MOTHER TERESA WOMEN'S UNIVERSITY

KODAIKANAL – 624 102

DEPARTMENT OF BIOTECHNOLOGY

M.Sc. BIOTECHNOLOGY

Curriculum Framework, Syllabus, and Regulations

(Based on TANSCHE Syllabus under Choice Based Credit System – CBCS)

(For the candidates to be admitted from the Academic Year 2023-2024)

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Mother Teresa Women's University,
Kodaikanal
Department of Biotechnology
M.Sc.
Biotechnology

1. About the Programme

M.Sc., Biotechnology is a 2 year Postgraduate Program that is divided into 4 semesters. This programme is to develop the students theoretically knowledgeable and experimentally competent in the field of Biotechnology. This Programme is designed in a way that it provides adequate knowledge of advanced Biotechnology and related subjects such as Biochemistry, Molecular Genetics, Molecular Cell Biology etc. The Programme will facilitate students get skills and learn techniques in biological science. This advanced Programme can help students in taking a career in Research as well as getting employed in companies like pharma, healthcare, agri-based and many other life science sectors.

2. Programme Educational Objectives (PEOs)

PEO1: To train the students in advanced areas of biotechnology and other related subjects and sensitizing them with all possible scopes.
PEO2: To endow the students with analytical and research skills, to enhance entrepreneurial accomplishments
PEO3: To prepare a knowledgeable generation of biotechnologists with proficient skills to excel in their careers.
PEO4: To enrich them with good communicative and technical skills to perform efficiently as an individual and as a team member in a professional environment.
PEO5: To develop biotechnologists with professional ethics in order to address socio- economic challenges and global issues logically.

3. Programme Outcomes (PO)

On completion of M.Sc. Biotechnology Programme, students will be able to

PO1: gain in-depth knowledge in the advanced concepts and principles of Biotechnology and apply in research.
PO2: apply the knowledge of bio-techniques to identify solutions to problems in a systemic way.
PO3: perform the advanced techniques in the field of biology and related fields.
PO4: acquire professional ethics, leadership qualities and team-building skills to accomplish a common goal.
PO5: apply their skills of Bioinformatics to offer new insight for design and discovery of Drug
PO6: apply the theoretical and practical knowledge in securing a successful career as researcher, product developer, employee in industries and bio-business sectors, educator or pursue higher studies.
PO7: use the scientific skills acquired to develop into a successful women entrepreneur and set up bio-business.
PO8: use the scientific knowledge obtained to contribute to the scientific society and research of our country.

4. Programme Specific Outcomes (PSOs)

On completion of M.Sc. Biotechnology Programme, students will be able to

PSO1: attain knowledge in the fundamentals and applications of biotechnology to solve problems.

PSO2: gain proficient and practical knowledge on advanced and modern techniques to be used in research and industries.

PSO3: apply their knowledge and the skills for the betterment and advancement of their professional career.

PSO4: apply the research skill to nurture Entrepreneurial Endeavor by various funding schemes of government.

PSO5 understand the ever evolving need of biotechnologist professionals and their impact in finding solutions for global issues pertaining to environment, health, food and agriculture.

5. Eligibility

- A candidate who has passed Graduation in Life Sciences (Biotechnology/ Botany/Zoology/Microbiology/Biochemistry/EnvironmentalScience/Food Science and Herbal Sciences) and other Relevant Subject
- Candidate should have secured at least 55% in the above subject from any recognized University.

6. General Guidelines for PG Programme

i. **Duration:** The Programme shall extend through a period of 4 consecutive semesters and the duration of a semester shall normally be 90 days or 450 hours. Examinations shall be conducted at the end of each semester for the respective subjects.

ii. **Medium of Instruction:** English

7. Evaluation (25+75): Evaluation of the candidates shall be through Internal Assessment and External Examination for Theory and Practical.

7.1. Evaluation Pattern

EVALUATION PATTERN		Maximum Marks (Theory & Practical)	Minimum Marks (Theory & Practical)
Internal Evaluation	Continuous Internal Assessment Test	**25 Marks**	**13 Marks**
	Assignments / Snap Test / Quiz		
	Seminars		
	Attendance and Class Participation		
External Evaluation	End Semester Examination	**75 Marks**	**38 Marks**
Total		**100 Marks**	**50 Marks**

***Minimum credits required to pass: 91**

7.2. Internal Assessment-CIA

There shall be three tests conducted by the faculty concerned and the average of the best two can be taken as the Continuous Internal Assessment (CIA) for a maximum of 25 marks. The duration of each test shall be one / one and a half hour.

7.3. End Semester Examination (Theory): Max. Marks: 75 Time: 3 hrs.

7.4. Written Examination Question Paper Pattern

Theory Paper (Bloom's Taxonomy based)

(Common for PG Programmes)

Intended Learning Skills	**Maximum 75 Marks** **Passing Minimum: 50% Duration:** **Three Hours**
Memory Recall/Example/ Counter Example / Knowledge about the Concepts/Understanding	**Part–A (10x2=20Marks)** Answer ALL questions **Each Question carries 2 marks** Two questions from each Unit **Question 1 toQuestion10**
Descriptions/Application (problems)	**Part–B (5x5=25Marks) Answer** **ALL questions** **Each question carries 5 Marks** **Either - or Type** Both parts of each question from the same Unit **Question 11 (a) or 11(b)** to **Question 15(a) or 15(b)**
Analysis/Synthesis / Evaluation	**Part-C (3x 10 = 30 Marks)** **Answer any THREE questions** **Each question carries 10 Marks** There shall be FIVE questions covering all the five units **Question 16 to Question 20**

Each question should carry the course outcome and cognitivelevel For instance,

[CO1 : K2] Question xxxx

[CO3 : K1] Question xxxx

7.5.Methods of Assessment

METHODS OF ASSESSMENT	
Remembering (K1)	• The lowest level of questions requires students to recall information from the course content • Knowledge questions usually require students to identify information in the text book.
Understanding (K2)	• Understanding of facts and ideas by comprehending organizing, comparing, translating, interpolating and interpreting in their own words. • The questions go beyond simple recall and require students to combine data together
Application (K3)	• Students have to solve problems by using / applying a concept learned in the classroom. • Students must use their knowledge to determine a exact response.
Analyze (K4)	• Analyzing the question is one that asks the students to break down something into its component parts. • Analyzing requires students to identify reasons causes or motives and reach conclusions or generalizations.
Evaluate (K5)	• Evaluation requires an individual to make judgment on omething. • Questions to be asked to judge the value of an idea, a character, a work of art, or a solution to a problem. • Students are engaged in decision-making and problem – solving. • Evaluation questions do not have single right answers.
Create (K6)	• The questions of this category challenge students to get engaged in creative and original thinking. • Developing original ideas and problem solving skills

8. Project

8.1. Project Report

A student should select a topic for the Project Work at the end of the third semester itself and submit the Project Report at the end of the fourth semester. The Project Report shall not exceed 40 typed pages in Times New Roman font with 1.5 line space.

8.2. Project Evaluation

There is a Viva Voce Examination for Project Work. The Guide and an External Examiner shall evaluate and conduct the Viva Voce Examination. The Project Work carries 100 marks (Internal: 25 Marks; External (Viva): 75 Marks).

9 . Conversion of Marks to Grade Points and Letter Grade (Performance in a Course/Paper)

Range of Marks	Grade Points	Letter Grade	Description
90 – 100	9.0 – 10.0	O	Outstanding
80-89	8.0 – 8.9	D+	Excellent
75-79	7.5 – 7.9	D	Distinction
70-74	7.0 – 7.4	A+	Very Good
60-69	6.0 – 6.9	A	Good
50-59	5.0 – 5.9	B	Average
00-49	0.0	U	Re-appear
ABSENT	0.0	AAA	ABSENT

10. Attendance

Students must have earned 75% of attendance in each course for appearing for the examination. Students with 71% to 74% of attendance must apply for condonation in the Prescribed Form with prescribed fee. Students with 65% to 70% of attendance must apply for condonation in the Prescribed Form with the prescribed fee along with the Medical Certificate. Students with attendance less than 65% are not eligible to appear for the examination and they shall re-do the course with the prior permission of the Head of the Department, Principal and the Registrar of the University.

11. Maternity Leave

The student who avails maternity leave may be considered to appear for the examination with the approval of Staff i/c, Head of the Department, Controller of Examination and the Registrar.

12. Any Other Information

In addition to the above mentioned regulations, any other common regulations pertaining to the PG Programmes are also applicable for this Programme.

13. Faculty Course File Structure-Contents

a.	Academic Schedule	**q.**	Laboratory Experiments related to the Courses
b.	Students Name List	**r.**	Internal Question Paper
c.	Time Table	**s.**	External Question Paper
d.	Syllabus	**t.**	Sample Home Assignment Answer Sheets
e.	Lesson Plan	**u.**	Three best, three middle level and three average Answersheets
f.	Staff Workload	**v.**	Result Analysis (CO wise and whole class)
g.	Course Design(content, Course Outcomes (COs), Delivery method, mapping of COs with Programme Outcomes(POs), Assessment Pattern interms of Revised Bloom's Taxonomy).	**w.**	Question Bank for Higher studies Preparation (GATE/Placement)
h.	Sample CO Assessment Tools	**x.**	List of mentees and their academic achievements
i.	Faculty Course AssessmentReport(FCAR)		
j.	Course Evaluation Sheet		
k.	Teaching Materials (PPT, OHP etc)		
l.	Lecture Notes		
m.	Home Assignment Questions		
n.	Tutorial Sheets		
o.	Remedial Class Record, if any		
p.	Projects related to the Course		

14. COMMON TEMPLATE FOR ALL PG PROGRAMMES AS PER TANSCHE-2023-24

Semester–I	Credits	Hours	Semester-II	Credit	Hours	Semester-III	Credit	Hours	Semester–IV	Credit	Hours
1.1. Core-I	5	7	2.1. Core-IV	5	6	3.1. Core-VII	5	6	4.1. Core-XI	5	6
1.2 Core-II	5	7	2.2 Core-V	5	6	3.2 Core-VII	5	6	4.2 Core-XII	5	6
1.3 Core – III	4	6	2.3 Core – VI	4	6	3.3 Core – IX	5	6	4.3 Project with viva voce	7	10
1.4 Discipline Centric Elective -I	3	5	2.4 Discipline Centric Elective – III	3	4	3.4 Core – X	4	6	4.4Elective - VI (Industry / Entrepreneurship) 20% Theory 80% Practical	3	4
1.5 Generic Elective-II:	3	5	2.5 Generic Elective - IV:	3	4	3.5 Discipline Centric Elective - V	3	3	4.5 Skill Enhancement course / Professional Competency Skill	2	4
			2.6 NME I	2	4	3.6 NME II	2	3	4.6 Extension Activity	1	
						3.7 Internship/ Industrial Activity	2	-			
	20	**30**		**22**	**30**		**26**	**30**		**23**	**30**
Total Credit Points -91											

15.Templates for Semesters

Choice Based Credit System (CBCS),
Learning Outcomes Based Curriculum Framework (LOCF) Guideline Based Credits and Hours Distribution System
for all Post – Graduate Courses including Lab Hours

SEMESTER-I

S.No.	Course Code	List of Courses	Credits	Hours		CIA	ESE	Total
				L	P			
1.	P23BTT11	Core – I	5	7	-	25	75	100
2.	P23BTT12	Core – II	5	7	-	25	75	100
3.	P23BTP11	Core – III	4	6	-	25	75	100
4.	P23BTE1A/ P23BTE1B/ P23BTE1C	Elective – I (Discipline Centric)	3	5	-	25	75	100
5.	P23WSG11	Generic Course-I	3	5	-	25	75	100
		Total	**20**	**30**		**-**	**-**	**500**

SEMESTER-II

S.No.	Course Code	List of Courses	Credits	Hours		CIA	ESE	Total
				L	P			
6.	P23BTT23	Core – IV	5	6	-	25	75	100
7.	P23BTT24	Core – V	5	6	-	25	75	100
8.	P23BTP22	Core – VI	4	6	-	25	75	100
9.	P23BTE2A/ P23BTE2B	Elective – II (Discipline Centric)	3	4	-	25	75	100
10.	P23CSG22	Generic Course-II	3	4	-	25	75	100
11.	P23BTS21	NME - Skill Enhancement Course-1	2	4	-	25	75	100
		Total	**22**	**30**		**-**	**-**	**600**

M. Sc. BIOTECHNOLOGY-SYLLABUS

Semester wise Structure

SEMESTER I

S. No.	Course Code	Course Components	Name of Course	Inst. Hours	Credits	Exam HRS	Max. Marks	
							CIA	External
1	P23BTT11	Core Paper-1	Biochemistry	7	5	3	25	75
2	P23BTT12	Core Paper-2	Cell and Molecular Biology	7	5	3	25	75
3	P23BTP11	Core-3 Practical-I	Lab in Biochemistry, Microbiology, Cell AndMolecular Biology	6	4	3	25	75
4	P23BTE1A/ P23BTE1B/ P23BTE1C	Elective -I	(A) Microbiology (B)Virology (C)Basic Analytical Methods	5	3	3	25	75
5	P23WSG11	Generic Course	Women Empowerment	5	3	3	25	75
6	P23BTM11	Mandatory Extra Credit Course*	Genetics	4	3*	3	25	75
			Total Credits		**20+3 ***		**600**	

***Extra Credit**

SEMESTER II

S .No.	Course code	Course Components	Name of Course	Inst. Hours	Credits	Exam HRS	Max. Marks	
							CIA	External
1	P23BTT23	Core Paper-4	Immunology	6	5	3	25	75
2	P23BTT24	Core Paper-5	Genetic Engineering	6	5	3	25	75
3	P23BTP22	Core Practical- II	Lab in Immunology and Genetic Engineering	6	4	3	25	75
4	P23BTE2A/ P23BTE2B	Elective –II	(A) Developmental and Stem cell Biology (B) Enzyme Technology	4	3	3	25	75
5	P23CSG22	Generic Course	Cyber security	4	3	3	25	75
6	P23BTS21	NME-I Skill Enhancement Course	Pharmaceutical Technology	4	2	3	25	75
			Total Credits : 22				**600**	

Course Code	P23BTT11	SEMESTER I	Credits	L	T	P	Hrs
CORE I: THEORY-I		BIOCHEMISTRY	5	7	-	-	7

Cognitive level	**K1:** Recall **K2:** Understand **K3:** Analyze **K4:** Apply
Aim	To enable the students to understand the basic concepts of biochemistry and biomolecules and also To learn the various metaboliccycles and also to analyze the significance of biochemical findings.
Learning Objectives	To learn the physical &chemical nature of Biomolecules. To learn various types of Biomolecules. To develop knowledge on intermediary metabolism of Carbohydrate, Proteins & Lipids. To teach the basics & advance of enzyme and their classification. To develop a piece of knowledge in clinical biochemistry.
Course Outcomes	1.After studying unit 1, the students will be able to identify the nature of solvents and solutions concerning pH and its importance. 2.After studying unit 2, the students will be able to classify carbohydrates, proteins lipids, and nucleic acids of biomolecules. 3.After studying unit 3, the students will be able to describe the biomolecules involved inintermediary metabolism. 4.After studying unit 4, the students will be able to explain enzymes and enzyme kinetics. 5.After studying unit 5, the students will be able to apply Biochemistry, in clinical biochemistry procedures.

Units	Course Contents	Teaching hours
Unit I	Basic Concepts: Units of measurements of solutes in solution, e.g. Normality, Molality, Molarity. The hyper and hypotonic solution, pH, pK, acids, bases, ionic bonds, covalent bonds, and secondary bonds (hydrogen bonds and Vander Waal‟ bonds)	**12 hours**
Unit-II	Biomolecules: Definitions, nomenclature, classification, structure, chemistry, and properties of carbohydrates, Definitions, nomenclature, classification, structure, chemistry, and properties of amino acids and proteins (hemoglobin, myoglobin, and plasma proteins), lipids and Nucleic acids,	**12 hours**
Unit-III	Metabolism: Metabolism of Carbohydrates, EMP, TCA, HMP. Glycogen metabolism,Gluconeogenesis.AminoAcids-Transamination, Deamination,Urea cycle. Lipids and Nucleic Acids-Their Biosynthesis.Mechanism of OxidativePhosphorylation and Its Inhibitors, Uncouplers, Photophosphorylation	**12 hours**
Unit-IV	Enzymology: Enzymes: general aspects (classifications and structure). The allosteric mechanism, regulatory and active sites, and active energy. Iso-enzymes. Enzyme kinetics (MM, LB plot, Km) and hormones.	**12 hours**
Unit-V	Clinical biochemistry: Blood sugar level, Factors controlling blood sugar level – hypo, hyperglycemia, Diabetes mellitus, types – GTT. Metabolism of bilirubin- jaundice-types. Differential diagnosis and liver function tests. Renal functional test and gastric function test.	**12 hours**
Unit-VI	**Internal Assessments, Seminars, and Guest lecture**	**05 hours**

Total Teaching hours	**65**
Textbook:	1. J.L. Jain, S. Jain and N. Jain. Fundamentals of Biochemistry. S. Chand & Co, 2016. 2. Ambika Shanmugam. Biochemistry. Published by Wolters Kluwer, 8th Edition, 2016. 3. A.C. Deb. Fundamental of Biochemistry. New Central Book Agency, 2012 4. Biochemistry ,7th Edition, jermy M.Berg John, Tymoczko, Lubertstryer 2012.W.H,freeman & company ,newYork 2. 5. Molecular Bio methods handbook,2nd edition R.Rapley & J.M Walker,2 008, Humanapress. 6. Principles of Biochmeistry, 5th Edition AL. Lehninger ,D.L. Nelson and M.M Cox .,2008.worth publishers , NewYork. 7. Biochemistry 4THEdition,G.Zubay,1998.Mc Millan publishing Co. NewYork.
Reference Book:	1. D.L. Nelson and M.M. Cox. Lehninger Principles of Biochemistry, WH Freeman Publishers, 7th Edition, 2017. 2. V.W. Rodwell, D.A. Bender, K.M. Botham, P.J. Kennell and P.A. Weil. Harper's Illustrated Biochemistry, 30th Edition. McGraw Hill, 2015. 3. Wilson and Walker. Principles and Techniques of Practical Biochemsitry, 6th edition, Cambridge University, Press. 2005. 4. Upadhyaya A Upadhyaya K and Nath. Biophysical Chemistry: Principles and Techniques, 3rd Edition. Himalayan publications, 2009. 5. M.N. Chatterjee and Rana Shinde, Textbook of Medical Biochemistry, 8th Edition. Jaypee Brothers Medical Publishers (P) Ltd., 2012. 6. Biochemistry – 4th edition Donald voet and Judith G.Voet ,VP Publishers 2011 steitz and A.M.Weiner ,The Benjamin /CUMMINGS publ.Co.,Inc.,California,2013 7. Genes VI(9th Ed).Benjamin Lewin, oxford universitypress,uk.,2007 10. Molecular biology of cell (5th edition) brucealberts,alexanderjohnson,Julianlewis,martinraff,keithRoberts,peterwalter ,garlandsciencepublications.2008 8. Molecular Biology (5th edition).weaver .R.F,McGraw Hillpublications,2011. Cell and molecular biology : concepts and experiments (5th edition).geraldkarp,wiley publications,2013
E-Reference	**https://nptel.ac.in/courses/104105076,** **https://oli.cmu.edu/courses/biochemistry-open-free/,** **https://onlinecourses.nptel.ac.in/noc20_cy10/preview,** **E-Books:** https://www.pdfdrive.com/biochemistry-books.html, E-E-Journals: Process Biochemistry (Elsevier), Journal of Cellular Biochemistry (Wiley)

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	M	M	M	S	S	S
CO2	M	M	M	S	S	M	S	S	M	M
CO3	M	M	M	S	S	S	S	M	M	M
CO4	S	S	S	M	M	M	S	S	M	S
CO5	M	M	M	S	M	S	M	M	S	S

PO – Programme Outcome, CO – Course Outcome S – Strong, = 3, M – Medium, L – Low (may be avoided)

Course Code	P23BTT12	SEMESTER I	Credits	L	T	P	Hrs
CORE II: THEORY-II		CELL AND MOLECULAR BIOLOGY	5	7	-	-	7
Cognitive level	**K1:** Recall **K2:** Understand **K3:** Analyze **K4:** Apply						
Learning Objectives	1. To understand the basic concepts of the prokaryotic and eukaryotic cells. 2. To understand the individual and coordinated functions of various cell organelles. 3. To familiarize the student with various aspects of cell and molecular biology streams including cellular organization and their interactions in DNA replication, protein biosynthesis, and translational regulation. 4. To develop a comprehensive understanding of the complete cellular and molecular function of cell organelles in terms of cell-to-cell interaction, gene regulation, cellular signaling. **5.** To impart the molecular biology knowledge in applications of various human health care.						
Course Outcomes	1. After studying unit-1, the student will be able to equip with a basic knowledge of thestructural and functional properties of cells. 2. After studying unit-2, the student will be able to understand process of cell division andreplication process. 3. After studying unit-3, the student will be able to understand the occurrence of central dogma of life in the cell and the machineries involved to initiate and inhibit RNA and proteinsynthesis. 4. After studying unit-4, the student will be able to control of gene expressions in prokaryotes and eukaryotes and transposable elements. 5. After studying unit-5, the student will be able to understand mechanism of epigenetic controlsand cancer biology.						
Units	**Course Contents**						**Teaching hours**
Unit I	**Cell Biology:** Structure and function of cells in prokaryotes and eukaryotes; Structure and organization of Membrane - Membrane Model, active and passive, transport channels and pumps, Structure & Biogenesis of Mitochondria and Chloroplast. Structure of Endoplasmic reticulum, Golgi complex, lysosomes.						**12 hours**
Unit-II	**Cell division:** Mitosis, Meiosis, regulation of cell cycle; factors regulating cell cycle. Nucleic acid structure, Genome Organization. DNA replication: Enzymes and mechanisms of DNA replication in prokaryotes and eukaryotes, Telomeres, telomerase, and end replication. Role of telomerase in aging and cancer. DNA replication models DNA damage, Mutations, DNA repair and recombination.,						**12 hours**
Unit-III	**Transcription:** Basic mechanism in prokaryotes and eukaryotes. RNA polymerase, Reverse transcriptase and regulation. Post- transcriptional processing: 5'-Cap formation; 3'-end processing and polyadenylation; splicing: RNA editing; Nuclear export of mRNA; mRNA stability. Translation-Prokaryotic and eukaryotic translation, the translation machinery, Mechanisms of initiation, elongation and termination,						**12 hours**

	Regulation of translation, co-and post-translational modifications of proteins and localization.	
Unit-IV	**Gene regulation:** Prokaryotic gene regulation- Operon concept ; Lac operon and tryptophan operon. Eukaryotic gene regulation: Chromatin Structure, Regulation at transcriptional Level: DNA binding domains of the regulatory proteins. Biochemistry and applications of ribozyme technologies. Transposable genetic elements	**12 hours**
Unit-V	**Epigenetics:** Epigenetic regulation of gene expression, Modifications, Cancer Epigenetics. Cancer Biology: Viral and cellular oncogenes; Tumor suppressor genes - Structure, function and mechanism of action of pRB and p53, p21, BRACA1.Oncogenes as transcriptional activators.	**12 hours**
Unit-VI	**Internal Assessments, Seminars, and Guest lecture**	**05 hours**
Total Teaching hours		**65**
Textbook:	Molecular cell Biology, by Darnell, Lodish, Baltimore, Scientific American Books,Inc., 1994. Molecular and cellular Biology, Stephen L.Wolfe, Wadsworth Publishing Company,1993 Cell and Molecular Biology: Concepts and Experiments 5th Ed,Gerald Karp. Wiley publications,2013. Cell biology D E Sadava CBS Publishers & Distributors, 2009.	
Reference Book:	1. Molecular Biology LabFax, T.A. Brown (Ed.), Bios Scientific Publishers Ltd., Oxford,1991. 2. Molecular Biology of the Gene (4th Edition), J.D.Watson, N.H.Hopkins, J.W.Roberts, 3. J.A. Steitz and A.M.Weiner, The Benjamin/Cummings Publ. Co., Inc., California,1987. 4. Genes VI (6th Edition) Benjamin Lewin, Oxford University Press, U.K.,1998 5. Molecular biology of cell – Albert Bruce et al.,1994 3rd. Ed. 6. Molecular Biology-Weaver. R. F. 3rd ed. Mc Graw Hill publication ,2005 **7.** The Molecular Biology of Cancer: S. Pelengaris, M. Khan. Blackwell Publication.2002.	
E.Reference	1. Swayam- Molecular biology course by Dr.Nayan K. Jain, Gujarat University 2. Swayam- Cell Biology by Dr K. Sanatombi 3. NPTEL - Molecular Cell Biology by Prof.D. Karunagaran 4. https://www.coursera.org/courses?query=molecular%20biology 5. https://www.cdc.gov/labtraining/training-courses/basic-molecular-biology/index.html	

Mapping with Programme Outcomes

PO –

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	S	S	S	M	S
CO2	S	S	M	S	S	S	S	M	S	M
CO3	S	S	S	S	S	M	S	S	S	S
CO4	S	M	S	S	M	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	M	S

Programme Outcome, CO – Course Outcome S – Strong, = 3, M – Medium, L – Low (may be avoided)

Subject Code	P23BTP11	**SEMESTER I**	**Credits**	**L**	**T**	**P**	**Hrs**
CORE-III PRACTICAL- I		**Lab in Biochemistry Microbiology Cell & Molecular Biology**	**4**	**-**	**-**	**6**	**6**

Cognitive level	**K1:** Recall **K2:** Understand **K3:** Analyze **K4:** Apply	
Learning Objectives	To learn the principles of the various analytical instrument. To teach the SOP of analytical instruments. To study the different chromatography separation methodologies To study different electrophoresis isolation methodologies To learn advanced microscopic methods in image processing	
	Course Contents	Teachinghours
Biochemistry	1. Determination of Chl.a, Chl.b& total Chl. By Arnon method. 2. Estimation ofCarbohydrates 3. Estimation of salivary amylase activity in relation to substrate/pH/Temperature 4. Estimation of blood glucose &urea 5. Estimation of LDH. 6. Estimation of total serum proteins 7. Estimation of creatinine in urine. 8. Paper / thin layer chromatography	10 hours
Microbiology	1. Sterilization techniques 2. Preparation of culture media(Selective and Enriched media) 3. Staining techniques- Simple, Differential, Negative staining and Motility studies 4. Determination of Bacterial growth curve 5. Enumeration of bacteria from environmental samples- soil, water, air and milk. 6. Pure culture techniques - Streak, pour plate and spread plate. 7. Biochemical tests for identification of bacteria (IMViC, TSI, Catalase,Oxidase) 8. Antimicrobial assay, phenol coefficient, agar plate sensitivity method. 9. Water quality analysis – MPN method. 10. Milk quality analysis – MBRT method	08 hours
Cell & Molecular Biology	1. Isolation of Genomic DNA from *E.coli* 2. Isolation of plasmid DNA from *E.coli* 3. Elution & quantification of DNA from agarose gel. 4. Preparation of competent cells and transformation 5. PCR 6. Isolation of Total RNA from bacteria 7. Synthesis of cDNA by Reverse transcription polymerase chain reaction	13 hours
Total Teaching hours		50

Text Book	➢ Introduction to Practical Biochemistry, E.F Plummer Mu, Plummer Tata McGraw-HillEducation,1998. ➢ Molecular cloning: a laboratory manual,4th ed. J.Sambrook, Fritsch andT.Maniatis.coldspring harbor laboratory press ,NewYork,2012 ➢ Essential cell biology : a practical approach volume 1: cell structure. John Davey,J.Michaellord. Oxford university press,USA,2003 ➢ Principles and techniques of biochemistry and molecular biology (7th ed).keithWilson(editor),john walker (editor),Cambridge universitypress,2010.	
Reference Book	➢ Principles and Techniques of Practical Biochemistry (Paperback) by KeithWilson (Editor),John Walker (Editor), John M. Walker (Author) " Fifth Edition2000 ➢ Introductory Practical Biochemistry (Hardcover).by S. K. Sawhney; RandhirSingh (Editor)2005 ➢ Principles of Physical Biochemistry (2nd Edition) by Kensal E van Holde,Curtis Johnson, andPui Shing Ho (Hardcover – April 16,2005) ➢ Physical Biochemistry: Applications to Biochemistry and Molecular Biologyby David M.Freifelder (Paperback – Aug 15,1982) ➢ Instrumental Methods of Chemical Analysis by G R Chatwal and S KAnand (Hardcover –Jun1980).	
Course Material:	➢ Microbiology- A Laboratory manual P. Gunasekaran . New age publications, Newdelhi,1995. ➢ Molecular cloning-A Laboratory manual. Sambrook, J , Fritsch. E.F, and T.Maniatis, 2ndEdition. Cold spring Harbor Laboratory press, New York,1989. ➢ Laboratory exercise of Microbiology, J.P. Harley and L.M. Prescott, 5th Edition, theMcGraw-Hill companies,2002. ➢ Microbiology: A Laboratory Manual, J.G. Cappuccino and N. Sherman, Addison-Wesley,2002. ➢ Laboratory Manual of Experimental Microbiology ,R.M.Atlas, A.E.Brown andL.C.Parks, 1995. Mosby,St.Louis,2002. ➢ Laboratory manual in General Microbiology, N.Kannan, Panimapublishers. ➢ Bergey"s Manual of Determinative Bacteriology. Ninth Edition J.G.Holt,N.R.Krieg.,Lippincott Williams, Wilkin publishers, 2000.	

Course Code	P23BTM11	SEMESTER I	Credits	L	T	P	Hrs
Mandatory Extra Credit Course		GENETICS	3	4	-	-	4

Cognitive level	**K1:** Recall **K2:** Understand **K3:** Analyze **K4:** Apply	
Learning Objectives	1. To provide the basic knowledge of genetics in higher eukaryotic domains and overall conceptsof Mendelian genetics. 2. To understand about genetic inheritance and linkages. 3. To provide the basic concept of sex determination. 4. To understand about genetic code, mutation, and regulations. **5.** To Enrich the students' knowledge with respect to genetic engineering, transgenesis, and ethics.	
Course Outcomes	1. After studying unit-1, the student will be able to know about Mendelian laws. 2. After studying unit-2, the student will be able to understand how gene inherited. 3. After studying unit-3, the student will be able to understand about sex determination. 4. After studying unit-4, the student will be able to gene re1gulations. 5. After studying unit-5, the student will be able to know about ethics and transgenesis.	
Units	**Course Contents**	**Teaching hrs**
Unit I	History of Genetics: Definition and scope of Genetics- Pre- mendelian genetic concepts. Basis of Mendelian Inheritance and Mendelian genetics. Chromosome theory of linkage, crossing over, recombinations and mapping of genes on chromosomes	**12 Hours**
Unit-II	Blood Groups and their Inheritance in Human – Linkage and Crossing Over:- Drosophila – Morgans" Experiments – Complete and Incomplete Linkage, Linkage Groups, Crossing Over types,Mechanisms – Cytological Evidence for Crossing Over, Mapping ofChromosomes – Interference and Coincidence.	**8 hours**
Unit-III	Sex Linkage in Drosophila and Man, Sex influenced and Sex Limited Genes – Non- Disjunction and Gynandromorphs – Cytoplasmic Inheritance – Meternal Effect on Limnaea(Shell Coiling), Male Sterlity (Rode"s Experiment)	**9 hours**
Unit-IV	Nature and Function of Genetic Material – Genetic code – Why the genetic code is comma less, non ambiguous, degenerate triplet code. Fine Structure of the Gene .Gene Regulation – Operon Concept – Lac Operon – Positive and Negative Regulation. Mutation – Molecular Basis of Mutation, Types of Mutation, Mutagens, Mutable and Mutator Genes. Chromosomal Aberrations – Numerical and Structural Examples from Human.	**8 hours**
Unit-V	Genetic engineering – Objectives, tools, gene cloning, and gene isolation. Transgenic plants and animal s, Animal Breeding – Heterosis, Inbreeding, Out Breeding, Out Crossing, Hybrid Vigour. Population Genetics- Hardy Weinberg Law – Gene Frequency, Factors Affecting Gene Frequency, Eugenics, Euphenics and Ethenics, Bioethics.	**8 hours**
Unit-VI	**Internal Assessments, Seminars, and Guest lecture**	**05 hours**

Total Teaching hours	**65**
Textbook:	Gardner et al (1991). Principles of Genetics. John Wiley. Hartl. D.L. A primer of population genetics. III edition, Sinauer associates inc. Sunderland,2000 Human genetics, A. Gardner, R. T. Howell and T. Davies, Published by Vinod Vasishtha forViva Books private limited, 2008. The science of Genetics by Alan G. Atherly, Jack. R, Girton, Jhon. F, Mc Donald. Sounderscollege publishers.
Reference Book:	1. Medical Microbiology: A Guide to Microbial Infections: Pathogenesis, Immunity, Laboratory Diagnosis and Control. With STUDENT CONSULT Online Access (Greenwood,Medical Microbiology) 17th Edition by David Greenwood BSc PhD DSc FRCPath (Author), Richard C. B. Slack MA MB BChir FFPHM MRCPath DRCOG (Author), John F. Peutherer BSc MB ChB MD FRCPath FRCPE (Author), & 1 more Churchill Livingstone; 17th edition (June 6, 2007) 2. Microbiology Experiments: A Health Science Perspective Paperback – International Edition,January 1, 2018MC GRAW HILL; 9th edition (January 1, 2018) 3. Hugo and Russell's Pharmaceutical Microbiology, 8th Edition 8th Editionby Denyer (Author)Wiley-Blackwell; 8th edition (August 12, 2011) 4. Clinical Bacteriology Hardcover – August 1, 1980 by E Joan Stokes E Arnold; Fifth Edition(August 1, 1980) **5.** Review of Medical Microbiology and Immunology (Medical Microbiology & Immunology(Levinson)) 9th Edition (March 10, 2006)

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	S	S	S	M	S
CO2	S	S	M	S	S	S	S	M	S	M
CO3	S	S	S	S	S	M	S	S	S	S
CO4	S	M	S	S	M	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	M	S

PO – Programme Outcome, CO – Course Outcome S – Strong, M – Medium, L – Low(may be avoided)

Course Code	P23BTE1A	SEMESTER I	Credits	L	T	P	Hrs
ELECTIVE-I-A		MICROBIOLOGY	3	5	-	-	5

Cognitive level	**K1:** Recall **K2:** Understand **K3:** Analyze **K4:** Apply	
Learning Objectives	1. To understand the History of Microbiology. 2. To well understand the Nutritional classification of bacteria, etc. 3. To obtain knowledge about Sterilization and Disinfection. 4. To obtain knowledge of Microbial diversity. **5.** To know the basic Microbial community in natural habitats.	
Course Outcomes	1. After studying unit, 1 the students will be able to identify the Classification of microorganismspractical's. 2. After studying unit 2, the students will be able to identify and differentiate the pure culture technique. 3. After studying unit 3, the students will be able to identify and describe the chemotherapeutic agent. 4. After studying unit 4, the students will be able to identify and explain enzymes and theirregulations by kinetic parameters. 5. After studying unit 5, the students will be able to identify and cross-examine theBiotechnological applications of Extremophiles.	
Units	**Course Contents**	**Teaching hours**
Unit I	History of Microbiology - Classification of microorganism – Kingdom - Protista, Prokaryotic and eukaryotic microorganisms, Five kingdom concept of classification, Archaebacteria, Eubacteria, and eukaryotes. Microscope - Light field, Dark field, Fluorescent and Electron microscope, Prokaryotic and Eukaryotic cell structure. Staining techniques - Simple and Differential staining.	**12 Hours**
Unit-II	Nutritional classification of bacteria, Isolation, cultivation, enumeration, and preservation of microbes; Culture media and its types - Pure culture technique - Growth curve; Axenic culture, Synchronous culture, Continuous culture; Effect of physical and chemical factors on microbial growth.	**12 hours**
Unit-III	Sterilization and Disinfection: Moist heat, Dry heat, Radiation, Filtration, Phenols, Halogens, Phenol coefficient method. Antibiotics - Inhibitors of Nucleic acid, protein, and cell wall synthesis. Chemotherapeutic agents - Antimicrobial susceptibility test.	**12 hours**
Unit-IV	Microbial diversity- methods to assess microbial diversity, Culture dependent, and culture-independent methods. Molecular analysis of bacterial community; Denaturating Gradient Gel Electrophoresis (DGGE), Terminal Restriction Fragment Length (TRFL) Polymorphism (T- RFLP), Amplified Ribosomal DNA and Restriction Analysis(ARDRA).	**12 hours**
Unit-V	Microbial community in natural habitats – air, water, soil, food, and milk. Food and milk-borne diseases, Extremophiles- habitant & Classification, Halophiles, Thermophiles, Alkaliphiles, Acidophiles, Biotechnological applications of Extremophiles.	**12 hours**
Unit-VI	**Internal Assessments, Seminars, and Guest lecture**	**05 hours**

Total Teaching hours		**65**
Textbook:	1. Microbiology 3rd Edition by Dave Wessner (Author), Christine Dupont (Author), TrevorCharles (Author), Josh Neufeld (Author) 3rd edition (December 3, 2020) 2. Fundamentals of Microbiology 12th Edition by Jeffrey C. Pommerville (Author) 12th edition(March 29, 2021) 3. Burton's Microbiology for the Health Sciences 11th Edition by Paul G. Engelkirk (Author) 11thedition (October 10, 2018) 4. Brock Biology of Microorganisms plus Pearson Mastering Microbiology with Pearson eText,Global Edition 15th Edition 15th edition (March 27, 2018) 5. Microbiology: An Evolving Science Fifth Edition by Joan L. Slonczewski (Author), John W.Foster (Author), Erik R. Zinser (Author) Fifth edition (July 1, 2020) **6.** Microbiology with Diseases by Taxonomy, Loose-Leaf Plus Mastering Microbiology withPearson eText -- Access Card Package (6th Edition) 6th Edition 6th edition (January 14, 2019)	
Reference Book:	6. Medical Microbiology: A Guide to Microbial Infections: Pathogenesis, Immunity, Laboratory Diagnosis and Control. With STUDENT CONSULT Online Access (Greenwood,Medical Microbiology) 17th Edition by David Greenwood BSc PhD DSc FRCPath (Author), Richard C. B. Slack MA MB BChir FFPHM MRCPath DRCOG (Author), John F. Peutherer BSc MB ChB MD FRCPath FRCPE (Author), & 1 more Churchill Livingstone; 17th edition (June 6, 2007) 7. Microbiology Experiments: A Health Science Perspective Paperback – International Edition,January 1, 2018MC GRAW HILL; 9th edition (January 1, 2018) 8. Hugo and Russell's Pharmaceutical Microbiology, 8th Edition 8th Editionby Denyer (Author)Wiley-Blackwell; 8th edition (August 12, 2011) 9. Clinical Bacteriology Hardcover – August 1, 1980 by E Joan Stokes E Arnold; Fifth Edition(August 1, 1980) **10.** Review of Medical Microbiology and Immunology (Medical Microbiology & Immunology(Levinson)) 9th Edition (March 10, 2006)	

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	M	M	M	S	S	S
CO2	M	M	M	S	S	M	S	S	M	M
CO3	M	M	M	S	M	S	S	M	M	M
CO4	S	M	S	M	M	S	S	S	M	S
CO5	M	M	M	S	M	S	M	M	S	M

PO – Programme Outcome, CO – Course Outcome S – Strong, M – Medium, L – Low(may be avoided)

Course Code	P23BTE1B	SEMESTER I	Credits	L	T	P	Hrs
ELECTIVE 1-B		VIROLOGY	3	5	-	-	5

Cognitive level	**K1:** Recall **K2:** Understand **K3:** Analyze **K4:** Apply	
Learning Objectives	Contrast differences in virus architecture and classification. To understand the viral diagnostic and detection methods. Distinguish characteristics of normal cells and virus-infected cells. Explain and apply methods used in research and diagnosis of viral diseases. Describe cellular and therapeutic antiviral strategies and social stigmas against infected individuals.	
Course Outcomes	After studying unit-1, the student will be able to–describe and review the General Virology andcultivation of viruses. After studying unit-2, the student will be able to –know the Viral diagnostic and detection methods. After studying unit-3, the student will be able to - explain viral replication strategies; and compareand contrast replication mechanisms used by viruses relevant to human disease. After studying unit-4, the student will be able to - discuss the principles of virus pathogenesis. After studying unit-5, the student will be able to - explain host antiviral immune mechanisms at acellular and molecular level and vaccine strategies and mechanisms of antiviral drugs.	
Units	**Course Contents**	**Teaching hrs**
Unit I	General Virology: Structure of viruses: Enveloped and non-enveloped viruses, Capsid symmetries-icosahedral, polyhedral and helical, structural proteins- matrix proteins and lipoproteins, viral genomic organization and replication- types of nucleic acids, protein-nucleic-acid interactions and genome packaging, Virus related structures-viroids and prions. Cultivation of viruses: Inovo, In vivo, Ex vivo/In vitro. Cytopathic effect-pock forming unit.	10 hours
Unit-II	Viral diagnostic and detection methods: Sample processing-enrichment and concentration, Direct methods of detection-light microscopy (inclusion bodies), electron microscopy, Immuno diagnosis, hemagglutination, Complement fixation, neutralization, Western blot, Radioactive Immuno precipitation Assay (RIPA), Flow Cytometry and Immuno histochemistry. Nucleic acid-based diagnosis: Nucleic acid hybridization, PCR, microarray and nucleotide sequencing, LINE probe assay.	08 hours
Unit-III	Bacterio phages and plant viruses: Bacterio phage: Morphology, genome organization, classification-Lifecycle-Lytic and Lysogenic Cycle, Head and tail phages-T4 phage- phage-Filamentous Bacteriophages-174-M13,phage therapy for control of bacterial poultry diseases. Viral Disease in Plants: Histological, physiological and cytological changes in infected plants, Behavior of viruses in plants, Methods for detection of plant viruses, Transmission of plant viruses through vectors-insects, nematodes and fungi.	13 hours

Unit-IV	Clinical virology: Pathogenesis, clinical symptoms, epidemiology and prophylaxis of DNA Viruses-pox virus, Herpes Virus, Adenovirus, Hepatitis Virus. RNA Viruses- Picorna Virus, Orthomyxo Virus, Rabies Virus, HIV. Oncogenic viruses; Virus-induced cell transformation and oncogenesis, Mechanism of cell transformation by tumor viruses, Retrovirus mediated oncogenesis.	08 hours
Unit-V	Viral vaccines and anti-viral drugs: Viral vaccines, conventional vaccines-killed and attenuated, Modern vaccines-DNA vaccines, recombinant DNA/protein vaccines, subunits vaccines, peptide vaccines, anti-idio type vaccines, edible vaccines, immuno modulators (cytokines), adjuvants to increase immunogenicity of vaccines. Antivirals: Interferons, 21 designing and screening for antivirals, mechanisms of action, anti retrovirals-mechanism of action and drug resistance.	05 hours
Unit-VI	**Internal Assessments, Seminars, and Guest lecture**	**05 hours**
	Total Teaching hours	**65**

Textbook:	Virology principles and application John Carter and Venetia Saunders (2007) John Wiley and Sons publishers. Principles of Virology 4th edition Jane Flint. Real –Time PCR: Current technology and applications 1st edition (2009) edited by Julie Logan *et al*., Analytical techniques in DNA sequencing edited by Brian K. Nunnally Medical Microbiology: with student consult by Patrick R. Murray Ph.D. (Author), Ken S. Rosenthal PhD Saunders; 7th edition. Antiviral Agents, Vaccines and Immunotherapies. Stephen K. Trying. October 2004. Marcel Dekker.
Reference Book:	International Congress on Taxonomy of Viruses ;http://WWW.ncbi.nlm.nih.gov/ICTV Knipe David M.,PeterM.Howley, Diane E.Griffin,Robert A.Lamb,Malcolm A. Martin,BernardRoizman,Stephen E.Straus,(2007),Field's Virology, 5th Ed. Lippincott Williams &Wilkins Cann Alan j, (2000), DNA virus Replication, Oxford University press https://www.yourgenome.org/facts/what-is-PCR-polymerase-chain-reaction.

Mapping with Programme Outcomes

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

PO – Programme Outcome, CO – Course Outcome S – Strong, M – Medium, L – Low (may be avoided)

Subject Code	P23BTE1C	SEMESTER I	Credits	L	T	P	Hrs
ELECTIVE I-C		BASIC ANALYTICAL METHODS	3	5	-	-	5
Cognitive level	**K1:** Recall **K2:** Understand **K3:** Analyze **K4:** Apply						
Learning Objectives	To learn the principles of the various analytical instrument. To teach the SOP of analytical instruments. To study the different chromatography separation methodologies. To study different electrophoresis isolation methodologies. To learn advanced microscopic methods in image processing.						
Course Outcomes	1.After studying unit 1, the students will be able to know the significance of instruments concerningdiagnostic procedures. 2.After studying unit 2, the students will be able to handle qualitative and quantitative chromatographictechniques 3.After studying unit 3, the students will be able to handle centrifugation and separate samples forfurther practical's/research 4.After studying unit 4, the students will be able to handle different qualitative and quantitativeelectrophoresis techniques 5.After studying unit 5, the students will be able to handle microscopes and validate microscopicimages.						
Units	**Course Contents**						Teaching Hrs
Unit I	Electrochemical techniques- basic principles- The pH electrode- Ion-selective gas- sensing and oxygen electrodes. Elementary details of biosensors. Beer-Lambert law, light absorption, and its transmittance. Basic principles & brief outline of instrumentation of UV- Visible Spectroscopy: Infrared Spectroscopy. NMR. Mass spectrometry. Spectrofluorometric, Flame photometry, Atomic bsorption spectrophotometry– Principles, instrumentation, and applications						10 hours
Unit-II	Introduction & classification of chromatography. Theory, instrumentation & applications of Column chromatography, TLC, Paper chromatography, GC, HPTLC, HPLC - detection methods, and systems qualitative and quantitativeaspects applications						08 hours
Unit-III	Centrifugation- basic principles-instrumentation-centrifugation units. Nature of particles centrifugation methods and accessories. Sedimentation velocity-sedimentation equilibrium-cell fractionation method. Differential, density gradient, isopycnic, and equilibrium centrifugation. Preparative and analytical ultracentrifugation techniques. Isoelectric focusing, blotting methods, western-southern and northern- application- methods in life sciences and biotechnology.						13 hours
Unit-IV	General principles. Factors affecting the migration rate – sample, electric field, buffer, and supporting medium. Tiselius moving boundary electrophoresis. PAGE. SDS– PAGE. Pulse-field gel electrophoresis. Cellulose acetate membrane electrophoresis. Agarose gel electrophoresis						08 hours

Unit-V	Radio isotopic techniques: Introduction to radioisotopes, Detection. Measurement and uses of radioisotopes, Counting efficiency and autoradiography. Principles of microscopy, Fluorescent, Transmission and Scanning electron microscopy, confocal microscopy. Biotechnological applications Microscopy. Microtome analysis and measurement of images	05 hours
Unit-VI	Internal Assessments, Seminars, and Guest lecture	5 hours
Total Teaching hours		50
Text Book	1. Keith Wilson, John M Walker. Principles and techniques of biochemistry and molecularbiology. Cambridge University Press. 7th edition, 2017. 2. Shawney. Practical Biochemistry. Narosa Publishing, 1995. 3. Upadhyaya A Upadhyaya K and Nath. Biophysical Chemistry: Principles and Techniques, 3rdEdition. Himalayan publications, 2009. 4. D. Frifelder and M. Malacinski. Essentials of Molecular Biology, Jones & Bartlett, 5th Edition,2015. 5. R.D. Braun. Introduction to Instrumental Analysis. Pharma Book Syndicate, 2006. 6. Chatwal and Anand. Instrumental Methods of Analysis. 5th Edition, Himalayan publication,2007. 7. Jag Mohan. Organic Spectroscopy, Principles and Application. Narosa Publishing House, 2ndEdition, 2007.	
Reference Book	1.Principles and Techniques of Practical Biochemistry (Paperback) by KeithWilson (Editor), John Walker (Editor), John M. Walker (Author) " Fifth Edition2000 2.Introductory Practical Biochemistry (Hardcover).by S. K. Sawhney; RandhirSingh (Editor)2005 3.Principles of Physical Biochemistry (2nd Edition) by Kensal E van Holde,Curtis Johnson, andPui Shing Ho (Hardcover – April 16,2005) 4.Physical Biochemistry: Applications to Biochemistry and Molecular Biologyby David M.Freifelder (Paperback – Aug 15,1982) 5.Instrumental Methods of Chemical Analysis by G R Chatwal and S KAnand (Hardcover –Jun1980).	
Course Material:	**Website links: https://www.edx.org/course/basic-analytical-chemistry,** **E-Books:http://shvaiko.ru/wp-content/uploads/2010/02/AnalyticalTechniques-Julia-C.-Drees-Alan-H.-B.-Wu.pdftml,** **https://www.uvm.edu/~gpetrucc/courses/chem196/Textbooks/Manahan%20-%20Fundamentals%20of%20Environmental%20Chemistry/1491Ch25.pdf,** **E- journals:** https://onlinelibrary.wiley.com/series/8247, **https://link.springer.com/chapter/10.1007/978-3-642-75490-6_15,**	

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	S	M	M	M	S	M	S	S
CO2	M	S	M	M	M	S	S	S	M	M
CO3	S	M	M	S	S	M	M	S	M	S
CO4	M	S	S	M	M	S	M	M	S	S
CO5	S	M	S	M	S	M	S	M	S	S

PO – Programme Outcome, CO – Course Outcome, S – Strong, M – Medium, L – Low

Course Code	Category	Course Title	Hrs	credits	CIA	ESE
P23WSG11	**Generic Course**	**Women Empowerment Offered by the Dept. and Centre for Women's Studies**	**5**	**3**	**25**	**75**

COURSE CODE	P23BTT23	SEMESTER II	Credits	L	T	P	Hrs
CORE IV: THEORY-III		IMMUNOLOGY	5	6	-	-	6

Cognitive level	**K1:** Recall **K2:** Understand **K3:** Analyze **K4:** Apply
Aim	To provide the students insights into the various aspects of immunology such as classical immunology, clinicalimmunology, immunotherapy and diagnostic immunology.
Learning Objectives	To Learn the basic components and principles of defense mechanism against infections To Understand the properties antigens and structure and types of Immunoglobulin To understand principle behind Antigens- Antibody reactions. To Expedite how the immune system recognizes foreign antigen and thesignificance of self/non-self-discrimination To Enrich the students' knowledge with respect to different applications of ImmunoTechnology
Course Outcomes	After studying unit-1, the student will be able to know about basics of Immunity and various components ofImmune system After studying unit-2, the student will be able to understand about Antigens and structural properties ofImmunoglobulin After studying unit-3, the student will be able to understand principle of antigen-antibody reaction and theirtypes After studying unit-4, the student will be able to how immune cells are signaled, processed and destroyed After studying unit-5, the student will be able to know various immunological technologies.

Units	Course Contents	Teaching hours
Unit I	Introduction to the study of Immunology: Historic perspective, Overview and Concepts, Humoral and cellular- Mediated Immunoresponses. Components of immunity, Innate and Adaptive immunity. Haematopoiesis and differentiation of immune cells. Cells and Tissues of the immune system: Cells involved in the Immune response: Macrophages, B and T lymphocytes, Dendritic cells, Natural killer and Lymphokine activated killer cells, Eosinophils, Neutrophils and Mast cells. The lymphoid organs: Thymus, Bone marrow, Spleen, lymph nodes, MALT.	12 hours
Unit-II	Antigens and Immunogenicity. Nature of Antigens and antibodies. Theories of Antibody formation. Antibody structure, structural basis of Antibody diversity; Immunoglobulin as Anitgen, Properties of immunoglobulin and subtypes. Complement and its role in Immune Responses.	12 hours

Unit-III	Antigen - Antibody Reaction, Strength of Antigen and Antibody reaction, Cross reactivity, Precipitation and Agglutination reactions, Radioimmunoassay and ELISA. B-cell generation, activation and differentiation. Antibody production, Regulation and Diversity.	12 hours
Unit-IV	Cytokines: structure of Cytokines; function of Cytokines. Complement fixation. Structure and function of MHC class I and II molecules - antigen recognition and presentation, HLA typing, Cellular Immunity. Hypersensitivity Reactions, Types of Hypersensitivity, Immune tolerance , Autoimmunity and transplantation.	12 hours
Unit-V	Hybridoma secreting monoclonal antibodies-Recombinant antibody molecules. Catalytic Antibodies. Vaccine technology including DNA vaccines. Immunological techniques for identification of infectious diseases : immune-electrophoresis, western blot, flowcytometry and immune-fluorescence microscopy including *in situ* localization techniques such as FISH and GISH.	12 hours
Unit-VI	Internal Assessment: Assignments, Seminars and Guest lecturers	5 hours
Total Teaching hours		**65 hours**
Textbook:	Parham, P. (2014). The Immune System (4th edition). W. W. Norton &Company. Murphy, K., Travers, P., Walport, M., &Janeway, C. (2012).Janeway'sImmunobiology. New York: Garland Science. Paul, W. E. (1993). Fundamental Immunology. New York: Raven Press. Goding, J. W. (1986). Monoclonal Antibodies: Principles and Practice C.V.Rao. 2002, An Introduction to Immunology, Narosa Publishing House,Chennai.	

Reference Book:	➢ Immunology (7th ed) J.Kuby ,W.H freeman and company , newYork.2013 ➢ Basic immunology updates ed: functions and disorders of immune system (3rd ed). abulk.abbas,Andrew H.HLictman ,saunders publishers , newYork,2010 ➢ Immunology: an introduction (4th) I.R Tizard, saunders college publishers, newYork. ➢ Essential immunology (11th ed).peterdelves,seamusmartin,dennjis burton, Ivan Roitt, Wiley –Blackwell publication, Singapore,2006 ➢ Immunology (Lippincotts illustrated reviews series) thaodoan, roger melvold, susanviselli, CarlWaltenbaugh, Lippincott Williams & Wilkins publications2012 ➢ Fundamental immunology (7th ed) William e Paul, Lippincott Williams & Wilkins publications,2012 ➢ Essentials of clinical immunology (6th ed) Helen chapel ,Manselhaeney, Siraj misbah, Neil snowden,Wiley-Blackwell publications,2014 ➢ Monoclonal antibodies principles and practice(3rd ed) W.Goodings, academic press,2010 ➢ Monoclonal antibodies :P methods and protocols (2nd ed) .Vincentossipo, Nicolas fisher, Humanapress,2014 ➢ Essentials of clinical immunology (6th ed).Helen chapel, Manselhaeney, ,Siraj misbah, Neil Snowden,Wiley- Blackwell publications,2014 J.Kuby, 2003, Immunology 5th edition, W.H. Freeman and Company, Newyork.. ➢ I.R.Tizard, 1995, Immunology: An Introduction , 4th edition , Saunders College Publishers, NewYork. ➢ I.Roitt, 1994, Essential Immunology, Blackwell Science,Singapore. o Bul and K.Abbas, 1994, Cellular and Molecularimmunology ➢ Current Protocols in Immunology 3 Volumes, Wiley Publications1994. ➢ Monoclonal Antibodies: Principles and Practice, J. W. Goding, 1983. AcademicPress ➢ Hybridoma Technology in the Biosciences and medicine, T.A. Springer, 1985. Plenum PressNY
E-Reference	https://nptel.ac.in/courses/102/105/102105083/ https://www.coursera.org/specializations/immunology

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	S	S	S	M	S
CO2	S	S	M	S	S	S	S	M	S	M
CO3	S	S	S	S	S	M	S	S	S	S
CO4	S	M	S	S	M	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S		S

PO – Programme Outcome, CO – Course Outcome S – Strong , M – Medium, L – Low

COURSE CODE	P23BTT24	SEMESTER II	Credits	L	T	P	Hrs
CORE V: THEORY-IV		GENETIC ENGINEERING	5	6	-	-	6

Cognitive level	**K1:** Recall **K2:** Understand **K3:** Analyze **K4:** Apply
Aim	To modify the genes to enhance the capabilities of the organisms beyond what is normal. Ethical controversy surrounds the possible use of both of these technologies in plants, nonhuman animals, and humans.
Learning Objectives	To understand the basis of Enzyme, Ligases in Genetic Engineering Tools. To well understood the Cloning Vectors. To obtain knowledge about Gene cloning strategies and transformation techniques. To obtain the knowledge of Selection, Screening, and analysis of recombinants. To know the basic Genetic Engineering Techniques- Application of rDNA technology
Course Outcomes	1. After studying unit 1, the students will be able to identify the tools which are used in Genetic Engineeringand exhibit them their practical's. 2. After studying unit 2, the students will be able to differentiate methods in Cloning Vector. 3. After studying unit 3, the students will be able to describe the Techniques in Gene cloning – Physical,chemical and methods. 4. After studying unit 4, the students will be able to explain techniques amo recombine recombinants likePCR, DNA sequencing, etc 5. After studying unit 5, the students will be able to analyze and can cross-examine the Genetic Engineeringof patients who visit the Lab.

Units	Course Contents	Teaching Hrs
Unit I	Tools of Genetic Engineering: Enzymes - endo &exo nucleases, Restriction endonucleases- types, nomenclature, recognition sequences and mechanism of action; Isochizomers, Iso customers - star activity, Methylation, and modification. Ligases – types (NAD and ATP dependent), mechanism of action. Role of Kinases, phosphatases, polynucleotide phosphorylase, polynucleotide kinases, terminal transferase, Alkaline phosphatase, Reverse transcriptase - Taq polymerase.	12 hours
Unit-II	Cloning vectors: General characteristics of vectors, Brief account of naturally occurring plasmids. The promoter, MCS, Ori, and Marker genes-lac Z. Construction of pBR 322, pBR325, pBR327, pUC8 , pUC 18 & 19 vectors, and Expression vectors, Bacteriophage vectors, Lambda phage, Insertion vectors, Replacement vectors, Cosmids, Phagemids, Mini chromosomes, BAC‟s, YAC‟s, Shuttle vectors, Ti plasmids, Vectors for animals-SV40 and Bovine papillomavirus.	12 hours

Unit-III	Gene cloning strategies and transformation techniques: Chimeric DNA, Cloning strategies- ligation, Transformation and selection, use of adaptors and linkers, Homopolymer tailing in cDNA cloning, genomic DNA libraries, Short gun method, Partial digestion, End modification, Cloning from mRNA- Isolation and purification of RNA, Synthesis of cDNA, Isolation of plasmids, Cloning cDNA in plasmid vectors, Cloning cDNA in bacteriophage vectors. cDNA library. Advanced cloning strategies-synthesis and Cloning of cDNA, PCR amplified DNA. Transformation techniques: Preparation of competent cells, Physical methods - Electroporation, Microinjection, Gene gun, chemical methods - PEG, DEAE, $CaCl_2$, calcium phosphate precipitation method, liposome-mediated method	12 hours
Unit-IV	Selection, screening, and analysis of recombinants: Genetic selection - Insertional inactivation, Antibiotic Resistant genes, lac Z genes, Blue white screening, α - Complementation, colony hybridization, Immunological screening, Plaque hybridization, Blotting techniques, DNA sequencing - chemical and enzymatic methods, PCR and its variants, Preparation of radio labelled and non - radiolabelled probes and its applications.	12 hours
Unit-V	Applications of rDNA technology: Production of vaccines – Hepatitis B, Edible Vaccine, Hormones – Somatotropin, Humulin, Blood clotting factor VIII, Interferons, Diagnostics of inherited disorders and infectious diseases, Gene therapy, ADA- Cystic fibrosis.	12 hours
Unit-VI	Internal Assessments, Seminars, and Guest Lecture	05 hours
Total Teaching hours		65 hours

Textbook:	Concepts of Genetics (Masteringgenetics) 12th Editionby William Klug (Author), Michael Cummings (Author), Charlotte Spencer (Author), Michael Palladino (Author), Darrell Killian (Author) Genetics: A Conceptual Approach Sixth Edition by Benjamin A. Pierce (Author) W. H. Freeman; Sixth edition (December 19, 2016) Genetics: From Genes to Genomes, 5th edition 5th Editionby Leland H. Hartwell (Author), Michael L.Goldberg (Author), Janice A. Fischer (Author), Leroy Hood (Author), Charles F. Aquadro (Author)McGraw-Hill Education; 5th edition (September 5, 2014) Genetics: Analysis of Genes and Genomes: Analysis of Genes and Genomes 9th Editionby Daniel L. Hartl (Author), Bruce Cochrane (Author) Jones & Bartlett Learning; 9th edition (December 14, 2017) Principles of Genetics 6th Edition by D. Peter Snustad (Author), Michael J. Simmons (Author) John Wiley and Sons; 6th edition (August 23, 2011) An Introduction to Genetic Engineering 3rd Edition, author : Desmonds S.T. Nicholl, University of Paisley May 2008. Gene Cloning and DNA Analysis: An Introduction 7th Editionby T. A. Brown Wiley-Blackwell; 7th edition(January 19, 2016) Biotechnology: Applying the Genetic Revolution 1st Editionby David P. Clark BA (honors)Christ's College Cambridge 1973 PhD University of Brsitol (England) 1977 (Author), Nanette Pazdernik Academic Cell;1st edition (September 19, 2008)
Reference Book:	An Introduction to Genetic Engineering (Studies in Biology) 2nd Edition**by** Desmond S. T. Nicholl Genetically Engineered Foods (Volume 6) (Handbook of Food Bioengineering, Volume 6) 1st Editionby Alexandru Mihai Grumezescu (Editor), Alina Maria Holban (Editor) 2017. Genetically Engineered Foods Hardcover – January 1, 2021 by Armando Mills (Author) ED-Tech Press; 1stedition Genetic Engineering: A Christian Perspective Paperback – December 27, 2019 by Michael Scaife.
E-Reference	**Website links: https://www.genome.gov/genetics-glossary/Genetic-Engineering** https://www.amazon.in/s?k=genetic+engineering+book&hvadid=82669701180826&hvbmt=bp&hvdev=c&hvq mt=p&tag=msndeskstdin-21&ref=pd_sl_3hztgcyjhj_p

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	M	M	M	M	S	S	S
CO2	M	M	M	S	S	M	S	S	M	M
CO3	M	M	M	S	S	S	S	M	M	M
CO4	S	S	S	M	M	M	S	M	M	S
CO5	M	M	M	S	S	S	M	M	S	S

PO – Programme Outcome, CO – Course Outcome S – Strong, M – Medium, L – Low

Subject code	P23BTP22	SEMESTER II	Credits	T	L	P	Hrs
CORE-VI PRACTICAL II		Lab in Immunology and Genetic Engineering	4	-	-	6	6

Cognitive level	**K1:** Recall **K2:** Understand **K3:** Analyze **K4:** Apply	
Learning Objectives	To learn the principles of the various analytical instruments. To teach the SOP of analytical instruments. To study the different chromatography separation methodologies. To study different electrophoresis isolation methodologies. To learn advanced microscopic methods in image processing.	
Units	**Course Contents**	**Teaching Hrs**
Immunology	Blood grouping Lymphocyte subset identification and enumeration. Radial immuno-diffusiontest. Ouchterlony double diffusion Immuno electrophoresis Rocket Immunoelectrophoresis LatexAgglutination Quantitative Precipitinassay Complement fixationtest ELISA WesternBlotting Antigen-antibody reaction (precipitation and agglutination reactiontests).	10 hours
Genetic Engineering	Isolation of genomic DNA from the given sample and its molecular weightdetermination Isolation of RNA from the given sample and its molecular weightdetermination Isolation of plasmid DNA from the givensample Restriction digestion of Lambda phageDNA Ligation of DNA and analysis byelectrophoresis DNA amplification by PCR andRAPD Preparation of competent cells and transformation by CaCl2 method and Selectionoftransformed colony by X-Galmethod Determination of molecular weight of proteins by SDSPAGE	08 hours
Total Teaching hours		**18 hrs**
Course Material:	Practical Immunology. Franck C.Hay, Olwyn M.R. Westwood. Wiley-Blackwellpublications,2010. Immunoassays:A Practical Approach. James P. Gosling (editor).Oxford university press,USA,2010. Lab manual in biochemistry, immunology and biotechnology .Arti Nigam Archana ayyagari.McGraw-Hill education, 2008 Practicalimmunology.RabindraNarain,dom&wisdompublications,2012	

Course code	P23BTE2B	SEMESTER II	Credits	L	T	P	Hrs
ELECTIVE II-B		ENZYME TECHNOLOGY	3	4	-	-	4
Cognitive level	**K1:** Recall **K2:** Understand **K3:** Analyze **K4:** Apply						
Aim	To provide knowledge of various enzymes and enzyme technology applied in the industries						
Learning Objectives	To learn about the classification and structure properties of enzymes. To understand the kinetics, catalysis, and inhibition activities of enzymes. To understand physical properties, downstream processes, and purification of enzymes. To expedite how enzymes are used as co-factors. To enrich the students' knowledge with respect to different applications of Enzymes.						
Course Outcomes	After studying unit-1, the student will be able to know about basic knowledge of enzymes After studying unit-2, the student will be able to understand mechanism of enzyme activities After studying unit-3, the student will be able to understand physical properties of enzyme. After studying unit-4, the student will be able to function of enzyme in different processes. After studying unit 5, the student will be able to know various applications of enzyme technologies.						
Units	**Course Contents**					**Teaching hours**	
Unit I	Introduction to enzymes: History of enzymes, nomenclature and classification of enzymes. Structural features of Enzymes: Chemical nature of Enzymes: amino acids, protein structure: Primary, secondary, tertiary and quaternary structure. Specificity of Enzymes: Types of specificity, the Koshland "induced fit" hypothesis, strain or transition-state stabilization hypothesis.					10 hours	
Unit-II	Enzyme Catalysis and Kinetics: Factors affecting the rate of chemical reactions, kinetics of uncatalyzed chemical reactions, kinetics of enzymes catalyzed reaction, methods for investigating the kinetics of enzyme-catalyzed reaction, nature of enzyme catalysis, inhibition of enzyme activity.					8 hours	
Unit-III	Extraction and purification of microbial enzymes: Importance of enzyme purification, different sources of enzymes. Extracellular an intracellular enzymes. Physical and Chemical methods used for cell disintegration. Enzyme fractionation by precipitation(using Temperature ,salt, solvent pH, etc.),liquid-liquid extraction, ionic exchange, gel chromatography, affinity chromatography and other special purification methods, Enzyme crystallization techniques. Criteria of purity of enzymes. Pitfalls in working with pure enzymes.					12 hours	

Unit-IV	Enzymes inhibition and Co-factors: Irreversible, reversible, competitive, non-competitive and un-competitive inhibition with suitable examples and their kinetic studies. Allosteric inhibition ,types of allosteric inhibition and their significance in metabolic regulation & their kinetic study Vitamins and their co-enzymes: Structure and functions with suitable examples, Metallo enzymes and Metal ions as co-factors and enzymes activators.	9 hours
Unit-V	Immobilization of microbial enzymes and Enzyme Engineering: Methods viz. adsorption, covalent bonding, entrapment& membrane confinement and their analytical, therapeutic & industrial applications. Applications of microbial enzymes: Microbial enzymes in textile, leather, wood industriesand detergents. Enzymes in clinical diagnostics. Enzyme sensors for clinical processes and environmental analyses. Enzymes as therapeutic agents.	9 hours
Unit-VI	Internal Assessment: Assignments, Seminars and Guest Lecturers	5 hours
Total Teaching hours		**53hrs**
Textbook:	Introduction to proteins Structure by Branden and Tooze (1998): Garland Publishing Group. Biotechnology . Volume 7 A- Enzymes in Biotechnology. 1983 Edited by H.J.Rehm and G.Reed. VerlagChemie. Methods of Enzymatic analysis by Hans Ulrich, Bergmeyer, AcademicPress. Methods in Enzymology by W.A.Wood, AcdemicPress. Topics in Enzyme and Fermentation Biotechnology by L.N. Wiseman ,John Wileyand sons.	
Reference Book:	Enzymes by palmer(2001): Horwood publishing series. Fundamentals of Enzymology by price and Stevens (2002): Oxford University Press. Enzyme Technology by Helmut Uling (1998): JohnWiley. Methods in Enzymology. Volume 22-Enzyme purification and related techniques. Edited by William B.Jakoby. Academic press, NewYork. Allosteric Enzymes-Kinetic Behaviour. 1982. By B.I .Kurganov ,John Wiley and Sons. Inc., NewYork. Enzymes as Drugs Edited by John S. Holcenberg and Joseph Roberts, John Wiley& sons NewYork. Advances in Enzmology by Alton Meister, Interscience Publishers.	

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	S	S	S	M	S
CO2	S	S	M	S	S	S	S	M	S	M
CO3	S	S	S	S	S	M	S	S	S	S
CO4	S	M	S	S	M	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	M	S

PO – Programme Outcome, CO – Course Outcome S – Strong, M – Medium, L – Low

P23CSG22	**Generic Course**	**Cyber security Offered by the Dept. of Com. Science**	**4**	**3**	**25**	**75**

Course code	**P23BTN21**	**SEMESTER II**	**Credits**	**L**	**T**	**P**	**Hrs**
NME-SKILL ENHANCEMENT COURSE		**PHARMACEUTICAL TECHNOLOGY**	**2**	**4**	**-**	**-**	**4**

Cognitive level	**K1:** Recall **K2:** Understand **K3:** Analyze **K4:** Apply	
Aim	To impart knowledge on the importance of drug during life span. To enlighten on the biotechnological modifications in drugs. To find mechanism of action of drugs used in therapy.	
Learning Objectives	To learn drugs and its involved detoxification through phase 1 & 2 reactions2 To teach drug mechanism like passive and active phases To learn the drugs manufacture biotechnological pharmaceutical industry To understand the importance of drugs in treating various metabolic disorders5 To teach various applications of drugs in various fields.	
Course Outcomes	After studying unit-1, the student will be able to know about basic knowledge of drugs of phase I & II. After studying unit-2, the student will be able to understand drug mechanism and its adverse effects. After studying unit-3, the student will be able to understand biotechnology in drug development, especiallyfor AIDS. After studying unit-4, the student will be able to know drugs and its importance various treatment likediabetes, cancer, lipidemia and infertility. After studying unit-5, the student will be able to know various applications of drug dependence and abuse-management.	
Units	**Course Contents**	**Teaching hours**
Unit I	Drug- structural feature and pharmacology activity, pro-drug concept. Absorption-first-pass effect distributor, metabolism- phase I, II reactions, action of cytochrome p450 & elimination of drug-receptor-localization, type and subtypes, models and their drug-receptor interaction, against & antagonist .	10 hours
Unit-II	Adverse response to drugs, drug tolerance, drug intolerance, Idio SYNERACY (pharmacogenesis), drug allergy. Tachyphylaxis, drug abuse, vaccination against infection	08 hours

Unit-III	Biotechnology and pharmacy: genetically engineered protein and peptide agents. novel drug delivery systems – nonconventional routes of administration. Anti AIDS drug development, oncogenes target for drugs, multi- drugs resistance.	13 hours
Unit-IV	Mechanism of action of drugs used in therapy of :respiratory system- cough, bronchial- asthma, pulmonary tuberculosis .GIT – digestents , appetite suppressants. hypolipidemia agents,, vomiting, constipation and peptic ulcer. antimicrobial drugs- sulfonamide s,trimethoprim, cotrimoxazole, penicillin and macrolides . amino glycosides, cephalosporin and bacterial resistance .Insulin and oral diabetic drugs, anti fertility and ovulation inducing drugs.	08 hours
Unit-V	Drugs of plant origin: drug dependence and abuse- management of self poisoning cancer. Chemotherapy- cytotoxic drug. immuno suppressive drug therapy. New biological targets for drug development. Novel drug screening strategies.	08 hours
Total Teaching Hours		**50 hrs**
Textbook:	The pharmacology Vol I and Vol II– Goodman and Gillman, Mc Graw Hillprofessional;12 ed (2010) Basic pharmacology – Foxter cox bulter worth‟s1980. Pharmacology and pharmaco therapeutics – R.S.Satoskar. S.D.Bhandhhakar&S.S.Anilapure popular PrakasharBombay.	
Reference Book:	Principles of medical chemistry – William O. Foge. B.I. Waverks Pvt Ltd, NewDelhi. Oxford text books of clinical pharmacology and drug therapy.D.G.Burger‟s Medicalchemistry & drugdiscovery. Principles and practice – Manfred. E. Wolf John Wiley and Sons.	

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	S	S	S	M	S
CO2	S	S	M	S	S	S	S	M	S	M
CO3	S	S	S	S	S	M	S	S	S	S
CO4	S	M	S	S	M	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	M	S

PO – Programme Outcome, CO – Course Outcome S – Strong, M – Medium, L – Low

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P23CSG22	**Generic Course**	**Cyber security Offered by the Dept. of Com. Science**	**4**	**3**	**25**	**75**

Course code	**P23BTS21**	**SEMESTER II**	**Credits**	**L**	**T**	**P**	**Hrs**
NME-SKILL ENHANCEMENT COURSE		**PHARMACEUTICAL TECHNOLOGY**	**2**	**4**	**-**	**-**	**4**

Cognitive level		
Aim	**K1:** Recall **K2:** Understand **K3:** Analyze **K4:** Apply To impart knowledge on the importance of drug during life span. To enlighten on the biotechnological modifications in drugs. To find mechanism of action of drugs used in therapy.	
Learning Objectives	To learn drugs and its involved detoxification through phase 1 & 2 reactions2 To teach drug mechanism like passive and active phases To learn the drugs manufacture biotechnological pharmaceutical industry To understand the importance of drugs in treating various metabolic disorders5 To teach various applications of drugs in various fields.	
Course Outcomes	After studying unit-1, the student will be able to know about basic knowledge of drugs of phase I & II. After studying unit-2, the student will be able to understand drug mechanism and its adverse effects. After studying unit-3, the student will be able to understand biotechnology in drug development, especiallyfor AIDS. After studying unit-4, the student will be able to know drugs and its importance various treatment likediabetes, cancer, lipidemia and infertility. After studying unit-5, the student will be able to know various applications of drug dependence and abuse-management.	
Units	**Course Contents**	**Teaching hours**
Unit I	Drug- structural feature and pharmacology activity, pro-drug concept. Absorption-first-pass effect distributor, metabolism- phase I, II reactions, action of cytochrome p450 & elimination of drug-receptor-localization, type and subtypes, models and their drug-receptor interaction, against & antagonist .	10 hours
Unit-II	Adverse response to drugs, drug tolerance, drug intolerance, Idio SYNERACY (pharmacogenesis), drug allergy. Tachyphylaxis, drug abuse, vaccination against infection	08 hours

Unit-III	Biotechnology and pharmacy: genetically engineered protein and peptide agents. novel drug delivery systems – nonconventional routes of administration. Anti AIDS drug development, oncogenes target for drugs, multi- drugs resistance.	13 hours
Unit-IV	Mechanism of action of drugs used in therapy of :respiratory system-cough, bronchial- asthma, pulmonary tuberculosis .GIT – digestents , appetite suppressants. hypolipidemia agents,, vomiting, constipation and peptic ulcer. antimicrobial drugs- sulfonamide s,trimethoprim, cotrimoxazole, penicillin and macrolides . amino glycosides, cephalosporin and bacterial resistance .Insulin and oral diabetic drugs, anti fertility and ovulation inducing drugs.	08 hours
Unit-V	Drugs of plant origin: drug dependence and abuse- management of self poisoning cancer. Chemotherapy- cytotoxic drug. immuno suppressive drug therapy. New biological targets for drug development. Novel drug screening strategies.	08 hours
Total Teaching Hours		**50 hrs**
Textbook:	The pharmacology Vol I and Vol II– Goodman and Gillman, Mc Graw Hillprofessional;12 ed (2010) Basic pharmacology – Foxter cox bulter worth‟s1980. Pharmacology and pharmaco therapeutics – R.S.Satoskar. S.D.Bhandhhakar&S.S.Anilapure popular PrakasharBombay.	
Reference Book:	Principles of medical chemistry – William O. Foge. B.I. Waverks Pvt Ltd, NewDelhi. Oxford text books of clinical pharmacology and drug therapy.D.G.Burger‟s Medicalchemistry & drugdiscovery. Principles and practice – Manfred. E. Wolf John Wiley and Sons.	

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	S	S	S	M	S
CO2	S	S	M	S	S	S	S	M	S	M
CO3	S	S	S	S	S	M	S	S	S	S
CO4	S	M	S	S	M	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	M	S

PO – Programme Outcome, CO – Course Outcome S – Strong, M – Medium, L – Low

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