

Dr. N.G.P.ARTS AND SCIENCE COLLEGE
REGULATIONS 2023-24 for Post Graduate Programme
(Outcome Based Education model with Choice Based Credit System)

M.Sc. BIOCHEMISTRY

(For the students admitted during the academic year 2023-24 and onwards)

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:

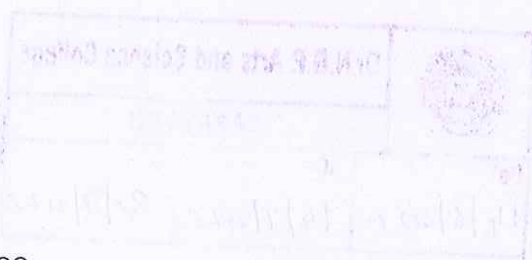
On the successful completion of the program, the following are the expected outcomes.

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	
			2600	92	



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M.Sc. Biochemistry (Students admitted during the AY 2023-24)

CURRICULUM

M.Sc.BIOCHEMISTRY
PROGRAMME

Course Code	Course Category	Course Name	L	T	P	Exam (hours)	Max Marks			Credits
							CIA	ESE	Total	
First Semester										
233BC2A1CA	Core-I	Chemistry of Biomolecules	4	-	-	3	25	75	100	4
233BC2A1CB	Core-II	Biochemical techniques and Instrumentation	4	-	-	3	25	75	100	4
233BC2A1CC	Core-III	Enzymes and Enzyme Technology	4	-	-	3	25	75	100	4
233BC2A1CD	Core-IV	Cellular Biochemistry	4	-	-	3	25	75	100	4
233BC2A1CP	Core Practical-I	Practical: Enzymes and Cellular Biochemistry	-	-	6	6	40	60	100	3
233BC2A1CQ	Core Practical-II	Practical: Biomolecules and Biochemical Techniques	-	-	4	6	40	60	100	2
233MB2A1DA	DSE-I	Microbial Technology	3	1	-	3	25	75	100	3
233BC2A1DA		Cancer Biology, Diagnosis and Therapy								
233BT2A1DA		Applied Biotechnology								
Total			19	1	10				700	24

Handwritten: 14/6/2023
 BoS Chairman/HoD
 Department of Biochemistry
 Dr. N. G. P. Arts and Science College
 Coimbatore – 641 048

 Dr.N.G.P. Arts and Science College		
APPROVED		
BoS- 14/6/2023	AC- 14/7/2023	GB- 20/7/2023



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Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
Second Semester										
233BC2A2CA	Core-V	Immunology	4	-	-	3	25	75	100	4
233BC2A2CB	Core-VI	Metabolism	4	-	-	3	25	75	100	4
233BC2A2CC	Core-VII	Microbial Biochemistry	4	-	-	3	25	75	100	4
233BC2A2CD	Core-VIII	Genetics and Molecular Biology	4	-	-	3	25	75	100	4
233BC2A2CP	Core Practical-III	Practical: Immunology and Molecular Biology	-	-	6	6	40	60	100	3
233BC2A2CQ	Core Practical-IV	Practical: Microbial Biochemistry and Metabolism	-	-	4	6	40	60	100	2
233MB2A2DA	DSE-II	Bionanotechnology	3	1	-	3	25	75	100	3
233BC2A2DA		Biochemistry of Toxicology								
233BT2A2DA		Forensic Biotechnology								
Total			19	1	10				700	24



Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ES E	Total	
Third Semester										
233BC2A3CA	Core-IX	Research Methodology and Biostatistics	4	-	-	3	25	75	100	4
233BC2A3CB	Core-X	Plant Biochemistry and Biotechnology	4	-	-	3	25	75	100	4
233BC2A3CC	Core-XI	Genetic Engineering	4	-	-	3	25	75	100	4
233BC2A3CD	Core-XII	Clinical Biochemistry	4	-	-	3	25	75	100	4
233BC2A3CP	Core Practical - V	Practical: Clinical Biochemistry	-	-	6	6	40	60	100	3
233BC2A3CQ	Core Practical- VI	Practical: Plant Biochemistry and Genetic Engineering	-	-	4	6	40	60	100	2
233MB2A3DA	DSE-III	Medical Laboratory Techniques	3	1	-	3	25	75	100	3
233BC2A3DA		Free Radicals and Antioxidant System								
233BT2A3DA		Molecular Therapeutics								
233BC2A3CT	IT	Internship	-	-	-	-	40	60	100	2
Total			19	1	10				700	26



Course Code	Course Category	Course Name	L	T	P	Exam(h)	Max Marks			Credits
							CIA	ESE	Total	
Fourth Semester										
233BC2A4CA	Core-XIII	Bioethics and Biosafety	4	1	-	3	25	75	100	3
233BC2A4CB	Core-XIV	Endocrinology and Developmental Biology	4	1	-	3	25	75	100	4
233BC2A4CV	Core	Project	-	-	16	6	80	120	200	8
233MB2A4DA	DSE-IV	Molecular Diagnostics and Bioinformatics	3	1		3	25	75	100	3
233BC2A4DA		Neurobiology								
233BT2A4DA		Stem Cell Technology								
Total			11	3	16				500	18
Grand Total									2600	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.	233MB2A1DA	Microbial Technology
2.	233BC2A1DA	Cancer Biology, Diagnosis and Therapy
3.	233BT2A1DA	Applied Biotechnology

Semester II (Elective II) List of elective Courses

S.No	Course Code	Name of the Course
1.	233MB2A2DA	Bionanotechnology
2.	233BC2A2DA	Biochemistry of Toxicology
3.	233BT2A2DA	Forensic Biotechnology

Semester III (Elective III) List of elective Courses

S.No	Course Code	Name of the Course
1.	233MB2A3DA	Medical Laboratory Techniques
2.	233BC2A3DA	Systems Biology
3.	233BT2A3DA	Molecular Therapeutics

Semester IV (Elective IV) List of Elective Courses

S.No.	Course Code	Name of the Course
1.	233MB2A4DA	Molecular Diagnostics and Bioinformatics
2.	233BC2A4DA	Neurobiology
3.	233BT2A4DA	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	233BC2ASSA	Bionanotechnology
2.		233BC2ASSB	Inheritance, Evolution and Behaviour



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M.Sc. Biochemistry (Students admitted during the AY 2023-24)

PG REGULATION (R5)

(2023-24 and onwards)

(OUTCOME BASED EDUCATION WITH CBCS)

Effective from the academic year 2023-24 and applicable to the students admitted to the Degree of Master of Arts/Commerce/Management/Science.

1. NOMENCLATURE

1.1 Faculty: Refers to a group of programmes concerned with a major division of knowledge. Eg. Faculty of Computer Science consists of Programmes like Computer Science, Information Technology, Computer Technology, Computer Applications, Cognitive Systems, Artificial Intelligence and Machine Learning and Cyber Security and Data Analytics etc.

1.2 Programme: Refers to the Master of Arts/Management/Commerce/Science Stream that a student has chosen for study.

1.3 Batch: Refers to the starting and completion year of a programme of study. Eg. Batch of 2023–2025 refers to students belonging to a 2-year Degree programme admitted in 2023 and completing in 2025.

1.4 Course: Refers to component of a programme. A course may be designed to involve lectures / tutorials / laboratory work / seminar / project work/ practical training / report writing / Viva voce, etc or a combination of these, to effectively meet the teaching and learning needs and the credits may be assigned suitably.

a) Core Courses A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

b) Extra Departmental Course (EDC): A course chosen generally from a related discipline/subject, with an intention to seek exposure in the discipline relating to the core domain of the student.



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c) **Discipline Specific Elective Course (DSE):** Elective courses are offered under main discipline/ subject of study.

d) Internship/Industrial Training (IT)

Students must undertake industrial / institutional training for a minimum of 15 days during the II semester summer vacation. The students will submit the report for evaluation during III semester.

e) **Project Work:** It is considered as a special course involving application of knowledge in problem solving/analyzing/exploring a real-life situation. The Project work will be given in lieu of a Core paper.

f) **Extra credits** Extra credits will be awarded to a student for achievements in co-curricular activities carried out outside the regular class hours. The guidelines for the award of extra credits are given in section two, these credits are not mandatory for completing the programme.

g) **Advanced Learner Course (ALC):** ALC is doing work of a higher standard than usual for students at that stage in their education. Research work / internships carried out in University/ Research Institutions/ Industries of repute in India or abroad for a period of 15 to 30 days.

2. STRUCTURE OF PROGRAMME

- Core Course
- Extra Departmental Course (EDC)
- Discipline Specific Elective (DSE)
- Industrial Training (IT)
- Project

3. DURATION OF THE PROGRAMME

M.Sc. /M.Com. / M.A. Programme must be completed within 2 Years (4 semesters) and maximum of 4 Years (8 semesters) from the date of acceptance to the programme. If not, the candidate must enroll in the course determined to be an equivalent by BoS in the most recent curriculum recommended for the Programme.



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4. REQUIREMENTS FOR COMPLETION OF A SEMESTER

Every student shall ordinarily be allowed to keep terms for the given semester in a program of his/ her enrolment, only if he/ she fulfills at least seventy five percent (75%) of the attendance taken as an average of the total number of lectures, practicals, tutorials, etc. wherein short and/or long excursions/field visits/study tours organised by the college and supervised by the faculty as envisaged in the syllabus shall be credited to his attendance. Every student shall have a minimum of 75% as an overall attendance.

5. EXAMINATIONS

The end semester examinations shall normally be conducted after completing 90 working days for each semester. The maximum marks for each theory and practical course as follows,

Mark distribution for Theory Courses

Continuous Internal Assessment (CIA) : 40 Marks

End Semester Exams (ESE) : 60 Marks

Total : 100 Marks

i) Distribution of Internal Marks

S.No.	Particulars	Distribution of Marks
1	CIA I (2.5 Units) (On completion of 45 th working day)	5
2	Model (All 5 Units) (On completion of 85 th working day)	5
3	Attendance	05
4	Library Usage	05
5	Skill Enhancement *	05
Total		25

Breakup for Attendance Marks:

S.No	Attendance Range	Marks Awarded
1	95% and Above	5
2	90% - 94%	4
3	85% - 89%	3
4	80% - 84%	2
5	75% - 79%	1



Note:

Special Cases such as NCC, NSS, Sports, Advanced Learner Course, Summer Fellowship and Medical Conditions etc. the attendance exemption may be given by principal and Mark may be awarded.

Break up for Library Marks:

S.No	Attendance Range	Marks Awarded
1	10h and above	5
2	9h- less than 10h	4
3	8h - less than 9h	3
4	7h - less than 8h	2
5	6h - less than 7h	1

Note:

In exception, the utilization of e-resources of library will be considered.

***Components for "Skill Enhancement" may include the following:**

Class Participation, Case Studies Presentation/Term paper, Field Study, Field Survey, Group Discussion, Term Paper, Presentation of Papers in Conferences, Industry Visit, Book Review, Journal Review, e-content Creation, Model Preparation, Seminar and Assignment.

Components for Skill Enhancement

Any one of the following should be selected by the course coordinator

S.No.	Skill Enhancement	Description
1	Class Participation	<ul style="list-style-type: none"> • Engagement in class • Listening Skills • Behaviour
2	Case Study Presentation/ Term Paper	<ul style="list-style-type: none"> • Identification of the problem • Case Analysis • Effective Solution using creativity/imagination
3	Field Study	<ul style="list-style-type: none"> • Selection of Topic • Demonstration of Topic • Analysis & Conclusion
4	Field Survey	<ul style="list-style-type: none"> • Chosen Problem • Design and quality of survey • Analysis of survey



5	Group Discussion	<ul style="list-style-type: none"> • Communication skills • Subject knowledge • Attitude and way of presentation • Confidence • Listening Skill
6	Presentation of Papers in Conferences	<ul style="list-style-type: none"> • Sponsored • International/National • Presentation • Report Submission
7	Industry Visit	<ul style="list-style-type: none"> • Chosen Domain • Quality of the work • Analysis of the Report • Presentation
8	Book Review	<ul style="list-style-type: none"> • Content • Interpretation and Inferences of the text • Supporting Details • Presentation
9	Journal Review	<ul style="list-style-type: none"> • Analytical Thinking • Interpretation and Inferences • Exploring the perception if chosen genre • Presentation
10	e-content Creation	<ul style="list-style-type: none"> • Logo/ Tagline • Purpose • Content (Writing, designing and posting in Social Media) • Presentation
11	Model Preparation	<ul style="list-style-type: none"> • Theme/ Topic • Depth of background Knowledge • Creativity • Presentation
12	Seminar	<ul style="list-style-type: none"> • Knowledge and Content • Organization • Understanding • Presentation
13	Assignment	<ul style="list-style-type: none"> • Content and Style • Spelling and Grammar • References



ii) Distribution of External Marks

Total	:	75
Written Exam	:	75

Marks Distribution for Practical course

Total	:	100
Internal	:	40
External	:	60

i) Distribution of Internals Marks

S. No.	Particulars	Distribution of Marks
1	Experiments/Exercises	15
2	Test 1	10
3	Test 2	10
4	Observation Notebook	05
Total		40

ii) Distribution of External Marks

S.No.	Particulars	External Marks
1	Practical	40
2	Record	10
3	Viva- voce	10
Total		60

Practical examination shall be evaluated jointly by Internal and External Examiners.

A) Mark Distribution for Project

Total	:	200
Internal	:	80
External	:	120

i) Distribution of Internal Marks

S.No.	Particulars	Internal Marks
1	Review I	30
2	Review II	40
3	Attendance	10
Total		80



ii) Distribution of External Marks

S.No	Particulars	External Marks
1	Project Work & Presentation	100
2	Viva -voce	20
Total		120

Evaluation of Project Work shall be done jointly by Internal and External Examiners.

6. Credit Transfer

a. Upon successful completion of 1 NPTEL Course (4 Credit Course) recommended by the department, during Semester I to II, a student shall be eligible to get exemption of one 4 credit course during the 3rd semester. The proposed NPTEL course should cover content/syllabus of exempted core paper in 3rd semester.

S. No.	Course Code	Course Name	Proposed NPTEL Course	Credit
1			Option - 1 Paper title	4
			Option - 2 Paper title	
			Option - 3 Paper title	

b. Upon successful completion of 2 NPTEL Courses (2 Credit each) recommended by the department, during Semester I to II, a student shall be eligible to get exemption of one 4 credit course during the 3rd semester. Out of 2 NPTEL proposed courses, at least 1 course should cover content/syllabus of exempted core paper in 3rd semester.

Mandatory

The exempted core paper in the 3rd semester should be submitted by the students for approval before the end of 2nd semester

Credit transfer will be decided by equivalence committee



S. No.	Course Code	Course Name	Proposed NPTEL Course	Credit
1			Option - 1 Paper title	2
			Option - 2 Paper title	
			Option - 3 Paper title	
2			Option - 1 Paper title	2
			Option - 2 Paper title	
			Option - 3 Paper title	

NPTEL Courses to be carried out during semester I - II.					
S. No.	Student Name	Class	Proposed NPTEL Course		Proposed Course for Exemption
			Course I	Option 1- Paper Title Option 2- Paper Title Option 3- Paper Title	Any one Core Paper in 3 rd Semester
			Course II	Option 1- Paper Title Option 2- Paper Title Option 3- Paper Title	
Class Advisor		HoD		Dean	

7. Internship/Industrial Training

Mark Distribution for Internship/ Industrial Training

Total	:	100
Internal	:	40
External	:	60

i) Distribution of Internal Marks

S.No.	Particulars	Internal Marks
1	Review I	15
2	Review II	20
3	Attendance	5
Total		40



ii) Distribution of External Marks

S.No	Particulars	External Marks
1	Internship /Industrial training Presentation	40
2	Viva -voce	20
Total		60

Internship/ Industrial training shall be evaluated jointly by Internal and External Examiners.

9. Extra Credits: 10

Earning extra credit is not essential for programme completion. Student is entitled to earn extra credit for achievement in Curricular/Co-Curricular/ Extracurricular activities carried out other than the regular class hours.

A student is permitted to earn a maximum of 10 extra Credits during the programme period. A maximum of 1 credit under each category is permissible.

Category	Credit
Self study Course	1
CA/ICSI/CMA (Foundations)	1
CA/ICSI/CMA (Inter)	1
Sports and Games	1
Publications / Conference Presentations (Oral/Poster)/ Awards	1
Innovation / Incubation / Patent / Sponsored Projects / Consultancy	1
Representation in State / National level celebrations	1
Awards/Recognitions/Fellowships	1
Advanced Learner Course (ALC)*	2

Credit shall be awarded for achievements of the student during the period of study only.

GUIDELINES

Self study Course

A pass in the self study courses offered by the department.

The candidate should register the self study course offered by the department only in the III semester.



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M.Sc. Biochemistry (Students admitted during the AY 2023-2.

CA/ICSI/CMA(Foundations)

Qualifying foundation in CA/ICSI/CMA / etc.

CA/ICSI/CMA(Inter)

Qualifying Inter in CA/ICSI/CMA / etc.

Sports and Games

The Student can earn extra credit based on their Achievement in sports in University/ State / National/ International.

Publications / Conference Presentations (Oral/Poster)

Research Publications in Journals

Oral/Poster presentation in Conference

Innovation / Incubation / Patent / Sponsored Projects / Consultancy

Development of model/ Products /Prototype /Process/App/Registration of Patents/ Copyrights/Trademarks/Sponsored Projects /Consultancy

Representation in State/National level celebrations

State / National level celebrations such as Independence day, Republic day Parade, National Integration camp etc.

Awards/Recognitions/Fellowships

Regional/ State / National level awards/ Recognitions/Fellowships

***Advanced Learner Course (ALC):**

ALC is doing work of a higher standard than usual for students at that stage in their education.

Research work/internships carried out in University/ Research Institutions/ Industries of repute in India or abroad for a period of 15 to 30 days will be considered as Advanced Learners Course.



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M.Sc. Biochemistry (Students admitted during the AY 2023-2)

QUESTION PAPER PATTERN

CIA Test I : [1½ Hours-2.5 Units] - 25 Marks

SECTION	MARKS	DESCRIPTION	TOTAL	Remarks
Section - A	8 x 0.5 = 04 Marks	MCQ	25 Marks	Marks secured will be converted To 5 mark
Section - B	3 x 2 = 06 Marks	Answer ALL Questions Either or Type ALL Questions Carry Equal Marks		
Section - C	3 x 05 = 15 Marks			

CIA Test II/ Model [3 Hours-5 Units] - 75 Marks

SECTION	MARKS	DESCRIPTION	TOTAL	Remarks
Section - A	10 x 1 = 10 Marks	MCQ	75 Marks	Marks secured will be converted To 5 mark
Section - B	5 x 3 = 15 Marks	Answer ALL Questions (Either or Type Questions) Each Questions Carry Equal Marks		
Section - C	5 x 8 = 40 Marks			
Section - D	1 x 10 = 10 Marks	Compulsory Question		

End Semester Examination [3 Hours-5 Units] - 75 Marks

SECTION	MARKS	DESCRIPTION	TOTAL
Section - A	10 x 1 = 10 Marks	MCQ	75 Marks
Section - B	5 x 3 = 15 Marks	Answer ALL Questions (Either or Type Questions) Each Questions Carry Equal Marks	
Section - C	5 x 8 = 40 Marks		
Section - D	1 x 10 = 10 Marks	Compulsory Question	



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Course Code	Course Name	Category	L	T	P	Credit
233BC2A1CA	CHEMISTRY OF BIOMOLECULES	CORE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The structural organization and functional properties of biomolecules.
- The structure and functions of biologically important macromolecules.
- The characterization of biological macromolecules

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Assess the importance of carbohydrate containing proteins, homo and heteropolysaccharides.	K4
CO2	Determine the conformational properties of biological proteins.	K4
CO3	Summarize the information about all lipids and their biological significance	K5
CO4	Explain the different forms of DNA& RNA	K5
CO5	Describe the structure and functions of important heterocyclic compounds.	K5

MAPPING WITH PROGRAMME OUTCOMES

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

<input checked="" type="checkbox"/>	Skill Development	<input type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input type="checkbox"/>	Innovations
<input type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



233BC2A1CA	CHEMISTRY OF BIOMOLECULES	SEMESTER I
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Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Polysaccharides 10 h

Homo polysaccharides: Structure and biological functions of starch, cellulose, glycogen, chitin, fructans, mannans, xylans, and galactans. 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. Isolation and Purification of Polysaccharides.

Unit II Proteins 10 h

Primary structure- determination of amino acid sequence of proteins. Denaturation and renaturation of proteins. The peptide bond: Ramachandran plot. Secondary structure- weak interactions involved, alpha helix, beta sheet and beta turn's. Pauling and Corey model for fibrous proteins. 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. Solid state synthesis of peptides. Protein folding

Unit III Lipids 10 h

Classification, structure, function, physical and chemical properties of lipids. Fattyacids-Saturated, Hydroxy and Unsaturated Fattyacids-Triacylglycerol. 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.

Unit IV Nucleic Acids 10 h

DNA double helical structure. A, B and Z forms of DNA. Triple and quadruple structures. Physical properties of DNA. Chemicals that react with DNA. Renaturation and denaturation. DNA super coiling and linking number. DNA bending: The Wedge model and Junction model, Protein induced bending.



Cruciform DNA, Left-handed DNA. Types of RNA, Secondary and tertiary structure of RNA.

Unit V Heterocyclic Compounds

8 h

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. Porphyrine – structure and biologically important compounds containing porphyrin ring.

Text Books

- 1 *David L Nelson and Michael M Cox, 2017, "Lehninger Principles of Biochemistry", 7th edition. Macmillan Publisher, New York.*
- 2 *Richard R Sinden, 2012, "DNA Structure and Function", 1st Edition, Academic Press, US.*

References

- 1 *Jeremy M Berg Lubert Stryer John Tymoczko and Gregory Gatto, 2019, "Biochemistry", 9th edition, W.H. Freeman and Company, New York*
- 2 *Donald Voet, Judith G. Voet , Charlotte W. Pratt,2018, "Voet's Principles of Biochemistry", 5th 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.*
- 4 *Garrett R H and Grisham C M, 2017, "Biochemistry", 6th edition, Brooks/Cole Cengage Learning, Boston.*



Course Code	Course Name	Category	L	T	P	Credit
233BC2A1CB	BIOCHEMICAL TECHNIQUES AND INSTRUMENTATION	CORE	4	-	-	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.

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Distinguish the conventional and recent techniques in the field of spectroscopy like ESR, NMR and MS etc	K5
CO2	Compare and contrast the preparative and analytical ultracentrifugation techniques and the advanced microscopic methods	K5
CO3	Evaluate the advantages and disadvantages of ancient and recent techniques in chromatography.	K5
CO4	Assess and explain the importance of different types of electrophoresis and blotting techniques.	K4
CO5	Differentiate the different biophysical techniques like X- ray diffraction, ORD, CD etc.	K5

MAPPING WITH PROGRAMME OUTCOMES

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

<input checked="" type="checkbox"/>	Skill Development	<input type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input type="checkbox"/>	Innovations
<input type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



233BC2A1CB	BIOCHEMICAL TECHNIQUES AND INSTRUMENTATION	SEMESTER I
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Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Spectroscopic techniques 10 h

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.

Unit II Centrifugation techniques and Microscopy 10 h

Principle, technique and applications of preparative ultracentrifugation, differential centrifugation, density gradient centrifugation (caesium chloride and sucrose density gradients) 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.

Unit III Chromatographic techniques 10 h

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.

Unit IV Electrophoresis and Blotting techniques 9 h

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.

Unit V Biophysical and Radio-isotopic methods 9 h

Principles and applications of X-ray diffraction, ORD and circular dichroism, Types of radiation, half-life and units of radioactivity, Applications of radioisotopes in disease diagnosis



Detection and measurement of radioactivity- Principle, instrumentation and applications of Liquid scintillation counter and Geiger-Muller counter. Autoradiography and its applications.

Text Books

- 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.*

References

- 1 *Boyer, R.F, 2012, "Modern Experimental Biochemistry", 3rd edition, Pearson Education Inc, NewYork.*
- 2 *Cooper, T.G, 2011, "The Tools of Biochemistry", 1st edition, John Wiley and Sons, New Jersey.*
- 3 *Pelczar Jr, Chan and Krieg, 2012, "Microbiology", 5th Edition, Tata Mc Graw Hill, NewYork.*
- 4 *Srivastava, S, 2010, "Molecular Techniques in Biochemistry and Biotechnology", 1st edition, NewCentral Book Publishers, Kolkata.*



Course Code	Course Name	Category	L	T	P	Credit
233BC2A1CC	ENZYMES AND ENZYME TECHNOLOGY	CORE	4	-	-	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.

COURSE OUTCOMES

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

CO Number	CO Statement	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	K4
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	Plan a project on enzyme isolation, purification and application of immobilized enzymes.	K6

MAPPING WITH PROGRAMME OUTCOMES

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

<input checked="" type="checkbox"/>	Skill Development	<input checked="" type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input type="checkbox"/>	Innovations
<input type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



233BC2A1CC	ENZYMES AND ENZYME TECHNOLOGY	SEMESTER I
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Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Classification, Purification and Active Site 10 h

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, Investigation of 3D Structure of Active site. Models of enzyme substrate binding: Lock and key model and Induced Fit model. Coenzymes and cofactors in enzyme catalysed reaction. Multi-enzyme complex- Pyruvate dehydrogenase, fatty acid synthase. Measurement of enzyme activity: two-point assay, kinetic assay, using radio-labelled substrates.

Unit II Enzyme Kinetics and Inhibition 10 h

Kinetics of single substrate enzyme catalysed reactions: Michaelis-Menten equation, importance of V_{max} , K_m , K_{cat} and specificity constant (K_{cat}/K_m), turnover number, Lineweaver-Burk plot, Eadie-Hofstee plot, Hanes-Woolf plot and Eisenthal and Cornish-Bowden plot. 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.

Unit III Mechanism of Enzyme Action and Regulation 10 h

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.

Unit IV Industrial and Clinical uses of Enzymes 9 h

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.



Clinical enzymology: Enzymes as thrombolytic agents, anti-inflammatory agents and digestive aids. Therapeutic use of asparaginase, streptokinase. Enzymes and isoenzymes in diagnosis: LDH, CK, transaminases, phosphatases, amylase and cholinesterase.

Unit V Immobilized Enzymes and Biosensors

9 h

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 immune-sensors. Enzyme engineering: Artificial enzymes. Abzymes and synzymes, Antioxidant enzymes.

Text Books

- 1 Palmer, T, 2004, "**Understanding enzymes**", 1st edition, East West Press Pvt. Ltd., New Delhi.
- 2 Bhatt S.M, 2014, "**Enzymology and Enzyme technology**", 15th edition, S. Chand publishing Ltd, New Delhi.

References

- 1 Palmer, T and Bonner, P L, 2004, "**Enzymes: Biochemistry, Biotechnology, Clinical chemistry**", 1st edition, East West Press Pvt. Ltd., New Delhi.
- 2 Price, N C, Stevens, L, 2009, "**Fundamentals of Enzymology: The Cell and Molecular Biology of Catalytic Proteins**", 3rd edition, Oxford University Press, United Kingdom.
- 3 Choudhary, N L, Singh, A, 2012, "**Fundamentals of Enzymology**", 1st edition, Oxford Book Company, New Delhi, India.
- 4 Berg, J M, Tymoczko, J L, Gatto Jr, G J, Stryer, L, 2015, "**Biochemistry**", 8th edition, W.H. Freeman and Company, New York, USA.



Course Code	Course Name	Category	L	T	P	Credit
233BC2A1CD	CELLULAR BIOCHEMISTRY	CORE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- the cellular organization and function
- cellular transport, communication, division, and cancer
- Structure and function of biological membranes

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Distinguish the composition of macromolecules constituting biomembranes 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 the pathways of energy generation and utilization, cytoskeleton organization in a cell.	K5
CO4	Explain the molecules of cellular integration and pathways of cellular communication.	K4
CO5	Examine cell division events and process of cell death. Explain the events leading to cellular transformation.	K5

MAPPING WITH PROGRAMME OUTCOMES

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

<input checked="" type="checkbox"/>	Skill Development	<input type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input type="checkbox"/>	Innovations
<input type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



233BC2A1CD	CELLULAR BIOCHEMISTRY	SEMESTER I
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Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Membrane Biology 9 h

Biomembrane structure: Fluid Mosaic model, the dynamic nature of the plasma membrane. 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, solubilisation of proteins, lipid anchored proteins. Membrane carbohydrates: cell surface carbohydrates, Lectins.

Unit II Membrane transport 10 h

Membrane transport: Overview, Passive diffusion, Facilitated diffusion in erythrocytes, Carriers and Ion-channels, Uniporter catalyzed transport. Active transport systems: Transport process driven by ATP powered ion Pumps- Calcium ATPase, Na⁺K⁺ATPase, Gastric H⁺K⁺ATPase, ATPases that transport peptides and drugs, ABC super family- 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

Unit III Energy metabolism and Cytoskeleton 9 h

Mitochondrial reduction potentials, electron transport chain- overview, complexes, Q-cycle, Cyt-C oxidase complex, translocation of Protons and the establishment of a proton motive force, machinery for ATP formation. Chemiosmotic mechanism, APT Synthase Experiments. Inhibitions of Oxidative phosphorylation- Uncouplers. Microtubules- Organization and dynamics of Kinesin and dynein. Microfilaments- Structures and Assembly of Actin and Myosin. Cilia and Flagella- Structure and functions. Intermediary filaments- Assembly and Disassembly. Striated muscle- structure, excitation- contraction.

Unit IV Cellular Integration 10 h

Cell-Cell and Cell-matrix adhesion: An overview. Cell-Cell interaction: ECM- Collagen, hyaluronan & proteoglycans, laminin, integrins and fibronectins. Cell-Cell adhesion- CAMs. Specialized junctions- Desmosomes, Gap junctions. Adhesion molecules- Cadherins, Connexins.



Cell-Cell signaling- Signaling molecules and their receptors: functions of cell surface receptors, pathways of intracellular signal transduction, second messengers - G-protein coupled receptors, receptor tyrosine kinases, MAP kinases.

Unit V Protein Transport and degradation and cell cycle 10 h

Protein targeting: post-translational modifications in prokaryotes and eukaryotes, role of signal peptide, role of endoplasmic reticulum and golgi apparatus. Targeting of proteins to different compartments, translocation, heat shock proteins, molecular chaperons, glycosylation, SNAPs and SNAREs, bacterial signal sequences, mitochondrial, chloroplast and nuclear protein transport, endocytosis-viral entry, ubiquitin tagged protein destruction, Sumoylation

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.

Text Books

- 1 Rodwell, V.W., Bender, D.A., Botham, K.M., Kennelly, P. and Weil, P.A., 2018, "**Harper's Illustrated Biochemistry**", 31st edition, The McGraw-Hill Inc, New York
- 2 Verma P S and Agarwal V K, 2004, "**Cell Biology, Genetics, Molecular Biology, Evolution and Ecology**", 1st edition, S. Chand and Company Limited, New Delhi

References

- 1 Alberts B, Johnson A, Lewis J, Raff M, Roberts K and Walltre P, 2015, "**Molecular Biology of the cell**", 6th edition, Taylor and Francis Company, UK.
- 2 Kar G, Iwasa J and Marshall M, 2016. "**Karp's Cell and Molecular Biology: Concepts and Experiments**", 8th edition, John Wiley and Sons, USA
- 3 Cooper G M, 2018, "**The Cell: A Molecular Approach**", 8th edition, Sinauer Associates, Inc., USA.
- 4 Harvey Lodish, Arnold Berk, Paul Matsudaira, Chris A. Kaiser, Monty Krieger, Matthew P. Scott, Lawrence Zipursky and James Darnell, 2016, "**Molecular Cell Biology**", 8th edition, WH Freeman and Company, New York



233BC2A1CP	CORE PRACTICAL I : ENZYMES AND CELLULAR BIOCHEMISTRY	SEMESTER I
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Total Credits: 3

Total Instructions Hours: 72 h

S.No	List of Experiments
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



References

- 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



233BC2A1CQ	CORE PRACTICAL II : BIOMOLECULES AND BIOCHEMICAL TECHNIQUES	SEMESTER I
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Total Credits: 2
Total Instructions Hours: 48 h

S.No	List of Experiments
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)



References

- 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.



Course Code	Course Name	Category	L	T	P	Credit
233MB2A1DA	MICROBIAL TECHNOLOGY	DSE	3	1	-	3

PREAMBLE

This course has been designed for students to learn and understand

- The production of Sustainable products using Microorganisms.
- The importance of Microorganisms in Pharmaceutical sector.
- How to explore the ideas in commercial level

COURSE OUTCOMES

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

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

MAPPING WITH PROGRAMME OUTCOMES

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

<input checked="" type="checkbox"/>	Skill Development	<input checked="" type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input checked="" type="checkbox"/>	Innovations
<input checked="" type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



233MB2A1DA	MICROBIAL TECHNOLOGY	SEMESTER I
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Total Credits: 3

Total Instruction Hours: 48 h

Syllabus

Unit I Microbial products 10 h

Single Cell Protein and its Economic Aspects: Bacterial, Yeast, Fungal and Algal Proteins - Brewer's and Baker's yeast - Food and Fodder yeast - Mushroom (Agaricus, Oyster) and Products from Higher fungi (Ganoderma lucidum).

Unit II Production of Biofuel & Biofertilizer 10 h

Production, Methods and Uses of Bioethanol (*S cerevisiae*) - Biodiesel (*Chlorella*) - Biohydrogen (*Chlamydomonas*) - Biogas (*Methanobacteria*). Biofertilizer - N₂ fixing, Phosphate Solubilizing, Phosphate Mobilizing, Plant Growth Promoting Rhizobacteria - Mass production and Applications.

Unit III Biopolymer production 8 h

Production and Uses of Polyhydroxybutyrate (PHB) - Xanthan - Alginate - Cellulose - Cyanophycin - Levan - Melanin - Welan - Succinoglucon- Curdlan- Chitosan - Polyhydroxyalkanoates - Hyaluronic acid.

Unit IV Immobilization of Cells & Enzymes 10 h

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

Unit V Microbial products with pharmaceutical importance 10 h

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. Antimicrobial compounds from soil microbes - Case study



Text Books

- 1 Patel A H, 2012, **Industrial Microbiology**, 2nd Edition, Trinity Press, New Delhi
- 2 El-Mansi E M T, Bryce C F A, Dahhou B, Sanchez S, Demain A L and Allman A R, 2012, **Fermentation Microbiology and Biotechnology**, 3rd Edition, CRC Press, USA

References

- 1 Bernard R Glick, Jack J Pasternek and Cheryl L Patten, 2010, **Molecular Biotechnology - Principles and Applications of Recombinant DNA**, 4th Edition, ASM Publishers, USA]
- 2 Nidhi Goel, 2013, **Pharmaceutical Microbiology**, 1st Edition, Narosa Publishing House, New Delhi
- 3 Puvanakrishnan R, Sivasubramanian S and Hemalatha T, 2012, **Microbial Technology - Concepts and Applications**, 1st Edition, MJP Publishers, New Delhi
- 4 https://agritech.tnau.ac.in/org_farm/orgfarm_biofertilizertechology.html



Course Code	Course Name	Category	L	T	P	Credit
233BC2A1DA	CANCER BIOLOGY,DIAGNOSIS AND THERAPY	DSE	3	1	-	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.

COURSE OUTCOMES

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

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

MAPPING WITH PROGRAMME OUTCOMES

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

<input checked="" type="checkbox"/>	Skill Development	<input type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input type="checkbox"/>	Innovations
<input type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



233BC2A1DA	CANCER BIOLOGY, DIAGNOSIS AND THERAPY	SEMESTER I
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Total Credits: 3

Total Instruction Hours: 48 h

Syllabus

Unit I Introduction 9 h

Introduction: Cancer cell-morphology and growth characteristics. Metastasis and cytoskeleton. Types of growth- hyperplasia, dysplasia, anaplasia and neoplasia. Types and prevalence of cancer. Nomenclature of neoplasms, classification based on origin/organ. Differences between benign and malignant tumors.

Unit II Carcinogenesis 9 h

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. Mutation Types-addition, deletion, inversion, reciprocal, translocation, insertional translocation and frame-shift mutations. Chemical carcinogenesis- genetic and epigenetic carcinogens, pro- carcinogens and co-carcinogens, promoters and initiators, testing for carcinogenicity, Ames test. Aberrant metabolism during cancer development.

Unit III Tumor Markers and Signal Transduction 10 h

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.

Unit IV Cell Cycle, Cell Death and Cancer 10 h

Cell Cycle Regulation cancer: control of the cell cycle - cyclins and CDKs, and tumor suppressor genes p53, p21Rb, BRAC1 and BRAC2. Telomeres, and Immortality; Epigenetics- role of DNA methylation in gene silencing- epigenetic silencing of tumor - suppressor genes. Death - signaling pathways - mitochondrial and death receptor pathways, (Intrinsic- extrinsic pathways). Mechanism and Impact of apoptosis.

Unit V Cancer Diagnosis and Cancer Therapy, Stem Cells and Cancer 10 h

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 and surgical therapy. Principles of cancer biomarkers and their applications.



Text Books

- 1 Mc Kinnell R.G et al, 2012, "The Biological Basis of Cancer", 2nd edition, Cambridge University Press, London.
- 2 Weinberg R.A, 2014, "The Biology of Cancer", 2nd edition, Garland Science, New York & London.

References

- 1 Vincent T. De Vita M. D et al, 2020, "Principles and Practice of Oncology: Primer of Molecular Biology in Cancer", 3rd 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", 2nd edition; Wiley Black well, London.
- 3 Hesketh R, 2013, "Introduction to Cancer Biology", 1st edition, Cambridge University Press, London.
- 4 Pezzella F et al, 2019, "Oxford textbook of Cancer Biology", 1st edition, Oxford University Press, London



Course Code	Course Name	Category	L	T	P	Credit
233BT2A1DA	APPLIED BIOTECHNOLOGY	DSE	3	1	-	3

PREAMBLE

This course has been designed for students to learn and understand

- the applications of biotechnology in plant , animal and Environmental field
- the applications of biotechnology in health care sector
- the products obtained from fermentation and its applications.

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Understand the fundamental applications of Biotechnology	K1
CO2	Know the basics and fundamentals of biotechnology applications in environment.	K2
CO3	Discuss about the disease and disease prevention.	K3
CO4	Discuss the applications of Enzymes in various fields.	K4
CO5	Discuss the production and application of products obtained from fermentation technology.	K1

MAPPING WITH PROGRAMME OUTCOMES

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

<input type="checkbox"/>	Skill Development	<input checked="" type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input type="checkbox"/>	Innovations
<input type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



233BT2A1DA	APPLIED BIOTECHNOLOGY	SEMESTER I
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Total Credits: 3

Total Instruction Hours: 48 h

Syllabus

Unit I Agricultural, Plant Biotechnology and Animal Biotechnology 10 h

Applications of transgenic crop technology: Herbicide resistance (Glyphosate Resistance plants), Pest resistance (Bt Cotton) and Virus Resistance. Enhancement of micro-nutrients (Vitamin A & Vitamin E). 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).

Unit II Environmental Biotechnology 08 h

Bioremediation- (Bioaugmentation and Biostimulation). Biodegradation of Xenobiotic compounds. Bioleaching. Microbially Enhanced Oil Recovery. Biotechnological methods for hazardous waste management. Bioindicators -Biomarkers -Biosensors -Management for effluent toxicity, heavy metal pollution, thermal and radioactive pollution

Unit III Health Care Biotechnology 10 h

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.

Unit IV Enzyme Biotechnology 10 h

Enzyme 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 industries, dairy industry and Textile industry.

Unit V Fermentation Biotechnology 10 h

Production, harvest, recovery and uses - enzymes, Antibiotics (Tetracycline), vitamins (B2), Aminoacids (glutamic acid), Organic solvents (ethanol); Organic acids (lactic acid). Single Cell Protein (algae), beverages (Wine). Formulation of Biofertilizer (Rhizobium), Biopesticides.




Text Books

- 1 Bernard R Glick and Jack J Pasternak, 2010, **Molecular Biotechnology: Principles and Applications of recombinant DNA**, 4th Edition. ASM Press
- 2 Slater, Scott, and Fowler, 2008, **Plant Biotechnology: The genetic manipulation of plants**. 2nd Edition. Oxford University Press, UK

References

- 1 S. S. Marwaha & K. Arora, 2000, **Food processing Biotechnological application**, Asiatech Publishers INC, New Delhi
- 2 T. Palmer, Bonner PLR, 2014, **Enzymes: Biochemistry, Biotechnology and Clinical Chemistry**, 2nd Edition. Woodhead Publishing Limited, Oxford.
- 3 P.F. Stanbury and A. Whitaker, 2005, **Principles of Fermentation technology**, 2nd Edition. Pergamon press.
- 4 El-.Mansi, C.F.A. Bryce, A.L. Demain, A.R. Allman , 2007, **Fermentation microbiology and Biotechnology**, 2nd edition, Taylor and Francis.

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COIMBATORE | INDIA

M.Sc. Biochemistry (Students admitted during the AY 2023-24)