MOTHER TERESA WOMEN'S UNIVERSITY

KODAIKANAL - 624 101
Tamil Nadu.

Curriculum Framework and Syllabus for

M.PHIL BIOCHEMISTRY

(For the candidates to be admitted from the academic year 2021-2022 onwards)

(UNDER CHOICE BASED CREDIT SYSTEM- CBCS)

MOTHER TERESA WOMEN'S UNIVERSITY
KODAIKANAL

Department of Biochemistry

M.Phil. Biochemistry

Eligibility : Master degree in the relevant discipline with 55% marks

Common Entrance Exam : University conduct a Common Entrance Test (CET) for M.Phil admission

M.Phil. Biochemistry syllabus 2021-2022

No	Paper Code	Course Title	Hours	Credits	CIS	ESE	Total
		Semester I					
1.	M21BCT11	Core I Research Methodology	10	4	40	60	100
2.	M21BCT12	Core II Instrumental Methods and Analysis	10	4	40	60	100
3.	M21PST13	Core III Professional Skills	10	4	40	60	100
		Total	**30**	**12**			**300**
		Semester II					
4.	M21BCT21	Core IV Special Paper	10	4	40	60	100
5.	M21BCD21	Dissertation + Viva-voce	20	14	-	-	200
		Total	**30**	**18**			**300**
Total			**60**	**30**			**600**

Special Papers related to Project

S.No	Course
1.	Special Paper I – Enzymology
2.	Special Paper II - Environmental Management
3.	Special Paper III- Free radicals and Endocrinology
4.	Special Paper IV – Nutritional and Clinical Biochemistry
5.	Directed Study[#]
6.	Any UGC approved online course related to research (equal credit)

[#] Any new course can be added as special paper by getting permission from BoS and Academic council.

The M.Phil course consists of three theory papers. Paper III is common for all the programmes. Area Paper (IV) is pertaining to the area of specialization chosen by the candidate with the approval of guide. Area paper is purely internal (framing syllabus, question setting and evaluation) whereas the external exam will also be conducted for area paper.

Each candidate will submit a dissertation on a topic in the relevant discipline after carrying out the project work under the supervision of a guide. The duration of the project work will be for six months.

The dissertation will be evaluated by an external examiner and viva voce will be conducted for the candidate.

The examination will be for 100 marks in each of the theory papers. The question paper will cover the entire syllabus. The duration of the examination is 3 hours.

PROGRAMME EDUCTION OUTCOMES (PEO)

PEO 1: To fulfill the need for applied aspects of biochemistry and prepares the students to become a researcher or entrepreneur.

PEO 2 : To attain a high level of expertise in biochemical methodology and to fit in to equipping the students to the future needs.

PEO 3: To understand the function and properties of living organisms under normal and abnormal conditions in response to changing environment.

PEO 4: To acquire jobs in multinational companies dealing in pharmaceuticals, agriculture, enzyme technology, immunology and food technology.

PEO 5: To equip the students in research and development, which ensures the enhancement of existing products or processes.

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO1: Develop and demonstrate an in depth knowledge of a specific area of biochemical research.

PSO2: Demonstrate independent and critical skills necessary to formulate specific experiments aimed at molecular processes.

PSO3: Develop skills and abilities for effective teaching of biochemistry.

PSO4: Apply computer knowledge and critically analyzed the problem and to find solutions for complex problems.

PSO5: Assist researchers and educators in moving forward with their area of knowledge to become entrepreneur.

PRAGRAMME OUTCOMES (PO)

PO1: Career and growth opportunities in biochemistry can be visually infinite, government agencies, private research institutions, hospitals, social and non profit organisations.

PO2: Identify and discuss the role and importance of research in the social sciences.

PO3: Use current biochemical and molecular techniques to plan and carry out experiments.

PO4: Improve the skills and intellectual background to succeed at post doctoral work in economics or in commercial sector.

PO5: Demonstrate ethical conduct within the research process and the responsibilities of the scientist.

<table>
<tr><td>Course Title & Code</td><td colspan="4">CORE I - RESEARCH METHODOLOGY - M21BC11</td></tr>
<tr><td>Semester</td><td colspan="2">Semester-I</td><td>Credits:4</td><td>Hours/weeks: 10</td></tr>
<tr><td>Cognitive Level</td><td colspan="4">K1:Recall
K2:Understand
K3:Apply</td></tr>
<tr><td>Learning Objective</td><td colspan="4">• To understand the concepts in research and computer.
• To develop the skills in the basic methods of data gathering and analysis.
• To provide knowledge to interpret statistical results in research papers.
• To acquire knowledge on Scientific documentation.
• To know the application of research findings</td></tr>
<tr><td rowspan="6">Course Outcomes</td><td colspan="4">At the end of the course, the student will be able to</td></tr>
<tr><td>CO1</td><td colspan="2">understand the Research objectives, hypothesis and significance of computer</td><td>K1, K2</td></tr>
<tr><td>CO2</td><td colspan="2">acquire knowledge on data representation and Statistical software</td><td>K3</td></tr>
<tr><td>CO3</td><td colspan="2">learn the biological and Structural database</td><td>K2</td></tr>
<tr><td>CO4</td><td colspan="2">develop skills in scientific writing</td><td>K3</td></tr>
<tr><td>CO5</td><td colspan="2">receive elaborate knowledge on bioethics and biosafety.</td><td>K2, K3</td></tr>
<tr><td>Unit I</td><td colspan="4">Introduction: Definition – research, theory and hypothesis and other related aspects, scientific problem- selection and solution ways and means for validation of scientific truth - various methods. Literature survey, introduction to internet concept of computer software, First hand information, data collection, field work and questionnaire.</td></tr>
<tr><td>Unit II</td><td colspan="4">Biostatistics : Collection and classification of data. Representation of data – mean, mode, median, central tendency, standard deviation, significance test, student's T- test, correlation and regression, Chi square test, ANOVA, DMRT. Probability distribution, Binomial, uses of biostatistics in biosciences, uses of computer in quantitative analysis uses of search engines and Statistical Software – SPSS.</td></tr>
<tr><td>Unit III</td><td colspan="4">Computer application: Biological database, DNA sequence database, protein sequence, database SRS - Similarity searching, Generating chart/ graph and other features, Data storing features or statistical data analysis. Microsoft excels. Level of significance, presentation tools – PPT, BLAST, FASTA multiple sequence alignment-phylogenies, structure database - secondary structure prediction, predicting 3D folds (Trending).</td></tr>
<tr><td>Unit IV</td><td colspan="4">Scientific documentation: Basic concept, objectives, significance techniques of research, characteristics - logical formula for writing thesis and papers for</td></tr>
</table>

	scientific community. Essential features – abstract, introduction, review of literatures, materials and methods, discussion, summary, conclusion, future plan and bibliography. Effective illustration of results – tables, figures and photos. Reference styles - Harvard and Vancouver system. Scientific writing for public in international and local language usages. Component of research paper, dealing with publishers, oral and poster presentation of research in symposia/conference preparation and research proposal writing to funding agencies.
Unit V	**Application of research findings to the society :** Lab to land and lab to industry. IPR product, process, patent, laws, rules and regulations. Bioethics and Biosafety with reference to animal models and human.
References	**Text Books** 1. Akash Ved. Biostatistics & Research Methodology. Publisher Thaukur Publication,2019. 2. Selzer, Paul M., Marhofer, Richard J., Koch, Oliver. An Introduction Applied Bioinformatics,Springer, 2018. 3. Goel and Parashar, IPR, Biosafety and Bioethics, 1st Edition, Pearson Education India, 2013. 4. M. K. Sateesh Bioethics and Biosafety Paperback, Dreamtech Press, 2013. 5. Gautam B.Singh, Fundamentals of Bioinformatics and Computational biology, Springer International publishing, 2015
	References Books 1. Dubey Diwedi, Usman, Srivastava. Biostatistics and Research Methodology.Publisher S VikaS and Company, 2019 2. MJ Reily. Bioinstrumentation. CBS Publishers & Distributors,2019. 3. B Annadurai. A Textbook of Biostatistics. Publisher New Age International Private Limited,2017. 4. Balaji.K, Biostatistics : Wiley publishers, 2014. 5. Kulkarni AP, Basics of Biostatistics, CBS publishers, 2020. 6. Selzer, Applied Bioinformatics: An Introduction, Publisher Springer, 2018. 7. Norman T.S. Bailey, Statistical Methods in Biology. Cambridge University Press, UK. . 2012 8. Rae Scott B- Willam B, Bioethics by. Eerdmans publishing house, 2013 9. M.K.Satheesh Bioethics and Biosafety. Wiley Publishers, 2020
E-reference links:	1. https://www.allassignmenthelp.com/blog/types-of-research/https://www.bioinformatics.org/ 2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1122955/ 3. https://www.csulb.edu/~msaintg/ppa696/696stsig.htm 4. https://www.enago.com/academy/importance-of-research-ethics/ 5. https://www.ebpi.uzh.ch/dam/jcr:ffffffff-c1f2-5119-0000-000078458c66/slides-anova.pdf 6. https://www.nap.edu/read/10866/chapter/68#1050

Mapping of COs with POs & PSOs:

CO	PO								PSO				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	S	M	M	S	S	S	S	S	S	S	M	S	S
CO2	S	S	M	M	S	S	M	S	S	S	S	M	M
CO3	S	M	S	M	S	S	S	M	M	S	S	S	S
CO4	S	S	M	M	M	M	M	S	S	M	S	S	M
CO5	M	S	S	S	S	M	S	S	S	M	M	S	S

Strongly Correlating (S) - 3 marks ;Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark ;No Correlation (N) - 0 mark

<table>
<tr><td>Course Title & Code</td><td colspan="4">CORE II- INSTRUMENTAL METHODS AND ANALYSIS - M21BC11</td></tr>
<tr><td>Semester</td><td colspan="2">Semester-I</td><td>Credits:4</td><td>Hours/weeks: 10</td></tr>
<tr><td>Cognitive Level</td><td colspan="4">K1: Recall
K2:Understand
K3:Apply</td></tr>
<tr><td>Learning Objective</td><td colspan="4">• To learn various types of solution
• To study about identification and characterization of genetic material.
• To gain knowledge about cell biology techniques.
• To know about DNA sequencing.
• To acquire knowledge on chromatographic techniques.</td></tr>
<tr><td rowspan="6">Course Outcomes</td><td colspan="4">At the end of the course, the student will be able to</td></tr>
<tr><td>CO1</td><td colspan="2">Know about quantitative analysis of macromolecules and micromolecules</td><td>K1,K2</td></tr>
<tr><td>CO2</td><td colspan="2">learn about the advanced eletrophoretic techniques</td><td>K2</td></tr>
<tr><td>CO3</td><td colspan="2">acquire knowledge on cell autoradiography and characterization of genetic material.</td><td>K2</td></tr>
<tr><td>CO4</td><td colspan="2">Learn about the instrumentation of MALDI-TOF and ESI MS</td><td>K2, K3</td></tr>
<tr><td>CO5</td><td colspan="2">gain knowledge on separation of proteins by fraction</td><td>K2</td></tr>
<tr><td>Unit I</td><td colspan="4">Basics of biochemical techniques: Various solution preparations: percentage solution, stock solution, working solution, molarity and normality, buffer and pH, quantitative analysis for macromolecules and micromolecules. Determination of SAP value.</td></tr>
<tr><td>Unit II</td><td colspan="4">Techniques in molecular biology :Identification and characterization of DNA, DNA and RNA, plasmid, Agarose gel electrophoresis, Southern, Northern, Western blotting. RAPD, RFLP, DGGE, TGGE, PCR.</td></tr>
<tr><td>Unit III</td><td colspan="4">Cell biology techniques :Cell line techniques, cell isolation, cell culture fixation and staining, cell counting conditional sorting, histochemistry and carbohydrates, proteins, lipids and nucleic acids, cell fixation, cell labelling, cell autoradiography and characterization of genetic material, RTPCR.</td></tr>
<tr><td>Unit IV</td><td colspan="4">Molecular techniques :Nucleic acid isolation, purification and quantification, peptide mass analysis, MALDI-TOF and ESI MS, DNA sequencing-manual and automatic microarray technology.</td></tr>
<tr><td>Unit V</td><td colspan="4">Research techniques :Enzyme assay, enzyme activity and specific determination, cell disintegration, hand extraction techniques, separation of proteins by fraction, ammonium sulphate, organic solvents, Ion exchange chromatography, molecular sieve chromatography, affinity chromatography, paper chromatography, thin layer</td></tr>
</table>

	chromatography, ultrafiltration, ultracentrifugation, gel electrophoresis, ion electric focusing and immune electrophoresis, capillary electrophoresis, pulsed field gel electrophoresis, microscopy, HPLC, HPTLC, GCMS, FTIR, SEM/TEM, confocal microscopy, NMR, AAS.
References	**Text Books** 1. M.H. Fulekar & Bhawana Pandey, I. K, Bioinstrumentation, International Publishing House Pvt. Ltd, 2014. 2. R. C. Dubey, A Text book of Biotechnology, S. Chand, 2014.
	References Books 1. S. Sadasivam, Biochemical Methods Paperback, New Age International Pvt Ltd Publishers, 3rd Edition, 2018. 2. Hofmann A, Wilson and Walkers Principles And Techniques of Biochemistry And Molecular Biology 8 ED, Cambridge University, 8th Edition, 2018. 3. M. J. Reilly Bioinstrumentation by, CBS Publishers & Distributers, 2016. 4. John G. Webster Bioinstrumentation by, Wiley, 2018. 5. Ulhask Patil, Kalyani – Muskan Essentials of Biotechnology, Dreamtech Press, 2020. 6. Gerald Karp, Cell and Molecular Biology, John Wiley and Sons, 2013.
E-reference links:	1. https://ugcnetpaper1.com/important-key-notes-communication/amp/ 2. https://ugcnetpaper1.com/important-study-material-for-communication-part-2/ 3. https://www.vanderbilt.edu/viibre/CellCultureBasicsEU.pdf 4. https://courses.lumenlearning.com/boundless-microbiology/chapter/molecular-techniques/ 5. http://maldi.ch.pw.edu.pl/pomiary/Artykuly/Introduction%20MALDI-TOF-TOF.pdf 6. https://www.future-science.com/doi/10.2144/000112089

Mapping of COs with POs & PSOs:

CO	PO								PSO				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	M	M	M	S	S	M	S	S	S	S	M	S	S
CO2	S	S	S	M	S	S	M	S	S	M	S	M	M
CO3	S	M	S	M	S	S	S	M	S	S	S	M	S
CO4	S	S	M	M	M	S	M	S	S	S	S	S	M
CO5	M	S	S	S	S	M	S	S	M	M	M	S	S

Strongly Correlating (S) - 3 marks ;Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark ;No Correlation (N) - 0 mark

<table>
<tr><td>Course Title & Code</td><td colspan="4">CORE III – Professional Skills- M21MBT13</td></tr>
<tr><td>Semester</td><td colspan="2">Semester- I</td><td>Credits:4</td><td>Hours/weeks: 10</td></tr>
<tr><td>Cognitive Level</td><td colspan="4">K1: Recall
K2: Understand
K3: Apply
K4:Analyze</td></tr>
<tr><td>Learning Objective</td><td colspan="4">● Develop skills to ICT and apply them in teaching, learning contexts and research.
● Acquire the knowledge of communication skills with special reference to its elements, types, development and styles.
● Understand the terms: Communication technology, Computer Mediated Teaching and develop Multimedia/E-contents in their respective subjects.
● Develop different teaching skills for putting the content across to targeted audience.</td></tr>
<tr><td rowspan="6">Course Outcomes</td><td colspan="4">Upon completion of this course the students will be able to</td></tr>
<tr><td>CO1</td><td colspan="2">Learn the computer basics and its application in science field.</td><td>K1</td></tr>
<tr><td>CO2</td><td colspan="2">Develop the communication skills in both English and tamil.c</td><td>K2</td></tr>
<tr><td>CO3</td><td colspan="2">Impart knowledge on computer mediated teaching.</td><td>K3</td></tr>
<tr><td>CO4</td><td colspan="2">Understand the basic concepts of micro teaching skills.</td><td>K2</td></tr>
<tr><td>CO5</td><td colspan="2">Get familiar with basics of industrial technology</td><td>K2</td></tr>
<tr><td>Unit I</td><td colspan="4">Computer Application Skills: Fundamentals of Computers and windows, Operating System – MS – Office Components; Word: Equation editor, Table Manipulation – Formatting Features – organizational Chart. MS – EXCEL: Statistical Functions – Number Manipulation – Chart Preparation with various types of graphs. MS Powerpoint: Powerpoint presentation with multimedia features. Internet and its applications: E-mail and attachments – working with search engines.</td></tr>
<tr><td>Unit II</td><td colspan="4">Communication Skills (English/Tamil/Both): English: Skills of Communication: Listening, Speaking, reading and Writing – Writing Synopsis, Abstract and proposals. Developing good language asbilities – Public speaking – Writing Skills. Tamil: gapw;Wtpf;Fk; jpwd; - Ngr;Rj;jpwd; - ntspg;ghl;Lj; jpwd; - Ma;Tj;jpl;lk; - Ma;Tr;R&f;fk; jahhpj;jy;.</td></tr>
<tr><td>Unit III</td><td colspan="4">Communication technology: Computer Mediated Teaching: Multimedia, E – Content, Satellite Based Communication – EDUSAT and ETV channels. Web: Internet I Education.</td></tr>
<tr><td>Unit IV</td><td colspan="4">Pedagogical Skills: Micro teaching Skills: Skill of Induction, Skill of Stimulus Variation. Skill of Explaining, Skill of Probing Questions, Skill of Blackboard, Writing and Skill of Closure – Integration of Teaching Skills – Evaluation of Teaching Skills – Research Extension and Consultancy.</td></tr>
<tr><td>Unit V</td><td colspan="4">Industrial Technology: Lecture Techniques: Steps, Planning of a lecture, Lecture</td></tr>
</table>

	Notes, Updating, Delivery of Lecture. Teaching – Learning Techniques: Team teaching, Group Discussion. Seminar, Workshops, Symposium and Panel Discussion – Games and Simulations – Web Based Instructions.
Text Books	1. Micael D. and William (2000). Integrating Technology into Teachnig and Learning: Concepts and Applications, Prentice Hasll, New York. 2. Information and Communication Technology in Education: A Curriuculum for Schools and Programme of Teacher development. Jonathan Anderson 3. Pandey S.K.(2005). Teaching communication. Commonwealth publisher, Delhi 4. Sharma. R.A.(2006), Fundamentals of education technology, Surya publication, Meerut
References	1. Kum Babu A. and Dandapani S. (2006), Microteaching, Neelkamal Publications, Hyderabad 2. Vanaja M and Rajasekhar S. (2006), Computer Education, Neelkamal Publications, Hyderabad

Mapping of COs with POs &PSOs:

CO	PO								PSO				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	S	S	S	M	S	M	S	S	S	S	S	S	S
CO2	S	S	S	S	M	S	S	S	S	M	S	S	S
CO3	S	S	S	M	M	S	S	S	S	S	S	S	S
CO4	S	S	S	M	M	S	S	S	S	S	S	S	S
CO5	S	S	S	S	M	S	S	S	S	M	S	S	S

Strongly Correlating (S) - 3 marks
Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark
No Correlation (N) - 0 mark

<table>
<tr><td>Course Title & Code</td><td colspan="4">CORE IV-SPECIAL PAPER I
ENZYMOLOGY- M21BC21</td></tr>
<tr><td>Semester</td><td colspan="2">Semester-II</td><td>Credits:4</td><td>Hours/weeks: 10</td></tr>
<tr><td>Cognitive Level</td><td colspan="4">K1:Recall
K2:Understand
K3:Apply</td></tr>
<tr><td>Learning Objective</td><td colspan="4">• To know the functions, composition and conformation of protein.
• To gain knowledge on the enzyme kinetics and mechanisms of enzyme action.
• To learn the immobilization methods and the applications.
• To understand the role of biosensor and their advantage</td></tr>
<tr><td rowspan="6">Course Outcomes</td><td colspan="4">At the end of the course, the student will be able to</td></tr>
<tr><td>CO1</td><td colspan="2">study the enzyme kinetics and catalysis.</td><td>K1,K2, K3</td></tr>
<tr><td>CO2</td><td colspan="2">know about the sources and extraction procedures for enzymes.</td><td>K1,K2</td></tr>
<tr><td>CO3</td><td colspan="2">study about the enzyme immobilization and their uses.</td><td>K2, K3</td></tr>
<tr><td>CO4</td><td colspan="2">learn about the types and applications of biosensors.</td><td>K1,K2</td></tr>
<tr><td>CO5</td><td colspan="2">understand the role of restriction enzymes.</td><td>K2</td></tr>
<tr><td>Unit I</td><td colspan="4">Protein: Protein structure, functions, compositions and conformation of proteins. Enzyme catalysis and Enzyme Kinectics, an e.g. of catalysis by serine proteases. Proteins in solution and in membranes. Liposomes and their preparation.</td></tr>
<tr><td>Unit II</td><td colspan="4">Enzymes: Sources of enzymes for industry, extraction of enzymes for scientific and industrial purpose. Downstream processing of enzymes, Uses of soluble enzymes. Study of enzymes in aqueous biphasic systems. Effects of pH and temperature on enzyme activity.</td></tr>
<tr><td>Unit III</td><td colspan="4">Enzyme Immobilization: Major types of enzyme immobilization. Techniques employed for immobilizing enzymes, kinetics of immobilized enzymes. Advantages and disadvantages in the utilization of soluble enzymes immobilized enzymes and immobilized cells. Different types of reactors of immobilized enzymes and their applications.</td></tr>
<tr><td>Unit IV</td><td colspan="4">Applications of Enzymes: Application of ELISA and EMIT in Clinical analysis. Different types of Biosensors- potentiometric, amphometric, piezo electric and immuno biosensors. Electro analytic applications of enzymes, Methods of coenzyme regeneration .Biochips and Biocomputers.</td></tr>
<tr><td>Unit V</td><td colspan="4">Molecular Enzymatic tools: Restriction endonucleases and their Uses, DNA ligase, DNA polymerase and their uses in Biotechnology, site directed mutagenesis,</td></tr>
</table>

	enzyme catalysis in organic solvents, artificial enzymes, ribozymes and Abzymes.
References	**Text Books** 1. Anil Kumar, Sarika Garg, Enzymes and Enzyme Technology Paperback – Import, Anshan Ltd, 1st Edition, 2015. 2. Paul Engel, Enzymes: A Very Short Introduction (Very Short Introductions) Paperback – Import, OUP Oxford, 1st Edition, 2020. 3. S. K. Jindal and M. C. Sharma, Biotechnology in animal health and Production, New India publishing Agency, 2015. 4. H.K. Das, Textbook of Biotechnology, Wiley India Pvt Ltd, 3rd Edition, 2017.
	References Books 1. Athel Cornish Bowden Fundamental of Enzyme kinetics, Wiley – Blackwell 4th Edition, 2012. 2. T.D.H. Bugg, Introduction to Enzymes & Co-Enzyme chemistry, Wiley 3rd Edition, 2012. 3. Irwin.H. Segel, Enzyme kinetics Wiley, 1st Edition, 2014. 4. A.C.Bowden, Fundamentals of Enzyme kinetics Medtech, 3rd Edition 2017. 5. N.S. Punekar, Enzymes: Catalysis, kinetics and Mechanisms Springer 1st Edition, 2018. 6. U. Satyanarayana, U. Chakrapani, Biotechnology Books & Allied Ltd, 2020. 7. Ulhask Patil, Kalyani – Muskan Essentials of Biotechnology, Dreamtech Press, 2020.
E-reference links:	1. https://medcraveonline.com/ATROA/effectiveness-of-enzyme-inhibitors-in-biomedicine-and-pharmacotherapy.html 2. http://biochem.du.ac.in/web/uploads/43%20Enzyme%20Kinetics.pdf 3. https://www.khanacademy.org/science/ap-biology/cellular-energetics/environmental-impacts-on-enzyme-function/a/enzyme-regulation 4. https://www.easybiologyclass.com/enzyme-cell-immobilization-techniques/ 5. https://nptel.ac.in/content/storage2/courses/102103012/pdf/mod2.pdf 6. https://www.ncbi.nlm.nih.gov/books/NBK21578/

Mapping of COs with POs & PSOs:

CO	PO								PSO				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	S	S	M	S	M	S	M	S	S	S	M	S	S
CO2	S	M	S	M	S	M	M	S	S	S	M	M	M
CO3	M	S	M	S	M	S	S	S	M	M	S	S	S
CO4	S	S	S	M	M	S	M	S	S	M	S	S	S
CO5	M	S	S	M	S	M	S	S	S	M	M	M	S

Strongly Correlating (S) - 3 marks ;Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark ;No Correlation (N) - 0 mark

<table>
<tr><td>Course Title & Code</td><td colspan="4">CORE IV-SPECIAL PAPER II
ENVIRONMENTAL MANAGEMENT- M21BC21</td></tr>
<tr><td>Semester</td><td colspan="2">Semester-II</td><td>Credits:4</td><td>Hours/weeks: 10</td></tr>
<tr><td>Cognitive Level</td><td colspan="4">K1:Recall
K2:Understand
K3: Apply</td></tr>
<tr><td>Learning Objective</td><td colspan="4">• To study about environment and its assessment
• To learn about different types of pollution
• To know the assessment management and treatment of different pollution
• To learn about marine environment
• To gain knowledge on remote sensing and its Advantages and limitations.</td></tr>
<tr><td rowspan="6">Course Outcomes</td><td colspan="4">At the end of the course, the student will be able to</td></tr>
<tr><td>CO1</td><td colspan="2">know about environment and its components</td><td>K1</td></tr>
<tr><td>CO2</td><td colspan="2">gain knowledge of causes, effects and control measure of various types of pollution</td><td>K2,K3</td></tr>
<tr><td>CO3</td><td colspan="2">acquire knowledge on the Renewable source of energy through waste materials</td><td>K1, K2</td></tr>
<tr><td>CO4</td><td colspan="2">understand the marine environment and industrial applications of marine organism</td><td>K1</td></tr>
<tr><td>CO5</td><td colspan="2">understand the Scope of Remote Sensing</td><td>K2, K3</td></tr>
<tr><td>Unit I</td><td colspan="4">Introduction : Types of environment (air, soil and water) and extreme environment. Biotic and abiotic components of environment.</td></tr>
<tr><td>Unit II</td><td colspan="4">Assessment of different types pollution :Causes, effects and control measure of Air pollution, Water pollution, Soil pollution, Noise pollution, Thermal Pollution and Bioleaching.</td></tr>
<tr><td>Unit III</td><td colspan="4">Assessment management: Assessment management and treatment of soil and liquid wastes using bioreactors. Industrial waste water treatment and recycling. Biodegradation of herbicides and pesticides. Heavy metal toxicity – effects of physicochemical and biological factors. Renewable source of energy through waste materials; biogas, energy crops, cellulose current levels of biodiversity and gene banks.</td></tr>
<tr><td>Unit IV</td><td colspan="4">Marine Studies: Classification of the marine environment. Marine microbial habitats, Estuarine Ecosystems: Marine microbes (viruses, bacteria, archaea, protists, fungi). Marine algae and plants (seaweeds, sea grasses, mangrove plants). Species identification and Industrial applications of marine organisms. DNA sequencing, RTPCR technique.</td></tr>
</table>

Unit V	**Fundamentals of remote sensing:** Concept and Scope of Remote Sensing: Definitions, Process and Characteristics of Remote Sensing System, Advantages and limitations.
References	**Text Books** 1. Harender.K.Gaur, Text book of Environmental Biochemistry , Book enclave, 2018. 2. Jeffrey S. Levinton, CD(2001). Marine Biology: Function, Biodiversity . Ecology (515pp)
	References Books 1. Ernie Hamilton, Environmental Biochemistry, Larsen and keller Education, 2017. 2. Sanju Kumari, Environmental Biochemistry, Research publication,2010. 3. Philip.L.Mladenov , Marine biology- A short introduction, oxford,2013. 4. John.F.Morrissey and James L. Sumich, Introduction to the Biology of Marine life,Jones and Bartlett Publisher,2011. 5. Sarah Maddocks, Understanding PCR, Academic press, 2016. 6. A.K.Chatterjee , Introduction to Environmental Biotechnology, Prentice Hall India Publisher,2011. 7. Indu shekhar Thakur, Environmental Biotechnology Basic concepts and Applications, Dream tech press,2019.
E-reference links:	1. https://byjus.com/biology/how-many-types-of-environment-are-there/ 2. https://www.vedantu.com/biology/types-of-environment 3. https://www.drishtiias.com/to-the-points/paper3/environmental-impact-assessment-1 4. https://www.britannica.com/science/pollution-environment 5. https://www.britannica.com/science/marine-ecosystem 6. https://www.nrcan.gc.ca/maps-tools-publications/satellite-imagery-air-photos/remote-sensing-tutorials/fundamentals-remote-sensing-introduction/9363

Mapping of COs with POs & PSOs:

CO	PO								PSO				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	M	S	S	S	M	M	S	S	M	S	M	S	S
CO2	S	S	M	S	M	S	M	S	S	S	S	M	M
CO3	M	S	M	M	M	S	S	M	M	S	S	S	S
CO4	S	M	S	M	S	S	M	S	S	M	M	S	S
CO5	M	S	S	S	S	M	S	S	S	M	M	M	S

Strongly Correlating (S) - 3 marks ;Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark ;No Correlation (N) - 0 mark

<table>
<tr><td>Course Title & Code</td><td colspan="4">CORE IV-SPECIAL PAPER III
FREE RADICALS AND ENDOCRINOLOGY - M21BC21</td></tr>
<tr><td>Semester</td><td colspan="2">Semester-II</td><td>Credits:4</td><td>Hours/weeks: 10</td></tr>
<tr><td>Cognitive Level</td><td colspan="4">K1:Recall
K2:Understand</td></tr>
<tr><td>Learning Objective</td><td colspan="4">• To learn the automation of the analytical process
• To acquire knowledge on free radicals and its effects
• To study about an Enzymatic antioxidants
• To know about the non enzymatic antioxidants and its functions
• To gain knowledge on endocrine hormones</td></tr>
<tr><td rowspan="6">Course Outcomes</td><td colspan="4">At the end of the course, the student will be able to</td></tr>
<tr><td>CO1</td><td colspan="2">know about the clinical laboratory equipments</td><td>K1,K2</td></tr>
<tr><td>CO2</td><td colspan="2">gain knowledge on oxidative process and detection of free radicals</td><td>K2</td></tr>
<tr><td>CO3</td><td colspan="2">understand the antioxidant effect of super oxidase dismutase</td><td>K1,K2</td></tr>
<tr><td>CO4</td><td colspan="2">learn about the antioxidant effects of vitamins and trace elements</td><td>K1, K2</td></tr>
<tr><td>CO5</td><td colspan="2">acquire knowledge on biosynthesis, mechanism of action and bioassay of different types of hormones</td><td>K1,K2</td></tr>
<tr><td>Unit I</td><td colspan="4">Automation in Clinical Biochemistry:Basic concept, definition, automation of the analytical process, integrated automation for clinical laboratory, development of standards for laboratory automation, blood gas analyser.</td></tr>
<tr><td>Unit II</td><td colspan="4">Free radicals: Formation of free radicals, auto oxidation initiated by oxygen radicals, influence of free radicals in metal toxicity. Free radicals, hepatotoxins, CCL4 model, free radicals in Cancer. Oxidative process in tissue injury. Detection of free radicals and radical ions.</td></tr>
<tr><td>Unit III</td><td colspan="4">Antioxidants :Enzymatic antioxidants - chemistry, mechanism, and antioxidant effect of super oxidase dismutase, catalase, glutathione peroxidase.</td></tr>
<tr><td>Unit IV</td><td colspan="4">Non enzymatic antioxidants : Sources, chemistry, toxicity, biochemical functions, bioassay, antioxidant effects of vitamin A, vitamin E, glutathione and selenium.
trace elements - introduction, sources, biochemical functions of zinc, copper, magnesium and iron.</td></tr>
<tr><td>Unit V</td><td colspan="4">Endocrinology : Definition- general characteristics, biosynthesis, mechanism of action and bioassay of steroid hormones, peptide hormones, adrenal hormones and thyroid hormones.</td></tr>
<tr><td>References</td><td colspan="4">Text Books
1. Hames B. D. et al., Instant Notes in Biochemistry, Bios, 4th Edition, 2011.
2. Eduardo A. Nillni, Textbook of Energy Balance, Neuropeptide Hormones,</td></tr>
</table>

	and Neuroendocrine Function Hardcover – Import, Springer, 1st Edition, 2018. 3. U. Satyanarayana and U. Chakrapani, Biochemistry, Elsevier, 5th Edition, 2020.
	References Books 1. C. Donnell Turner, Joseph. T. Bagnara, General Endocrinology Affiliated East – West Press Pvt. Ltd – New Delhi, 6th edition, 2012. 2. Shiomo Melmed, Kenneth S. Polonsky, P. Reed Larsen, Henry. M. Kronberg, Williams Textbook of Endocrinology Elsevier, 13th Edition, 2015. 3. Bernhard Kleine, Winfried. G. Rossmanith Hormones and the Endocrine System – Textbook of Endocrinology Springer Nature, First Edition, 2016. 4. J.Larry. Jameson, Harrison's Endocrinology Chaukhamba Auriyantaliya, 4th Edition, 2017. 5. David. G. Gardner & Dolores Shoback, Greenspan's Basic & Clinical Endocrinology Overruns, 2017.
E-reference links:	1. https://nios.ac.in/media/documents/dmlt/Biochemistry/Lesson-25.pdf 2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3614697/ 3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4606614/ 4. https://academic.oup.com/metallomics/article/6/1/25/6015460 5. https://www.britannica.com/science/hormone/The-hormones-of-vertebrates

Mapping of COs with POs & PSOs:

CO	PO								PSO				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	M	S	M	M	S	M	M	S	S	S	M	S	S
CO2	S	S	M	M	S	S	M	M	S	S	S	M	M
CO3	S	M	S	M	M	S	S	S	M	M	S	S	S
CO4	S	S	M	M	M	M	M	S	S	S	M	S	S
CO5	M	S	M	S	S	M	S	S	S	M	S	M	S

Strongly Correlating (S) - 3 marks ;Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark ;No Correlation (N) - 0 mark

<table>
<tr><td>Course Title & Code</td><td colspan="4">CORE IV-SPECIAL PAPER IV
NUTRITIONAL AND CLINICAL BIOCHEMISTRY - M21BC21</td></tr>
<tr><td>Semester</td><td colspan="2">Semester-II</td><td>Credits:4</td><td>Hours/weeks: 10</td></tr>
<tr><td>Cognitive Level</td><td colspan="4">K1:Recall
K2:Understand
K3: Apply</td></tr>
<tr><td>Learning Objective</td><td colspan="4">• To know the energy values of food.
• To understand the sources of nutrients such as carbohydrates, proteins, fibers and fats for good health.
• To acquire knowledge on Energy malnutrition.
• To learn the diet related diseases
• To understand the diseases related to Digestion and absorption of food</td></tr>
<tr><td rowspan="6">Course Outcomes</td><td colspan="4">At the end of the course, the student will be able to</td></tr>
<tr><td>CO1</td><td colspan="2">gain knowledge on energy Metabolism, Determination and Expenditure.</td><td>K1, K2, K3</td></tr>
<tr><td>CO2</td><td colspan="2">ability to understand the nutritional aspects of the carbohydrates, proteins and fats.</td><td>K2</td></tr>
<tr><td>CO3</td><td colspan="2">know about the disorders associated with lipid metabolism.</td><td>K2, K3</td></tr>
<tr><td>CO4</td><td colspan="2">acquire knowledge on diseases related to digestion and diagnosis of metabolic diseases</td><td>K2</td></tr>
<tr><td>CO5</td><td colspan="2">Understand the Deficiency diseases of fat and water soluble vitamins.</td><td>K2, K3</td></tr>
<tr><td>Unit I</td><td colspan="4">Energy Value of Foods :Determination of Energy value using Bomb calorimeter-Respiratory Quotient (RQ), Basal metabolism, Determination of Basal Metabolic Rate (BMR), Factors affecting BMR, Determination of energy metabolism during work, Energy expenditure for various types of activities, Recommended Daily Allowance (RDA), Specific Dynamic Action (SDA) of foods.
Carbohydrate: Digestion, absorption and metabolism of carbohydrates. Diseases associated with carbohydrate metabolism.</td></tr>
<tr><td>Unit II</td><td colspan="4">Proteins : Digestion and metabolism of proteins. Diseases associated with proteins metabolism. Energy malnutrition, Kwashiorkor and Marasmus- cause, diagnosis and treatment.</td></tr>
<tr><td>Unit III</td><td colspan="4">Lipid :Digestion, absorption and metabolism of lipid. Diseases associated with lipid metabolism.</td></tr>
<tr><td>Unit IV</td><td colspan="4">Enzymes: Serum enzyme markers in the diagnosis of metabolic diseases and tissue damage (liver, heart and kidney).</td></tr>
<tr><td>Unit V</td><td colspan="4">Vitamins : Sources –daily requirements, structure and functions fat and water soluble vitamins. Deficiency diseases of fat and water soluble vitamins.</td></tr>
<tr><td>References</td><td colspan="4">Text Books
1. Sharma D. C Nutritional Biochemistry, CBS Nursing, 2017
2. B Srilakshmi Food Science New Age International Publishers, 2018</td></tr>
</table>

	3. B Srilakshmi Dietetics - Multi Colour Edition, New Age International Publishers, 2019 4. S. Azhagu Madhavan, P. Vinotha, V. Uma, Chemistry of Biomolecules, Notion Press, 2020.
	References Books 1. Crovetto G M, Energy And Protein Metabolism And Nutrition, Wageningen Academic Publishers, 3rd Edition,2010. 2. Bernstein L E, Nutrition Management of Inherited Metabolic Diseases Lessons From Metabolic University, SPRINGER, 2015. 3. John P. Bilezikian MD, PhD *et al.*, Primer on the Metabolic Bone Diseases and Disorders of Mineral Metabolism, Ninth Edition, American Society for Bone and Mineral Research, 9th Edition, 2018. 4. Prasad R Manjeshwar, Nutrition & Biochemistry Simplified – Text Book of Nutrition and Biochemistry for BSc Nursing Students, Sheetal Distributors, 6th Edition, 2019. 5. B Srilakshmi, Dietetics - Multi Colour Edition, New Age International Publishers, 2019. 6. Chatterjee, Textbook Of Medical Biochemistry: Eighth Edition Paperback, JPB, 8th Edition, 2012.
E-reference links:	1. https://www.biologydiscussion.com/energy/metabolism-energy/basal-metabolic-rate-bmr-definition-factors-and-significance/17342 2. http://pressbooks-dev.oer.hawaii.edu/humannutrition/chapter/digestion-and-absorption-of-carbohydrates/ 3. https://www.lecturio.com/magazine/malnutrition/ 4. https://www.medicalnewstoday.com/articles/lipid-disorder#summary 5. https://my.clevelandclinic.org/health/diseases/14803-connective-tissue-diseases 6. https://www.niddk.nih.gov/health-information/kidney-disease/heart-disease

Mapping of COs with POs & PSOs:

CO	PO								PSO				
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**1**	**2**	**3**	**4**	**5**
CO1	M	S	M	S	S	S	M	S	S	M	S	S	S
CO2	S	S	M	S	M	S	M	S	S	S	S	M	M
CO3	S	S	S	M	S	S	S	S	M	S	S	S	S
CO4	S	S	M	M	M	M	S	S	S	M	S	M	M
CO5	S	M	S	M	S	M	M	M	S	M	M	S	S

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