

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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2026-27 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 2026-27)

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 2026- 2027

Course Code	Course Category	Course Name	L	T	P	Instruction Hours		Exam (h)	Max Marks			Credits
						Week	Total		CIA	ESE	Total	
First Semester												
26BTP1CA	Core -I	Molecular Biology and Genetics	4	-	-	4	48	3	25	75	100	4
26BTP1CB	Core -II	Biochemistry	4	-	-	4	48	3	25	75	100	4
26BTP1CC	Core -III	Microbiology	4	-	-	4	48	3	25	75	100	4
26BTP1CD	Core - IV	Biodiversity and Bioprospecting	4	-	-	4	48	3	25	75	100	4
26BTP1CP	Core Practical- I	Molecular Biology, Genetics and Biochemistry	-	-	5	5	60	6	40	60	100	2
26BTP1CQ	Core Practical II	Microbiology, Biodiversity and Bioprospecting	-	-	5	5	60	6	40	60	100	2
26BTP1DA	DSE-I	Applied Biotechnology	3	1	-	4	48	3	25	75	100	3
26MBP1DA		Microbial Technology										
26BCP1DA		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												
26BTP2CA	Core - V	Immunotechnology	4	-	-	4	48	3	25	75	100	4
26BTP2CB	Core -VI	Genetic Engineering	4	-	-	4	48	3	25	75	100	4
26BTP2CC	Core -VII	Environmental Biotechnology	4	-	-	4	48	3	25	75	100	4
26BTP2CD	Core -VIII	Bioprocess Technology	4	-	-	4	48	3	25	75	100	4
26BTP2CP	Core Practical – III	Immunotechnology and Bioprocess Technology	-	-	4	4	48	6	40	60	100	2
26BTP2CQ	Core Practical –IV	Genetic Engineering and Environmental Biotechnology	-	-	6	6	72	6	40	60	100	3
26BTP2DA	DSE- II	Forensic Biotechnology	3	1	-	4	48	3	25	75	100	3
26MBP2DA		Bionanotechnology										
26BCP2DA		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												
26BTP3CA	Core - IX	Research Methodology and IPR	4	-	-	4	48	3	25	75	100	4
26BTP3CB	Core - X	Genomics and Proteomics	4	-	-	4	48	3	25	75	100	4
26BTP3CC	Core -XI	Marine Biotechnology	4	-	-	4	48	3	25	75	100	3
26BTP3CD	Core -XII	Plant Biotechnology	4	-	-	4	48	3	25	75	100	4
26BTP3CE	Core -XIII	Animal Biotechnology	4	-	-	4	48	3	25	75	100	4
26BTP3CP	Core Practical - V	Plant, Animal, Marine Biotechnology, Genomics and Proteomics	-	-	6	6	72	6	40	60	100	3
26BTP3DA	DSE -III	Molecular Therapeutics	3	1	-	4	48	3	25	75	100	3
26MBP3DA		Medical Laboratory Techniques										
26BCP3DA		Free Radicals and Antioxidant System										
26BTP3CT	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		CI A	ESE	Total	
Fourth Semester												
26BTP4CA	Core - XIV	Pharmaceutical Biotechnology	4	-	-	4	48	3	25	75	100	4
26BTP4CP	Core Practical - VI	Pharmaceutical Biotechnology	-	-	6	6	72	6	40	60	100	3
26BTP4CV	Core	Project and Viva Voce	-	-	16	16	192	-	80	120	200	8
26BTP4DA	DSE - IV	Stem Cell Technology	3	1	-	4	48	3	25	75	100	3
26MBP4DA		Molecular Diagnostics and Bioinformatics										
26BCP4DA		Neurobiology										
Total			7	1	22	30	36	-	-	-	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.	26BTP1DA	Applied Biotechnology
2.	26MBP1DA	Microbial Technology
3.	26BCP1DA	Cancer Biology, Diagnosis and Therapy

Semester II (Elective II)

List of Elective Courses

S. No.	Course Code	Name of the Course
1.	26BTP2DA	Forensic Biotechnology
2.	26MBP2DA	Bionanotechnology
3.	26BCP2DA	Biochemistry of Toxicology

Semester III (Elective III)

List of Elective Courses

S. No.	Course Code	Name of the Course
1.	26BTP3DA	Molecular Therapeutics
2.	26MBP3DA	Molecular Diagnostics in Microbiology
3.	26BCP3DA	Free Radicals and Antioxidant System

Semester IV (Elective IV)
List of Elective Courses

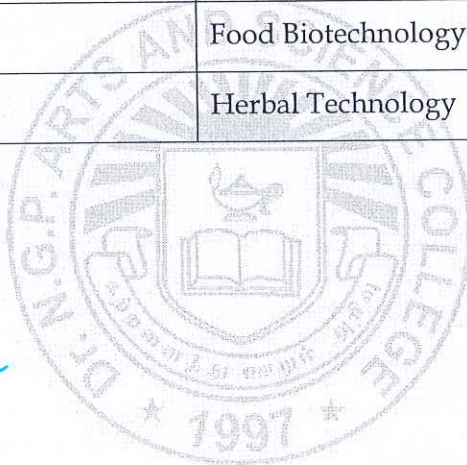
S. No.	Course Code	Name of the Course
1.	26BTP4DA	Stem Cell Technology
2.	26MBP4DA	Molecular Diagnostics and Bioinformatics
3.	26BCP4DA	Neurobiology

EXTRA CREDIT COURSES

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

S. No.	Course Code	Course Title
1.	26BTPSSA	Food Biotechnology
2.	26BTPSSB	Herbal Technology


BoS Chairman/HoD
Department of Biotechnology
Dr. N. G. P. Arts and Science College
Coimbatore – 641 048



Semester - I
CORE: MOLECULAR BIOLOGY AND GENETICS

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	26BTP1CA	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	Analyze the mode of DNA replication and repair mechanisms.	K4
CO2	Examine the mechanism of transcription.	K4
CO3	Evaluate translational events and their role in gene expression.	K5
CO4	Assess human genetics and various genetic disorders.	K5
CO5	Develop models explaining inheritance patterns and population genetics.	K6

Mapping with Program Outcomes:					
COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	S
CO2	S	S	S	M	M
CO3	M	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	M

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 aberrations: 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.	09	Reference Book
V	Pedigree analysis; Diagnosis of disease: Molecular cytogenetics, DNA markers - VNTR, STR, microsatellite, SNP and their detection techniques - RFLP genotyping, RAPD, AFLP.	10	Reference Book

	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.		
	Total	48	

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

Learning Methods	Chalk and Talk/Assignment/Seminar/Video presentation
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Focus of the Course	Skill Development/Employability
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Semester - I
CORE: BIOCHEMISTRY

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	26BTP1CB	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	Design an integrated model illustrating the regulatory mechanisms of various metabolic activities and their associated nucleic acid disorders.	K6

Mapping with Program Outcomes:

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

26BTP1CB	CORE: BIOCHEMISTRY
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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, Z and H-DNA. Types of RNA and 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	

Text Book	1.	Lehninger AL and Cox M M, 2013, "Principles of Biochemistry", 6 th 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", 31 st Edition, McGraw Hill publications, New Delhi.
	2.	Voet D and Voet J G, 2011, "Biochemistry". 4 th Edition. John Wiley and Sons Inc. USA.
	3.	Ramadevi K, 2016, "Ambika Shanmugam's Fundamentals of Biochemistry for Medical Students". 8 th Edition, Wolters Kluwer (India) Pvt, Ltd., New Delhi.
	4.	Fromm HJ and Hargroves, 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=MNhNzp1RQIU+6LM40KjY1Q==

Learning Methods	Chalk and Talk/Assignment/Seminar
Focus of the Course	Skill Development/Employability

Semester - I
CORE : MICRO BIOLOGY

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	26BTP1CC	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	Develop innovative strategies to control and prevent the spread of infections.	K6

Mapping with Program Outcomes:

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

26BTP1CC	CORE: MICROBIOLOGY
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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.	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. Modern methods to study microbial diversity: NGS and WGS.	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 (<i>B. thuringiensis</i> 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: <i>Aspergillus</i> 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", 5 th Edition, Tata McGraw Hill, New Delhi.
	2.	Vijaya Ramesh, K, 2020, "Food Microbiology" 1 st Edition, MJP Publishers, Chennai
Reference Books	1.	Joanne Willey, Kathleen Sandman, Dorothy Wood, 2020, "Prescott's Microbiology", 11 th 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, 1 st Edition, ASM Press, Washington, DC.
	3.	William C. Frazier, Dennis C. Westhoff, 2021, "Food Microbiology", 1 st 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", 16 th 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
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Focus of the Course	Entrepreneurial Development /Employability
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Semester - I
CORE: BIODIVERSITY AND BIOPROSPECTING

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	26BTP1CD	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	Analyze the types of biodiversity, associated threats, and biodiversity hotspots.	K4
CO2	Examine the discovery of medicinal compounds from natural products and their significance.	K4
CO3	Assess the sustainable utilization of microbial resources and benefit-sharing practices.	K5
CO4	Critique the screening and purification processes of various bioactive substances.	K5
CO5	Develop regulatory frameworks and laws for bioprospecting.	K6

Mapping with Program Outcomes:

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

26BTP1CD	CORE: BIODIVERSITY AND BIOPROSPECTING
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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. Choleric – 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", 1 st Edition, Springer International Publications.
Reference Books	1.	Santosh Kumar Upadhyay, Sudhir P. Singh, 2021, "Bioprospecting of Plant Biodiversity for Industrial Molecules", 1 st Edition, John Wiley & Sons Ltd, USA.
	2.	Jeffries MJ, 2006, "Biodiversity and Conservation", 2 nd Edition, Routledge, USA.
	3.	Vanesha S, 2010, "Marine Bioprospecting and Natural Product Research", 1 st Edition, LAP Lambert Academic Publishing, Germany.
	4.	Dubey KN and Yadav GP, 2011, "Biodiversity - Threats to Conservation", 1 st 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
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Focus of the Course	Skill Development/Employability/ Intellectual Property Rights/ Social Awareness/ Environment
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Semester – I CORE PRACTICAL: MOLECULAR BIOLOGY, GENETICS AND BIOCHEMISTRY							
Semester	Course Code	Course Name	Category	L	T	P	Credits
I	26BTP1CP	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	S	S	S	S	S
CO2	S	S	S	S	M
CO3	S	S	S	S	M
CO4	S	S	S	S	M
CO5	S	S	S	S	S

26BTP1CP	CORE PRACTICAL: MOLECULAR BIOLOGY, GENETICS AND BIOCHEMISTRY
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S.No	List of Programs
1	Isolation of genomic DNA from human blood sample.
2	Bacterial conjugation.
3	Bacterial Transformation.
4	DNA amplification by Polymerase Chain Reaction.
5	Molecular analysis using RAPD.
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 by Paper Chromatography.

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

Learning Method	Demonstration/ Hands on Experiments
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Focus of the Course	Skill Development/ Employability
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Semester – I							
CORE PRACTICAL: MICROBIOLOGY, BIODIVERSITY AND BIOPROSPECTING							
Semester	Course Code	Course Name	Category	L	T	P	Credits
I	26BTP1CQ	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	S	S	S	S	S
CO2	S	S	S	S	M
CO3	S	S	S	S	M
CO4	S	S	S	S	M
CO5	S	S	S	S	S

26BTP1CQ	CORE PRACTICAL: MICROBIOLOGY, BIODIVERSITY AND BIOPROSPECTING
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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).

Text 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
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Focus of the Course	Skill Development/ Employability
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Semester - I
DSE: APPLIED BIOTECHNOLOGY

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	26BTP1DA	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
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Prerequisite	Knowledge on Applied Biotechnology
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Course Outcomes (COs)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Analyze the fundamental applications of biotechnology.	K4
CO2	Examine the basic principles and applications of biotechnology in environmental contexts.	K4
CO3	Evaluate diseases and strategies for disease prevention using biotechnological approaches.	K5
CO4	Assess the applications of enzymes across various industrial and medical fields.	K5
CO5	Design production and application strategies for products obtained through fermentation technology.	K6

Mapping with Program Outcomes:					
COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	M	S	M
CO2	S	M	S	S	S
CO3	M	M	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	S

26BTP1DA	DSE: APPLIED BIOTECHNOLOGY
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Syllabus

Unit	Content	Hours	E-Contents / Resources
I	Introduction to Recombinant DNA Technology: Strategies of cloning, Cutting and Joining of DNA – Linker and Adapters, enzyme involved in cloning. Selectable markers and reporter genes. Cloning vectors: Bacterial vectors - pBR322 and pUC vectors. Animal Viral vectors - SV-40, retroviral vectors. Plant vectors -Ti and Ri Plasmids. Yeast Vectors - YAC. Shuttle vectors and expression vectors. Introduction of cloned genes into cell: transformation, particle bombardment, liposome mediation and Electroporation, microinjection.	10	Text Book - 1
II	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.	08	Reference Book - 2 and NPTEL
III	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 (<i>Rhizobium</i>), Biopesticides.	10	You Tube Videos and Reference Book - 4
IV	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	Referece Book – 3
V	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
	Total	48	

Text Book	1.	Bernard R Glick and Jack J Pasternak, 2010, "Molecular Biotechnology: Principles and Applications of recombinant DNA", 4 th 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", 2 nd Edition, Woodhead Publishing Limited, Oxford..
	3.	Owen, Jenni Punt and Sharon A Stranford, 2013, "Kuby Immunology", 7 th Edition, W.H. Freeman and Company, New York.
	4.	Stanbury PF and Whitaker A, 2007, "Fermentation microbiology and Biotechnology", 2 nd 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.drishtiiias.com/to-the-points/paper3/biotechnology-and-its-applications https://nptel.ac.in

Learning Methods	Chalk and Talk/Assignment/Seminar
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Focus of the Course	Entrepreneurial Development /Employability
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Semester – I DSE: MICROBIAL TECHNOLOGY							
Semester	Course Code	Course Name	Category	L	T	P	Credits
I	26MBP1DA	MICROBIAL TECHNOLOGY	DSE	36	12	-	3

Preamble	This course has been designed for students to learn and understand
	• The production and applications of microbial products in food, agriculture, and pharmaceutical industries. • Microbial products of pharmaceutical importance along with bioentrepreneurship opportunities and funding sources. • The sustainable technologies, industrial relevance, and real-world applications of microbial biotechnology.
Prerequisite	Fundamentals of Microbiology and Fermentation technology

Course Outcomes (Cos)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Perform analysis of microbial and algal protein products and interpret their applications in nutrition, functional foods, and industrial biotechnology.	K2
CO2	Cultivate and optimize microorganisms for biofuel and biofertilizer production in research and industry	K3
CO3	Utilize microbial strains for production of biopolymers, and analyze their suitability for industrial and biomedical applications.	K4
CO4	Immobilize cells and enzyme for industrial and research applications.	K5
CO5	Design innovative approaches for vaccine development and evaluate their applicability in pharmaceutical production and bio entrepreneurship ventures.	K6

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

26MBP1DA	DSE: MICROBIAL TECHNOLOGY
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Syllabus

Unit	Content	Hrs	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 (<i>Agaricus</i> , <i>Oyster</i>) and Products from Higher fungi (<i>Ganoderma lucidum</i>).	9	Text Book
II	Production of Biofuel & Biofertilizer Production, Methods and Uses of Bioethanol (<i>S. cerevisiae</i>) – Biodiesel (<i>Chlorella</i>) – Biohydrogen (<i>Chlamydomonas</i>) – Biogas (<i>Methanobacteria</i>). Biofertilizer - N ₂ fixing, Phosphate Solubilizing, Phosphate Mobilizing, Plant Growth Promoting Rhizobacteria - Mass production and Applications.	9	Text Book
III	Biopolymer production Production and Uses of Polyhydroxybutyrate (<i>Cupriavidus necator</i>) – Xanthan (<i>Xanthomonas campestris</i>) – Alginate (<i>Azotobacter vinelandii</i>) – Cellulose (<i>Komagataeibacter xylinus</i>) –Cyanophycin (<i>Anabaena</i> sp.) – Levan (<i>Bacillus subtilis</i>) – Melanin (<i>Aspergillus niger</i>) – Welan (<i>Sphingomonas</i> sp.) – Succinoglucan (<i>Agrobacterium tumefaciens</i>)- Chitosan (<i>Mucor rouxii</i>) - Polyhydroxyalkanoates (<i>Pseudomonas putida</i>)- Hyaluronic acid (<i>Streptococcus zooepidemicus</i>).	9	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
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 – Diphtheria toxoid. Pharmaceutical industry – certification & accreditation required. Bioentrepreneurship opportunities and Funding sources - Government funds, Venture capital, NGOs, Crowd funding and Incubation centers. Case study- Antimicrobial compounds from soil microbes: Discovery and Applications.	11	Reference Book
Total		48	

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

Text book	1.	Patel A H, 2016, Industrial Microbiology, 2 nd Edition, Trinity Press, New Delhi.
	2.	Casida J R, 2015, Industrial Microbiology, 3 rd Edition, New Age International
Reference Books	1.	El-Mansi E M T, Bryce C F A, Dahhou B, Sanchez S, Demain A L and Allman A R, 2018, Fermentation Microbiology and Biotechnology, 4 th Edition, CRC Press, USA.
	2.	Bernard R Glick, Jack J Pasternek and Cheryl L Patten, 2022, Molecular Biotechnology -Principles and Applications of Recombinant DNA, 6 th Edition, ASM Publishers, USA
	3.	Nidhi Goel, 2013, Pharmaceutical Microbiology, 1 st Edition, Narosa Publishing House, New Delhi.
	4.	Puvanakrishnan R, Sivasubramanian S and Hemalatha T, 2019, Microbial Technology -Concepts and Applications, 1 st Edition, MJP Publishers, New Delhi.

Journal and Magazines	<u>Industrial Microbiology</u>
E-Resources and Website	<u>Modern Industrial Microbiology and Biotechnology</u>

Learning Method	Chalk and Talk/Assignment/Seminar/ Group Discussion/Case Study
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Focus of the Course	Skill Development/ Employability/ Entrepreneurial Development/ Innovations
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Semester – I							
DSE : CANCER BIOLOGY, DIAGNOSIS AND THERAPY							
Semester	Course Code	Course Name	Category	L	T	P	Credits
I	26BCP1DA	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	Knowledge on Cancer 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	Elaborate on the choice of diagnosis and therapy available for cancer patients.	K6

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

26BCP1DA	DSE: CANCER BIOLOGY, DIAGNOSIS AND THERAPY
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Syllabus

Unit	Content	Hrs	Resources
I	Introduction: Cancer cell-morphology and growth characteristics. Metastasis and cytoskeleton. Types and prevalence of cancer. Nomenclature of neoplasms, classification based on origin/organ. Differences between benign and malignant tumors. IKS Conceptual Framework for Cancer Biology.	9	Text Book and E-resources
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 carcinogenicity, Ames test. Aberrant metabolism during cancer development.	9	Text Book and You tube Video
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 signaling 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	Text Book and NPTEL
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; Apoptosis. Epigenetics- role of DNA methylation in gene silencing- epigenetic silencing of tumor - suppressor genes.	10	Text Book and Reference books
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 therapy, immuno therapy, radiotherapy, surgical therapy and molecular therapy- CART T-cell therapy. Principles of cancer biomarkers and their applications. AI in Cancer Diagnosis & Therapy	10	Text Book and Reference book
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/kcvt20/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
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Focus of the Course	Skill Development/ Employability/ Entrepreneurial Development/ Innovations
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