

Loyola Academy Degree & PG College
M.Sc. Biotechnology (2021-23) (Choice-Based Credit System)

Year	Sem	Course- 1	Course - 2	Course - 3	Course - 4	Course - 5	Course - 6	Hours		Credits	
I	I	*Communicative Competence (2) (AECC-1)	Environmental Awareness Activity (2) (SEC-1)	Genetics (4+2) (Core-1)	Cell Biology (4+2) (Core-2)	Biochemistry (4+2) (Core-3)	Microbiology (4+2) (Core-4)	32	Remedial courses (1 hr for Communicative competence, 1hr for core paper) Competitive exam guidance 1hr (3hrs)	26	*AECC=1 SEC=1 CORE=4
I	II	*Human Values and Professional Ethics(2) (AECC-2)	Biostatistics, Ethical issues & Research Methodology (4) (Core5)	Immunology (4+2) Core-6	Molecular biology-I THE GENOME (4+2) Core-7	Molecular biology-II GENES TO PROTEINS (4+2) Core-8	r-DNA Technology (4+2) Core-9	34	Remedial courses (1 hr) Competitive exam guidance 1hr (2hrs)	28	*AECC=1 CORE=5
II	III	*Computer Applications (2) (AECC-3)	Environmental Biotechnology/ Food Biotechnology (DSE-1) (4)	Plant & Agriculture Biotechnology (4+2) (Core-10)	Medical Biotechnology (4+2) (Core-11)	Bioinformatics (4+2) (Core-12)	Bioprocess Engineering (4+2) (Core-13)	34	Remedial courses(1hr for core paper) Competitive exam guidance 1hr (2hrs)	28	*AECC=1 DSE-1 CORE=4
II	IV	Animal Biotechnology (4+2) (Core-14)	Nano- Biotechnology / Advanced Techniques in Biotechnology DSE-II(4)	Inter-Disciplinary* (ID) Basic Biotechnology/ Advances In Biotechnology (4)	Project Work& Seminar (6)			21	Remedial courses(2hrs for each core paper) Competitive exam guidance 9hrs (15hrs)	20	CORE=1 DSE=1 ID=1
Legend: *1. Ability Enhancement Compulsory Course (AECC): 03(Not included in CGPA Score) 2. Skill Enhancement Course (SEC) : 01 3. Inter disciplinary(ID) : 01 4. Core : 14 5. Discipline - Specific Elective(DSE) : 02								TOTAL HOURS	122	22	102
									144		

*Ability Enhancement Compulsory Course (AECC) Marks are not included in CGPA Score in the main Certificate. But there is a Compulsory pass in the examination.
 *Planet Program (1), *ID paper will be offered to the students of other Non-Biotechnology PG Students, #In III Semester in addition to the regular paper students will take one month summer project of 2 credits(Non CGPA).

John

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LOYOLA ACADEMY

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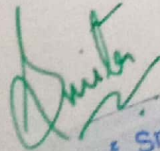
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MEMBERS OF BOARD OF STUDIES MEETING(ONLINE) 2022-23

M.Sc. BIOTECHNOLOGY

S. No.	Name & Designation	Signature
1.	Rev. Fr. Dr. L.JojiReddy SJ Principal, LA. Associate professor in Biotechnology LA	
2.	Rev. Fr. Dr.S.Emmanuel SJ Correspondent LA.	P. S. Emmanuel
3.	Mrs. Dr. Rama IQAC Coordinator, LA.	Rama
4.	Rev. Fr. Ch. Anand Kumar SJ Vice principal (P.G.) & Lecturer in Biotechnology, LA.	Ch. Anand Kumar
5.	Dr. Ch. Sirisha Dean of Academics (P.G), Associate professor in Biotechnology LA	Ch. Sirisha
6.	Mr. V.V.S. Chalapathi Rao HOD, Dept. of M.Sc. Biotechnology, LA.	V.V.S. Chalapathi Rao
7.	Mrs. D. Guru Devi Lecturer in Biotechnology, LA	D. Guru Devi
8.	Mrs. Swarna Dhavala Lecturer in Biotechnology, LA.	S. Dhavala
9.	Dr. Rajasekhar chikati (Expert outside University Asst professor in Biochemistry, LA. Yogi Vemana University, A.P.	—
10.	Dr. K. Narendra Manager, QA/QC, Meenakshi Agrochemicals, Hyderabad	—


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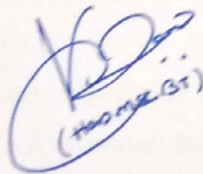
THE DEPARTMENT OF M.Sc. BIOTECHNOLOGY

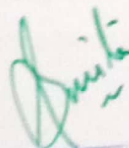
BOARD OF STUDIES MEETING(2022-2023)

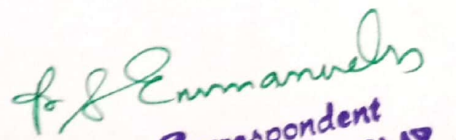
A meeting of Board of Studies-II for the Department of M.Sc. Biotechnology was held on February 8th 2022(Tuesday) by online mode :Zoom meeting at 11A.M

The following members were present:

- ✓ Rev. Fr. Dr. L. Joji Reddy SJ, Principal
Associate professor, Dept. of M.Sc. Biotechnology, LA.
- ✓ Rev.Fr.Dr.S.Emmanuel SJ, Correspondent, LA
- ✓ Fr. K Anand Kumar SJ ,vice-principal(PG), LA
- ✓ ^{Prof} Dr. Smita C.pawar, ^{Asst} Assistant professor, Chairperson BOS,
Dept. of Biotechnology, Osmania University Nominee
- ✓ Mrs. Dr. Ch. Sirisha, Dean of Academics, LA
- ✓ Mr. V. V. S. Chalapathi Rao, (HOD), LA
- ✓ Mrs.. D. Guru Devi, Lecturer in M.Sc Biotechnology, LA
- ✓ Ms.S.Dhaval Joseph, Lecturer in M.Sc Biotechnology, LA


(HOD M.Sc. (BT))




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1

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Minutes of Meeting Board of studies (2022-2023) :

The following resolutions were made;

1. It was resolved to Approve the Revised syllabus for M.Sc. Biotechnology II Year, Semester III,(2022-2023) for batch 2021-2023 as per CBCS Scheme.

2. For 2021-23 batch

It was resolved to follow the Revised syllabus for Semester III- IV, ,&II Year (2022-2023) as per Choice-based Credit system (CBCS)

It was resolved to offer the following papers in Semester III ,Year II

- I Environmental Biotechnology (Theory)(DSE-1)/
Food Biotechnology Theory & Practicals (DSE-I)
- II Plant biotechnology Theory & Practicals(Core-10)
- III Medical BioTechnology Theory & Practicals(Core-11)
- IV Bioinformatics Theory & Practicals(Core-12)
- V Bioprocess Engineering Theory & Practicals(Core-13)

It was suggested to remove Computer Applications(SEC II)in Semester III

It was resolved to offer the following papers in Semester IV, Year II

- I Animal Biotechnology Theory&practicals(Core-14)
- II Nanobiotechnology (Theory)(DSE-2)/
Advanced techniques of Biotechnology Theory (DSE-II)
- III Basic Biotechnology(Interdisciplinary Elective paper-ID)

It was suggested to Retain the same syllabus for papers in semester IV.

IV Project&Seminar

3.It was resolved to offer self study course: BIO ENTER PRENUERSHIP.

4.Department budget proposed of the Academic year 2022-2023 was presented and it was recommended to increase the budget for library books, journals.

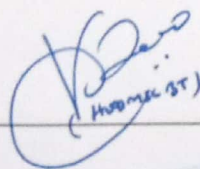
The following changes were made as a part of Revision of syllabus paper wise:

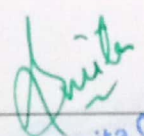
Year II, III Semester

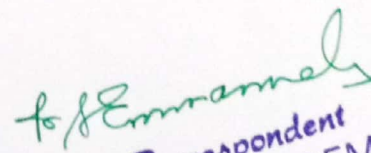
Environmental Biotechnology: Theory: Subjectcode: MBT19302 A

Unit III

1. It was suggested to be retain 3.6 topic.
2. It was recommended to reframe the heading of unit 5 as –Applications of GMO in EBT.
Topic 5.6 is removed.
3. Biosafety aspects of GMO's is introduced.


(HOD/MBT ST)

2

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Food Biotechnology: Theory: Subjectcode:MBT19302 B

1. Changed made in syllabus topics of unit 3 : Concept of Nutraceuticals were elaborated and subtopics were newly introduced in topics 3.1, and 3.2
2. Five topics of unit V In existing syllabus is removed .
3. In unit 5, five new topics on Food Quality & Safety standards are introduced.

Animal Biotechnology :Theory subject code:MBT 19303

Title of unit V is changed as Bioinspired systems &AI In medicine.

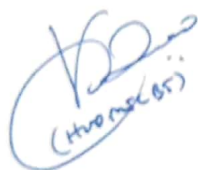
Topic 5.4 Artificial intelligence and its applications in medicine is Newly introduced.


Topic 5.6 is changed as Biologically inspired systems and Robotics in medicine.


Bioinformatics : Theory: subjectcode:MBT19305

1. It was suggested to remove the repeated topic 4.7 in both unit 4 & unit 5 and place in only Unit V.
 2. It was suggested to retain the Topic Ramchandran plot in Unit V
- It was suggested introduce student seminar in semester IV With 2 credits.

All the Above Resolutions were unanimously approved at Board of studies meeting.


(H. V. S. S. S.)


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YEAR-WISE AND SEMESTER-WISE DISTRIBUTION OF SUBJECTS
DEPARTMENT OF BIOTECHNOLOGY
M. Sc - FIRST YEAR – FIRST SEMESTER
ACADEMIC YEAR 2021-22 OF 2021-23 BATCH (CBCS)

Sl. No.	Part	Subject Code	Title of the subject	Hours / week	Duration of Exam (Hrs.)	Marks			Credits
						Internal	External	Total	
1	*I	*MBT 21101	*Communicative Competence (AECC-1)	3	2	*20	*30	*50	*2
2	I	MBT 21102	Environmental Awareness Activity (SEC-1)	2	1	20	30	50	2
3	II	MBT 21103	Genetics (Core-1)	4	3	40	60	100	4
4	II	MBT 21104	Cell Biology (Core-2)	4	3	40	60	100	4
5	II	MBT 21105	Biochemistry (Core-3)	4	3	40	60	100	4
6	II	MBT 21106	Microbiology (Core-4)	4	3	40	60	100	4
PRACTICALS									
7	II	MBT 21107	Genetics (Core-1)	3	2	20	30	50	2
8	II	MBT 21108	Cell Biology (Core-2)	3	2	20	30	50	2
9	II	MBT 21109	Biochemistry (Core-3)	3	2	20	30	50	2
10	II	MBT 21110	Microbiology (Core-4)	3	2	20	30	50	2
			Total	33		260	390	650	26


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Syllabus w.e.f 2021-22 for 2021-23 batch (CBCS)



PROGRAMME OUTCOMES

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Syllabus w.e.f 2021-22 for 2021-23 batch (CBCS)



COMMUNICATIVE COMPETENCE (AECC-I)

Credits: 2
Subject code: MBT21101

I Year/ I Semester
No. of lecture hours: 30

Objective:

English language course will help students to develop a natural and accurate style of English pronunciation.

Outcome: The course will improve students ability to express ideas clearly and confidently in English.

Unit I:	6Hrs
1. Features of Indian English	(1)
2. Correction of sentences, Structures	(1)
3. Tenses, ambiguity- idiomatic distortions	(1)
4. Informal conversation Vs Formal expression	(1)
5. Verbal and non-verbal communication	(1)
6. Barriers to effective communication – kinesics	(1)
Unit II: Types of Communication	6Hrs
1. Oral, Aural, Writing and reading	(1)
2. Word-Power, Vocabulary-Jargon	(1)
3. Rate of Speech, Pitch, Tone-Clarity of voice	(1)
4. Technical presentations	(1)
5. Types of presentation, Video conferencing	(1)
6. Participation in meetings, Chairing sessions	(1)
Unit III:	6Hrs
1. Formal and informal interviews	(1)
2. Ambiance and polemics	(1)
3. Interviewing in different settings and for different purposes	(1)
4. e.g., eliciting and giving information	(1)
5. Recruiting, performance appraisal	(1)
6. Group discussions and Curriculum vitae	(1)
Unit IV:	6Hrs
1. Written communication	(2)
2. Differences between Spoken and Written Communication	(1)
3. Features of Effective Writing such "as Clarity, Brevity	(1)
4. Appropriate tone clarity, balance etc.	(1)
5. Analysis of sample reports from industry -Synopsis and thesis writing	(1)
Unit V:	6Hrs
1. Letter-writing business letters	(1)
2. Proforma, culture-format-style- effectiveness, promptness	(1)
3. Analysis of sample letters collected from industry –email, fax.	(1)
4. Technical Report writing –Business and Technical Reports	(1)
5. Types of reports-Progress Reports, Routine Reports	(1)
6. Annual Reports - Formats	(1)

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Reference Books:

1. Essentials of Business Communication, Rajendra Pal, J S KorlahaHi: Sultan Chand & Sons, New Delhi.
2. Basic Communication Skills for Technology, Andrea J. Rutherford: Pearson Education Asia, Patparganj, New Delhi-92.
3. Advanced Communication Skills, V. Prasad, Atma Ram Publications, New Delhi.
4. 4.Raymond V. Lesikav; John D. Pettit Jr.; Business Communication; Theory & Application, All India Traveller Bookseller, New Delhi-51.
5. Business Communication, RK Madhukar, Vikas Publishing House Pvt. Ltd.

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ENVIRONMENTAL AWARENESS ACTIVITY
Skill Enhancement Course (SEC-1)

Credits: 2
Subject code: MBT 21102

I Year / I Semester
No. of lecture hours: 2

1. Students are given:
 - A case study
 - A survey
 - Planting trees to promote greenery in their locality
 - Study on solid & liquid waste management.
2. Students are involved in preparing charts and models on promoting environmental awareness.
3. Method of Evaluation:
Internal Evaluation:20 marks
MCQ based Test on present Environmental issues & Concerns(15Marks)
Attendance:5Marks
External Evaluation:30 marks
Activity report submission & Viva voce.

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GENETICS

Credits: 4
Subject code: MBT 21103

I Year / I Semester
No. of lecture hours: 60

Objective: The syllabus covers all major areas of genetics balancing classical & molecular aspects to give students an integrated view of genetic principles; it also includes modern genetics of daily lives with numerous examples of applications from human genetics which provides a natural curiosity to learn about themselves and our species.

CO1: Explains the basics of genetics, Mendel's laws and dominance-recessive relationships

CO2: Gives detailed information about chromosomes and pedigree analysis in man

CO3: Explains the variations in chromosomal structure and numbers

CO4: Describes linkage and gene mapping concepts

CO5: Clearly gives information about Organellar inheritance in contrast to Mendelian inheritance

Unit I: Mendelian Genetics **12Hrs**

- 1.1 Basic concepts of Genetics- Terminology, notations and Organisms for genetic studies.
- 1.2 Mendel's experimental design, Monohybrid crosses and Mendel's principle of segregation. (2)
- 1.2.1 Dihybrid and trihybrid Crosses -Mendel's principle of Independent Assortment.
- 1.3 Extensions to Mendel's laws: Multiple Alleles (eg. Coat color in Rabbits, Eye color in drosophila, ABO Blood groups, Rh blood groups - incompatibility, Complex loci - R-locus in maize). (2)
- 1.4 Modifications of Dominance Relationships. (1)
- 1.4.1 Incomplete Dominance -Eg: flower color in Snapdragon & 4^oclock plant.
- 1.4.2 Co dominance – Eg: ABO Blood groups & MN Blood groups.
- 1.5 Gene interactions and modified Mendelian ratios- i) Dominant epistasis ii) Recessive epistasis iii) Duplicate dominant epistasis, iv) Duplicate recessive epistasis v) Duplicate genes with cumulative effect, vi) Recessive and Dominant epistasis. (2)
- 1.6 Gene Expression & the Environment (Penetrance & Expressivity Eg: Polydactyly, Diabetes mellitus. (2)
- 1.7 Pleiotropism - Eg Marfan's syndrome, Vestigial wings in drosophila. (3)
- 1.8 Phenocopy – Eg: Phecomelia, Black coat phenocopy in himalayan rabbits.
- 1.9 Inheritance of quantitative traits - Skin color in man, kernel color in wheat.

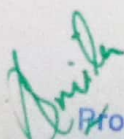
Unit II: Chromosomal basis of inheritance **12Hrs**

- 2.1 Prokaryotic and Eukaryotic chromosomes- morphology, classification– karyotyping. (2)
- 2.2 Specialized chromosomes-Polytene, Lamp brush chromosomes & B-chromosomes. (2)
- 2.3 Chromosomal Theory of Inheritance-sex chromosomes and sex linkage. (1)

M.Sc. Biotechnology

Syllabus w.e.f 2021-22 for 2021-23 batch (CBCS)

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2.4	Inheritance patterns in Man - Pedigree analysis.	(1)
2.5	Sex determination - Drosophila, Birds, Man and Bonellia.	(2)
2.6	X-linked inheritance and Y-linked inheritance	(2)
2.7	Sex limited and sex influenced inheritance	(2)
Unit III: Chromatin Organization and Chromosomal aberrations		12Hrs
3.1	Euchromatin and Heterochromatin, X-chromosome inactivation.	(2)
3.2	Chromatin organization-Nucleosome, loops & Scaffolds.	(2)
3.3	Nucleosome phasing.	(1)
3.4	Chromatin under transcription.	(1)
3.5	Variation in chromosome number - Euploidy, Aneuploidy (plants & animals).	(3)
3.6	Variation in chromosome structure- deletions, duplication, inversions & Translocations.	(3)
Unit IV: Linkage and gene mapping		12Hrs
4.1	Phases of linkage, test cross and back cross.	(2)
4.2	Crossing over & gene recombination - Cytological proof of crossing over	(1)
4.3	Gene mapping & determination of map distances based on two and three point test crosses, coincidence, Interference	(3)
4.4	Tetrad analysis – Neurospora.	(2)
4.5	Mitotic Crossing Over.	(2)
4.6	Genetic mapping, sib pairs, LOD scores, homozygosity mapping, Linkage disequilibrium and Transmission disequilibrium (TDT) test.	(2)
Unit V: Organellar Inheritance		12Hrs
5.1	Non- Mendelian Inheritance-Organisation of Extranuclear Genomes (Mitochondrial & Chloroplast Genome).	(3)
5.2	Rules of Non Mendelian Inheritance.	(1)
5.3	Examples of Non Mendelian Inheritance (Shoot Variegation in <i>Mirabilis jalapa</i> , Poky in Neurospora, Yeast <i>petite</i> Mutants, Non- Mendelian Inheritance in Chlamydomonas.	(3)
5.4	Human Genetic Diseases due to Mitochondrial DNA defects Eg:Lebers Hereditary Optic Neuropathy).	(1)
5.5	Cytoplasmic male sterility in Maize.	(1)
5.6	Exceptions to Maternal Inheritance (Infectious Heredity: Killer Yeast, kappa particles in paramecium).	(2)
5.7	Contrasts to Non Mendelian Inheritance (Maternal Effect- shell coiling in snail).	(1)

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Reference Books:

1. An introduction to Genetic analysis, J.F .Anthony, J.A. Miller, D.T. Suzuki, R.C. Richard Lewontin, W.M-Gilbert, W.H. Freeman & company, New York 7th edition, 1998
2. Principles of Genetics, E.J.Gardner, D.P. Snustad and Michael.J.Simmons, John Wiley & Sons, Newyork, 8th edition, 1984.
3. The science of Genetics, A.G. Atherly J.R. Girton, J.F. Mcdonald, Saunders College publication, Philadelphia, 1st edition,1999.
4. Concepts of Genetics, William S.Klug, Michael R.Cummings, Prentice hall International, New Jersey, 3rd edition, 2000
5. Genetics- A Molecular Approach, Peter J.Russell , Pearson Benjamin Cummings, san Francisco,5th edition ,2006
6. Principles of Genetics, Robert.H. Tamarin, McGrawhill publication, New York, 7th edition, 1996
7. Genetics Principles and Analysis, Daniel.L.Hartl, Elizabeth.W.Jones, Jones and Bartlett Publishers, Massachusetts, 4th edition, 1998
8. Genetics the continuity of life, Daniel.J.Fairbanks, W.Ralph Anderson Brooks/Cole Publishing Company, California, 1st edition, 2005
9. Principles of Genetics, Michael.J.Simmons and D.P. Snustad , John Wiley & Sons, New Jersey, 3th edition, 2003
10. Schaum out line series of Theory & problems in Genetics, Stansfield, McGrahill publication, New York, 3rd edition –2000

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Osmania University, Hyd-500 007.



CELL BIOLOGY

Credits: 4
Subject code: MBT 21104

I Year / I Semester
No. of lecture hours: 60

Objective: Covers the Different Molecular mechanism of cellular transport, signaling, cell division and cell death.

CO1: Structures and purposes of basic components of prokaryotic and eukaryotic cells, especially membranes, and organelles.

CO2: How the cellular components are used in protein sorting through various pathways.

CO3: How Cell Signalling Works and how cells will communicate with the surrounding cells & can have a clear understanding of the signal

CO4: Cellular components underlying mitotic cell division

CO5: The knowledge how the cells undergo apoptosis and its applications

Unit I: Membrane Structure and Transport **12Hrs**

- 1.1 Membrane structure– The Lipid Bilayer (Properties and function). (2)
- 1.2 Structure & function of cytoskeleton- introduction to microfilaments, intermediate filaments, microtubules, myosin structure and role in motility. (2)
- 1.3 Membrane proteins (Spectrin, Glycophorin, Band 3 protein and Bacteriorhodopsin. (3)
- 1.4 Membrane transport - Active & Passive transport driven by ion gradients (uniport, symport and antiport). (2)
- 1.5 Ion Channels and Carriers. (2)
- 1.6 ABC Transporters. (1)

Unit II: Protein sorting **12Hrs**

- 2.1 The transport of molecules between the nucleus and the cytosol. (2)
- 2.2 The transport of proteins into mitochondria and chloroplast. (3)
- 2.3 Transport from the ER through the Golgi apparatus. (2)
- 2.4 Transport from the Trans Golgi Network to Lysosomes (1)
- 2.5 Transport into the cell from the plasma membrane: Endocytosis (2)
- 2.6 Transport from the Trans Golgi Network to the cell exterior: Exocytosis (2)

Unit III: Cell communication **12Hrs**

- 3.1 Overview of extra cellular & intra cellular cell signaling. (2)
- 3.2 Tight junctions and Gap junctions. (2)
- 3.3 Second messengers and their role in signal transduction-cAMP, lipid derived (PIP& IP3) & Calcium. (3)
- 3.4 Cell surface receptors in signal transduction - structure and function.
- 3.4.1 G-protein coupled receptor. (2)
- 3.4.2 Ion channel receptors. (1)
- 3.4.3 Tyrosine kinase linked receptors. (2)

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Unit IV: Cell Cycle and Cell Division	12Hrs
4.1 Components in cell cycle control - Cyclin, CDKs.	(2)
4.2 Check points in cell cycle.	(1)
4.3 Abnormalities in Cell Cycle: Cancer	(1)
4.4 Mechanics of Cell Division - An over view of M-Phase.	(1)
4.4.1 Different Stages of Mitosis.	(1)
4.4.2 Cohesins and Condensins in sister chromosome segregations.	(1)
4.4.3 Microtubules, Kinetochore & centrosomes in spindle assembly.	(1)
4.5 Cytokinesis - actin & myosin; Cytokinesis in plants.	(1)
4.6 Meiosis, Significance.	(1)
4.6.1 Chiasma formation - Synaptonemal complex.	(1)
4.6.2 Recombination during meiosis - Recombination nodules.	(1)
Unit V: Cell Death Pathway	12Hrs
5.1 Introduction to Necrosis, Senescence, Apoptosis - Programmed cell death	(1)
5.2 Mechanisms of apoptosis.	(6)
5.2.1 Apoptosis triggered by internal signals.	
5.2.2 Apoptosis triggered by external signals.	
5.2.3 Apoptosis inducing factor.	(1)
5.3 Apoptosis in cancer, immune system, organ transplants.	(3)
5.4 Apoptosis in plants.	(1)

Reference Books:

1. Cell & Molecular Biology. E. D. D. De Robertis & E. M. F De Robertis, Lippincott Williams and Wilkins, Philadelphia, 8th edition, 2005
2. Molecular biology of the cell. Bruce Alberts, Alexander Johnson, Lewis Julian, Raff Martin, Roberts Keith, Walter Peter, Garland Science publication, New York, 5th edition, 2008
3. Cell & Molecular Biology -Concepts & experiments, Gerald Karp, John Wiley & Sons, Newyork, 3rd edition ,2002
4. Molecular Cell Biology, H. Lodish, D. Baltimore, A. Berk, S. L. Zipursky, J. Darnell W. H. Freeman & company, New York, 4th edition 2004
5. Cell Biology–organelle structure & Function, David E. Sadhava, Jones and Bartlett Publishers, Massachusetts, 1st edition, 1993
6. The Cell- A Molecular Approach, Geoffrey. M. Cooper, ASM Press, Washington. D. C, 1st edition, 1997

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PROGRAMME OUTCOMES

- **PO1 Scientific Knowledge.** Apply the knowledge of Science, Mathematics, Engineering & Technology fundamentals to solve the complex problems.
- **PO2. Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
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**BIOCHEMISTRY**

Credits: 4
Subject code: MBT 21105

I Year / I Semester
No. of lecture hours: 60

Objective: To Understand the Chemistry of Basic Biomolecules of Biological systems. To enable the students to gain knowledge about various Biochemical interactions of living systems. To focus on imparting strong foundations in chemistry to M.Sc. Biotechnology students.

- CO1:** Explains Chemical bonds, molecular interactions in cell
CO2: Apply the knowledge of bonds & shows in representing structure of carbohydrates
CO3: Identifies the structure of lipids, relates & distinguishes with carbohydrates.
CO4: Compares, discriminates the structure & functional relationship of proteins & nucleic acids with other biomolecules in cell.
CO5: Explains the catalytic nature & kinetic properties & inhibition mechanisms of enzymes.

Unit I: Introductory Biochemistry**12Hrs**

- 1.1 Chemical basis of life, Hierarchy and emergent Properties of Biomolecules (1)
 1.2 Macromolecular Assemblies, Structure and Functional Relationships and hydro dynamic properties of Biomolecules (1)
 1.3 Interactions in biological systems (covalent & Non covalent)-Intra and intermolecular forces, Electrostatic and Hydrogen bonding interactions, Vanderwaal's and hydrophobic interaction, Weak inter actions Disulphide bridge (3)
 1.4 Buffers, pH, pK, Henderson Hassalbalch Equation (3)
 1.5 Basic concept of metabolism - definition, carbohydrate, lipid and amino acid Metabolism (outline)-Anabolic & Catabolic pathways with examples (3)
 1.6 ATP Cycle and Role of ATP in metabolism (1)

Unit II: Glycobiology**12Hrs**

2. Overview of Classification of Carbohydrates with example (1)
 2.1 Derivatives of Sugars-DeoxySugars, Glycosides, Amino Sugars (1)
 2.2 Energy Storage Molecules, Homo Polysaccharides: Starch, Glycogen, Pectin, Chitin & Hemicelluloses (3)
 2.3 Hetero polysaccharides - Acid mucopolysaccharides (Glycosamino glycans)
 2.4 Structure, chemistry and Biological role of Cell Surface Molecules: Glyconjugates- Glycoproteins, Glycolipids, proteoglycans, and Bacterial Cell wall Polysaccharides (3)
 2.5 Carbohydrates as informatory molecules -Lectins (2)
 2.6 Methods of carbohydrate Analysis
 2.7. Complete overview of carbohydrate metabolism and networks (2)

Unit III: Lipids**12Hrs**

- 3.1 Overview of Classification of lipids (2)
 3.2 Fatty acids in Plants and Animals (3)
 3.3 Comparative study of Structure, chemistry and biological properties of Phospholipids, Spingolipids and Glycolipids (3)

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- 3.4. Pharmacological role of Eicosanoids (1)
 3.5. Steroid Lipids –Plant & Animal Sterols (2)
 3.6. Lipoproteins and its Applications .
 3.7. Fatty Acid Biosynthesis and Beta Oxidation of FattyAcids. (1)

Unit IV: Proteins and Nucleic Acids **12Hrs**

- 4.1 Classification, structure and characteristics of amino acids (1)
 4.2 Peptide bond stability & formation of polypeptides (Glutathione, oxytocin, vasopressin & Tyrocidin) Synthesis of peptides(solid phase technique) (1)
 4.3 Methods for determining N–termini & C-terminus of Polypeptide (2)
 4.4 Structural organization of proteins Primary, Secondary, Tertiary, Quaternary and subunit Structure of Protein & Denaturation and Renaturation of proteins
 4.5 Structure of Hemoglobin, Myoglobin, Collagen (1)
 4.6 Protein Folding –Models, Anfensons experiment-Ribonuclease (1)
 4.7 Introduction to Protein Ligand interaction (Small Molecule including drugs)
 4.7.1 Phospholipase A2 complex with anti-inflammatory agent Aspirin
 4.7.2. Structure - ligand complex of Glucose transporter
 4.8. Nucleic Acids (6)
 4.8.1 Structure of Purines, Pyrimidines, Nucleosides and Nucleotides. Stability and formation of Phosphodiester bond
 4.8.2 Structural features of Watson & Crick model of DNA, Polymorphic Structural forms of DNA (A,B,Z) Circular DNA, Cruciform & Hair pin, Palindromes, Inverted Repeats, DNA triple helix and quadruplex DNA and DNA super coiling,
 4.8.3 Role of polymorphic Structural forms of DNA in Recognition.
 4.8.4 Role of electrostatics in polymorphic structural transitions in DNA .
 4.8.5. Chemical and enzymatic susceptibility of nucleic acids.

Unit V: Enzymology **12Hrs**

- 5.1 General Characteristics and Catalytic Activity of Enzymes (2)
 5.2 Enzyme Catalysis, Energy Considerations (3)
 5.3 Enzyme kinetics: Michaelis-Menton Equation (2)
 5.4 Transformations of Michaelis-Menton Equation & Double reciprocal plot (1)
 5.5 Enzyme inhibitions: Reversible & Irreversible, Feedback inhibition (2)
 5.6 Metabolic Regulation of Enzymes with Reference to Carbohydrate and Aminoacid Metabolism. (2)

Reference Books:

1. Lehninger Principles of Biochemistry, David.L.Nelson, Michael.M.Cox, W.H. Freeman & company, New York, 4th edition, 2005
2. Biochemistry, Jeremy M.Berg, John L.Tymorzko, Lubert Stryer W.H. Freeman & company, New York, 6th edition, 2007
3. Text Book of Biochemistry with Clinical Correlations Thomas M. Devlin, John Wiley & Sons, New Jersey, 6th edition, 2006
4. Biochemistry Geoffrey L. Zubay McGrahill publication, San Francisco, 4th edition, 1997

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5. Biochemistry Donald Voet, Judith G.Voet, John Wiley & Sons, New York, 2nd edition, 1995
6. Text Book of Biochemistry Edward Staunton West, Wilbert R.Todd, Howard S.Mason, MacMillan Publishing Co, New York, 4th edition, 1966
7. Enzymes, Trevor Palmer, Horwood Publishing Ltd, Chichester, 2nd edition 2004
8. Harpers Biochemistry, Robert K.Murray, Darye K.Granner, Peter A.Mayes McGrawhill publication, New York, 25th edition, 2000
9. An Introduction to Practical Biochemistry, David T.Plummer McGrawhill publication, New York, 3th edition, 2001
10. Experimental Biochemistry-A Student Companion, Beedu Sashidhar Rao, Vijay Deshpande. I.K. International Pvt Ltd, Bangalore, 1st edition, 2005

PROGRAMME OUTCOMES

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MICROBIOLOGY

Credits: 4

Subject code: MBT 21106

I Year / I Semester
No. of lecture hours: 60

Objectives: To impart knowledge about microbiology basic concepts and to comprehend easily. These concepts are very much useful for research purpose.

- CO1:** Explains the basics of Microbiology. Different media used for their culturing and their identification methods
- CO2:** Gives detailed information about systemic classification of Bacteria, Algae, Archae and Fungi
- CO3:** Explains in detail about microbial physiology and their growth
- CO4:** Describes about microbial genetics like Transformation, Transduction, and recombination
- CO5:** Clearly gives information about classification of viruses and chemotherapeutic agents.

Unit I: Introduction to Microbiology 12Hrs

- 1.1 Microscopic identification of Microorganisms: (2)
Microscopy (Light & Electron Microscopy)–Specimen preparation & Staining
- 1.2 Microbiological media and its applications. (2)
- 1.2.1 Bacteriological media: L.B media, Mac Conkey agar, EMB agar.
- 1.2.2 Fungal media: PDA agar, sabourauds Agar, Czapek-Dox Agar.
- 1.2.3 Algal media: Bristols media, Pringsteins Media.
- 1.3 Use of Physical methods in controlling microorganisms: sterilization - Methods of Sterilization and their application in industry (Dry heat, moist heat, Filtration & Radiation). (2)
- 1.4 Use of chemical agents in controlling microorganisms. (1)
- 1.4 Concept of pure culture and methods of pure culture development. (2)
- 1.5 Identification methods of bacteria and other microorganisms. (3)
- 1.5.1 Grams staining, Acid fast staining, spore staining.
- 1.5.2 IMVIC Test, oxidase and catalase test.
- 1.5.3 Lacto phenol test for fungi and Benecks broth for algae.

Unit II: Systemic classification of bacteria, algae, archae and fungi. 12Hrs

- 2.1 Over view of Bergeys Manual of Systemic Bacteriology and general characters of bacteria (structure). (3)
- 2.1.1 Detection & Isolation of mutants – Replica plating technique, Ames test. (1)
- 2.2. The characteristics of fungi
- 2.2.1 Fungal classification. (2)
- 2.2.2 Fungal life cycles, importance, structure. (1)



2.3	The characteristics of Algae, Algal classification, Algal reproduction.	(2)
2.4	The characteristics of Archea	
2.4.1	Archea classification.	(2)
2.4.2	Structure, metabolism.	(1)
Unit III: Microbial physiology and growth		12Hrs
3.1	Nutrition in Microorganisms and assimilation of nutrients.	(1)
3.1.1	Macro Nutrients, Importance of each nutrient and its sources.	(1)
3.1.2	Trace elements and their importance.	(1)
3.1.3	Mechanism of assimilation of nutrients from surroundings by microbes.	(1)
3.2	Nutritional classification of microorganisms based on the energy, carbon and electron donors.	(2)
3.3	Microbial growth (Lag, log, stationary, death phase.) and growth curve.	(2)
3.4	Methods of measurement of growth	
3.4.1	Cell number, Cell mass. Calculation of generation time	(2)
3.5	Continuous culture of microorganisms (turbidostat, chemostat).	(2)
3.6	Influence of environmental factors on growth pH, temperature. Oxygen concentration, Water activity and pressure	(3)
Unit IV: Microbial Genetics		12Hrs
4.1	Transformation: Competence factors, mechanism of transformation.	(2)
4.2	Conjugation	
4.2.1	Structure of F plasmid, Mechanism of transfer of F plasmid.	(1)
4.2.2	Hfr Recombination.	(1)
4.2.3	Mechanism of integration of F plasmid into bacterial chromosome, Circularization of chromosome	(2)
4.3	Transduction - Generalized transduction, lysogeny and lytic cycle.	(2)
4.3.1	Example Structure and replication of Bacteriophage (T2).	(1)
4.3.2	Specialised Transduction – structure of λ phage, mechanism of integration λ bio λ & dgal.	(1)
4.3.3	Structure and replication of lamda phage.	(2)
Unit V: Viruses and Chemotherapeutic agents		12Hrs
5.1.	Classification of viruses and important characters of each group.	(2)
5.2	Methods of cultivation of viruses.	(1)
5.3	Importance of viruses in biotechnology.	(2)
5.4	Chemotherapeutic agents - Classification of Antibiotics (Broad and narrow Spectrum Antibiotics), mode of action of Antibiotics	(3)
5.5	Overview of Anti-fungal and antiviral agents.	(2)
5.6	Mechanism of drug resistance.	(2)

Reference Books:

1. Microbiology Principles & Explorations, Jacquelyn G.Black, John Wiley & Sons, New Jersey, 6th edition, 2005
2. Microbiology, Lansing M.Prescott, John P.Harley, Donald A.Klein, McGrawhill publication, New Jersey, 6th edition, 2005
3. Microbiology, M.J. Pelzar, E.S.N. Cfan and N.R. Kreig, McGrawhill publication, New Jersey, 5th edition, 2011



4. General Microbiology by R.Y Stanier, J.L. Ingrahm, M.L. Wheel is & P.R. Painter, MacMillan Publishing Co, New Jersey, 5th edition, 1995
5. Brock Biology of Microorganisms, Michael T.Madigan,John M.Martinko, Prentice hall International, New Jersey, 11th edition, 2006
6. Foundations in Microbiology, Kathleen Park Talora, Arthur Talora, McGrawhill publication, New Jersey, 4th edition, 2002
7. Alcamos Fundamentals of Mirobiology, Jeffrey C. Pommerville Jones and Bartlett Publishers, Massachusetts, 7th edition, 2004
8. Microbiology- A Laboratory Manual, James G.Cappuccino & Natalie Sherman, Pearson Benjamin Cummings, san Francisco,6th edition ,2005
9. Practical Microbiogy, R.C.Dubey, D.K.Maheshwari, S.Chand& Company Ltd, 2nd edition, 2006

A handwritten signature in green ink, appearing to read 'Smita'.

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Syllabus w.e.f 2021-22 for 2021-23 batch (CBCS)



GENETICS PRACTICALS

Credits: 2

Subject code: MBT 21107

I Year / I Semester

No. of lectures: 3hr/week

1. Drosophila Genetics- a) Preparation of media
b) Observation of wild types and mutants,
c) Handling of drosophila
d) Life cycle of drosophila
2. Isolation and staining of salivary gland chromosomes in Drosophila
3. Monohybrid, Dihybrid ratios, Multiple alleles, Epistasis – Problems
4. Quantitative Inheritance–Problems
5. Inheritance patterns in Man–Pedigree analysis
6. Localization of genes–two & three point test crosses in drosophila–Problems
7. Tetrad analysis-Problems
8. Localisation of genes in man by sib pair method & Lod score estimation
9. Gene mapping by Transmission disequilibrium test (TDT) - Problems
10. Multipoint analysis- determining flanking loci
11. Demonstration of Barr bodies in buccal cells

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CELL BIOLOGY PRACTICALS

Credits: 2

Subject code: MBT 21108

I Year / I Semester

No. of lectures: 3hrs/week

1. Total count and differential count.
2. Study of mitosis in Onion Root tips.
3. Study of meiosis in plants Maize tassels.
4. Qualitative Estimation of cell wall Properties by Histo-Chemical Staining.
5. Demonstration of Cell Cycle Analysis by Flow Cytometry
6. Isolation of mitochondria.
7. Isolation of Chloroplast from spinach leaves.
8. Human Lymphocyte culture.
9. Giemsa banding of chromosomes.
10. Karyotyping of Human normal chromosome sets.
11. Karyotyping of Human abnormal chromosome sets.

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BIOCHEMISTRY PRACTICALS

Credits: 2
Subject code: MBT 21109

I Year / I Semester
No. of lectures: 3hrs/week

Instrumentation & Solutions Preparation.

1. Lab Instrumentation.
2. Preparation of solutions (Molar and Normal),
Preparation of Standard solutions. concept of primary and secondary standards solutions.
3. Calibration of pH meter & Preparation of buffers.(phosphate, Tris EDTA and saline sodium citrate.)

Biochemical Isolations:

- 4.Isolation of Glycogen from liver.
- 5..Isolation of Casein from Milk.
- 6..Isolation of Albumin from Egg.

Titrimetry & Colrimetry

- 7.Determination of Glycine by formal titration method.
- 8.Estimation of Vitamin c by Dichloro phenol indophenol dye method
- 9.Estimation of RNA by Orcinol method.

Enzyme Assays:

- 10.Assay of Amylase/Catalase, SGOT ,SGPT.
- 11.Standardization of Conditions for Enzyme Activity.
- 12.Effect of Temperature on Enzyme Activity.
- 13.Effect of PH on Enzyme Activity.

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MICROBIOLOGY PRACTICALS

Credits: 4

Subject code: MBT 21110

I Year / I Semester

No. of lectures: 3hrs/week

1. Isolation and identification of bacteria and fungi by serial dilution method
2. Methods for detection of specific bacteria by -
wet mount method and hanging drop mount method.
3. Microscopic observation and Staining of bacteria and fungi.
4. Preparation of microbiological media: minimal media, basic media, enriched media and differential media.
5. Methods of Sterilization (Autoclaving, Hot air oven, radiation and filtration).
6. Culturing methods of microorganisms:
 - i) Culturing of microorganisms using Tube culture (slant/broth method),
 - ii) Culturing of microorganisms using plate culture (spread, streak and pour plate)
 - iii) Culturing of microorganisms using flask culture
7. Staining techniques for bacteria – simple, differential and special staining.
8. Methods for Preservation and maintenance of microbial cultures.
9. Measurement of microbial growth (Viable count and turbidometry).
10. Study of bacterial growth curve.

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YEAR-WISE AND SEMESTER-WISE DISTRIBUTION OF SUBJECTS
DEPARTMENT OF BIOTECHNOLOGY
M. SC - FIRST YEAR – SECOND SEMESTER
ACADEMIC YEAR 2020-21 OF 2020-22 BATCH (CBCS)

SL No.	Part	Subject Code	Title of the subject	Hours/ week	Duration of Exam (Hrs.)	Marks			Credits
						Internal	External	Total	
1.	*I	*MBT 21201	COMPUTER APPLICATIONS COMPUTER APPLICATIONS (AECC-2)	2	2	*20	*30	*50	*2
2.	I	MBT 21202	Biostatistics & Research Methodology (Core-5)	4	3	40	60	100	4
3.	II	MBT 21203	Immunology (Core -6)	4	3	40	60	100	4
4.	II	MBT 21204	Molecular biology-I (Core -7)	4	3	40	60	100	4
5.	II	MBT 21205	Molecular biology-II (Core -8)	4	3	40	60	100	4
6.	II	MBT 21206	r-DNA Technology (Core -9)	4	3	40	60	100	4
PRACTICALS									
7	II	MBT 19207	Immunology (Core -6)	3	2	20	30	50	2
8	II	MBT 19208	Molecular biology-I (Core -7)	3	2	20	30	50	2
9	II	MBT 19209	Molecular biology-II (Core -8)	3	2	20	30	50	2
10	II	MBT 19210	r-DNA Technology (Core -9)	3	2	20	30	50	2
Total				34		280	420	700	28

*Ability Enhancement Compulsory Course (AECC) Marks are not included in CGPA Score in the main Certificate. But there is a Compulsory pass in the examination.

Evaluation for AECC

Internal : 20Marks(Mid Exam:2hrs-10M, Activity or interactive based:5M, Attendance:5M)

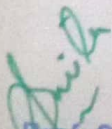
External: 30Marks(2hrs)

Note : No Prefinal Examination.

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CIA Components for Internal Marks Of theory paper:

- (i) Weekly Test : 6M (ii) Mid Semester: 10M (iii) Prefinal: 16M (iv) Assignment: 2M
(v) Viva: 2M
(vi) Attendance: 4M

A handwritten signature in green ink, appearing to read 'Smita', written over the printed name.

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COMPUTER APPLICATIONS
Ability Enhancement Compulsory Course (AECC-3)

Credits: 2
Subject code: MBT 19301

II Year / I Semester
No. of lecture hours: 30

Objective: To study the applications of computer and its techniques in Biotechnology.
Outcome: Students will gain knowledge in computer techniques and their application in Biotechnology.

UNIT-I: Basics of Computers	6Hrs
1.1 History of computers, generations of computers	(1)
1.2 Characteristics of computers	(1)
1.3 Data representation – number system	(1)
1.4 Binary, octal and hexadecimal	(1)
1.5 Conversion from one number system to another	(1)
1.6 Hardware, Software, Translators, Compilers and interpreters	(1)
UNIT- II: Concepts & Commands	6Hrs
2.1 System software, application software	(1)
2.2 Simple operating concepts, flowchart	(1)
2.3 Algorithms with simple examples	(1)
2.4 DOS commands – Internal and external commands	(2)
2.5 File management and directory structure	(1)
UNIT- III: Computer Networks	6Hrs
3.1 Network Types : Local Area Network, Metropolitan Network, Wide Area Network	(1)
3.2 LAN Topologies: Bus Topology, Ring Topology, Star Topology,	(1)
3.3 Communication Protocol	(1)
3.3 Network Devices: Network Interface Card, Repeater, Bridge, Hub, Switch, Router, Gateway.	(1)
3.4 Wireless Networking : Bluetooth Technology, Wireless LAN, Wireless WAN	(1)
3.5.1 Computer Security: Introduction, Security Threat and Security Attack.	(2)
3.5.2 Malicious Software: Virus, Worms, Torjan Horses.	(1)
UNIT-IV: Computing Technologies	6Hrs
4.1 Cloud computing: IAAS, PAAS, SAAS. Grid computing	(2)
4.2 Excel : Creating a new worksheet-select, edit (Copy, move, format, setting column width etc.)	(1)
4.3 Referencing cells (Addressing methods), Formulae, charts, macros.	(1)
4.4 Functions-logical, mathematical, statistical, date and time.	(1)
4.5 Creating an excel database-sort and filter database. Performing what –if analysis on worksheet data And Analysis data with pivot tables.	(1)



UNIT-V: Fundamentals of Database

6Hrs

- 5.1 Introduction (1)
- 5.2 File-Oriented Approach and Database Approach (1)
- 5.3 Characteristics of Database Approach, Data Models, Schema and Instances. (2)
- 5.4 Access Basics: Database, tables, records, fields, Entering data, Queries. (2)

ESSENTIAL READING

1. Bharihoke, Deepak. 2012. **Fundamentals of Information Technology**. Excel Books.
2. Crawford, Sharon. and Neil J. Salkind. 1998. **ABCs of Windows**. BPB Publications.
3. Dennis P. Curtin, Kim Foley, Kunal Sen, Cathleen Morin. 2008. "**Information Technology**", **The Breaking Wake**. Tata Mc.Graw- Hill
4. Anita Goel, 2010. "**Computer Fundamentals**". Pearson

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PROGRAMME OUTCOMES

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A handwritten signature in blue ink, appearing to read 'Smrita'.

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Syllabus w.e.f 2021-22 for 2020-22 batch (CBCS)



BIostatistics, Ethical Issues & Research Methodology

Credits: 4

I Years / II Semester

Subject code: MBT 21202

No. of lecture hours: 60

Objective: To cover the theoretical, practical & applied aspects of Biostatistics & Research Methodology in a clear & exhaustive manner from fundamental core to advanced tools & methods which is comprehensive and easier to grasp.

CO1: Introduction to Bio-Statistics

CO2: Descriptive Statistics & Probability Distribution

CO3: Statistical Inference of Qualitative & Quantitative Variables

CO4: It describes importance of ethics in life. It values good laboratory and manufacturing practices.

CO5: Integrates training from different sources to solve a problem during research and writing a publication

UNIT-I: Introduction to Bio-Statistics

12Hrs

- 1.1. Data & Its Collection: Types of data (2)
- 1.2. Tabulation & Frequency distribution (2)
- 1.3. Diagrammatic representation of data: Line diagram, bar diagram & pie diagram (2)
- 1.4. Graphical representation of data: Histogram, Frequency polygon, Frequency curve, cumulative frequency curve (2)
- 1.5. Sampling: random methods of sampling (2)
- 1.6. Non random methods of sampling, classification of errors (2)

UNIT-II: Descriptive Statistics & Probability Distribution

12Hrs

- 2.1 Measures of Central Tendency: Mean, Median & Mode (2)
- 2.2 Measures of Dispersion: Range, mean deviation, standard deviation, Coefficient of variation (2)
- 2.3 Moment, Skewness & kurtosis. (2)
- 2.4 Probability: Concept of Probability (2)
- 2.5 Theorems of probability (2)
- 2.6 Probability Distributions: Binomial distribution, Normal distribution, Poisson distribution & their applications (2)

UNIT-III: Statistical Inference of Qualitative & Quantitative Variables

12Hrs

- 3.1 Concept of Test of Hypothesis: Null and alternative hypothesis, level of significance. (2)
- 3.2 Chi-Square Test: Degrees of freedom, applications of chi-square test. (2)
- 3.3 Large Sample Tests: Z-Test of mean (2)
- 3.4 Small Sample Test: T-Test for mean (2)
- 3.5 Analysis Of Variance And Covariance: one way ANOVA, two way ANOVA & F-Test. (2)
- 3.6 Correlation And Regression Coefficients: Simple regression, Test of regression coefficient, correlation and correlation Coefficient (2)

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UNIT-IV: Ethical Issues	12Hrs
4.1 Introduction- causes of unethical acts, ignorance of laws, codes, policies and procedures, recognition, friendship, personal gains	(2)
4.2 Professional ethics – professional conduct	(2)
4.3 Ethical decision making, Ethical dilemmas	(2)
4.4 Ethical values in Research,	(2)
4.5 Good laboratory practices, good manufacturing practices	(2)
4.6 Laboratory accreditation	(2)
 UNIT-V: Research Methodology	 12Hrs
5.1 Introduction- Basic researches, applied research, need based research	(2)
5.2 Identification of the problem, defining the problem	(2)
5.3 Research project planning: Introduction, review literature, materials methods, results and conclusion	(2)
5.4 Literature search–information sources, library resources-books, journals, abstracts, hand books, procedure manuals, encyclopedias, annual reports, data banks, CDROMS, online literature search–internet access, websites, directories of information resources	(2)
5.5 Design of the experimental programme–variables in the experiments, materials and methods, evolution of methods, and application of methods	(2)
5.6 Progress of research–evaluation of results, statistical approach, comparison with existing methodologies, validation of findings, research communications and impact factor of journals	(2)

ESSENTIAL READING

1. Khan, and Khanum. 2008 **Fundamentals of Biostatistics**. 3rd edition, Ukaaz publication.
2. Arora P. N, and Malhan P.K. 2006 **Biostatistics**. 2nd edition Himalaya Publishing House.
3. Albert R.Jonsen, Robert A. Pearlman, Nancy Ann Silbergeld Jecker. 1997 **Bioethics: an Introduction to the History, Methods and Practice**. 3rd edition, Jones & Bartlett Learning.
4. Richard Sherlock, John D. Morrey Rowman & Littlefield. 2002 **Ethical Issues in Biotechnology**. 1st edition, Rowman & Littlefield publishers.
5. C. R. Kothari . 1985 **Research Methodology: Methods and Techniques**. New age International publishers.
6. Ranjith Kumar. 2011, **Research Methodology A Step-By-Step Guide For Beginners**. 3rd edition. SAGE Publishers

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Syllabus w.e.f 2021-22 for 2020-22 batch (CBCS)



IMMUNOLOGY

Credits: 4
Subject code: MBT 21203

I Year / II Semester
No. of lecture hours: 60

Objectives: All the units cover basics of immunology, focusing on immunity types, cells, organs of immunity, antigens and antibodies, transplantation, B and T cell activation and MHC classes.

- CO1:** Explains the basics of immunology
CO2: Gives detailed information about antigens and their pathways
CO3: It gives knowledge about various types of Immunoglobulin structures their and functions
CO4: explains about Organization of MHC complex and Transplantation
CO5: Summarizes about cell mediated and humoral responses and auto immune diseases

Unit I: Basics of Immunology	12Hrs
1.1 Immunity – Phylogeny and Types of Immunity.	
1.1.2 Innate Immunity- deficiencies of innate immunity. Example- CGD	(2)
1.1.3 Acquired Immunity	(2)
1.2 Cells of the Immune System	
1.2.1 Innate cells of immune system	(2)
1.2.2 B & T Lymphocytes; T-cell sub-sets; The Antigen Presenting Cells	(2)
1.3 Organs of the System:	
1.3.1 Primary lymphoid organs (Bone marrow and Thymus)	(2)
1.3.1.1 Secondary lymphoid organs (lymph nodes, spleen and mucosal-associated lymphoid tissue)	(2)
Unit II: Antigens	12Hrs
2.1 Immunogenicity versus Antigenicity, Factors that influence immunogenicity (Physical factors: foreignness, molecular size, chemical composition, lipids as antigens and biological factors: genotype, immunogen dosage, route of administration and adjuvants	(2)
2.2 Epitopes - Properties of B-cell epitopes and T-cell epitopes.	(2)
2.3 Haptens and the study of Antigenicity.	(1)
2.4 Antigen processing by endocytic pathway	(2)
2.5 Antigen processing by exocytic pathway	(2)
2.6 Complement system– functions and components of complement system; complement activation; regulation of complement system	(3)
Unit III: Immunoglobulins: Structure and Functions	12Hrs
3.1 Basic structure of Immunoglobulins - The role of multiple myeloma in understanding Ig structure	(2)
3.2 Fine structure of Immunoglobulins - Immunoglobulin domains-variable region and constant region domains	(2)
3.3 Immunoglobulin classes - IgG, IgM, IgA, IgD and IgE; functions of Ig classes	(2)

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- 3.4 Organization and expression of Immunoglobulin Light and Heavy chain genes (V-j and VDJ chain rearrangements and allelic exclusion). (2)
- 3.5 Antigen- Antibody interactions and applications (2)
- 3.6 Monoclonal Antibodies - Formation and selection of hybrid cells; Production of Monoclonal Antibodies and their clinical uses (2)

Unit IV: Major Histocompatibility Complex (MHC) and transplantation 12Hrs

- 4.1 General organization and inheritance of MHC; MHC Haplotypes (1)
- 4.2 The structure of MHC class-I and class-II molecules; (1)
- 4.2.1 Organization of MHC class I and class II genes, peptide binding of MHC molecules (2)
- 4.3 Polymorphism of MHC class I and class II molecules (1)
- 4.4 Role of HLA typing in organ transplantation (1)
- 4.5 Cellular distribution of MHC molecules; MHC molecules and immune responsiveness (2)
- 4.6 Immunologic basis of graft rejection (2)
- 4.7 Significance of immune suppressive therapy. (2)

Unit V: Humoral and Cell-mediated Immune Responses 12Hrs

- 5.1 B-cell activation and proliferation by Thymus independent and Thymus dependant antigens; *in vivo* sites for induction of humoral response; (2)
- 5.2 B-cell differentiation, class-switching and B-cell immunodeficiency disorders- X-linked agammaglobulinemia / selective immunoglobulin deficiency (2)
- 5.3 The structure and functions of T-cell receptors (TCR); the TCR-peptide-MHC tri-molecular complexes (1)
- 5.4 Cell-mediated immune response: General properties of effector T-cells; Direct Cytotoxic response; (2)
- 5.5 Auto-immunity and auto-immune diseases-Insulin Dependent Diabetes; Rheumatoid Arthritis and Auto-immune Thyroid disease. (2)
- 5.6 T cell primary immunodeficiency disorders- AIDS as an example (2)
- 5.7 Hypersensitivity- types; Delayed Type of Hypersensitivity (DTH) (2)

Reference Books:

1. Kuby Immunology, Thomas J. Kindt, Barbara A. Osborne, Richard A. Goldsby, W.H. Freeman & company, New York, 6th edition, 2007
2. Roitt's Essential Immunology, Peter J. Delves, Seamus J. Martin, Dennis R. Burton and Ivan M. Roitt, Blackwell Publishing, Massachusetts, 11th edition, 2006
3. Basic & Clinical Immunology, Daniel P. Stites, Abba I. Terr, Tristram G. Parslow, Appleton & Lange, Connecticut, 8th edition, 1994
4. Cellular & Molecular Immunology, Abul K. Abbas, Andrew H. Litchman, Shiv Pillai, Saunders College Publishing, Philadelphia, 7th edition, 2012
5. An Introduction to Immunology, Ian R. Tizard, Saunders College Publishing, Philadelphia, 7th edition, 2004
6. Immunology: A Short Course, Richard Coico, Geoffrey Sunshine, Eli Benjamini, John Wiley & Sons, New York, 5th edition, 2003



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Syllabus w.e.f 2021-22 for 2020-22 batch (CBCS)

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Syllabus w.e.f 2021-22 for 2020-22 batch (CBCS)



MOLECULAR BIOLOGY-I THE GENOME

Credits: 4

Subject code: MBT 21204

I Year / II Semester

No. of lecture hours: 60

Objectives: Units cover the structure of DNA, Genome organization, molecular mechanism of mutations and repair; explains the DNA replication, Genome Rearrangements & Recombination.

CO1: Know the life with molecular functionalities, chemical and molecular processes that occur in and between cells.

CO2: Genome Organization from prokaryotes to Eukaryotes.

CO3: Genome Replication in from prokaryotes to Eukaryotes.

CO4: Knowledge about the changes or losses in cell function, includes alterations of cell function brought about by mutations and DNA repair

CO5: How genes are evolved by gene rearrangements and recombination and by transposons.

Unit 1: DNA: Chemical composition of DNA 12Hrs

- | | |
|--|-----|
| 1.1 Experimental proof of DNA and RNA as genetic material. | (3) |
| 1.2 Structure and function of DNA. Watson and Crick Model of DNA | (1) |
| 1.3 Forms of DNA (A and Z). | (1) |
| 1.4 Importance of super helical DNA and their structural forms. | (2) |
| 1.5 Types of Topoisomerases and their function. | (2) |
| 1.6 Types of RNA. | (3) |

Unit 2: Genome Organization 12Hrs

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| 2.1 Genome size, C-value paradox. | (1) |
| 2.2 Organization of prokaryotic genome and eukaryotic nuclear genome (Chromosome Number, Gene size, Gene density). | (2) |
| 2.3 Unique sequences, repeated sequences– interspersed and tandem repeats; satellite DNA, mini satellites and microsatellites. | (2) |
| 2.4 Gene families (Clustered and Dispersive– Haemoglobin gene and Histone gene Clusters). | (2) |
| 2.5 Pseudogenes– processed and unprocessed. | (1) |
| 2.6 Organization of Mitochondrial and Chloroplast genomes. | (3) |

Unit 3: Genome Replication 12Hrs

- | | |
|--|-----|
| 3.1 DNA Replication- enzymes involved in the replication of DNA, origin of replication fork. | (3) |
| 3.2 Replication of Prokaryotic genome. | (2) |
| 3.3 Replication of nuclear genome of eukaryotes. | (3) |
| 3.4 Replication associated errors. | (2) |
| 3.5 Inhibitors of DNA replication. | (2) |

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Unit 4: DNA Damage and Repair

12Hrs

- 4.1 Spontaneous and Induced mutations– physical and chemical mutagens.(2)
- 4.2 DNA damages (oxidative damages, depurinations, depyrimidinations, O6-methylguanines, cytosine deamination, single and double strand breaks).(2)
- 4.3 Types of mutagenesis– transition, transversion, frame shifts, missense and non-sense mutations. (2)
- 4.4 Repair mechanisms– Photo-reactivation, Excision repair (base excision repair, nucleotide excision repair), mismatch repair, SOS repair. (3)
- 4.5 Double strand DNA breaks and their repair via Homologous recombination.(1)
- 4.6 Post replication repair. (2)

Unit 5: Genome Rearrangements and Recombination

12Hrs

- 5.1 Whole genome duplication. (2)
- 5.2 Segmental Duplication- insertion, deletion and translocation of sequences. (2)
- 5.3 Single nucleotide variations. (2)
- 5.4 Homologous recombination– rec pathways. (2)
- 5.5 Non-Homologous End Joining and site specific recombination. (2)
- 5.6 Transposons and repeat mediated rearrangements and Gene conversion. (2)

REFERENCE BOOKS

1. Molecular Biology of the Cell, Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts and Peter Walter.
2. Molecular Biology of the Gene by J.D. Watson, N.H. Hopkins, J.W. Robertis, A. Steitz & A.M. Weiner, Benjamin Cummings Publ. California
3. Molecular Cell Biology Lodish, H., Baltimore, D; Fesk, A, Zipursky S.L., Matsudaride, P. and Darnel American Scientific Books. W.H. Freeman, NewYork
4. Genes VII. Benjamin Lewis, OxfordUniv. Press, Oxford
5. Molecular Biology by D, Freifelder Narosa Publishing house New York, Delhi
6. Advance Molecular Biology Twyman, R.M., Bios Scientific publishers Oxford
7. Molecular Biology by T.A. Brown
8. Essentials of Molecular Biology. D. Freifelder, Panima publishing co-operation

M.Sc. Biotechnology

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Syllabus w.e.f 2021-22 for 2020-22 batch (CBCS)



MOLECULAR BIOLOGY II-GENES TO PROTEINS

Credits: 4

Subject code: MBT 21205

I Year / II Semester

No. of lecture hours: 60

Objectives: Units covers the central dogma of life - transcription and translation in prokaryotes and eukaryotes; regulation of gene expression & Epigenetic analysis.

CO1: Know the life with molecular functionalities, chemical and molecular processes that occur in and between cells.

CO2: Concept of gene structure and function, gene expression and gene regulation at transcriptional level

CO3: Concepts of translation and gene expression

CO4: Gene regulation at translational level.

CO5: Development of solid foundation and requisite research aptitude for further higher studies on epigenetic analysis.

Unit 1: Prokaryotic and Eukaryotic genes	12Hrs
1.1 Organization of prokaryotic genes- operons (promoters & repressors).	(2)
1.2 Fine structure of eukaryotic gene (introns, exons, UTRs, core and proximal promoters& enhancers).	(3)
1.3 Number of genes in prokaryotes and eukaryotes.	(1)
1.4 Essential genes– Proportion and distribution in the genome.	(1)
1.5 Functional RNA genes (rRNA, tRNA, snoRNA, snRNA).	(3)
1.6 Regulatory small RNA coding genes (miRNAs).	(2)
Unit 2: Transcription	12Hrs
2.1 Transcription in prokaryotes, Structure of RNA polymerase and promoter.	(2)
2.2 Transcription initiation- role of sigma, alpha sub units, abortive initiation, Elongation core.	(3)
2.3 RNA polymerase, role of β , β' subunits, proof reading, Termination-Rho independent and Rho dependent.	(2)
2.4 Transcription in eukaryotes, types of RNA polymerases (I, II, III) and promoters, transcription factors for I, II, III RNA polymerases, transcription activators, specific factors (zinc fingers, HAL4, homeodomain, leucine zipper proteins, helix-turn-helix and helix-loop-helix proteins).	(3)
2.5 Mechanism of transcription in eukaryotes, initiation, elongation and termination.	(2)
2.6 Post transcriptional modifications, capping and polyadenylation. Splicing mechanism- Alternative splicing in sex determination of Drosophila. Trans splicing: Trans-splicing in C.elegans. Self-splicing introns: Group-I introns, Group-II introns, Group III introns.	(2)
Unit 3: Translation and Post translational modifications	12Hrs
3.1 Properties of genetic code (universal code, degeneracy, redundancy).	(2)
3.2 Correspondence of amino acid sequence with nucleotide sequence in DNA (Single letter code for amino acids).	(2)

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- 3.3 Translation machinery in prokaryotes, initiation (IF-1, IF-2, IF-3) (t-RNA charging, disassociation & assembly of ribosomal subunits), elongation (EF-Tu, EF-Ts, EF-G) (translocation, t-RNA identity, aminoacyl t-RNA, peptide bond formation), termination (RF-1, RF-2, RF-3) (termination codons). (3)
- 3.4 Translation mechanism in eukaryotes, initiation (factors, assembly of ribosomes), elongation, termination (termination codons, stop codon suppression). (2)
- 3.5 Translational activators and inhibitors. (1)
- 3.6 Post translational modifications of proteins (2)

Unit 4: Regulation of Gene expression

12Hrs

- 4.1 Control of gene expression at transcription and translation level, co-ordinated regulation of gene expression in prokaryotes. (2)
- 4.2 Regulation of gene expression in prokaryotes, regulation of lactose operon and tryptophan operon. (3)
- 4.3 Regulation of gene expression in eukaryotes- genes controlling yeast mating type. (2)
- 4.4 Regulation of gene expression during development of an organism- class switching (Alpha and Beta Globin gene expression), Altered gene expression- HOX genes in Drosophila. (3)
- 4.5 Gene regulation in eukaryotes (antisense RNA & RNAi). (2)

Unit 5: Epigenetics

12Hrs

- 5.1 Epigenetic reprogramming, Genomic imprinting: Nuclear Cloning, and Cellular Differentiation in Early Mammalian Development, Genomic Imprinting: Germ Line and Early Embryo. (3)
- 5.2 DNA & Histone modifications: Role of chromatin in regulating gene expression and gene silencing, DNA methylation, histone modifications (acetylation, deacetylation, analysis of epigenetic modifications, epigenetic memory). (3)
- 5.3 Chromatin remodelling in regulation of transcription: chromatin modifying enzymes and complexes (HATs, HDACs, SWI/SNF)
- 5.4 .Genome wide mapping of chromatin factors and modifications. (2)
- 5.5 Role of nutrition and environment in epigenetic modifications. (2)
- 5.6 Techniques used in epigenetic studies- bisulfite sequencing, Chip-Seq, Hi-C (1)
- 5.7 Epigenetic perspective of diseases. (1)

REFERENCE BOOKS

1. Molecular Biology of the Gene by J.D. Watson, N.H. Hopkins, J.W, Robertis, A.
2. Steitz & A.M. Weiner, Benjamin Cummings Publ. California
3. Genes VII. Benjamin Lewin, Oxford Univ. Press, Oxford
4. Molecular Biology by D. Freifelder Narosa Publishing house New York, Delhi,
5. Molecular Cell Biology Lodish, H., Baltimore, D; Fesk, A, Zipursky S.L., Matsudaride, P. and Darnel American Scientific Books. W.H. Freeman, New York
6. Advance Molecular Biology Twyman, R.M., Bios Scientific publishers Oxford
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Osman M.Sc. Biotechnology



r-DNA TECHNOLOGY

Credits: 4
Subject code: MBT 21206

I Year / II Semester
No. of lecture hours: 60

Objectives: Units cover the enzymes and vectors used in molecular cloning, construction of genomic and cDNA Libraries, techniques employed in molecular cloning, selection and analysis of recombinant Clones for better understanding of the subject of recombinant technology.

- CO1:** Explains usage of enzymes in molecular cloning
CO2: Apply the principles of Vectors used in molecular cloning
CO3: Illustrates Construction of Genomic and cDNA Libraries
CO4: Describes Techniques employed in molecular cloning
CO5: Relates Selection and Analysis of recombinant Clones

Unit I: Enzymes used in molecular cloning	11Hrs
1.1 Discovery of restriction enzymes - Host controlled modification	(2)
1.2 Restriction endonucleases and classification	(2)
1.3 Modifying enzymes used in molecular cloning; methylases, ligases, kinases & phosphatases	(3)
1.4 Nucleases	(2)
1.5 Polymerases: RNA dependent DNA polymerase, Terminal De-oxynucleotidyl transferase	(2)
Unit II: Vectors used in molecular cloning	11Hrs
2.1 E. coli plasmid vectors-pBR322, pUC18	(2)
2.2 Bacteriophage vectors - λ and M13	(2)
2.3 Cosmids, phagemids and Phasmids	(2)
2.4 Shuttle vectors - Yeast vectors	(2)
2.5 Baculo virus vector, SV-40	(3)
Unit III: Construction of Genomic and cDNA Libraries	10Hrs
3.1 DNA cloning	(2)
3.2 Strategies for construction of genomic libraries	(2)
3.3 Jumping and linking libraries	(2)
3.4 Chromosome walking	(1)
3.5 Strategies for construction of cDNA libraries	(1)
3.6 Subtraction libraries	(2)
Unit IV: Techniques employed in molecular cloning	16Hrs
4.1 Labeling of Nucleic acids and proteins	(1)
4.2 Blotting and Hybridization techniques- Southern Blotting	(1)

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4.2.1	Northern Blotting	(1)
4.2.2	Western Blotting	(1)
4.2.3	Zoo blots	(1)
4.2.4	Colony hybridization	(1)
4.3	DNA sequencing: Maxam and Gilbert method	(1)
4.3.1	Sanger's method	(2)
4.4	PCR technology	(1)
4.5	Genome editing techniques-TALENs, CRISPR-Cas system	(2)
4.6	Molecular marker types: Hybridization based	(2)
4.7	Molecular marker types: PCR based	(1)
4.8	Molecular markers: applications	(1)

Unit 5: Selection and Analysis of recombinant Clones **12Hrs**

5.1	Genetic selection: Alpha complementation & Insertional inactivation	(1)
5.2	Screening of libraries using labeled probes	(1)
5.3	Restriction mapping of cloned fragments	(2)
5.4	S ₁ Nuclease Mapping	(1)
5.5	Hybrid arrest and hybrid released translation	
5.6	Site directed mutagenesis	(2)
5.7	Factors influencing cloned gene expression	(2)
5.8	Applications of rDNA technology	(2)

Reference Books:

- Principles of gene manipulation, S. B. Primrose, R. M. Twyman, R. W. Old Blackwell Publication, Massachusetts, 6th edition, 2001
- Molecular Cloning –A laboratory Manual, Joseph Sambrook, David W. Russell, volume -I, II, III, Cold Spring Harbour Laboratory Press, Newyork, 3rd edition, 2001
- Molecular Biotechnology-Principles & Applications of Recombinant DNA Bernard R. Glick, Jack. J. Pasternak, Panima Publishing House, New Delhi, 1st edition 2002
- From Genes to Clones-Intoduction to Gene Technology, Ernst L.Winnacker, Panima Publishing House, New Delhi, 1st edition , 2003
- DNA Science-A First Course, David A. Micklos,Greg A.Freyer, I. K International Pvt. Ltd, New Delhi, 2nd edition ,2003
- Recombinant DNA: Genes & Genomes-A Short Course, James D.Watson,Amy A. Caudy, Cold Spring Harbour Laboratory Press,Newyork,3rd edition,2007
- Molecular Biology, Robert F. Weaver, Mc Grawhill publication, Newyork, 2nd edition, 2002
- Molecular Biology of the Gene J. D. Watson, N. H. Hopkins, J. W. Robertis, A. Steitz, A. M. Weiner, Benjamin Cummings Publication, California, 7th edition, 1988.
- Genes: Volume VI, VII, VIII Benjamin Lewin, Oxford University Press, Oxford, 7th edition, 2000

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Syllabus w.e.f 2021-22 for 2020-22 batch (CBCS)



IMMUNOLOGY PRACTICALS

Credits: 2

Subject code: MBT 21207

I Year / II Semester

No. of lecture hours: 3hrs/week

1. ABO blood grouping
2. Dot Enzyme-Linked Immuno-sorbent Assay
3. Single Radial Immunodiffusion
4. Micro-hemagglutination Test
5. Ouchterlony double diffusion
6. Counter current Immuno electrophoresis
7. IgG Purification
8. Differentiation of titers of Rheumatoid Arthritis
9. Principle and procedure for Enumeration of specific cell types by Fluorescence Activated Cell Sorter (FACS)

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MOLECULAR BIOLOGY I-THE GENOME PRACTICALS

Credits: 4

Subject code: MBT 21208

I Year / II Semester
No. of lectures: 3hrs/week

1. Isolation of DNA from Bacteria
2. Determine purity of DNA by Agarose gel electrophoresis
3. Estimation of DNA by diphenyl amine method
4. Determining melting temperature of DNA
5. Reassociation Kinetics and estimation of cot values, construction of cot curves
6. Induction of mutations by chemical agents
7. Determination of DNA damage by Comet assay

A handwritten signature in green ink, appearing to read 'Smita'.

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MOLECULAR BIOLOGY II -GENES TO PROTEINS PRACTICALS

Credits: 4

Subject code: MBT 21209

I Year / II Semester

No. of lectures: 3hrs/week

1. Isolation of Genomic DNA from Plant Cells.
2. Isolation of Genomic DNA from Human blood.
3. Isolation of Plasmid DNA
4. Determination of purity and concentration of DNA - Spectrophotometric method.
5. Amplification of DNA by PCR.
6. Isolation of mRNA from blood/tissue.
7. Gene expression by RT PCR

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r-DNA TECHNOLOGY PRACTICALS

Credits: 4

Subject code: MBT 21210

I Year / II Semester

No. of lectures: 3hrs/week

1. Restriction digestion of genomic or lambda DNA
2. Molecular size determination of the fragments
3. Double digestion of DNA and restriction mapping,
4. PCR analysis-interferon gene using own DNA
5. RAPD analysis - rice varieties
6. DNA fingerprinting by RFLP
7. Problems on restriction mapping


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Syllabus w.e.f 2021-22 for 2020-22 batch (CBCS)

YEAR-WISE AND SEMESTER-WISE DISTRIBUTION OF SUBJECTS
DEPARTMENT OF BIOTECHNOLOGY
M. Sc - SECOND YEAR – FIRST SEMESTER
ACADEMIC YEAR 2022-23 OF 2021-23BATCH (CBCS)

Sl. No.	Part	Subject Code	Title of the subject	Hours/ week	Duration of Exam (Hrs.)	Marks			Credits
						Internal	External	Total	
1	*I	*MBT 21301	* Human Values and Professional Ethics (AECC-3)	2	1	*20	*30	*50	*2
2	II	MBT 21302A/B	Environmental Biotechnology/ Food Biotechnology (DSE-1)	4	3	40	60	100	4
3	II	MBT 21303	Plant & Agriculture Biotechnology (Core -10)	4	3	40	60	100	4
4	II	MBT 21304	Medical Biotechnology (Core -11)	4	3	40	60	100	4
5	II	MBT 21305	Bioinformatics (Core -12)	4	3	40	60	100	4
6	II	MBT 21306	Bioprocess Engineering (Core -13)	4	3	40	60	100	4
PRACTICALS									
7	II	MBT 21307	Plant & Agriculture Biotechnology (Core -10)	3	2	20	30	50	2
8	II	MBT 21308	Medical Biotechnology (Core -11)	3	2	20	30	50	2
9	II	MBT 21309	Bioinformatics (Core -12)	3	2	20	30	50	2
10	II	MBT 21310	Bioprocess Engineering (Core -13)	3	2	20	30	50	2
Total				34		280	420	700	28


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YEAR-WISE AND SEMESTER-WISE DISTRIBUTION OF SUBJECTS
DEPARTMENT OF BIOTECHNOLOGY
M. Sc - SECOND YEAR – FIRST SEMESTER
ACADEMIC YEAR 2022-23 OF 2021-23BATCH (CBCS)

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6	II	MBT 21306	Bioprocess Engineering (Core -13)	4	3	40	60	100	4
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M.Sc. Biotechnology

Syllabus w.e.f 2022-23 for 2021-23 batch (CBCS)

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*Ability Enhancement Compulsory Course (AECC) Marks are not included in CGPA Score in the main Certificate. But there is a Compulsory pass in the examination.
Discipline-Specific Elective (DSE)

Evaluation for AECC

Internal : 20Marks(Mid Exam:2hrs-10M, Activity or interactive based:5M,
Attendance:5M)

External: 30Marks(2hrs)

Note : No Prefinal Examination.

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Human Values and Professional Ethics (AECC-3)

Credits: 2

I Year / III Semester

Subject code: MBT 19301

No. of lecture hours: 30

Objective: To emphasize the importance of human values and inculcating them for the betterment of the society.

Outcome: The student will learn about the human values and professional ethics.

UNIT- I INTRODUCTION TO ETHICS No of hours: 6

1.1 Reasons to have Ethics for Life	1
1.2 Accepted Norms and Counter Values	1
1.3 Happiness as life Goal	2
1.4 Human Context-self and another	2

UNIT-II TOWARDS A NEW SOCIETY No of hours: 6

2.1 What is true society	1
2.2 Moral problem of the society	1
2.3 Social desire, social fear, social satence, social indifference	1
2.4 Values revealed and lived in various religions-practicing religious harmony	2
2.5 Eradication of social evil-towards a new society	1

UNIT-III GENDER SENSITIZATION No of hours: 6

3.1 Why we study it?	1
3.2 Socialization-making women and men	1
3.3 Being together as equals-through the lens of gender	1
3.4 Knowledge through the lens of gender	1
3.5 Gender spectrum-beyond the binary	1
3.6 Just relationship-being together as equals	1

UNIT-IV PROFESSIONAL ETHICS No of hours: 6

4.1 Ethics, Professional Ethics, Environmental Ethics	1
4.2 Ethical Situation, Current Ethical Issues	1
4.3 Values, Policies and Organisation Culture	2
4.4 Moral Situation, Rights and Duties, Codes of Ethics, Their Limitation	2
4.5 WORK SHEET (1): Self Estimation	

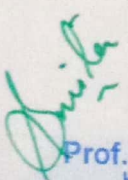
UNIT- V ETHICS IN SCIENCE No of hours: 6

5.1 Professional Research in Academia and Industry, Scientific fraud	1
5.2 Plagiarism, Conflict of Inters	1
5.3 Student-Advisor relationship, Intellectual property and Patents	2

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TEXT BOOKS:

1. Human Values - Development Programme - AIACHE
2. In Harmony
3. S.S. Dara and D.D. Mishra 2010. Environmental Chemistry and Pollution Control
New Delhi: S. Chand Publisher.
4. Jeffery Kovac, Ethics in Science, Accountability in Research 22, 312, 2015.
5. A.Suneetha, B.Uma, D. Vasanta, M. Rama, N. Vasundha, A. Raheed, G,
Shamala, D. Sreenivas and S. Tharu 201. Towards a World of Equals: A
Bilingual Text on Gender. Hyderabad: Telugu Akademi

A handwritten signature in green ink, appearing to read 'Smita'.

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Syllabus w.e.f 2021-22 for 2020-22 batch (CBCS)

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PROGRAMME OUTCOMES

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Department of Genetics & Biotechnology
Osmania University, Hyd-500 007.

ENVIRONMENTAL BIOTECHNOLOGY

Credits: 4

II Year / I Semester

Subject code: MBT 21302 A

No. of lecture hours: 60

Objective: To offer the students a good command of the basic principles of Environmental Biotechnology and to understand the present day environmental related issues and exposure to preventive measures.

CO1: Students will be able to understand the basic concepts in microbial ecology, ecological niches,

CO2: Students will be able to understand Principles of methods for quantification of organic carbon in wastewater and Evaluate the potential for biodegradation of organic pollutants, taking microbial and physical/chemical environments.

CO3: Students will be able to understand Biofertilizers and their importance in crop productivity

CO4: Students will be able to understand Biopesticides

CO5: Students will be able to understand Genetic Engineering in Environmental Biotechnology.

UNIT- I: Biomass and Bio-fuels

12Hrs

- 1.1 Plant biomass (Cellulose, starch, pectin, gum materials). (2)
- 1.2 Animal biomass (chitin, milk whey, Slaughter house wastes). (2)
- 1.3 Microbial biomass (algal blooms -in fresh and sea waters, Fungal- Mushrooms, Yeasts and bacterial fermentation biomass wastes). (2)
- 1.4 Concepts of single cell proteins. (2)
- 1.5 Microbial production of fuels: hydrogen and methane. (2)
- 1.6 Microbial production of polymers (xanthan gums). (2)

UNIT- II: Bioremediation and Bio-leaching

12Hrs

- 2.1 Types and sources of pollution - Inorganic, organic and biotic; environmental impact Of pollution and measurement methods (biomonitoring). (2)
- 2.2 Composting of organic wastes, microbial bioremediation of oil spills. (2)
- 2.3 Waste water treatment - sewage treatment and common industrial effluent treatment. (2)
- 2.4 Concepts of bioremediation (in-situ and ex-situ), Concepts of Phytoremediation. (2)
- 2.5 Bioremediation of oil spills, pesticides and xenobiotics. (2)
- 2.6 Microbial leaching of ores – direct and indirect mechanisms (2)

UNIT- III: Biofertilizers

12Hrs

- 3.1 Biofertilizers and their importance in crop productivity. (2)
- 3.2 Algal biofertilizers and Fungal (mycorrhizae) biofertilizers. (2)
- 3.3 Bacterial biofertilizers (rhizobial, free living N₂ fixers and phosphate solubilizing Bacteria). (2)
- 3.4 Production of Biofertilizers for large scale application. (2)
- 3.6 Applications of Biofertilizers. (2)
- 3.7 Integrated Nutrient Management. (2)

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UNIT- IV: Biopesticides	12Hrs
4.1 Biopesticides : Bacterial (Bt pesticides).	(2)
4.2 Fungal (Trichoderma).	(2)
4.3 Viral biopesticides – Baculovirus, NPV insecticides.	(2)
4.4 Production of biopesticides for large scale application.	(2)
4.5 Applications of Biopesticides.	(2)
4.6 Integrated Pest Management.	
4.7. General account of the microbes used as biofertilizers for plants	(2)
 UNIT- V: Genetic Engineering in Environmental Biotechnology	 12Hrs
5.1 Genetically engineered microorganisms in environmental health.	(2)
5.2 Genetically engineered plants and microorganisms in agriculture and productivity.	(2)
 5.3 Genetically engineered bacteria for bioremediation of inorganic pollutants- Heavy metals.	 (2)
5.4 Genetically engineered bacteria for bioremediation of organic pollutants- pesticides, Oil spills and Xenobiotics.	(2)
5.5 Hazards of genetically engineered microorganisms, plants and animals.	(2)
5.6 .Biosafety Genetically modified organisms	(2)

ESSENTIAL READING

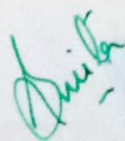
1. Young .Ed. 2011 **Comprehensive Biotechnology**. 2nd edition, Pergmon Press.
2. Grant, WD, and Long PE. 1981 **Environmental Microbiology**. Blakie Glasgow.

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PROGRAMME OUTCOMES

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FOOD BIOTECHNOLOGY

Credits: 4

Subject code: MBT 21302 B

II Year / I Semester

No. of lecture hours: 60

Objective: To offer the students a good command of the basic principles of Food Science and Technology and to apply and understand the growing and dynamic needs of the Food and Beverage Industries.

CO1: Explains the nutrients present in diet & aspects of food different food additives.

CO2: Summarizes the different methods of food preservation & processing

CO3: Identifies the nutrients in functional foods, relates & distinguishes bioactive compounds role in functional foods.

CO4: Compares, discriminates the GM Foods with functional foods. Explains & interprets the safety of GM foods with traditional foods.

CO5: Evaluates, relates the principles of food preservation & processing in food safety

UNIT-I: Introduction To Food & Nutrition, Adulteration. **12Hrs**

- 1.1 Introduction to food & nutrition, nutrient, malnutrition and balanced diet. (2)
- 1.2 RDA: Recommended dietary allowances. (2)
- 1.3 Food colorants: pigments in plants & Animal tissues. (2)
- 1.4 Food Flavours: Vegetable, fruit, and spice flavor. (2)
- 1.5 Food Additives: Acids, bases, buffer systems, chelating agents, antioxidants, sweeteners. (2)
- 1.6 Food toxins. (2)

UNIT-II: Food Processing & Preservation **12Hrs**

- 2.1 Food spoilage: characteristic features, dynamics, & significance of spoilage of foods. (2)
- 2.2 Processing and preservation by heat, drying, dehydration (2)
- 2.3 Processing and preservation by low temperature, Food irradiation. (2)
- 2.4 Processing and preservation by non thermal methods (2)
- 2.5 Food preservatives & permissible limits. (2)
- 2.6 Application of enzymes and microbes in food processing and preservation (2)

UNIT-III: Functional Foods **12Hrs**

- 3.1 Definition, Development of functional foods. (2)
- 3.2 Nutraceuticals: concept and classification. Pharma foods- diabetic foods (sugar free), confectionaries, sodium-free, lactose-free, phenylalanine free, and fiber-rich foods - nutritional implications
- 3.3 Dietary supplements- fortification of nutrients in the processed foods & other dietary supplements, hyper nutritious foods (protein powders) 3.4 Fat-free foods- PUFA oils n3, n6 fatty acids, fat-free milk powder, low cholesterol oils, and cholesterol-free foods (2)
- 3.4 Pre and probiotics: Definition, types, development and recent advances. (2)
- 3.5 Research frontiers in functional foods. (2)
- 3.6 Nutrigenomics- concept of personalized medicine. Use of Nanotechnology in

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Chair, Department of Biotechnology
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Functional food industry. (2)

UNIT-IV: Genetically Modified Foods **12Hrs**

- 4.1 Genetically modified foods – concept, types and Application. (2)
4.2 Current guidelines for the production, release and movement of GMOs; labeling and traceability. (2)
4.3 Testing for GMOs. (2)
4.4 Biosafety; risk assessment and risk management. Safety Regulations of GM foods. (2)
4.5 Ethical issues concerning GM foods. (2)
4.6 Public perception of GM foods. (2)

UNIT-V: Food Quality and Safety Management: **12Hrs**

- 5.1 Introduction, the scope of food quality and food safety, food adulteration- adulteration in different foods. (1)
5.2. Evaluation of food quality- appearance, color texture, viscosity, consistency, flavor defects, and foreign matter. (2)
5.3 Methods of identification of microbial contamination (bacteria, fungi & virus) of food. (2)
5.4 Methods of identification of toxic chemicals (food additives, food preservatives, pesticides, dyes, etc.) of food. (2)
5.5 . Methods of identification of toxic chemicals (food additives, food preservatives, pesticides, dyes, etc.) of food. (1)
5.6. Quality Assurance in food production:ISO 22000FoodCertifications. (1)
5.7. Nanotechnology-driven food safety- nano packaging, nanosensors. (1)
5.8. Food standards and laws- national food safety and food standards regulations FSSAI (2016), prevention of food adulteration act (2)

ESSENTIAL READING

1. Lopez, G.F.G, and Canovas, G.V.B. 2003 **Food Science and Food Biotechnology**. CRC Press, Florida, USA.
2. Lee, B.H. 2006 **Fundamentals of Food Biotechnology**. VCH.

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PROGRAMME OUTCOMES

- **PO1 Scientific Knowledge.** Apply the knowledge of Science, Mathematics, Engineering & Technology fundamentals to solve the complex problems.
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- **PO6. Individual and team work:** Function objectively as an individual and as a member in diverse teams.
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PLANT AND AGRICULTURAL BIOTECHNOLOGY

Credits: 4

II Year / I Semester

Subject code: MBT21303

No. of lecture hours: 60

Objective: To learn Plant biotechnology for improving the crop yield and quality. This subject broadly refers to the Invitro cultivation of plants under aseptic conditions.

CO1: Use protocols for preparation of Culture Media, Cell Culture and Micro Propagation

CO2: It relates the techniques used for Protoplast Culture and Soma clonal Variations in Plants

CO3: It evaluates Production of Commercially Useful Compounds By Cell Cultures

CO4: This study differentiate between Molecular Mechanisms of Abiotic & Biotic Stress Tolerance in plants

CO5: It explains Transformation Techniques in Transgenic Plants

UNIT-I: Culture Media, Cell Culture and Micro Propagation 12Hrs

- 1.1 Laboratory requirements for plant tissue culture (2)
- 1.2 Introduction to totipotency of Plant cells (2)
- 1.3 Culture media and their constituents (2)
- 1.4 Initiation of Callus and suspension cultures (2)
- 1.5 Micro-propagation of plants via organogenesis (2)
- 1.6 Micro-propagation of plants via embryogenesis (2)
- 1.7 Production of haploids via Anther and pollen cultures (2)

UNIT-II: Protoplast Culture and Somaclonal Variation of Plants 12Hrs

- 2.1 Encapsulation and production of synthetics seeds (2)
- 2.2 Embryo culture and embryo rescue (2)
- 2.3 Protoplast culture and fusion. (2)
- 2.4 Development of somatic hybrids (2)
- 2.5 Somaclonal variations and crop improvement (2)
- 2.6 Genome editing techniques-TALENs, CRISPR-Cas system (2)

UNIT-III: Production of Commercially Useful Compounds by Cell Cultures 12Hrs

- 3.1 Advantages of cultured plant cells and tissues as a source of secondary plant products (2)
- 3.2 Physical and chemical factors that influence the production of secondary metabolites in vitro (2)
- 3.3 Immobilization of cells for enhanced production of secondary products (2)
- 3.4 Induction of hairy root cultures and their uses (2)
- 3.5 Biotransformation using cell culture methods (2)
- 3.6 Cryo-preservation (2)

UNIT-IV: Molecular Mechanisms of Abiotic & Biotic Stress Tolerance 12Hrs

- 4.1 Mechanism of plants by Drought stress tolerance (2)
- 4.2 Mechanism of plants by Flooding stress tolerance or submergence tolerance (2)

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- 4.3 Mechanism of plants by Salt and Metal stress tolerance (2)
- 4.4 Mechanism of plants by Insect resistance (2)
- 4.5 Mechanism of plants by Bacterial resistance (2)
- 4.6 Mechanism of plants by Fungal resistance (2)

UNIT-V: Transformation Techniques And Transgenic Plants 12Hrs

- 5.1 Vectors of gene transfer: Ti and Ri plasmids of agro-bacterium (2)
- 5.2 Transformation techniques using agro-bacterium (2)
- 5.3 Improved crop productivity: transgenic plants for hybrid seed production-
rice/wheat /cotton (2)
- 5.4 Improved nutritional quality: transgenic plants for oil production, Golden rice (2)
- 5.5 Transgenic plants as edible vaccines: tobacco, potato and banana (2)
- 5.6 Marker assisted selection: rice/wheat and cotton (2)

ESSENTIAL READING

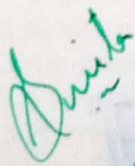
- 1 Barz. W, Reinhard. E, and Zenk M.H. **Plant Tissue Culture and its Biotechnological Applications**. Springer-Verlag, Berlin, Heidelberg, New York.
- 2 Bhojwani S.S, and Razdan. A. 1996 **Plant Tissue Culture : Theory and Practice**. Elsevier Science.
- 3 Chawla H. S. 2002 **Introduction to plant biotechnology**. Science publishers inc., Enfield, NH, USA
- 4 Adrian Slater, Nigel W. Scott, Mark R. Fowler 2008 **Plant biotechnology: the genetic manipulation of plants**. Oxford University Press Publisher.

Smita

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PROGRAMME OUTCOMES

- **PO1 Scientific Knowledge.** Apply the knowledge of Science, Mathematics, Engineering & Technology fundamentals to solve the complex problems.
- **PO2. Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- **PO3. Problem analysis:** Identify, formulate, research literature, and analyze complex scientific problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- **PO4. Modern tool usage:** Create, select and apply appropriate techniques, resources, modern technology and IT tools to complex science and technological activities.
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MEDICAL BIOTECHNOLOGY

Credits: 4
Subject code: MBT21304

II Year / I Semester
No. of lecture hours: 60

Objective: Medical biotechnology deals with the use of genetically engineered products to solve environmental problems and cure human diseases.

- CO1:** Students will be able to gain knowledge in basic principles of genetic disease.
CO2: To identify and comprehend experimental knowhow of various techniques involved in techniques in disease diagnosis.
CO3: Knowledge regarding various therapeutics, gene products in medicine and healthcare.
CO4: The knowledge to know about the stem cell technology and regenerative Medicine.
CO5: Knowledge regarding advances in medicine and AI.

UNIT-I: Molecular basis of disease

12Hrs

- 1.1 Chromosomal disorders- Numerical disorders e.g., Trisomies and Monosomies, Structural disorders e.g. Deletions, Duplications, Translocations and Inversion (2)
1.2 Single gene disorders- Sickle Cell Anaemia and Thalassemia. (2)
1.3 Mitochondrial diseases- MELAS, MERRF. (2)
1.4 Identification of disease genes: Functional cloning- eg. Haemophilia, Positional cloning- eg. DMD; Candidate gene approach- eg. Marfan syndrome. (2)
1.5 Molecular pathology of genetic diseases- Gain of function mutations- Pittsburg variant of alpha 1 antitrypsin; Loss of function mutations- PAX-3 gene; Gene dosage effect- PMP22, Collagen gene. (2)
1.6 Genomic imprinting- mechanisms, Prader-willi & Angelman syndrome. (2)

UNIT-II: Techniques for disease diagnosis

- 2.1 Prenatal diagnosis- indications for prenatal diagnosis; pre-implantation genetic diagnosis; invasive techniques- amniocentesis, fetoscopy, chorionic villi sampling (CVS); non-invasive techniques- ultrasonography, X-ray, TIFA, maternal serum screening and fetal cells in maternal blood (2)
2.2 Diagnosis using protein and enzyme markers (PKU- Guthrie test, Dystrophy- Creatine kinase) (2)
2.3 Diagnosis using monoclonal antibodies- hormonal disorders & infectious diseases (2)
2.4 DNA/RNA based diagnosis- Hepatitis, CML- bcr/abl, HIV (2)
2.5 Microarray technology- genomic and cDNA arrays, application to disease diagnosis (2)
2.6 Genetic counselling- calculating risk & discussing the options (2)

UNIT-III: Therapeutics

12Hrs

- 3.1 Gene therapy- Ex-vivo, In-vivo, In-situ gene therapy. (2)
3.2 Strategies of gene therapy: gene augmentation – ADA deficiency, CFTR. (2)
3.3 Antisense Therapy: antisense RNA, Ribozymes and antisense Oligonucleotide. (2)
3.4 Therapeutic genome editing- ZFN, CRISPR-Cas gene editing technology (HIV) (2)
3.5 Pharmacogenomics- Single gene disorders (G6PD) and Multigenic diseases (CHD); Benefits of pharmacogenomics. (2)

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3.6 Gene products in medicine: Humulin, Erythropoietin, Somatostatin / Growth Hormone and Recombinant coagulation factor. (2)

UNIT-IV: Regenerative medicine

12Hrs

- 4.1 Regenerative medicine: Stem cells- Embryonic and Adult stem cells, Totipotent, Pluripotent and Multipotent cells. (2)
- 4.2 Characteristics and properties of stem cells. (2)
- 4.3 Stem cell-Isolation and culture. (2)
- 4.4 Potential use of stem cells- Cell based therapies. (2)
- 4.5 Cell and tissue engineering- Characteristics of cells involved in tissue engineering.(2)
- 4.6 Types and characteristics of Biomaterials. (2)

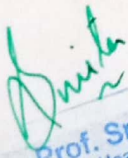
UNIT- V: Bioinspired Systems & AI in Medicine

12Hrs

- 5.1 Biosensors in medicine & health care. (2)
- 5.2 Biologically inspired artificial devices: artificial Heart and circulatory assist devices, artificial lungs, artificial kidney, artificial cell, artificial muscle. (2)
- 5.3 Bioartificial organs (Liver, Blood vessels & Skin) . (2)
- 5.4 Artificial Intelligence & it's Applications in Medicine. (2)
- 5.5 Artificial vision: Computer vision. (2)
- 5.6 Biologically inspired systems: Robotic systems and devices. (2)

REFERENCE BOOKS

1. Introduction to Human Molecular Genetics- J.J Pasternak, John Wiley Publishers
2. Human Molecular Genetics- Tom Strachen and A P Read, Bios Scientific Publishers
3. Human Genetics Molecular Evolution- Mc Conkey
4. Recombinant DNA Technology- AEH Emery
5. Principles and Practice of Medical Genetics, I, II, III Volumes by AEH Edts. Emery
6. Medical Biotechnology- Pratibha Nallari, V. Venugopal Rao- Oxford Press
7. Medical Biotechnology 1st Edition- Judit pongracz, Mary Keen
8. Medical Biotechnology by Bernard R. Glick, Terry L. Delovitch, Cheryl L. Pattern. ASM press, 2014
9. Molecular Biotechnology-Principles and Applications of Recombinant DNA- 4th Edition by Bernard R. Glick, Jacj J. Pasternack, Cheryl L. Pattern
10. Bioinspired Nanoscale Hybrid System : Conference Proceeding Held on Nov'02, Editor : Author: G. Schmid.
11. Biomedical Engineering Handbook, Author: J.D. Bronzino, Publisher: CRC press.


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BIOINFORMATICS

Credits: 4
Subject code : MBT21305

II Year / I Semester
No. Of lecture hours: 60

Objective: To enable practical insight for assessing life sciences with computing technology and giving guidance for using them effectively in rapidly evolving areas in the research.

- CO1:** It summarizes foundations of Bioinformatics
CO2: To explain methods for Comparison and evaluation of data
CO3: Analysis of Genomic Applications of Bioinformatics
CO4: Analysis of Proteomic Applications of Bioinformatics
CO5: It summarise Applications of Bioinformatics

UNIT-I: Foundations to Bioinformatics 12Hrs

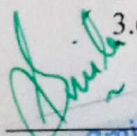
- 1.1 Foundations to bioinformatics–Evolution, similar macromolecular components, constancy of gene number and core proteome in closely related organisms (2)
- 1.2 Bioinformatics data–nucleic acid sequence, protein sequence, protein structure, genomic, proteomic and metabolomic information (2)
- 1.3 Bioinformatics databanks: Importance of creating data types, design, access tools with examples (2)
- 1.4 File formats: Genpept, FAST A, PDB and Swissprot (2)
- 1.5 Basics of sequence alignment–match, mismatch, gaps, scoring alignments, gap penalty, protein vs. DNA alignment (2)
- 1.6 Bioinformatics tools and Resources–free online tools, downloadable free tools, software packages, Bioinformatics books and Journals, Bioinformatics web-portals (2)

UNIT-II: Comparison methods in Bioinformatics 12Hrs

- 2.1 Dot-matrix comparison (2)
- 2.2 PAM and BLOSUM matrices (2)
- 2.3 Pair wise alignment based heuristic algorithms - FASTA algorithm, Blast algorithm (2)
- 2.4 Pair wise alignment algorithms–Needleman and Wunch algorithm, Smith&Watermann algorithm (2)
- 2.5 Multiple sequence alignment algorithms– progressive alignment algorithms, Iterative alignment algorithms (2)
- 2.6 Multiple sequence alignment based databases searching: Consensus sequence, patterns and profiles (2)

UNIT-III: Genomic Applications of Bioinformatics 12Hrs

- 3.1 Nucleic acid Data banks-NCBI, EMBL, DDBJ (2)
- 3.2 EST Clustering and analyses (2)
- 3.3 Finding genes in prokaryotic genomes: open reading frames, contents, signals (2)
- 3.4 Finding genes in eukaryotic genomes: Glimmer, Grail II, Genmark and Genscan (2)
- 3.5 Regulatory sequence analysis: core and distal promoter sequences (2)
- 3.6 Methods of Gene prediction-Homology-based, Feature-based, Statistical and HMM approaches (2)


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UNIT-IV: Proteomic Applications Of Bioinformatics	12Hrs
4.1 Bioinformatics in support of Proteomic research	(2)
4.2 Protein primary data banks-Swissprot & PIR	(2)
4.3 Protein secondary data banks-SCOP & CATH	(2)
4.4 Protein structure data banks: PDB and Prosite patterns	(2)
4.5 Protein structure classification	(2)
4.6 Methods for Protein secondary structure prediction	(2)
4.7 Transcription factor binding sites	(2)

UNIT-V: Advanced Applications of Bioinformatics	12Hrs
5.1 Medical application of Bioinformatics—disease genes, drug targets, pharmacogenomics	(2)
5.2 Drug designing	(2)
5.3 Structural biology - Homology modeling	(2)
5.4 Bioinformatics for micro array designing and transcriptional profiling	(2)
5.5 Bioinformatics for phylogenetic analysis-Phenetic and cladistic approaches	(2)
5.6 Methods for studying phylogenetic analysis- Distance and character based methods	(2)
5.7 Ramachandran plot	

ESSENTIAL READING


1. David W. Mount. 2004 **Bioinformatics: Sequence and Genome Analysis**. 2nd edition, Cold Spring Harbor Laboratory Press, New York.
2. Richard Durbin, Sean R. Eddy, Anders Krogh, Graeme Mitchison. 2000 **Biological Sequence Analysis : Probabilistic Models of Proteins and Nucleic Acids**. 1st edition. Cambridge University Press.

Smita

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 Osmania University, Hyd-500 007.

PROGRAMME OUTCOMES

- **PO1 Scientific Knowledge.** Apply the knowledge of Science, Mathematics, Engineering & Technology fundamentals to solve the complex problems.
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BIOPROCESS ENGINEERING

Credits: 4

Subject code: MBT 21306

II Year / I Semester
No. of lecture hours: 60

Objective: The objective of the course is to create general understanding amongst the students in the subject of bioprocess technology through in-depth lectures and to understand them a general overview, concepts and basic principles in the subject of Industrial Biotechnology with emphasis on how to apply the knowledge in bio processing engineering.

- CO1:** Students will understand the basic principles of engineering knowledge to solve a critical problem and will be more confident to use the knowledge in pursuing Bioprocess knowledge in industrial biotechnological application
CO2: Summarizes the different types of designs of fermentors and operations.
- CO3:** Identifies & relates microbiological and the fermentation media, illustrates the principles of upstream process of fermentation
- CO4:** Compares, discriminates the product isolation with product purification methods. Explains & interpretes the product purification strategies
- CO5:** Evaluates, relates the principles of upstream & downstream process of fermentation in different fermentative productions.

Unit I: Fundamentals of bioprocess engineering

12Hrs

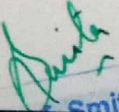
1.1 Introduction to bioprocess engineering, bioprocess development and interdisciplinary connections, bioprocess kinetics: quantitative description of bioprocess, Malthus law, defining rates and yield coefficients (2)

1.2 Kinetic modelling, model structures, unstructured and structured kinetic models (2)

1.3 Material balances: modes of operation of bioreactors (batch, continuous, fed-batch or semi-batch) mass balances for ideal bioreactors, general dynamic mass balance equations, specific mass balance equations for different modes of operation with dynamic state variables, dilution rate, productivity and reactor volume, energy balances: basic energy concepts (2)

1.4 Transport phenomenon in bioprocess system: mass transfer (gas-liquid, liquid-liquid, liquid-solid, gas-solid, gas-liquid-solid), mass transfer steps, mass transfer equations, oxygen transfer, transfer steps, oxygen transfer equations, volumetric oxygen transfer coefficient ($K_L a$), measurement of $K_L a$, heat transfer principles, heat transfer mass balance, heat generation and exchange, heat removal. (2)

1.5 Fluid dynamics and mixing: fluid types, Newtonian and non-Newtonian fluid, newton's law of viscous flow, flow curve, shear stress and shear rate (2)


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1.6 Mixing: mixing equipments, impellers, baffles, impeller types (axial flow and radial flow impellers), mechanism of mixing (2)

Unit II: Upstream bioprocess infrastructure, knowhow and considerations 12Hrs

2.1 Designing of bioreactors: bioreactor types (stirring and non stirring), design configurations, STR, BCR, ALB and FBR. Criteria of positioning baffles agitators and spargers, bioreactor vessel design features, construction inputs, designs of bioreactors

for sterile operations, pipe work valve types and filters, steam traps, clean- in- place issues (2)

2.2 Photobioreactors: laboratory and industrial scale photobioreactors, solar photobioreactors, wave bioreactor (2)

2.3 Sterilization of media and air for bioprocess. Liquid media sterilization, kinetics of sterilization, del factor, heating, holding and cooling cycles, design of sterilization process (batch and continuous), design of sterilization cycles (Richard's graphical integration rapid method) (2)

2.4 Continuous sterilization (direct & indirect), continuous sterilization system for fermentation media sterility using spiral heat exchangers (2)

2.5 Filter sterilization: mechanism, interception, filter types, absolute (fixed) and depth (non-fixed) filters, construction of depth filter types, zeta potential, hydrophilic membrane cartridges, hydrophobic membrane cartridges, construction, theory of depth filter (2)

2.6 Cell immobilization, merits and demerits. cell immobilization strategies, active and passive immobilization (bio-films), microencapsulation (special immobilization system: beads, coated bead & hollow sphere), methods in microencapsulation, dropping methods, coaxial dropping, binding (adsorption, cross-linking, covalent binding), passive immobilization: biological films formation process, diffusion limitations in immobilized system, overall cell immobilization Applications. (2)

Unit III: Downstream processing 12Hrs

3.1 Downstream processing: a multi stage operation, unit operations (1)

3.2 solid liquid separation: filtration (batch, continuous), clarification, filter aids, flocculation, floatation/foam separation (1)

3.3 centrifugation (batch, continuous), (principle, theory & equipments) (2)

3.4 Methods for disruption of cells, recovery of intracellular components: mechanical and non-mechanical (chemical & enzymatic methods), high-pressure homogenization, microfluidization (2)

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3.5 Concentration of biological products: evaporation (principles and equipments), membrane filtration, electrodiyalysis, pervaporation, perstraction, (2)

3.6 Liquid-liquid extraction, aqueous two phase system (ATPS), precipitation, adsorption (break through curve), supercritical fluid extraction (SFE) Purification of product: chromatography methods and types, product formulation: principles and equipments, drying and types of dryers and lyophilization (sublimation, triple point) (2)

3.7 Monitoring of downstream process and process integration bioprocess monitoring flow injection analysis.(FIA) (2)

Unit IV: Bioprocess instrumentation, measurement, control and automation 12Hrs

4.1 Fundamentals of bioprocess control, physical, chemical and biological sensors, classes of sensors: in-line, on-line and off- line sensors (2)

4.2 Instrumentation and principles or measurement of temperature, flow rate, Pressure, agitation shaft power, foam sensing, biomass, dissolved oxygen, pH, carbon dioxide. (2)

4.3 Deflection and thermal type paramagnetic oxygen analyzer for inlet/exhaust air (2)

4.4 Basic control system, automation and control system: control loops (open and closed), controllers, manual control, automatic control, cascade control, ratio control, complex control systems, cascade feedback control, proportional, integral and derivative (PID) control (2)

4.5 Application of computers in bioprocess engineering: data logging, analysis and control, computerized bioprocess control, bioprocess computers: limitations (2)

4.6 Artificial neural network and role neural network computers in bioprocess control process economics, requisites for setting up of a biotech company: stating point of discussion, cost benefit analysis (2)

UNIT-V :PRODUCTS OF BIOPROCESS 12Hrs

5.1 Organic acids: citric acid (2)

5.2. Enzymes: protease (2)

5.3 Health care: *Penicillin* (2)

5.4 Beverages: Ethanol (2)

5.5 Food products: cheese (2)

5.6. Proteins: single cell protein. (2)

REFERENCE BOOKS

1. Bioprocess Engineering Principles by P. M. Doran
2. Bioprocess Engineering Basic Concepts by Kargi and Shuler
3. Fundamentals of Biochemical Engineering by Bailey and Ollis
4. Introduction to Biochemical Engineering Principles by D. G. Rao

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5. Bioreaction Engineering Principles by Jens Høiriis Nielsen, John Villadsen, Gunnar Lidén
6. Principles of Fermentation Technology by P.F. Stansbury, A. Whitaker and S. J. Hall
7. Basic Biotechnology by C. Ratledge and Bjorn Kristiansen
8. Bioprocess Engineering by Bjorn K, Lydersen, Nancy, D'Elia, Nelson

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M.Sc. Biotechnology

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PLANT BIOTECHNOLOGY PRACTICALS


Credits: 2

Subject Code: MBT21307

II Year / I Semester

No. of practical hours: 60

1. Preparation of Plant Tissue Culture media- Seed culture
2. Sterilization techniques - Surface sterilization of explants
3. Micro-propagation of banana using suckers
4. Elite plant species-callus induction
5. Micro-propagation of elite species Shoot & Root regeneration
6. Protoplast Isolation
7. Anther/Pollen culture for haploid plants
8. GM testing in crops by PCR technology (Cotton /Brinjal)
9. Preparation of Synthetic seeds
10. Agrobacterium tumefaciens mediated transformation technique


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MEDICAL BIOTECHNOLOGY PRACTICALS

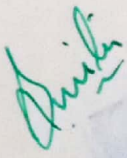
Credits: 2

Subject Code: MBT21308

II Year / I Semester

No. of practical hours: 3hrs/week

1. Genotyping of candidate genes for diseases by RFLP/Microsatellite/VNTR analysis
2. Screening for known mutations by ARMS-PCR/ASO
3. Detection for dynamic mutations- Trinucleotide repeat polymorphism
4. Screening for unknown mutations by SSCP
5. Detection of congenital abnormalities by triple test.
6. Pedigree Analysis.
7. Meta Analysis.


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BIOINFORMATICS PRACTICALS

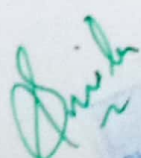
Credits: 2

Subject code: MBT 21309

II Year / I Semester

No. of practical hours: 60

1. Dot-matrix comparison
2. All types of BLAST- BLASTp, BLASTn, BLASTx&tBLASTn
3. Searching DNA databases with FASTA and BLAST
4. Searching protein sequence databases with FASTA and BLAST
5. Pairwise alignment-Local, Global for protein and DNA
6. Multiple sequence alignment-ClutalX, Clustal W
7. Making Patterns (prosite syntax) and consensus sequence from multiple sequence alignments
8. Compositional analysis of DNA-GC/AT content - codon usage-codon bias
9. ORF and gene prediction by Glimmer, Grail II, Genmark and Genscan
10. Phylogenetic analysis-Rooted, unrooted
11. Homology modelling.


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BIOPROCESS ENGINEERING PRACTICALS

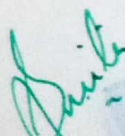
Credits: 2

Subject code: MBT 21310

II Year / I Semester

No. of practical hours: 3hrs/week

1. Bioprocess description in quantitative terms, calculation of doubling time, estimation of specific growth rate of target organism, preparation of growth curve.
2. Evaluation of Malthus law .
3. Determination of yield coefficient and evaluation of Monod model
4. Cell immobilization technique, biomass generation and harvesting of biological organism for analysis
5. Development of laboratory scale bioreactors: Know-how
6. Production of biotechnological products from immobilized yeast cells in packed bed bioreactor
7. Purification and identification of unknown compounds from a mixture of compounds using column chromatography and TLC
8. Extraction of protein from a crude bioprocess homogenate using aqueous two phase system (ATPS)
9. Extraction of protein from milk and papain homogenate using aqueous two phase system (ATPS)
10. Protein purification by using Ni-NTA affinity column chromatography
11. Protein purification by using Size exclusion column chromatography
12. Analysis of purified protein by Polyacrylamide gel electrophoresis
13. Qualitative Analysis of microbial quality of milk.


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YEAR-WISE AND SEMESTER-WISE DISTRIBUTION OF SUBJECTS
DEPARTMENT OF BIOTECHNOLOGY
M. Sc - SECOND YEAR – SECOND SEMESTER
ACADEMIC YEAR 2022-23 OF 2021-23BATCH (CBCS)

Sl. No.	Part	Subject Code	Title of the subject	Hours/ week	Duration of Exam (Hrs.)	Marks			Credits
						Internal	External	Total	
1	I	MBT 21401	Animal Biotechnology (Core-14)	4	3	40	60	100	4
2	II	MBT 21402 A/B	Nano-Biotechnology/ Advanced Techniques in Biotechnology (DSE-2)	4	3	40	60	100	4
3	III	MBT 21403 A/B	Inter-Disciplinary*(ID) Basic Biotechnology/ Advances In Biotechnology	4	3	40	60	100	4
PRACTICALS									
4	IV	MBT 21404	Animal Biotechnology (Core-14)	3	2	20	30	50	2
5	V	MBT 21405	Project	6	-	60	90	150	6
			Total	21		200	300	500	20

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ANIMAL BIOTECHNOLOGY

Credits: 4
Subject code: MBT21401

II Year / II Semester
No. of lecture hours: 60

Objective: To encompass a broad range of techniques for the genetic improvement of domesticated animal species.

CO1: The basics of maintenance of mammalian cell and generation of cell line using proper sterile techniques and optimum conditions of growth to develop mammalian cells.

CO2: To identify and comprehend experimental knowhow of various techniques involved in cell separation and quantitation using latest technology also know how to relate and evaluate the applications of animal biotechnology In gene therapy, animal breeding, cloning.

CO3: The knowledge to know about overview of transgenic technology Development of transgenic mice and other animal models

CO4: The knowledge to know about the Genetic tools and their applications


CO5: Knowledge regarding various **Gene targeting and Animal Models UNIT-I: Animal Tissue Culture basics 12Hrs**

- 1.1 Media and reagents: Introduction to growth medium. Types of cell culture media and ingredients. Natural media (plasma clots, biological fluids, tissue extracts) (2)
- 1.2 Defined media. (Physicochemical properties of media, balanced salt solution, and complete media). Serum, serum free media and antibiotics sterilization of cell culture media and serum using filter sterilization. (2)
- 1.3 Primary cell culture: Isolation of cells from biopsy, chick and mouse embryo and Establishing primary cell culture by enzymatic and mechanical disaggregation method. (2)
- 1.4 Mass culture of cells - types of cell lines, maintenance of cell lines, manipulation of cells- cell transfection (electroporation and chemical methods) and transduction, immobilization of cells and its application. (2)
- 1.5 Synchronization of cell cultures, production of secondary metabolites, biotransformation, scaling up of animal cell culture. (2)
- 1.6 Commercial applications of cell culture: tissue culture mass production of biologically important compounds (e.g. vaccines), harvesting of products, purification, assays. (2)

UNIT-II: Animal Breeding

12Hrs

- 2.1 Conventional methods of animal Improvement- selective breeding, cross breeding.
- 2.2 Principles of animal breeding; structure of the livestock breeding industry: dairy cattle, beef cattle, swine, sheep, poultry and aqua culture. (2)
- 2.3 Artificial insemination (AI) techniques and their development, In vitro fertilization, ICSI and preservation of endangered species. (2)
- 2.4 Estrus synchronization, semen collection, evaluation, storage. (2)
- 2.5 In-vitro Fertilization In vitro fertilization, ICSI and preservation of endangered species (2)
- 2.6 Embryo transfer technology, Super ovulation, cryo preservation of embryos, Hormones involved in embryo transfer technology. (2)


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- 2.7 Microinjection and Macroinjection – introduction – procedure – applications advantages and limitations. (2)

UNIT- III: Transgenic Animals

- 3.1 An overview of transgenic technology Development of transgenic mice and other animal models: by injection of foreign DNA/gene into zygote; optimization of construct for in vivo expression (2)
- 3.2 Generation of chimeric, transgenic and knockout mice and other animals and their characterization. (3)
- 3.3 Transgenic fishes, transgenic poultry and transgenic insects as bioreactors. (3)
- 3.4 Potential application of transgenic animals: models for various diseases/disorders (2)
- 3.5 Production of peptides and proteins of biopharmaceutical interest (molecular farming) (2)

UNIT IV: Genetic tools and their applications

12Hrs

- 4.1 Basic concepts: genesis and importance of molecular techniques; physical and genetic map, current status of genome maps of livestock. (2)
- 4.2 Statistical techniques for analyzing molecular genetic data: quantitative trait loci (QTL) mapping and its application in animal breeding, genome scan, candidate gene approach, genomic selection. (2)
- 4.3 Fundamentals of animal genetics: aqua culture (shrimp, prawns and oyster) and cattle (sheep, buffalo and pig). (2)
- 4.4 Molecular markers and their application in animal improvement- RFLP, RAPD, microsatellite/minisatellite markers, SNP Marker, DNA fingerprinting. (2)
- 4.5 DNA sequencing, genome sequencing, genomic library, polymerase chain reaction (PCR): its types (PCR-RFLP, AS-PCR) and applications in livestock development. (2)
- 4.6 Identification and isolation of genes of economic importance. (2)

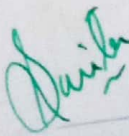
Unit V: Gene targeting and Animal Models

12Hrs

- 5.1 Cancer models (carcinogenic injection; bone marrow transplantation; xenografts, Retrovirus- lentivirus- & adenovirus-based models) (3)
- 5.2 Neurodegenerative disease models (Alzheimers & Parkinsons) (2)
- 5.3 Infectious disease models: Mouse models of Streptococcus and HIV (2)
- 5.4 Metabolic disease (Obesity & Diabetes) models. (2)
- 5.5 Genome editing tools: zinc finger nucleases (ZFNs), TALENs and the CRISPR-Cas System. (3)

REFERENCE BOOKS

1. Practical animal breeding. Blackwell Science.
2. Houdebine L.M. Animal transgenesis and cloning. Wiley Publishers.
3. R. Ian Freshney. Culture of animal cells: a manual of basic technique and specialized applications.
4. Falconer DS & Mackay TFC. An introduction to quantitative genetics. Longman.
5. Jain JP. Statistical techniques in quantitative genetics. Tata McGraw-Hill.
6. Pirchner F. Population genetics in animal breeding. S. Chand.
7. Sambrook et al. Molecular cloning Volume 1, 2, 3.


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8. Wilson K. and Walker J. Principles and techniques of biochemistry and molecular biology
9. Pasternack and Glick. Molecular biotechnology
10. Comparative Reproductive Biology. Edited by H. Schatten and G.M. Constantinescu. Blackwell Publishers, UK.
11. Comparative Endocrinology and Reproduction. Edited by K. P. Joy, A. Krishna, C. Haldar, Narosa Publishers, Delhi.
12. Daltons Introduction to Practical Animal Breeding. Edited by Malcolm B. Willis, Blackwell Science, UK.
13. Williams Text Book of Endocrinology, Edited by J. D. Wilson and others, Saunders, USA. 5. Animal Transgenesis and Cloning. Edited by L. M. Houdebine, Wiley, USA.

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PROGRAMME OUTCOMES

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M.Sc. Biotechnology

Syllabus w.e.f 2022-23 for 2021-23 batch (CBCS)

NANO-BIOTECHNOLOGY

Credits: 4

Subject code: MBT 21402 A

Semester: III

No. of lecture hours: 60

Objective: To cover the synthesis, characterization, studying properties, processing and applications of the nano-materials in the field of biotechnology.

CO1: Explains new horizons of science by fundamental study of Nanotechnology

CO2: It extends Nanotechnology different areas and its utilization

CO3: Categorize different types of Nano Structures by their fundamental properties and utility in different areas

CO4: Support of Nano-biotechnology in Health Care

CO5: Summarizes the Applications of Nano-biotechnology

UNIT- I Introduction to Nanotechnology 11Hrs

- 1.1 Introduction and Definitions of Nanotechnology (1)
- 1.2 Importance of Knowing and understanding size of Nano (1)
- 1.3 Broad, Narrow and Cultural perspective of nanotechnology (1)
- 1.4 Nanotechnology in different fields: Optics, electronics, computers etc... (2)
 - 1.4.1 Nanobiology: applications and types of self assembly (2)
 - 1.4.2 Nanobiophysics: building block of nano-devices and nano-helices (2)
 - 1.4.3 Molecular nanotechnology: Abundent clean energy, eradicating diseases and extending life, healing the environment and smart materials and green manufacturing (2)

UNIT- II Nano-Chemistry 09Hrs

- 2.1 Self assembly of molecules and materials (2)
- 2.2 Nano-particles: Types of nano-particles: pure metals and metal oxides (2)
- 2.3 Techniques to synthesize nano gold particles - top down and bottom up (2)
- 2.4 Characterization and significance of nano particles (1)
- 2.5 Manipulation of nanoparticles (1)
- 2.6 Toxic effects of nanoparticles (1)

UNIT- III Different classes of Nano-materials 14Hrs

- 3.1 Nanodendrimers (2)
- 3.2 Buckyball and Nanotubes: single walled (SWNT), multiwalled (MWNT) (2)
- 3.3 Synthesis and characterization of Scanning electron microscope (SEM), Transmission electron microscope(TEM) and atomic force microscope (AFM)(4)
- 3.4 Nanosomes: Properties and applications (2)
- 3.5 Quantum dots: Properties and applications (2)
- 3.6 Nanowires: fabrication, electrons in atomic wires, production, conductivity and use (2)

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UNIT- IV Nano-biotechnology in Health Care	14Hrs
4.1 Nano capsule	(2)
4.2 Biosensor chips	(3)
4.3 Artificial Pancreas	(2)
4.4 Spinal cord treatment	(2)
4.5 Artificial muscles	(2)
4.6 Medibots: nano-robots and immune system	(3)

UNIT- V Applications of Nano-biotechnology	12Hrs
5.1 Nanobiotechnology in Computing	(1)
5.2 Nanobiotechnology in Electronics	(2)
5.3 Nanobiotechnology in Defence	(2)
5.4 Nanobiotechnology in Industries	(2)
5.5 Nanobiotechnology in Environment	(2)
5.6 Ethical issues in Nanobiotechnology	(1)

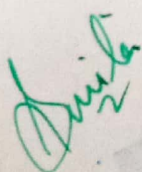
ESSENTIAL READING

1. Carol Crane, Michael Wilson, Kamali Kannangara, and Smith Geoff. 2004 **Nanotechnology: Basic Science and Merging Technology**. Chapman and Hall CRC.
2. Varghese, Thomas. Balakrishna. K.M. 2012 **Nanotechnology: An Introduction to synthesis, properties and applications of Nanomaterials**. Atlantica.
3. T. Pradeep 2012 **A text book of Nano science and Nanotechnology** Tata McGraw Hill Education Private Limited, New Delhi.
4. T. Pradeep, 2007. **Nano: The Essentials; understanding Nanoscience and Nanotechnology**. McGraw Hill Education Private Limited, New Delhi.

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ADVANCED TECHNIQUES IN BIOTECHNOLOGY (DSE-II)

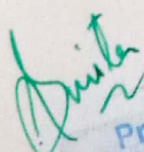
Credits: 4
Subject code: MBT 21402 B

II Year / II Semester
No. of lecture hours: 60

Objective: To have an exposure about Bioanalytical techniques and to prepare students to learn the techniques so that they are easily absorbed and placed in R&D Laboratories and Biotechnology industries.

Out Comes: students will be able to gain knowledge on techniques in biotechnology

UNIT- I Chromatography	12Hrs
1.1 Basic principle, instrumentation and applications of:	(2)
1.1.1 Paper chromatography.	(1)
1.1.2 Thin layer chromatography.	(1)
1.1.3 Gel filtration (molecular sieve).	(1)
1.1.4 Ion Exchange chromatography.	(1)
1.1.5 Affinity chromatography.	(1)
1.2 Matrices & support materials used in chromatography.	(1)
1.3 Types of partition chromatography.	(2)
1.4 HPLC	(2)
1.5 Gas chromatography.	(1)
UNIT- II Electrophoresis	12Hrs
2.1 Introduction of electrophoresis - Migration of an ion in field, principle factors affecting rate of electrophoretic mobility.	(2)
2.2. Types of electrophoresis - Basic principle experimental procedures-	(2)
2.3 Paper electrophoresis	(2)
2.4 Agarose gel electrophoresis	(2)
2.5 PAGE	(2)
2.6 Capillary electrophoresis & Immuno Electrophoresis	(2)
2.7 2-D electrophoresis & Gradient Gel electrophoresis.	(1)
2.8 Isoelectric focusing.(IEF)	(1)
UNIT- III	
Electrophysiological Techniques	12Hrs
3.1 single neuron recording	(2)
3.2 patch-clamp recording	(2)
3.3 Electrocardiogram(ECG)	(2)
3.4 Brain activity recording	(2)
3.5 Lesion and stimulation of brain	(2)
3.6 Electroencephalogram(EEG)	(2)


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UNIT- IV Spectroscopy		12Hrs
4.1	Basic principles-electromagnetic radiation, electromagnetic spectrum.	(1)
4.2	Calorimetry & Spectrophotometry	(2)
4.3	U.V.& Visible absorption Spectroscopy	(1)
4.4.	IR Spectroscopy - Basic principles & applications	(1)
4.5.	N.M.R. Spectroscopy Basic principles & applications	(1)
4.6	Raman spectroscopy- Basic principles & applications	(1)
4.7	Optical rotatory Dispersion& circular Dichroism (CD,ORD)	
4.8.	Mass spectrometry	(1)
4.9.	Basic principles & Applications of Autoradiography	(1)
4.10	Phosphorescence Fluorescence, Fluorescent Activated Cell Sorter (FACS)	(2)

UNIT- V Microscopy & Diagnostic Radiographic techniques **12Hrs**

5.1	Basic Microscopy	(2)
5.2	Confocal Microscopy& Laser microscopy	
5.3	Electron Microscopy-Transmission electron microscopy (TEM), Scanning Electron Microscopy (SEM)	(2)
5.4	Magnetic resonance Imaging (MRI)	(1)
5.5	PET SCANS	(2)
5.6	Optical Tomography	(2)
5.7	X-ray diffraction	(1)
5.8	Imaging technologies	(2)

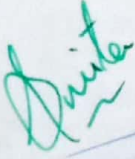
ESSENTIAL READING

1. Avinash Upadhyay, Kakoli Upadhyay, & Nirmalendu Nath. 2003 **Biophysical Chemistry-Principles & Techniques**. 4th edition, Himalaya Publishing House, Bangalore.
2. Freifelder, D. 1982 **Physical Biochemistry**. 2nd edition. ACS Publication, Washington.D.C.

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**BASIC BIOTECHNOLOGY
(GENERIC ELECTIVE-I)**

Credits : 4

II Year / II Semester

Subject code : MBT21403 A

No. of lecture hours: 60

OBJECTIVE: To learn fundamentals in biotechnology and to gain knowledge on industrial applications of Biotechnology

CO1: Explains the basics in Biotechnology

CO2: Gives detailed information about concepts in Genetics

CO3: Explains the basics in Microbiology

CO4: Describes concepts of Plant Biotechnology

CO5: Clearly gives information about applications of Biotechnology in various fields

Unit I: Introduction to Biotechnology 12Hrs

- 1.1 Introduction to Biotechnology (2)
- 1.2 Scope and Importance of Biotechnology (2)
- 1.3 Concept of Cell as basic unit of life (2)
- 1.4 Prokaryotic cell (2)
- 1.5 Eukaryotic cell (2)
- 1.6 Importance of Biomolecules in cell (2)

Unit II: GENETICS 12Hrs

- 2.1 Introduction to genetics (2)
- 2.2 Concept of gene (2)
- 2.3 Chromosomes (2)
- 2.4 Genetic inheritance-Mendel Laws (2)
- 2.5 Genetic Disorders (2)
- 2.6 Applications of genetics (2)

Unit III: MICROBIOLOGY 12Hrs

- 3.1 Introduction to Microbiology (2)
- 3.2 Microbial media and its applications (2)
- 3.3 Sterilization (2)
- 3.4 Bacteria, Fungi, Algae & Virus (2)
- 3.5 Use of Chemical Agents in Controlling microorganisms (2)
- 3.6 Importance of Microbes in Biotechnology (2)

UNIT -IV: PLANT BIOTECHNOLOGY 12Hrs

- 4.1 Introduction to Tissue Culture (2)
- 4.2 Tissue Culture Media and Composition (2)
- 4.3 Sterilization Techniques (2)
- 4.4 Initiation of Callus (2)
- 4.5 Micro propagation-Organogenesis (2)
- 4.6 Applications of Plant Biotechnology (2)

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Unit V: Applications of Biotechnology

12Hrs

- | | |
|--|-----|
| 5.1 Applications of Biotechnology in Plants | (2) |
| 5.2 Applications of Biotechnology in Animals | (2) |
| 5.3 Applications of Biotechnology in Fermentation Industry | (2) |
| 5.4 Applications of Biotechnology in Medical Diagnostics | (2) |
| 5.5 Applications of Biotechnology in Environment | (2) |
| 5.6 Ethics in Biotechnology | (2) |

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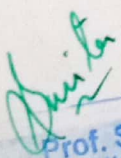
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**ADVANCES IN BIOTECHNOLOGY
(GENERIC ELECTIVE-II)**

Credits : 4
Subject code : MBT21403 B

II Year / II Semester
No. of lecture hours: 60

Unit 1: Biotechnology applications in agriculture	12Hrs
1.1 Crop seasons and crop rotation	(2)
1.2 Introduction to GM Crops	(2)
1.3 Sustainable agriculture	(2)
1.4 Applications of GM Crops: (Bt- Cotton; and golden rice)	(2)
1.5 Limitations of GM Crops	(2)
1.6 Bioethical issues on GM crops	(2)
Unit 2: Biotechnological applications in environment	12Hrs
2.1 Introduction to Environmental Biotechnology	(2)
2.2 Bioremediation and application	(2)
2.3 Phytoremediation- Concepts	(2)
2.4 Phytoremediation-Application	(2)
2.5 Conservation of biodiversity	(2)
2.6 Ethical Concerns	(2)
Unit 3: Biotechnological applications in Medicine	12Hrs
3.1 Stem Cells-Introduction	(2)
3.2 Stem cells – Properties	(2)
3.3 Types of stem cells – Embryonic, Foetal and Adult stem cells	(2)
3.4 Applications of stem cells	(2)
3.5 Human stem cells – Applications in reproduction and regenerative medicine	(2)
3.6 Ethical and legal issues	(2)
Unit 4: Biotechnological applications in Industrial biotechnology	12Hrs
4.1.Introduction to industrial biotechnology	(2)
4.2.Industrial Microorganisms	(2)
4.3.Isolation of microorganisms for industrial products	(2)
4.4.Preservation of industrial microorganisms	(2)
4.5.Microbial products	(2)
4.6.Applications of Industrial biotechnology	(2)
Unit 5: IPR	12Hrs
5.1 Introduction to IPR	(2)
5.2 Protection of copy rights	(2)
5.3 Ignorance of Laws	(2)
5.4 Patents in Biotechnology and their importance	(2)
5.5 Societal Aspects of Biotechnology	(2)
5.6 Ethical Aspects of Biotechnology	(2)


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ANIMAL BIOTECHNOLOGY PRACTICALS

Credits: 2

Subject Code: MBT21404

II Year / II Semester

No. of practical hours: 3hrs/week

1. Isolation and establishment of primary cell culture
2. Passaging of monolayer cells.
3. Enumeration of cell viability by Trypan blue.
4. Mechanism of cryopreservation
5. Preparation of single cell suspension from spleen/liver/thymus
6. Establishment of primary cell culture: mouse splenocyte culture
7. Mammalian cell transfection (transient)
8. Immunofluorescence detection to check transfection efficiency (using fluorescence and confocal microscopes)

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M.Sc. Biotechnology

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PROJECT

Credits: 6

Subject code: MBT 21404

II Year / II Semester

No. of hours: 6hrs/week

1. Students will go for project work in a Research Institute /Industry for a duration of 90 working days.
2. Students will be reporting to the college every first and third Saturdays of every month.
3. In each visit students will have to present the work progress of their project to the internal guides.
4. At the end of 90 working days students will be submitting their final project thesis.

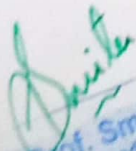
5. Method of evaluation:

1. Internal evaluation: 60 Marks

- Attendance – 30M
- 1st Internal project presentation –10M
- Last Internal project presentation –15M
- Thesis submission -5M

2. External evaluation: 90 Marks

- Final project presentation –30M
- Thesis evaluation-30M
- Viva-Voce-30M


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SYLLABUS FOR SELF STUDY COURSE

SUBJECT : BIOENTREPRENEURSHIP

Objectives:

- Acquiring Entrepreneurial spirit and resourcefulness
- Familiarization with various uses of human resource for earning dignified means of living
- Understanding the concept and process of entrepreneurship - its contribution and role in the growth and development of individual and the nation
- Acquiring entrepreneurial quality, competency and motivation
- Learning the process and skills of creation and management of entrepreneurial venture.

UNIT 1: INTRODUCTION TO ENTREPRENEURSHIP

- 1.1 Entrepreneurship – Concept, Functions and Need
- 1.2 importance of Entrepreneurship
- 1.3 Myths about Entrepreneurship
- 1.4 Pros and Cons of Entrepreneurship
- 1.5 Process of Entrepreneurship, Startup: Concept
- 1.6 Entrepreneurship – The Indian Scenario

UNIT 2: CONCEPT OF ENTREPRENEURSHIP

- 2.1 Why be an Entrepreneur
- 2.2 Types of Entrepreneurs
- 2.3 Competencies and characteristics
- 2.4 Entrepreneurial Values, Attitudes and Motivation
- 2.5 Intrapreneur: Importance in any organization
- 2.6 Difference between Entrepreneur & Intrapreneur

UNIT 3: ENTREPRENEURSHIP JOURNEY

- 3.1 Self-Assessment of Qualities, Skills, Resources and Dreams
- 3.2 Generation of Ideas, Business Ideas vs. Business Opportunities
- 3.3 Opportunity Assessment – Factors, Micro and Macro Market Environment



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3.4 Types of start-ups- Big Business Startups, Social Entrepreneurship Startups, Buyable Startups, Scalable Startups, Small and Medium Sized, enterprise Startups, Lifestyle Startups.

3.5 Business Plan Preparation and Execution of Business Plan

3.6 Role of networking in entrepreneurship

UNIT 4: ENTREPRENEURSHIP AS INNOVATION AND PROBLEM SOLVING

4.1 Entrepreneurs - as problem solvers

4.2 Innovations and Entrepreneurial Ventures – Global and Indian

4.3 Role of Biotechnology related entrepreneur

4.4 Social Entrepreneurship Concept

4.5 Risk Taking-Concept; types of business risks

4.6 Types of Resources - Human, Capital and Entrepreneurial tools and resources

UNIT 5: UNDERSTANDING THE MARKET

5.1 Market; Concept & Types

5.2 Market Research - Concept, Importance and Process; Marketing Mix

5.3 Selection and utilization of human resources and professionals like Accountants, Lawyers, Auditors, Board Members, etc.

5.4 Estimating Financial Resources requirement

5.5 Methods of meeting the financial requirements – Debt vs. Equity

5.6 Size and capital based classification of business enterprises.

COURSE REFERENCES

- S.S.Khanka, Entrepreneurial Development, S. Chand & Co, New Delhi, 1997
- CHARANTIMATH, Entrepreneurship development & Small business enterprise, Pearson Edn., New Delhi
- Jayashree Suresh, Entrepreneurial Development, Margham Publications, New Delhi, 1999
- C.B. Gupta & N. P. Srinivasan, Entrepreneurial Development, Sultan Chand & Sons, 1998
- David . H. Holt- Entrepreneurship New Venture Criterion
- Poornima M. Entrepreneurship Development and Small Business Enterprises (2nd Edition-Pearson)

• Dair and Sundaram (Revised by A. Mahjan), Indian Economy, 70th Edition, S Chand.

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