

Dr. N.G.P.ARTS AND SCIENCE COLLEGE
REGULATIONS 2026-27 for Post Graduate Programme
(Outcome Based Education model with Choice Based Credit System)

M.Sc. BIOCHEMISTRY
(For the students admitted during the academic year 2026-27)

Eligibility

The eligibility conditions for admission to M.Sc., in Biochemistry is candidates with B.Sc., in Biochemistry, Biotechnology, Microbiology, Biomedical Science, Biomedical Instrumentation Science, Medical Lab Technology, Bioinformatics, Environmental Sciences, Clinical Lab Technology, Biochemistry (Nanotechnology), Chemistry, Life Sciences, Botany, Zoology, Nutrition and dietetics or an Examinations accepted as equivalent there by Academic Council, subject to such conditions as may be prescribed there to are permitted to appear and qualify for the **Master of Science Degree in Biochemistry Examination** of this College after a programme of study of two academic years.

Programme Educational Objectives

1. Instill inquisitiveness in students to explore realms of modern biology (Molecular genetics, Marine biochemistry, Pharmaceutical biochemistry, and Immunology, Enzymology and Clinical biochemistry) through interdisciplinary cutting edge research.
2. Empower students to acquire, develop and demonstrate skills in bioinstrumentation, biostatistical and bioinformatic software and tools, and in the fields of Industrial Biochemistry, and Nanotechnology and Cancer biology to meet the relevant demands of traditional and emerging industries.

PROGRAMME OUTCOMES:

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

PO Number	PO Statement
PO1	Postgraduates are cognizant of progressive principles and concepts in diverse branches of modern biology that govern the integrity of dynamic bio-molecular assembly in varied life forms. Alumni are expressive of mastered wisdom to peers and public to expedite basic understanding of issues of social importance through practice and investigation.
PO2	Postgraduates are comprehensive of complex of biological systems, and they have broadened and perfected competency and skills in principal and contingent areas of modern biology. Thereby, alumni as an individual or as a team member can address, investigate, design, develop and demonstrate solutions to important issues facing humanity and preserve natural ecosystems.
PO3	Postgraduates are advantaged to identify and exploit functionally crucial areas in diverse branches of modern biology, and combine it with modern tools to investigate, design, develop, demonstrate and familiarize solutions to both basic and applied research questions in areas of industry, medicine, agriculture, pharmacy, food technology, biotechnology, etc. Alumni are valuable performers as an individual or in a team.
PO4	Postgraduates are competent to enroll in research programs and modeled to receptive of successful career options in diverse branches of modern biology as scholars, managers, counselors, writers, technical experts, field experts, teachers, entrepreneur and a responsible citizen. Alumni have acquired and developed skills to manage projects and finances as individual or as a team member. While discharging duties at varied capacities, postgraduates are inculcated to keep sustainable environment as a goal, and follow ethics of professional stature.
PO5	Postgraduates are infused with metamorphic qualities of education, and inspired to develop scientific temperament and lead a scientific way of life in facing socio-economical challenges that will benefit the society. Alumni are adept at evaluating their learning's to worldwide events. Thereby, they continue their learning lifelong.

TOTAL CREDIT DISTRIBUTION

Course	Credits	Total		Total Credits	Cumulative Total
Core	4	13x 100	1300	52	90
Core	3	1X100	100	03	
Core Practical	3	3 x 100	300	09	
Core Practical	2	3 x 100	300	06	
Project Work	8	1 x 200	200	08	
Discipline Specific Elective (DSE)	3	4 x 100	400	12	
Industrial Training	2	1 x 100	100	2	
			2700	92	92

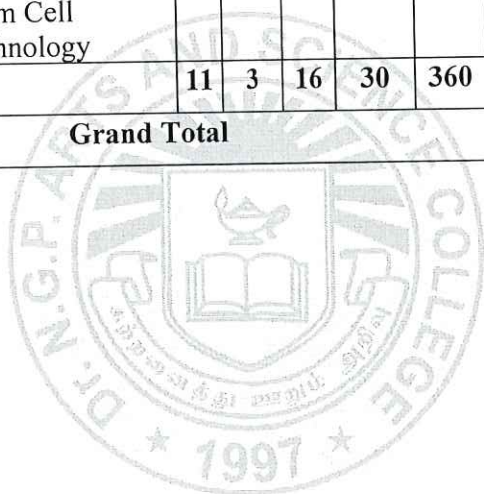
CURRICULUM
M.Sc.BIOCHEMISTRY
PROGRAMME

Course Code	Course Category	Course Name	L	T	P	Instruction Hours		Exam (h)	Max Marks			Credits
						Week	Total		CIA	ESE	Total	
First Semester												
26BCP1CA	Core-I	Chemistry of Biomolecules	4	-	-	4	48	3	25	75	100	4
26BCP1CB	Core-II	Biochemical techniques and Instrumentation	4	-	-	4	48	3	25	75	100	4
26BCP1CC	Core-III	Enzymes and Enzyme Technology	4	-	-	4	48	3	25	75	100	4
26BCP1CD	Core-IV	Cellular Biochemistry	4	-	-	4	48	3	25	75	100	4
26BCP1CP	Core Practical-I	Enzymes and Cellular Biochemistry	-	-	6	6	72	6	40	60	100	3
26BCP1CQ	Core Practical-II	Biomolecules and Biochemical Techniques	-	-	4	4	48	6	40	60	100	2
26MBP1DA	DSE-I	Microbial Technology	3	1	-	4	48	3	25	75	100	3
26BCP1DA		Cancer Biology, Diagnosis and Therapy										
26BTP1DA		Applied Biotechnology										
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	
Second Semester												
26BCP2CA	Core-V	Immunology	4	-	-	4	48	3	25	75	100	4
26BCP2CB	Core-VI	Metabolism	4	-	-	4	48	3	25	75	100	4
26BCP2CC	Core-VII	Microbial Biochemistry	4	-	-	4	48	3	25	75	100	4
26BCP2CD	Core-VIII	Genetics and Molecular Biology	4	-	-	4	48	3	25	75	100	4
26BCP2CP	Core Practical-III	Immunology and Molecular Biology	-	-	6	6	72	6	40	60	100	3
26BCP2CQ	Core Practical-IV	Microbial Biochemistry and Metabolism	-	-	4	4	48	6	40	60	100	2
26MBP2DA	DSE-II	Bionanotechnology	3	1	-	4	48	3	25	75	100	3
26BCP2DA		Biochemistry of Toxicology										
26BTP2DA		Forensic Biotechnology										
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	ES E	Total	
Third Semester												
26BCP3CA	Core-IX	Research Methodology and Biostatistics	4	-	-	4	48	3	25	75	100	4
26BCP3CB	Core-X	Plant Biochemistry and Biotechnology	4	-	-	4	48	3	25	75	100	4
26BCP3CC	Core-XI	Genetic Engineering	4	-	-	4	48	3	25	75	100	4
26BCP3CD	Core-XII	Clinical Biochemistry	4	-	-	4	48	3	25	75	100	4
26BCP3CP	Core Practical-V	Clinical Biochemistry	-	-	6	6	72	6	40	60	100	3
26BCP3CQ	Core Practical-VI	Plant Biochemistry and Genetic Engineering	-	-	4	4	48	6	40	60	100	2
26MBP3DA	DSE-III	Medical Laboratory Techniques	3	1	-	4	48	3	25	75	100	3
26BCP3DA		Free Radicals and Antioxidant System										
26BTP3DA		Molecular Therapeutics										
26BCP3CT	IT	Internship	-	-	-	-	-	-	40	60	100	2
Total			19	1	10	30	360				800	26

Course Code	Course Category	Course Name	L	T	P	Instruction Hours		Exam(h)	Max Marks			Credits	
						Week	Total		CIA	ESE	Total		
Fourth Semester													
26BCP4CA	Core-XIII	Bioethics and Biosafety	4	1	-	5	60	3	25	75	100	3	
26BCP4CB	Core-XIV	Endocrinology and Developmental Biology	4	1	-	5	60	3	25	75	100	4	
26BCP4CV	Core - XV	Project and Viva Voce	-	-	16	16	192	6	80	120	200	8	
26MBP4DA	DSE-IV	Molecular Diagnostics and Bioinformatics	3	1	-	4	48	3	25	75	100	3	
26BCP4DA		Neurobiology											
26BTP4DA		Stem Cell Technology											
Total			11	3	16	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 to IV

Semester I (Elective I) List of Elective Courses

S.No	Course Code	Name of the Course
1.	26MBP1DA	Microbial Technology
2.	26BCP1DA	Cancer Biology, Diagnosis and Therapy
3.	26BTP1DA	Applied Biotechnology

Semester II (Elective II) List of elective Courses

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

Semester III (Elective III) List of elective Courses

S.No	Course Code	Name of the Course
1.	26MBP3DA	Medical Laboratory Techniques
2.	26BCP3DA	Free Radicals and Antioxidant System
3.	26BTP3DA	Molecular Therapeutics

Semester IV (Elective IV) List of Elective Courses

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

EXTRACREDIT COURSES

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

S.No.	Semester	Course Code	Course Title
1.	III	26BCPSSA	Principles of Downstream Techniques in Bioprocessing
2.		26BCPSSB	Herbal Product Technology and Regulatory Science

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

M.Sc Biochemistry (Students admitted during the AY 2026-27)

 Dr. N. G. P. Arts and Science College		
APPROVED		
BoS- 215 02/04/26	AC -	GB -

Semester - I							
CORE I: CHEMISTRY OF BIOMOLECULES							
Semester	Course Code	Course Name	Category	L	T	P	Credits
I	26BCP1CA	CHEMISTRY OF BIOMOLECULES	CORE	48	-	-	4

Preamble	This course has been designed for students to learn and understand • The structural organization and functional properties of biomolecules. The basic principles of cancer development and available therapeutic options • The structure and functions of biologically important macromolecules. • The characterization of biological macromolecules.
Prerequisite	Knowledge on Biomolecules

Course Outcomes (Cos)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Assess the importance of carbohydrate containing proteins, homo and heteropolysaccharides.	K4
CO2	Determine the conformational properties of biological proteins.	K5
CO3	Summarize the information about all lipids and their biological significance.	K5
CO4	Explain the different forms of DNA& RNA.	K5
CO5	Elaborate the structure and function of important heterocyclic compounds.	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

26BCP1CA	CHEMISTRY OF BIOMOLECULES
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Syllabus

Unit	Content	Hrs	Resources
I	Polysaccharides Homo polysaccharides: Structure and biological functions of starch, hemicellulose cellulose, glycogen, chitin, inulin, lignin and peptidoglycans. Hetero polysaccharides: Structure and biological importance of sugar derivatives- glycosaminoglycans, proteoglycans. Glycoprotein - Blood group and bacterial cell wall polysaccharides, O- linked and N- linked oligosaccharides and Lectins. Indigenous Methods of Purification (Shodhana) and Their Scientific Basis in Polysaccharide Extraction. Isolation and Purification of Polysaccharides.	10	Text Book
II	Proteins Primary structure- determination of amino acid sequence of proteins. The peptide bond, Peptides of biological importance. Chemical synthesis of peptides- Solid phase peptides synthesis. Denaturation and Renaturation of Proteins. Ramachandran plot. Secondary structure- weak interactions involved, alpha helix, beta sheet and beta turns. Collagen triple helix. Super secondary structures- helix-loop helix, zinc finger and leucine zipper. Tertiary structure- alpha and beta domains. Quaternary structure- structure of haemoglobin and myoglobin. Protein folding. Outline of various biological functions of proteins. AI-based protein structure prediction (e.g., AlphaFold concept).	10	Reference Book
III	Lipids Classification, structure, function, physical and chemical properties of lipids. Fatty acids-Saturated, Hydroxy and Unsaturated Fatty acids-Triacylglycerol. Ayurvedic classification of fats (Sneha dravyas). Phospholipids classification, structure and functions. Ceramides and sphingomyelins. Eicosanoids: Structure and functions of prostaglandins, thromboxanes, leukotrienes. Types and functions of plasma lipoproteins. Amphipathic lipids membranes, micelles, emulsions and liposomes. Steroids structure and biological role of cholesterol, bile acids, bile salts. Lipid Peroxidation and antioxidants. Growth Factor receptors. Free radicals and antioxidants in cancer. Diet and cancer. Traditional knowledge on lipid balance and health (dosha theory)	10	Reference Book
IV	Nucleic Acids Bases, Nucleosides, Nucleotides, Nucleotides as energy carriers. DNA double helical structure. A, B, G, H and Z forms	10	NPTEL

	of DNA. AI-based analysis of DNA structure (A, B, Z forms). Triple and quadruple structures. Physical properties of DNA. Chemicals that react with DNA. Renaturation and denaturation. DNA super coiling and linking number. DNA bending-Protein induced bending. Cruciform DNA, Left-handed DNA. Types of RNA, Secondary and tertiary structure of RNA.		
V	Heterocyclic Compounds Hetero cyclic rings of biologically important compounds. Structure and biological importance of pyridine, pyrrole, quinolene, pyrimidine, purine, pteridine, thiazole, imidazole and indole ring containing compounds. Porphyrin – structure and biologically important compounds containing porphyrin ring. Correlation of Ayurvedic Concepts (Doshas, Dhatus) with Biochemical Molecules like Porphyrins and Alkaloids. AI-based drug discovery involving heterocyclic compounds	08	E-Resources and Websites
	Total	48	

Text book	1.	David L Nelson and Michael M Cox, 2017, "Lehninger Principles of Biochemistry", 7 th edition. Macmillan Publisher, New York.
	2.	Richard R Sinden, 2012, "DNA Structure and Function", 1st Edition, Academic Press, US.
Reference Books	1.	Jeremy M Berg Lubert Stryer John Tymoczko and Gregory Gatto, 2019, "Biochemistry", 9 th edition, W.H. Freeman and Company, New York..
	2.	Donald Voet, Judith G. Voet, Charlotte W. Pratt, 2018, "Voet's Principles of Biochemistry", 5 th edition, John Wiley & Sons, New York
	3.	Theophil Eicher, Siegfried Hauptmann and Andreas Speicher, 2013, "The Chemistry of Heterocycles: Structure, Reactions, Synthesis and Applications", 3rd Edition, Wiley--VCH Verlag & Co, Weinheim.

Journal and Magazines	Journal of Biomolecules and Biochemistry Open Access Journals All biomolecules articles Chemistry World
E-Resources and Website	https://ncert.nic.in/textbook/pdf/lech205.pdf Biomolecule Definition, Structure, Functions, Examples, & Facts Britannica https://archive.nptel.ac.in/courses/104/103/104103121/

Learning Method	Chalk and Talk/ Assignment/Seminar/ Group Discussion
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Focus of the Course	Skill Development/ Employability
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Semester – I CORE II: BIOCHEMICAL TECHNIQUES AND INSTRUMENTATION							
Semester	Course Code	Course Name	Category	L	T	P	Credits
I	26BCP1CB	BIOCHEMICAL TECHNIQUES AND INSTRUMENTATION	CORE	48	-	-	4

Preamble	This course has been designed for students to learn and understand - An overview of the scientific basis of instruments. - The advantages and limitations of conventional and modern bio-analytical techniques - The analytical techniques such as Spectroscopy, Centrifugation, Microscopy, Chromatography, Electrophoresis and Radioisotopes.
Prerequisite	Knowledge on Biochemical Techniques

Course Outcomes (Cos)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Distinguish the conventional and recent techniques in the field of spectroscopy like ESR, NMR and MS etc.	K4
CO2	Compare and contrast the preparative and analytical ultracentrifugation techniques and the advanced microscopic methods.	K2
CO3	Evaluate the advantages and disadvantages of ancient and recent techniques in chromatography	K4
CO4	Categorize the importance of different types of electrophoresis and blotting techniques.	K5
CO5	Interpret the different biophysical techniques like X- ray diffraction, ORD, CD etc..	K6

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

26BCP1CB	BIOCHEMICAL TECHNIQUES AND INSTRUMENTATION
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Syllabus

Unit	Content	Hrs	Resources
I	Spectroscopic techniques Principle, instrumentation and applications of Colorimetry, UV-Visible, FTIR, IR, Fluorescence spectrophotometry, Turbidimetry, Luminometry and Flame emission spectrometry, Electron Spin Resonance, Nuclear Magnetic Resonance, Mass and Raman Spectroscopy. Traditional methods - varna pariksha (color test), flame-based observations (agni pariksha) and purity assessment of metals (e.g., mercury, gold)	10	Text Book
II	Centrifugation techniques and Microscopy Tissue homogenization. Disruption of tissues and cells, Centrifuges – Principle, applications, and types. Differential centrifugation, density gradient centrifugation of tissues and cells, Preparative and analytical ultracentrifugation. Basic principles, instrumentation, and applications of Microscopes: Light and Compound, Fluorescence, Phase contrast, Scanning electron microscopy (SEM), Transmission electron microscopy (TEM) and Confocal.	10	Text Book/ NPTEL
III	Chromatographic techniques Definition – Principle, technique and applications of paper, TLC, HPTLC, column, affinity, ion- exchange, gel filtration, hydrophobic interaction, and adsorption chromatography. Principle, components, limitations and applications of GC, GC-MS, HPLC, RP- HPLC, LCMS.	10	Text Book/Reference Book
IV	Electrophoresis and Blotting techniques Principle, technique and applications of paper, Gels Electrophoresis: Agarose, Native and SDS- PAGE, Isoelectric focusing, 2D PAGE, Denaturing gels, 3D Electrophoresis and applications. Electrophoresis in DNA sequencing, Peptide mapping, N-terminal sequencing of proteins, Next generation sequencing. Principle, technique, and applications of western, southern and northern blotting. Chemiluminescence and Phosphorimaging.	9	Text Book
V	Biophysics, Radio-isotopic methods and AI Principles and applications of X-ray diffraction, ORD and circular dichroism, Types of radiation, half-life and units of	9	Text Book/e- source

	radioactivity, Applications of radioisotopes in disease and diagnosis. Radioisotopes – Advantages and Disadvantages. Detection and measurement of radioactivity– Principle, instrumentation and applications of Liquid scintillation - counter and Geiger-Muller counter. Autoradiography and its applications. Artificial Intelligence of Bioanalysis: Role and its applications.		
	Total	48	

	Note: Case studies related to the above topics to be discussed (Examined Internal only)
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Text book	1.	Sawhney and Singh, 2015, "Introductory Practical Biochemistry", 11th edition, Narosa Publishing house, New Delhi.
	2.	Wilson and Walker, 2018, "Principles and Techniques of Biochemistry and Molecular, Biology", 8th edition, Cambridge University Press, London.
Reference Books	1.	David T Plummer 2017. "An Introduction to Practical Biochemistry", Third Edition, McGraw Hill Education, New Delhi.
	2.	Avinash Upadhyay, Kakoli Upadhyay, Nirmalendu Nath, 2023, "Biophysical Chemistry (Principles and Techniques)", Fourth Edition, Himalaya Publishing House, Mumbai.
	3.	Keith Wilson and John Walker, 2011, "Principles and Techniques of Biochemistry and Molecular biology", Seventh Edition, Cambridge University Press New York.
	4.	Boyer, R.F, 2012, "Modern Experimental Biochemistry", Third Edition, Pearson Education Inc, New York.

Journal and Magazines	home - Journal Of Biochemical Technology (jbiochemtech.com) Biochemical Research Methods Augustus C. Long Health Sciences Library (columbia.edu)
E-Resources and Website	NPTEL :: Biotechnology - Bioanalytical Techniques and Bioinformatics

Learning Method	Chalk and Talk/Assignment/Seminar/ Group Discussion/Case Study
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Focus of the Course	Skill Development/ Employability
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Semester – I CORE III: ENZYMES AND ENZYME TECHNOLOGY							
Semester	Course Code	Course Name	Category	L	T	P	Credits
I	26BCP1CC	ENZYMES AND ENZYME TECHNOLOGY	CORE	48	-	-	4

Preamble	This course has been designed for students to learn and understand • The structure, function and mechanism of enzymes action. • The current and possible future applications of enzyme technologies. • The field of biosensors and enzymes immobilization.
Prerequisite	Basic knowledge about Enzymes

Course Outcomes (Cos)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Examine the structural and functional properties of enzymes, Isolation and purification of enzymes	K4
CO2	Analyze the enzyme kinetics, types of enzyme inhibition and its kinetics, solve simple problems related to kinetics	K5
CO3	Evaluate the enzyme specificity, mechanism of enzyme action and regulation of enzyme activity	K5
CO4	Value the use of enzymes in industry and the importance of enzymes in clinical diagnostics and therapeutics.	K5
CO5	Assess and Plan a project on enzyme isolation, purification and application of immobilized enzymes.	K6

Mapping with Program Outcomes:					
Cos/ POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	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

26BCP1CC	ENZYMES AND ENZYME TECHNOLOGY
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Syllabus

Unit	Content	Hrs	Resources
I	[Classification, Purification and Active Site] Classification of enzymes, isolation and purification of enzymes, criteria of purity- specific activity, molecular weight determination. Active site: structure, determination of active site amino acids, AI tools for enzyme 3D structure modeling: AlphaFold, ColabFold, ESMFold. Models of enzyme substrate binding: Lock and key model and Induced Fit model. Coenzymes and cofactors in enzyme catalysed reaction. Multi-enzyme complex- fatty acid synthase. Measurement of enzyme activity: two-point assay, kinetic assay, using radio-labelled substrates.	10	Text Book
II	[Enzyme Kinetics and Inhibition] Kinetics of single substrate enzyme catalysed reactions: Derivation and Significance of MM Equation, LineweaverBurk plot, Eadie- Hofstee plot, Hanes-Woolf plot and Eisenthal and Cornish-Bowden plot. Arrhenius equation, King and Altman method Kinetics of Allosteric enzymes: MWC and KNF models, Hill' equation coefficient. Sequential and non-sequential bisubstrate and multi-substrate reactions. Enzyme inhibition- types and kinetics. Simple problems related to enzyme kinetics.	10	[Reference Book]
III	[Mechanism of Enzyme Action and Regulation] [Enzyme specificity, Significance and Evaluation of activation energy. Mechanism of enzyme action: general acid-base catalysis, covalent catalysis, proximity and orientation effects, Strain and Distortion theory, mechanism of serine proteases - chymotrypsin, lysozyme, and ribonuclease. Metal activated enzymes and metalloenzymes. Role of metal ions in carbonic anhydrase, superoxide dismutase, carboxy peptidase. Regulation of enzyme activity-covalently modified regulated enzymes, allosteric enzymes, isozymes]	10	[Reference Book]
IV	[Applications of Enzymes in Industry and Clinical Diagnosis] Enzyme applications in food and allied industries: sources of industrial enzymes, thermophilic enzymes, amylases, glucose isomerases, cellulose degrading enzymes, lipases, proteolytic enzymes in meat and leather industry, detergents and cheese production. Panchagavya and Jeevamrutham as a Source of Industrially Important Enzymes. Clinical enzymology: Enzymes as thrombolytic agents, antiinflammatory agents and digestive aids. Therapeutic use	[10]	[NPTEL]

	of asparaginase, streptokinase. Enzymes and isoenzymes in diagnosis: LDH, CK and cholinesterase.		
V	Immobilized Enzymes and Biosensors [Immobilized enzymes: various methods of immobilization, kinetics and applications of immobilized enzyme. Biosensors: Principle, technique and mechanism of Biosensors - Calorimetric biosensors, potentiometric biosensors, Amperometric biosensors, optic biosensors, and immunesensors. Enzyme engineering: Artificial enzymes. Abzymes and synzymes, Antioxidant enzymes. Strategies and Challenges for the Development of Engineered Enzymes in the Food Industry.]	[8]	[E-Resources & Website]
Total		48	

	Note: Case studies related to the above topics to be discussed (Examined Internal only)
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Text book	1.	Palmer, T, 2004, "Understanding enzymes", 1st edition, East West Press Pvt. Ltd., New Delhi.
	2.	
Reference Books	1.	Bhatt S.M, 2014, "Enzymology and Enzyme technology", 15th edition, S. Chand publishing Ltd, New Delhi.
	2.	Palmer, T and Bonner, P L, 2004, "Enzymes: Biochemistry, Biotechnology, Clinical chemistry", 1st edition, East West Press Pvt. Ltd., New Delhi.
	3.	Price, N C, Stevens, L, 2009, "Fundamentals of Enzymology: The Cell and Molecular Biology of Catalytic Proteins", 3rd edition, Oxford University Press, United Kingdom.
	4.	Choudhary, N L, Singh, A, 2012, "Fundamentals of Enzymology", 1st edition, Oxford Book Company, New Delhi, India..

Journal and Magazines	https://www.sciencedirect.com/science/article/pii/S2001037014600957 https://internationalbulletins.com/intjour/index.php/ibet/article/view/418 https://www.sciencedirect.com/science/article/abs/pii/S1043452616300377 https://www.sciencedirect.com/science/article/pii/S1871678426000336
E-Resources and Website	https://onlinecourses.nptel.ac.in/noc23_bt05/preview[NPTEL] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7123961/ https://pubmed.ncbi.nlm.nih.gov/30609693/

Learning Method	Chalk and Talk/Assignment/Seminar/ Group Discussion/Case Study
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Focus of the Course	Skill Development/ Employability
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Semester – I CORE IV: CELLULAR BIOCHEMISTRY							
Semester	Course Code	Course Name	Category	L	T	P	Credits
I	26BCP1CD	CELLULAR BIOCHEMISTRY	CORE	48	-	-	4

Preamble	This course has been designed for students to learn and understand - An overview on cellular organization and function - Mechanism of cellular transport, communication, division, and cancer
Prerequisite	Knowledge about Cell organelles and their functions

Course Outcomes (Cos)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Distinguish the composition and orientation of macromolecules constituting bio-membranes and structure and function.	K5
CO2	Distinguish various types of transport system in cells. Compare and contrast different transport process in cells.	K5
CO3	Evaluate pathways of energy generation and utilization, cytoskeleton organization in a cell.	K5
CO4	Assess and explain molecules of cellular integration and pathways of cellular communication.	K4
CO5	Construct a detailed representation explaining how alterations in cell cycle regulation and cell death pathways contribute to cellular transformation.	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

26BCP1CD	CELLULAR BIOCHEMISTRY
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Syllabus

Unit	Content	Hrs	Resources
I	Membrane Biology Bio membrane structure - Fluid Mosaic Model. Membrane lipids - Fluidity, Asymmetry phase transition, Liposomes, Scott Syndrome. Membrane proteins-Types, Orientation, Mobility- Experiments, flippases, proteins on RBC membrane, Bacteriorhodopsin, Porins-aquaporin. RBC ghosts, Solubilization of proteins, lipid anchored proteins. Carbohydrates- cell surface carbohydrates-Lectins.	09	Text Book
II	Membrane Transport Membrane transport - Overview, Passive diffusion, Facilitated diffusion in erythrocytes. Carriers and Ion-Channels. Ion cone, Gradients, Uniporter Catalyzed transport. Active transport systems-Transport process driven by ATP-Ion Pumps: Calcium ATPase, $\text{Na}^+\text{K}^+\text{ATPase}$, Gastric $\text{H}^+\text{K}^+\text{ATPase}$, ATPases that transport peptides and drugs, ABC superfamily- Bacterial PM permeases, Mammalian MDR proteins: Transport process driven by light and ion gradients. Co-transport by Symporters and antiporters. Group translocation, Osmosis and Receptor mediated endocytosis.	10	Text Book
III	Energy metabolism and Cytoskeleton Mitochondria- Reduction potentials, overview of Electron Transport Chain, Complexes, Q-cycle, Cyt-C oxidase complex, Proton translocation and proton motive force, Machinery for ATP formation. Chemiosmotic mechanism, ATP Synthase and Key Experiments, Inhibitions of Oxidative phosphorylation, Uncouplers. Microtubules - Organization and dynamics, Motor Proteins-Kinesin and dynein. Microfilaments- Actin- Structures, Assembly, Myosin. Cilia and Flagella- Structure and functions, Intermediary filaments. Striated muscle- structure, excitation- contraction.	09	Text Book
IV	Cellular Integration Extracellular Matrix - Collagen, hyaluronan & proteoglycans, laminin, Elastins, fibronectins, Growth factors, Matrix Metalloproteinases and Integrins. Cell adhesion molecules (CAMs). Cell junctions - Occluding junctions, Anchoring junctions, Communicating junctions. Cell signaling- Signaling molecules and their receptors, functions of cell surface receptors. Pathways of intracellular signal transduction- cAMP pathway, Cyclic GMP, phospholipids and Ca^{2+} , Ras, Raf and Map kinase pathway	10	Text Book
V	Protein transport, degradation and cell cycle Post-translational modifications in prokaryotes and eukaryotes, Protein Targeting and Signal Sequences-Signal peptide and signal sequence hypothesis-Bacterial signal sequences-Mechanism of protein translocation- Organelle-Specific Protein Transport-Role of Endoplasmic Reticulum and Golgi Apparatus-Targeting to mitochondria, chloroplast, and nucleus-Targeting to lysosomes, peroxisomes, and plasma membrane-Vesicular transport: SNAPS and SNAREs- Intracellular trafficking pathways-Endocytosis and viral entry mechanisms-Ubiquitin mediated protein	10	Reference book

	degradation Cell Cycle: Overview and its phases. Regulation of cell cycle and regulatory proteins (Cyclins and CDKCs). Studies of frog oocyte maturation and the discovery of Cyclins. Cell cycle control and check points in yeast and mammalian cells.		
	Total	48	

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Text book	1.	Harvey Lodish, Arnold Berk, Chris A. Kaiser, Angelika Amon, Hidde Ploegh, 2016, "Molecular Cell Biology", 8 th edition, WH Freeman and Company, New York
	2.	Cooper G M, 2018, "The Cell: A Molecular Approach", 8 th edition, Sinauer Associates, Inc., USA
Reference Books	1.	Jocelyn E. Krebs, Elliott S. Goldstein and Stephen T. Kilpatrick, 2017 "Lewin's GENES XII", 12 th Edition, Jones and Bartlett Publishers, USA.
	2.	Alberts B, Johnson A, Lewis J, Raff M, Roberts K and Walter P, 2015, "Molecular Biology of the cell" 6 th edition, Taylor and Francis Company, United Kingdom.
	3.	Kar G, Iwasa J and Marshall M, 2016. "Karp's Cell and Molecular Biology: Concepts and Experiments", 8 th edition, John Wiley and Sons, USA.
	4.	James D. Watson, A. Baker Tania, P. Bell Stephen, Gann Alexander, Levine Michael and Losick Richard, 2017, "Molecular Biology of the Gene", 7 th edition, Pearson Education, United Kingdom.

Journal and Magazines	https://bmcmolcellbiol.biomedcentral.com/ https://www.springer.com/gp/journal-impact/life-sciences/cell-biology
E-Resources and Website	https://onlinecourses.swayam2.ac.in/cec19_bt12 https://www.edx.org/learn/cellular-biology https://nptel.ac.in/courses/102103012

Learning Method	Chalk and Talk/Assignment/Seminar
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Focus of the Course	Skill Development/Employability
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Semester – I							
CORE PRACTICAL -I: ENZYMES AND CELLULAR BIOCHEMISTRY							
Semester	Course Code	Course Name	Category	L	T	P	Credits
I	26BCP1CP	ENZYMES AND CELLULAR BIOCHEMISTRY	CORE PRACTICAL		-	72	3

Preamble	This course has been designed for students to learn and understand essential laboratory skills in enzyme handling, cellular analysis, cell viability assessment, and protein separation.
Prerequisite	Knowledge on cellular Biochemistry

Course Outcomes (Cos)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Purify and characterize enzymes, analysing kinetic properties and stability.	K5
CO2	Observe and analyze cell structures and processes using microscopy.	K5
CO3	Quantify cell populations and assess viability with various assays.	K5
CO4	Immobilize enzymes and understand metal effects on kinetics.	K5
CO5	Elaborate and evaluate protein separation techniques like PAGE for isoenzymes.	K6

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

26BCP1CP	ENZYMES AND CELLULAR BIOCHEMISTRY
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S.No	List of Practicals
1	Partial purification of catalase from natural source
2	Effect of pH, Temperature, Substrate concentration on catalase and determination of K_m and V_{max} using Lineweaver-Burk graph
3	Assay of enzyme activity and specific activity of catalase
4	Kinetics of activity loss of an enzyme in the presence of trace amounts of metals.
5	Immobilization of enzyme and measurement of its activity
6	Separation of isoenzymes by Native PAGE and SDS PAGE (Demonstration)
7	Preparation of permanent slides and observation of prokaryotic and eukaryotic cells with the help of light microscope
8	Mitosis and cell cycle in Onion root-tip cell
9	Cell counting and viability (Yeast/Bacteria)
10	Determination of osmotic fragility of a cell (Goat RBC) and RBC ghost cell preparation
11	Study of cell viability/ death assay by use of trypan blue or MTT assay
12	Isolation of organelles by subcellular fractionation

Text Books	1.	Srivastava S, 2010, "Molecular Techniques in Biochemistry and Biotechnology", 1st edition, New Central Book Publishers, New Delhi.
	2.	Keith Wilson, John Walker, 2010. "Principle of Practical Biochemistry", 7th edition, Cambridge University Press, England.

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 II: BIOMOLECULES AND BIOCHEMICAL TECHNIQUES							
Semester	Course Code	Course Name	Category	L	T	P	Credits
I	26BCP1CQ	BIOMOLECULES AND BIOCHEMICAL TECHNIQUES	CORE PRACTICAL		-	48	2

Preamble	This course has been designed for students to learn and understand • about the isolation and estimation of Biomolecules • the identification of samples using chromatography • the techniques for electrophoresis.
Prerequisite	Knowledge on biomolecules and analytical techniques

Course Outcomes (Cos)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Analysis of sample using colorimeter, UV- Visible	K3
CO2	Preform separation and purification based on density and size using centrifugation.	K3
CO3	Develop practical knowledge on chromatographic techniques	K2
CO4	Assess DNA, RNA using electrophoresis	K5
CO5	Develop the various samples using Flame photometry	K6

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	M	S	M	S
CO4	S	S	S	S	S
CO5	S	M	S	S	M

26BCP1CQ	BIOMOLECULES AND BIOCHEMICAL TECHNIQUES
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S.No	List of Programs
1	Isolation and estimation of Starch from potato
2	Isolation and estimation of Glycogen from the liver
3	Hemagglutination assay of lectins
4	Isolation and estimation of DNA and RNA from goat liver
5	Isolation and Estimation of Phospholipids
6	Isolation and estimation of Casein from Milk
7	Estimation of sodium by Flame photometry
8	Isolation of lymphocytes from Whole blood using Density Gradient Centrifugation
9	Separation of amino acids/ Sugars by thin layer chromatography
10	Separation of plant pigments by column chromatography
11	Agarose gel electrophoresis of genomic and plasmid DNA
12	Analysis of secondary metabolites using HPLC and HPTLC (Demonstration)

Text Books	1.	Srivastava S, 2010, "Molecular Techniques in Biochemistry and Biotechnology", 1 st edition, New Central Book Publishers, New Delhi.
	2.	Keith Wilson, John Walker, 2018. "Principle of Practical Biochemistry", 8 th edition, Cambridge University Press, England..

Learning Method	Demonstration/ Hands on Experiments
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Focus of the Course	Skill 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	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 - Diptheria toxoid. Pharmaceutical industry - certification & accreditation required. Bioentreprenurship 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, 2nd 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, 1st Edition, Narosa Publishing House, New Delhi.
	4.	Puvanakrishnan R, Sivasubramanian S and Hemalatha T, 2019, Microbial Technology -Concepts and Applications, 1st 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 I: 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	M
CO2	S	S	S	S	S
CO3	S	M	S	S	S
CO4	S	S	M	S	S
CO5	M	S	S	S	S

26BCP1DA	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, karyotype, 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)
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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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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	Reference 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.drishtias.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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Anand
24/26

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 Dr.N.G.P. Arts and Science College		
APPROVED		
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