AC – 20/05/2025
Item No. – 6.19 (N) (1ab) Sem. III

As Per NEP 2020

University of Mumbai

Syllabus for Minor Vertical 2		
Faculty of Science		
Board of Studies in Biochemistry		
Second Year Programme in Minor (Biochemistry)		
Semester	**III & IV**	
Title of Paper	**Sem.**	**Total Credits 4**
I)Enzymology	**III**	**2**
II)Practical		**2**
Title of Paper		**Credits**
I)Genetics	**IV**	**2**
II)Practical		**2**
From the Academic Year		**2025-26**

Sem. - III

Syllabus
B.Sc. (Biochemistry)
(Sem.- III)

Title of Paper Enzymology

Sr. No.	Heading	Particulars
1	**Description of the course :** **Including but Not limited to :**	This course describes the mechanism of the enzyme activity. It also describes the enzyme kinetics, diagnostic importance and industrial applications of enzymes.
2	**Vertical :**	Minor
3	**Type :**	Theory
4	**Credit**:	2 credits (1 credit = 15 Hours for Theory or 30 Hours of Practical work in a semester)
5	**Hours Allotted :**	30 Hours
6	**Marks Allotted**:	50 Marks
7	**Course Objectives**: This course is intended to provide students with a basic understanding of the biochemical nature and properties and applications of enzymes.	
8	**Course Outcomes**: After the successful completion of the Course, the learner will be able to: **1.** Describe the classification, reactions and biochemical importance of enzymes including mechanism of action of enzymes and enzyme kinetics **2.** Explain the diagnostic and industrial applications of enzymes.	
9	**Modules**:- 2,Credits:-2	
	Unit 1: Basic concepts in Enzymology	

	● Introduction to enzymes, concept of apoenzyme, holoenzyme, prosthetic group, coenzyme, cofactor. ● IUB classification of enzymes (up to 1 digit) ● Specificity of enzymes, General mechanism of enzyme action: Fischer's lock and key hypothesis, Koshland's induced fit hypothesis. Enzyme active site. ● Factors affecting enzyme reaction: Substrate concentration, enzyme concentration, pH and temperature. ● Enzyme kinetics: Derivation of Michaelis - Menten equation and Lineweaver - Burk plot for mono-substrate reaction, Einsethal Cornish Bowden Plots ● Measures of enzyme activity: Katal, IU; concept of turn over number and specific activity ● Enzyme inhibition: Competitive, Non-competitive and uncompetitive. ● Numerical problems based on the above concepts.	
	Module 2: Applications of enzymes	
	● Iso-enzymes – Definition, separation and significance ● Allosteric Enzymes-Definition, Kinetics, Significance of Sigmoidal Behaviour, Role in metabolic Regulation. ● Diagnostic importance of Enzymes: ALT/SGPT, AST/SGOT, ALP, LDH, CK, GGT. ● Enzymes in analysis: Horse radish peroxidase, alkaline phosphatase in ● immunoassay ● Enzymes in therapy: Streptokinase. ● Industrially important Enzymes - Applications of proteases, amylases and lipases in industry. ● Enzyme Immobilization: Definition, different methods and applications	
10	**Text Books:** 1. Principles of Biochemistry by Lehninger, Albert L., Nelson David and Cox, Michael M.; CBS publishers. 2. Biochemistry by Voet, Donald and Voet, Judith G.; John Wiley & sons publishers. 3. Biochemistry by Zubay, Geoffrey L.; Wm.C. Brown publishers	
11	**Reference Books:** 1. Harpers illustrated biochemistry by Murray, Robert K. etal.; Mc Graw Hill. 2. Outlines of Biochemistry by Conn, E.E. and Stumpf, P.K.; Wiley publication.	
12	**Internal Continuous Assessment: 40%**	**External, Semester End Examination 60% Individual Passing in Internal and External Examination**
13	**Continuous Evaluation through:** Quizzes, Class Tests, presentation, project, role play, creative writing, assignment etc.(at least 3)	

S.Y. B. Sc. (BIOCHEMISTRY) SEMESTER III
COURSE TITLE: Practicals based on Minor course
[CREDITS - 02]

Practicals based on Minor course

Course Learning Objective and Outcome

Learning Objective:

This course is intended to provide students with a basic understanding of the several concepts associated with practical Biochemistry

Learning Outcomes:

After the completion of the course, the learner would be able to:

CO1: The learner will be able to demonstrate the extraction process of various enzymes and will be able to qualitatively determine the enzymes
CO2 :Understand the relationship between organelle structure and cellular function.
CO3: Observe and interpret the effects of solution tonicity on onion peel cells.

Practical	Topics	Credits	Hours
I	1.Extraction of beta Amylase and qualitative determination of its activity 2. Extraction of Urease and qualitative determination of its activity 3. Extraction of Invertase and qualitative determination of its activity 4.Extraction of Acid phosphatase and qualitative determination of its activity 5.Extraction of Alkaline phosphatase and qualitative determination of its activity 6. Extraction of Catalase and qualitative determination of its activity 7.Determination of the achromic point of Salivary Amylase. 8. Study of electron micrographs of I. Mitochondria II. Chloroplast III. Golgi apparatus IV. Endoplasmic reticulum V. Ribosomes VI. Lysosomes 9. Demonstration of analytical balance. 10. A 5 page assignment on contribution of scientist to the field of biochemistry	2	60

References:

1. A biologist's guide to principles and techniques in practical biochemistry by William, B.L.and Wilson, K; Universities press publishers.
2. Principles and techniques of practical biochemistry by Wilson, Keith and Walker,John ; Cambridge University Press publishers
3. Tools of biochemistry by Cooper, Terence G.; Wiley & Sons publishers.
4. Outlines of Biochemistry by Conn, E.E. and Stumpf, P.K.; Wiley publication.
5. Introduction to practical biochemistry by Plummer, David T.; Tata Mc. Graw and Hill publishers.
6. Modern experimental biochemistry by Boyer, Rodney F.
7. Introductory practical biochemistry by Sawhney, S.K. and Singh, Randhir; Narosa Publishing House.
8. Biochemical calculation by Segel, Irwin H.; John Wiley & Sons publishers.

Sem. - IV

Syllabus
B.Sc. (Biochemistry)
(Sem.- IV)

Title of Paper: Genetics

Sr. No.	Heading	Particulars
1	**Description of the course :** **Including but Not limited to :**	This course describes the fundamentals of the prokaryotic and eukaryotic genome including the organization of DNA. It also describes about the Mendelian genetics.
2	**Vertical :**	Minor
3	**Type :**	Theory
4	**Credit**:	2 credits (1 credit = 15 Hours for Theory or 30 Hours of Practical work in a semester)
5	**Hours Allotted :**	30 Hours
6	**Marks Allotted**:	50 Marks
7	**Course Objectives**: Genetics is the study of transfer of information from one generation to another and with the biochemistry helping explore newer horizons in this field it becomes an indispensable topic for the learner. In this course on Genetics, Students will explore Mendelian principles, applying concepts like segregation and independent assortment to predict inheritance patterns in different genetic scenarios. He/She is made aware of the scientists, and concepts that laid the foundation of modern day genetics, followed by the understanding of the genome at a molecular level, where the learner is educated about the structure of DNA in prokaryotic and eukaryotic organisms, its organization, association and concepts like overlapping, genes, split genes etc. DNA is an information carrier and the learner is also educated about different mechanisms by which the information is carried from one organism to the other in lower organisms with their applications.	

8	**Course Outcomes**: (List some of the course outcomes) **1.** Describe and apply the laws of inheritance proposed by Gregor Mendel and other scientists **2.** Explain the organization, composition, and role of chromosomes in genetic inheritance, including chromatin structure, karyotyping, and chromosomal abnormalities.
9	**Modules**:- 2,Credits:-2
	Module 1: Genetics I
	Prokaryotic Genome: Circularity; Single origin; nucleoid extrachromosomal DNA-plasmid Eukaryotic chromosomes: Centromere, kinetochore, telomere. Chromatin organization, nucleosomes, Euchromatin, heterochromatin DNA supercoiling, Topoisomerase; DNA denaturation (melting),melting temperature of DNA, re-association kinetics (Cot curve analysis) Repetitive and unique sequences; Satellite DNA Introduction to Overlapping genes and; Split genes Recombination in prokaryotes Transformation: Definition and transformation in *S.pneumoniae* Transduction: Definition; general features and mechanism with one example Conjugation: Mechanism, F^+ , F^- and Hfr strain
	Module 2: Genetics II
	History: Contributions of Mendel, Bateson, Hardy-Weinberg, Garrod, Morgan, Beadle and Tatum, Tatum, Barbara Mclintock, Hershey & Chase, Watson & Crick. Mendelian genetics: Mendel's experiments, Laws of inheritance Extension of Mendelian genetics: Incomplete dominance, Co-dominance, Multiple Alleles, Epistasis, Maternal Inheritance, Maternal effects, Genetics of Chloroplast & Mitochondria Karyotyping Pedigree analysis Numericals on above concepts and Case studies on the same

10	**Text Books:** 1. Genetics : a molecular approach / [by] Peter J. Russell 2. Principles of Biochemistry by Lehninger, Albert L., Nelson David and Cox, Michael M.; CBS publishers. 3. Biochemistry by Voet, Donald and Voet, Judith G.; John Wiley & sons publishers. 4. Biochemistry by Zubay, Geoffrey L.; Wm.C. Brown publishers	
11	**Reference Books:** 1. Harpers illustrated biochemistry by Murray, Robert K. etal.; Mc Graw Hill. 2. Outlines of Biochemistry by Conn, E.E. and Stumpf, P.K.; Wiley publication.	
12	**Internal Continuous Assessment: 40%**	**External, Semester End Examination 60% Individual Passing in Internal and External Examination**
13	**Continuous Evaluation through:** Quizzes, Class Tests, presentation, project, role play, creative writing, assignment etc.(at least 3)	

S.Y. B. Sc. (BIOCHEMISTRY) SEMESTER IV
COURSE TITLE: Practicals based on Minor course
[CREDITS - 02]

Practicals based on Minor course

Course Learning Objective and Outcome

Learning Objective:

1) This course is intended to provide students with a basic understanding of the several concepts associated with practical Biochemistry

Learning Outcomes:

After the completion of the course, the learner would be able to:

CO1: Observe, analyze, and interpret cellular processes such as mitosis, meiosis, and karyotype variations through various practical techniques.

CO1: Apply Mendelian principles and pedigree analysis to understand genetic inheritance patterns and their real-world implications.

Practical	Topics	Credits	Hours
I	1. Study of Osmosis using potato osmoscope 2. Effect of different solution tonicity on onion peel cells. 3. Effect of organic solvent on plant cells. 4. Analysis of permanent slides of Mitosis and meiosis. 5. a) Stages of mitosis b) Stages of meiosis 6. Mendel's Laws: [i] Problems based on the laws [ii] Case studies based on the law 7. A study of Human Karyotypes a) normal _ Male and females b) abnormal- Insertion, deletion, trisomy 8. Case studies based on pedigree analysis	2	60

References:

1. A biologist's guide to principles and techniques in practical biochemistry by William, B.L.and Wilson, K; Universities press publishers.
2. Principles and techniques of practical biochemistry by Wilson, Keith and Walker,John ; Cambridge University Press publishers
3. Tools of biochemistry by Cooper, Terence G.; Wiley & Sons publishers.
4. Outlines of Biochemistry by Conn, E.E. and Stumpf, P.K.; Wiley publication.
5. Introduction to practical biochemistry by Plummer, David T.; Tata Mc. Graw and Hill publishers.

6. Modern experimental biochemistry by Boyer, Rodney F.
7. Introductory practical biochemistry by Sawhney, S.K. and Singh, Randhir; Narosa Publishing House.
8. Biochemical calculation by Segel, Irwin H.; John Wiley & Sons publishers.

QUESTION PAPER PATTERN
(External and Internal)

A. Evaluation of the Minor Theory courses:

Course 1 – 50 marks

Course 2 - 50 marks.

The evaluation of these courses would include continuous evaluation (internal assessment) and Semester end examinations (External assessment). The evaluation pattern would be as follows:

Internal assessment of each course: 20 marks (total of 40 marks).

a. Class test 1: **10 marks**
b. Quizzes, presentation, project, role play, creative writing, assignment etc. **5 marks**
c. Attendance and active participation in academic and co-curricular activities: **5 marks**.

External assessment of each course: – 30 Marks (total of 60 marks)

- Duration: 1 **Hour per course**
- Theory question paper pattern:

Question	Based on	Options	Marks
Q.1	Unit I	Any 5 out of 7 / Any 2 out of 3	10
Q.2	Unit II	Any 5 out of 7 / Any 2 out of 3	10
Q3.	Unit I and II	Any 5 out of 7 / Any 2 out of 3	10
		Total	**30**

B. Evaluation for Minor Practical Courses (2 Credits): 50 marks.

The evaluation of these courses would include continuous evaluation (internal assessment) and Semester end examinations (External assessment). The evaluation pattern would be as follows:

- Each practical course carries a **total of 25 Marks**, distributed as follows:

No.	Criterion	Marks
1	Journal	05
2	Viva / Spots / Application based questions	05 10
3	Experiments during exams	15 20
	Total Marks	25

- The duration of each practical course evaluation is **2 hours**.
- To be eligible for evaluation, students must complete a minimum of 80% of the practical work assigned in each core subject.
- It is mandatory for students to submit a certified journal at the time of the practical examination. The journal serves as a record of their practical work and is an essential component of the evaluation process.
- **Letter Grades and Grade Points:**

Letter Grades and Grade Points:

Semester GPA/ Programme CGPA Semester/ Programme	% of Marks	Alpha-Sign/ Letter Grade Result	Grading Point
9.00 - 10.00	90.0 - 100	O (Outstanding)	10
8.00 - < 9.00	80.0 - < 90.0	A+ (Excellent)	9
7.00 - < 8.00	70.0 - < 80.0	A (Very Good)	8
6.00 - < 7.00	60.0 - < 70.0	B+ (Good)	7
5.50 - < 6.00	55.0 - < 60.0	B (Above Average)	6
5.00 - < 5.50	50.0 - < 55.0	C (Average)	5
4.00 - < 5.00	40.0 - < 50.0	P (Pass)	4
Below 4.00	Below 40.0	F (Fail)	0
Ab (Absent)	-	Ab (Absent)	0

Sd/-
Sign of the BOS Chairman
Dr. Samidha Pawaskar
Coordinator
BOS in Biochemistry

Sd/-
Sign of the Offg. Associate Dean
Dr. Madhav R. Rajwade
Faculty of Science & Technology

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Prof. Shivram S. Garje
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