.	10	Reference Book
IV	**Cell Cycle, Cell Death and Cancer** Cell Cycle Regulation cancer: control of the cell cycle - cyclins and CDKs, and tumor suppressor genes p53, p21Rb, BRAC1 and BRAC2. Telomeres, and Immortality; Epigenetics- role of DNA methylation in gene silencing- epigenetic silencing of tumor - suppressor genes.	10	NPTEL
V	**Cancer Diagnosis and Cancer Therapy, Stem Cells and Cancer** Principles and methods of cancer diagnosis - biochemical, genetic, cytotoxic, cell growth and viability tests. Diagnosis of cancer by histopathology, MRI scans, PET scan, cytogenetics test, kariotype, FISH. Strategies of anticancer drug therapy– chemotherapy, gene	10	You Tube Videos

	therapy, immuno therapy, radiotherapy and surgical therapy. Principles of cancer biomarkers and their applications.		
	Total	**48**	

	Note: Case studies related to the above topics to be discussed (Examined Internal only)

Text book	1.	Mc Kinnell R.G et al, 2012, "The Biological Basis of Cancer", Second edition, Cambridge University Press, London.
	2.	Weinberg R.A, 2014, "The Biology of Cancer", Second edition, Garland Science, New York & London.
Reference Books	1	Vincent T. De Vita M. D et al, 2020, "Principles and Practice of Oncology: Primer of Molecular Biology in Cancer", Third edition, Lippincott Williams and Wilkins, Philadelphia.
	2.	Pelengaris S and Khan M, 2010, "The Molecular Biology of Cancer - A bridge from bench to bed side", Second edition, Wiley Black well, London
	3.	Hesketh R, 2013, "Introduction to Cancer Biology", First edition, Cambridge University Press, London.
	4.	Pezzella F et al, 2019, "Oxford textbook of Cancer Biology", First edition, Oxford University Press, London.

Journal and Magazines	https://www.tandfonline.com/toc/kcbt20/current https://journals.lww.com/amjclinicaloncology/pages/default.aspx
E-Resources and Website	https://www.cancer.gov>research>resources; https://nptel.ac.in

Learning Method	Chalk and Talk/Assignment/Seminar/ Group Discussion/Case Study

Focus of the Course	Skill Development/ Employability