।। सा विद्या या विमुक्तये ।।

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

"ज्ञानतीर्थ" परिसर, विष्णुपूरी, नांदेड - ४३१६०६ (महाराष्ट्र)

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY NANDED

"Dnyanteerth", Vishnupuri, Nanded - 431606 Maharashtra State (INDIA)

Established on 17th September 1994 – Recognized by the UGC U/s 2(f) and 12(B), NAAC Re-accredited with 'A' Grade

ACADEMIC (1-BOARD OF STUDIES) SECTION

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संलग्नित महाविद्यालयांतील विज्ञान व तंत्रज्ञान विद्याशाखेतील पदव्युत्तर स्तरावरील द्वितीय वर्षाचे CBCS Pattern नुसारचे अभ्यासक्रम शैक्षणिक वर्ष २०२०–२१ पासून लागू करण्याबाबत.

प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, **दिनांक २० जून २०२० रोजी संपन्न झालेल्या ४७व्या मा. विद्या परिषद बैठकीतील विषय क्र.११/४७–२०२०**च्या ठरावानुसार प्रस्तुत विद्यापीठाच्या **संलग्नित महाविद्यालयांतील विज्ञान व तंत्रज्ञान विद्याशाखेतील पदव्युत्तर स्तरावरील द्वितीय वर्षाचे** खालील विषयांचे **C.B.C.S. (Choice Based Credit System) Pattern** नुसारचे अभ्यासक्रम शैक्षणिक वर्ष २०२०–२१ पासून लागू करण्यात येत आहेत.

1. M.Sc.-II Year-Botany
2. M.Sc.-II Year-Herbal Medicine
3. M.Sc.-II Year-Analytical Chemistry
4. M.Sc.-II Year-Biochemistry
5. M.Sc.-II Year-Organic Chemistry
6. M.Sc.-II Year-Physical Chemistry
7. M.Sc.-II Year-Computer Management
8. M.Sc.-II Year-Computer Science
9. M.Sc.-II Year-Information Technology
10. M.C.A. (Master of Computer Applications)-II Year
11. M.Sc.-II Year-Software Engineering
12. M.Sc.-II Year-System Administration & Networking
13. M.Sc.-II Year-Dairy Science
14. M.Sc.-II Year-Environmental Science
15. M.Sc.-II Year-Applied Mathematics
16. M.Sc.-II Year-Mathematics
17. M.Sc.-II Year-Microbiology
18. M.Sc.-II Year-Physics
19. M.Sc.-II Year-Zoology
20. M.Sc.-II Year-Biotechnology
21. M.Sc.-II Year-Bioinformatics

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या **www.srtmun.ac.in** या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी.

'ज्ञानतीर्थ' परिसर,
विष्णुपुरी, नांदेड – ४३१ ६०६.
जा.क्र.: शैक्षणिक–१/परिपत्रक/पदव्युत्तर–सीबीसीएस अभ्यासक्रम/२०२०–२१/**३३५**

दिनांक : १६.०७.२०२०.

स्वाक्षरित/–
उपकुलसचिव
शैक्षणिक (१–अभ्यासमंडळ) विभाग

प्रत माहिती व पुढील कार्यवाहीस्तव :
१) मा. कुलसचिव यांचे कार्यालय, प्रस्तुत विद्यापीठ.
२) मा. संचालक, परीक्षा व मूल्यमापन मंडळ यांचे कार्यालय, प्रस्तुत विद्यापीठ.
३) प्राचार्य, सर्व संबंधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
४) साहाय्यक कुलसचिव, पदव्युत्तर विभाग, प्रस्तुत विद्यापीठ.
५) उपकुलसचिव, पात्रता विभाग, प्रस्तुत विद्यापीठ.
६) सिस्टम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Post Graduate (PG) Programs under Faculty of Science

(Affiliated Colleges)

(w.e.f. Academic Year 2019-20)

SYLLABUS FOR M.Sc. PART- II EXAMINATION

M.Sc. BIOCHEMISTRY

(SEMESTER PATTERN)

JUNE- 2020

Draft Syllabus Prescribed For
M.Sc. Part- I and Part- II Examination in Biochemistry
(Semester Pattern)

There Shall be total four semester (Two for M.Sc. Part- I and Two for M.Sc .Part- II) . There shall be four theory papers (100 marks each) and four practical papers (100 marks each) Annual pattern.

Eligibility: Any Science graduate

It is expected that the students should visit Research Laboratories and industrial establishments of repute.

M.Sc. Part – II Third Semester

Paper No.	Title of the Theory Papers	Credit	No. Periods
BCH-15	Genetic Engineering	4	60
BCH-16	Industrial Biochemistry**OR Elective paper** Molecular basis ofnon-infectious diseases	4	60
BCH-17	Drugs Metabolism	4	60
BCH-18	Hormonal Biochemistry	4	60
BCH-19	Research Methodology	4	60
BCH-20	Seminar	1	16
Title of the Practical Papers			
BCHLC-21	Lab course G. Engg and Industrial Biochemistry	2	60
BCHLC-22	Lab course Drugs Metabolism and Hormonal Biochemistry	2	60

M.Sc. Part – II Fourth Semester

Paper No.	Title of the Theory Papers	Credit	No. Periods
BCH-23	Metabolmic **OR Elective paper** Molecular basis of non-infectious diseases	4	60
BCH-24	Medical Biochemistry	4	60
BCH-25	Plant Biochemistry	4	60
BCH-26	Seminar	1	16
Title of the Practical Papers			
BCH-27	Lab course Clinical and Plant Biochemistry	2	60
BCH-28	Industry Based Project	6	80

CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Post Graduate (PG) Programs under Faculty of Science

(Affiliated Colleges)

(w.e.f. Academic Year 2019-20)

Name of the faculty	Total credits	Average credits per semester
Science	**100**	**22**

Note:

Assessment shall consists of continuous assessment (CA) and End of Semester Examination **(ESE).**

Weightage: 75% for ESE and 25% For CA

Tentative Distribution of Credits for PG under Science Faculty:

Semester	Paper No.	External (ESE)	Internal (CA)	Total
Sem III	Paper-I (BCH-15)	(75 marks)(25marks)	(2 Test: 15 marks + Assignments:10 marks)	Credits: 4 (100 marks**)**
	Paper-II (BCH-16)	(75 marks)(25marks)	(2 Test: 15 marks + Assignments:10 marks)	Credits: 4 (100 marks**)**
	Paper-III (BCH-17)	(75 marks)(25marks)	(2 Test: 15 marks + Assignments:10 marks)	Credits: 4 (100 marks**)**
	Paper-IV(BCH-18)	(75 marks)(25marks)	(2 Test: 15 marks + Assignments:10 marks)	Credits: 4 (100 marks**)**
	Paper-IV(BCH-19)	(75 marks)(25marks)	(2 Test: 15 marks + Assignments:10 marks)	Credits: 4 (100 marks**)**
	Paper-V (BCH-20) (Seminar)	(25 marks)	Credits: 1 (25 marks)	Credits: 1
	Semester III Credits: 21			**Credits: 21**
Sem IV	Paper-I (BCH-23)	(75 marks)(25marks)	(2 Test: 15 marks + Assignments:10 marks)	Credits: 4 (100 marks**)**
	Paper-II (BCH-24)	(75 marks)(25marks)	(2 Test: 15 marks + Assignments:10 marks)	Credits: 4 (100 marks**)**
	Paper-III (BCH-25)	(75 marks)(25marks)	(2 Test: 15 marks + Assignments:10 marks)	Credits: 4 (100 marks**)**
	Paper-V (BCH-26) (Seminar)	(25 marks)	Credits: 1 (25 marks)	Credits: 1
	Semester IV Credits: 13			**Credits: 13**
Lab Course Work(Annual Practical)	LC- I (BCH-25)	(40 marks)	(10 marks)	Credits: 2 (50 marks**)**
	LC-II (BCH-26)	(40 marks)	(10 marks)	Credits: 2 (50 marks**)**
	LC-III (BCH-27)	(40 marks)	(10 marks)	Credits: 2 (50 marks**)**
	LC-IV (BCH-28)	(40 marks)	(10 marks)	Credits: 8 (200 marks**)**
	Total for Lab Course work (Semester)			**Credits: 14**
	Total For M.Sc. II Year: Sem. III + Sem. IV + Lab Course work (Semester) Credit: 48			**Credit: 48**

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Paper setting Pattern

M.Sc. Biochemistry Part II (CBCS)

Time: 3 hours **Maximum Marks: 75 (3 Credits)**

Unit	Question No	Section	Marks
I	1.	a	7
	OR	b	8
	1.	x	7
		y	8
II	2.	a	7
	OR	b	8
	2.	x	7
		y	8
III	3.	a	7
	OR	b	8
	3.	x	7
		y	8
IV	4.	a	7
	OR	b	8
	4.	x	7
		y	8
V	5.	a	7
	OR	b	8
	5.	x	7
		y	8

M.Sc. Biochemistry
Second Year (Semester-III)
Genetic Engineering
(BCH -15)

CREDIT 04 **Periods: 60**

Objective(s):

This course aims to give clear understanding of the basic concept of genetic engineering, vector, cloning and mutagenesis..

Course Outcome(s): The student will be able to

1. Understand the basic concept of genetic engineering.
2. Know the different type of vector
3. Understand the different hybridization technique.
4. Know the molecular marker.
5. Explain mutagenesis

Chapter	Contents & Name of the Topic	Hours
1	Concept of Genetic Engineering, Enzyme in Genetic Engineering,Plasmid, Bacteriophages Shuttle Vector	10 hrs
2	Cloning in yeast, bacillus and streptomyces, Animal, virus and derived vector- Phage, cosmid,M13,Ti plasmid and Plant genetic Engineering	10 hrs
3	Genomic and C-DNA library Construction,Selection of recombinant DNA clone, Southern, Northen and Western Blotting	10 hrs
4	Hybridization and immunological technique, Characterisation of recombinants gene- S1 Mapping,Sequencing,Restrication mapping, chromosomes walking, In Vitro mutagenesis	10 hrs

5	RRLP, PCR, RTPCR, RAPD, Transgenic Plant and Animal and Microarray	10 hrs
6	Application of Genetic Engineering in Medicine, Agriculture and pharmaceutical industry, Protein Engineering	10 hrs

Reference Books:

1. Principles of Gene manipulation – R.W. Old and S.B. Primrose
2. Molecular Biotechnology: Principles and Applications of Recombinant DNA- B.R. Glick and J. J. Pasternak
3. Genetic Engineering –Williamson
4. Gene Cloning -Glover
5. Molecular Cloning: A Laboratory Manual -Sambrook et al. 1989
6. Basic Methods in Molecular Biology- L. G. Davis, M. D. Dibner and J.F. Battey
7. Methods for General and Molecular Bacteriology- Gerhardt, Murray, Wood and Krieg
8. Methods in Microbiology-Vol. 21 (Plasmid Technology)- J. Grinsted & P. M. Bennett (Ed)
9. Genetic Engineering – Kreutzer and Massey

M.Sc. Biochemistry
Second Year (Semester – III)
Industrial Biochemistry
(BCH -16)

CREDIT 04 **Section A** **Periods: 60**

Objective(s):

This course aims to give clear understanding of the basic concept of industrial biochemistry such as fermentation process, industrial microorganism and biochemical product.

Course Outcome(s): The student will be able to

1. Understand the basic concept of fermentation.
2. Know the different type of enzyme/industrial microorganism
3. Understand the production of biochemical product.
4. Know the production of pharmaceutical product.
5. Know the mechanism probiotic preparation.

Chapter	Contents & Name of the Topic	Hours
1	**I Industrial bioreactor designs** 1. Fermenters: design of fermenters, types of fermenters. 2. Fermentation process, maintenance of aseptic conditions, aeration and agitation. 3. Fermentation: batch, fed-batch and continuous. Scale up and scale down. Solid state fermentation. 4. Control of various parameters – online and offline monitoring, rheological properties of fermenter, computerization offementer operation. 5. Downstream processing, recovery and purification of fermentation products. Effluent treatment	15 hrs
2	**II Food technology** 1. Characteristics of industrial microorganisms; strain improvement; use of auxotrophic mutants; Cultivation of microorganisms. 2. Processed foods – cheese, cold meats 3. Fermentations – wine, beer, vinegar. 4. Oriental fermented foods: Soy sauce, tofu, tempeh 5. Indian fermented foods: Idli, dosa, dokhla. 6. Probiotics – yoghurt/ curd	15 hrs

3	**III Industrial productionof biochemically important products** 1. Production of protein/ carbohydrate/ lipids (a) Proteins from milk and SCP; Industrially important enzymes (b) Production of dextrins, glucose. (c) Preparation of fatty acids, lecithins; Production of essential oils and their fractionation	15 hrs
4	2. Production of pharmaceuticals/neutraceuticals/ biochemicals (a) Antibiotics: penicillins (b) Vitamins: B_1, B_6, B_{12}; A, D, E concentrates. (c) Amino acids: lysine. (d) Alcohol: ethanol (e) Organic acid: citric acid	10 hrs

Reference Book

1. Food Microbiology by W.C Frazier
2. Industrial Microbiology by Presscott.
3. Microbiology by Noel R. Krieg.
4. . Industrial Microbiology – AH Patel, McMillan India Ltd, 1st Edition
5. Food Microbiology – Frazier &Westhoff, Tata McGraw Hill Publishers, New Delhi
6. Food Microbiology by J. M. Jay
7. Total synthesis of natural products, Vol I-John Apsinon
8. Chemical Process Industries – Norris Shreeve& Joseph Brink
9. Roger's Industrial Chemistry Vol I & II – Edited by CC Furnas

M.Sc. Biochemistry
Second Year (Semester – III)
Molecular basis of infectious diseases
(BCH -16)

CREDIT 04 **Section B** **Periods: 60**

Objective(s):

To familiarize the students with the concept of infectious disease, infectious agent and disease caused by bacteria, virus and parasite.

Course Outcome(s): The student will be able to

1. Understand the basic concept infectious disease.
2. Know the students diseases due to virus**.**
3. Understand the disease cause by bacteria.
4. Know infectious agent.

Chapter	Contents & Name of the Topic	Hours
1	**Classification of infectious agents** Bacteria, Viruses, protozoa and fungi. Past and present emerging and re-emerging infectious diseases and pathogens. Source, reservoir and transmission of pathogens, Antigenic shift and antigenic drift. Host parasite relationship, types of infections associated with parasitic organisms. Overview of viral and bacterial pathogenesis. Infection and evasion.	15 hrs
2	**Overview of diseases caused by bacteria.** Detailed study of tuberculosis: History, causative agent, molecular basis of host specificity, infection and pathogenicity, Diagnostics, Therapeutics, inhibitors and vaccines. Drug resistance and implications on public health. Other bacterial diseases including Typhoid, Diphtheria, Pertussis, Tetanus, Typhoid and Pneumonia.	15 hrs
3	**Overview of diseases caused by Viruses** Detailed study of AIDS, history, causative agent, pathogenesis, Diagnostics, Drugs and inhibitors. Other viral diseases including hepatitis, influenza, rabies, chikungunya and polio.	15 hrs

4	**Overview of diseases caused by Parasites** Detailed study of Malaria, history, causative agents, Vectors, life cycle, Host parasite interactions, Diagnostics, Drugs and Inhibitors, Resistance, Vaccine development. Other diseases including leishmaniasis, amoebiasis.	10 hrs

SUGGESTED READINGS

1. Prescott, Harley, Klein's Microbiology (2008) 7th Ed., Willey, J.M., Sherwood, L.M., Woolverton, C.J. Mc Graw Hill International Edition (New York) ISBN: 978-007- 126727. 44

2. Mandell, Douglas and Bennett.S, Principles and practices of Infectious diseases, 7th edition, Volume, 2. Churchill Livingstone Elsevier.

3. Sherris Medical Microbiology: An Introduction to Infectious Diseases by Kenneth J. Ryan, C. George Ray, Publisher: McGraw-Hill

4. Medical Microbiology by Patrick R. Murray, Ken S. Rosenthal, Michael A. Pfaller, Elsevier Health Sciences

M.Sc. Biochemistry
Second Year (Semester – III)
Drugs Metabolism
(BCH -17)

CREDIT 04 **Periods: 60**

Objective(s):

This course aims to give clear understanding of the basic concept of drugs, route of drug administration, biotransformation and toxicity.

Course Outcome(s): The student will be able to

1. Understand the basic concept of drugs.
2. Know the different type of drugs
3. Understand the different phase of biotransformation.
4. Know the toxicity.
5. Know the mechanism enzyme therapeutic drugs monitoring.

Chapter	Contents & Name of the Topic	Hours
1	**Drugs** Drugs – Definition; types – therapeutic, drugs of abuse, poisons. Routes of drug administration Absorption and distribution of drug through organ /tissue - factors affecting distribution Physicochemical properties of drugs, organ/tissue size, blood flow to the organ, physiological barriers to the distribution of drugs, drug binding blood/ tissue/ macromolecules. Protein/tissue binding of drugs – factors affecting protein binding of drugs, significance and kinetics, tissue binding of drugs	15 hrs
2	**Metabolism** Biotransformation of drugs Organs of drug metabolism: hepatic and extrahepatic Mechanism – inactivation, bioactivation, reactive intermediates, Cytochrome P450 I (CYP I), Cytochrome P450 II (CYP II), and oxidation enzymes, epoxide hydrolase, quinoneoxidoreductation, conjugation enzymes. Phase 1: CYP-Catalyzed: Hydroxylation (Primarily at C, N, some at S), Dealkylation (N- and O-dealkylation), Deamination, Epoxidation, Reduction. Non-CYP-Catalyzed: Oxidation (Alcohol and Aldehyde Dehydrogenase, Flavin-Containing Monooxygenase, Monoamine Oxidase), Reductase (Quinone Reductase), Hydrolysis (Esterases, Amidases, Epoxide Hydrolase) Phase 2: Glucuronidation, Sulfation, Acetylation, Glycine conjugation (minor), Glutathione conjugation (toxic substances). Extrahepatic metabolism. Excretion of drugs: renal excretion, factors affecting renal excretion,	30 hrs

	nonrenal routes of excretion & factors affecting excretion and enterohepatic circulation. Factors affecting biotransformation. Pharmacological activity of metabolite, deposition of metabolite. Significance of drug metabolism Drug – drug interaction	
3	**Genetic variation in drug response and toxicity** Pharmacogenetics: a tool for identifying genetic factors in drug dependence and response to treatment Clinically relevant genetic variations in drug metabolizing enzymes **Therapeutic drug monitoring** *A prioiri* and *a posteriori* drug monitoring Characteristics of drugs subject to monitoring	15 hrs

Reference Book

1. Goodman & Gilman's The pharmacological basis of therapeutics, Brunton, L. L., Chabner, B., Knollmann, B. C., (Eds.), McGraw Hill Medical.

2. Drug metabolism. Gonzalez, F. J., Tukey, R. H. In: Brunton, L. L., Chabner, B., Knollmann, B. C., (Eds.), Goodman & Gilman's The pharmacological basis of therapeutics, McGraw Hill Medical.

3. Casarett and Doull's Toxicology. Klaassen, C. D., Amdur, M. O. and Doull, J. Macmillan publishing company, New York.

4. Principles and methods of toxicology. Hayes, A. W. Raven press, New York

M.Sc. Biochemistry
Second Year (Semester – III)
Hormonal Biochemistry
(BCH -18)

CREDIT 04 **Periods: 60**

Objective(s):

This course aims to give clear understanding of the basic concept of hormone, classification and regulation.

Course Outcome(s): The student will be able to

1. Understand the basic concept of hormone.
2. Know the different type of hormone
3. Understand the hormone regulation.
4. Know the pituitary hormone.
5. Know the mechanism hormone action

Chapter	Contents & Name of the Topic	Hours
1	**1.** 1. Introduction: History, endocrine glands, chemical messengers; 2. Classification of hormones 3. Receptor type, Intracellular receptors - Steroid hormone receptors, Thyroid hormone receptors, sensitisation & desensitization of receptors, short term regulation & Long term regulation. 4. Stimulus of hormones, regulation of biosynthesis and release, feedback mechanism. 5. Cell signalling and Mechanism of secretion of hormone, physiological and biochemical actions, pathophysiology – hyper- and hypo- secretion. 1. Hypothalamic Hormones - CRH, TRH, GnRH, PRL/PRIH, GHRH/GHRIH. 2. Pituitary Hormones - Anterior Pituitary hormones - Growth hormone, Prolactin, POMC peptide family, LH, FSH, TSH; Posterior Pituitary - Vasopressin, Oxytocin. 3. Pancreatic Hormones - Insulin, Glucagon, Diabetes type I &II . 4. GI tract Hormones - Gastrin, Secretin, CCK, GIP, Ghrelin.	20 hrs
2	**2.** 1. Adrenal Cortex Hormones - Aldosterone (renin angiotensin system) & cortisol; Pathophysiology - Addisons disease, Conn's syndrome, Cushings syndrome; Hormones of Adrenal Medulla, Epinephrine and norepinephrine. 2. Hormones regulating Ca^{2+} Homeostasis - PTH, Vit D, Calcitonin; Pathophysiology - Rickets, Osteomalacia, Osteoporosis. 3. Reproductive Hormones - Male and female Sex hormones, interplay of hormones during reproductive cycle, Pregnancy, Parturition and Lactation; Oral Contraceptives. 4. Endocrine disorders: Gigantism, Acromegaly, dwarfs, pigmies;	20 hrs

	Pathophysiology - Diabetes insipidus, Thyroid Hormone (include biosynthesis) - Goiter, Graves' disease, Cretinism, Myxedema, Hashimoto's disease. 5. Other organs with endocrine function - Heart (ANP), Kidney (erythropoietin), Liver(Angiotensinogen, IGF-1), Adipose tissue(Leptin, adiponectin); Pathophysiology - Obesity. Growth factors: PDGF, EGF, IGF-I,II , & NGF.	
3	Composition and architecture of membranes and membrane dynamics: Lipid bilayer, membrane protein, membrane carbohydrate , Phases of membrane and phase transition, lipid- lipid interaction, lipid- protein interaction. Role of Lipid raft and Caveolins in membrane function.	10 hrs
4	. Solute transport across the membrane: passive and active transport, transporter protein (Channel protein and carriers), kinetics of glucose transport. 3. Membrane receptors: Types of receptor, Molecular mechanism of signal transduction: Recognition of receptors and mode of action. Role of glycolipid and diacyglycerol in signal transduction.	10 hrs

Reference Book

1. Jeremy M Berg, John L Tymoczko, Lubert Stryer. Biochemistry.
2. Christopher K. Mathews., Kensal E. van Holde., Kevin G. Ahern. Biochemistry.
3. Nelson and Cox. Lehningers Principles of Biochemistry.
4. Anthony W. Norman., Gerald Litwack. 1997. Hormones.
5. David Gardner, Dolores Shoback. Greenspan's Basic and Clinical Endocrinology.
6. Thomas C. Moore. Biochemistry and Physiology of Plant Hormones.

M.Sc. Biochemistry
Second Year (Semester – III)
Research Methodology
(BCH -19)

CREDIT 04 **Section A** **Periods: 60**

Objective(s):

This course aims to give clear understanding of the basic concept of research and research methodology.

Course Outcome(s): The student will be able to

1. Understand the basic concept of ethic in research.
2. Know the concept of basic and applied research
3 Understand the different literature survey.
4. Know the plagiarism.
5. Know the writing description

Chapter	Contents & Name of the Topic	Hours
1	1. Biosafety in the laboratory (i) Good laboratory practices (GLP) maintained (ii) Precautions necessary for personal safety with regard to use of organisms and/or hazardous chemicals (iii) Proper treatment and/or disposal of experimental substances. 2. Ethics in research (i) Sincerity in experimental design. (ii) Integrity in report of results, eschewing manipulated observations. (iii) Evil of plagiarism.	10 hrs
2	3. Defining the problem. (i) Selecting a emerging/ vital / thrust area for research. (ii) Concept of basic and applied research. (iii) Gathering information about the problem. (iv) Reasoning out strategies to engage into the research topic. 4. Literature survey (i) Gathering information on existing research findings on the topic and on state-of-the-art techniques to achieve some advancement in the field of research. (ii) Lacunae in current knowledge in the area of research (iii) Writing a description of the literature survey with due citations and proper record of bibliography .	10 hrs

3	5. Defining the Aims and Objectives (i) Aim: The intent of the work. (ii) Objectives: The main 3-5 points to achieve the aim. 6. Work Plan – Time-bound Frame (i) Long term plan of work: Month-wise. (ii) Short term/Immediate plan of work: Week/Day-wise. (iii) Time management in experimental planning. 7. Research design (i) Maintaining a laboratory note book (ii) Field trip: Sample collection; viewing and assessment of habitats/location. (iii) Experimental: Description of strategies to meet the objectives using state-of-the-art techniques and proper citation of established/recorded procedures. (iv) Instrumentation: Involves proper handling and correct usage: - Maintaining proper record on log books. - Reporting duly any mishap/ misfunctioning - Maintaining cleanliness and care of the instrument during and after use.	10 hrs
4	**8. Experimental** protocol (i) Flow-sheet (ii) Importance of date, time of individual steps (iii) Materials: chemicals and glassware – size and numbers required (iv) Significance of triplicate readings. 9. Presentation of data (i) Record of observations : Importance of recording in the laboratory note book, every observation during the experimental process – intended/unintended; value of serendipity. (ii) Tabular presentations of results (iii) Graphical presentations (iv) Statistical and computational analysis where required 10. Analysis and Conclusions (i) Analyzing the data (ii) Drawing an inference/conclusion from the analysis (iii) Planning the next experiment based on the conclusion of the previous.	10 hrs
5	11. Presentations (i) Seminar on research reports/ personal research findings (ii) Presentations at Conferences (a) Poster: Title, Authors and Affiliation; Abstract; Introduction; Methodology – Flow charts; Results – Graphical display; Conclusions; References significant to the presented data (b) Oral : Title with Authors and Affiliation; Introduction; Methodology and Results – Graphical display; Summary/Conclusions. 12. Research manuscript writing (i) Choice of scientific journal – attention to 'Aim and Scope' of the journal with respect to the area of personal research, impact factor.	20 hrs

	(ii) Following explicitly the 'Instructions to authors of the journal (iii) Reference to sample papers of the journal for proper layout and details. 13. Thesis Writing (i) Preliminary: Content page; Certificates; Acknowledgements. (ii) Literature survey (with proper flow of thought, due citations and proper indexing of bibliography) (iii) Abstract (iv) Methodology with due citation (v) Results – Text, arrangement of figures, tables (vi) Discussion (substantiated with reported data duly cited, corroborating earlier records or defending new findings) (vii) Conclusion (viii) Bibliography (ix) Appendix 14. Viva Voce Introduction Methodology Results & Discussion Conclusion/Summary Acknowledgements.	

Reference Book

1. Research Methodology methods and techniques. Kothari C. R. New Age Internat Publ.
2. Research Methodology. Rajendra Kumar C. APH Publ Corporation, New Delhi.
3. Methods of Research Good C. V. and Douglas E.
4. How to write a scientific paper. Day R.A. Cambridge University Press.
5. Guide to scientific and technical writing. Cooray P.G.
6. The craft of scientific writing. Alley, M. N.N. Prentice.

M.Sc. Biochemistry
Second Year (Semester – III)
Seminar
(BCH -20)
CREDIT 01

M.Sc. Biochemistry
Second Year (Semester – III)
Lab course I
(BCHLC -21)

CREDIT 04

Lab course Genetic Engineering and Industrial Biochemistry

Objective(s): To understand varies technique and its application in biochemistry.

Course Outcome(s): The student will be able to

1. Gathering basic knowledge of blotting technique
2. Determine vitamin in varies dairy productt and explain is significance
3. Analyse DNA product
4. Explaining fermentation process
5. perorming citric acid production

1. Demonstration of activity of restriction endo nuclease
2. Restrication digestion and separation of DNA fragment by agarose gel electrophoresis.
3. Transformation of DNA in bacterial cell
4. Transduction
5. Conjutation
6. Induction of Lac operon
7. Demonstration of southern blotting
8. Demontration of northern blotting
9. Demontration of Western blotting
10. Demonstration of components of fermentor
11. Preparation of mother culture and starter culture for alcohol production
12. Preparation of beer / alcohol.
13. Estimation of protein and fat in paneer
14. Estimation of vitamin in various dairy products
15. Production of citric acid.

Reference Book

1. Plummer D. T. (2005) An Introduction to Practical Biochemistry, TATA McGraw-Hill.

2. Sadasivam S. and Manickam A. (2008) Biochemical Methods, 3rd edition, New Age International Publishers.

3. Rao B. S. and Deshpande V. (2005) Experimental Biochemistry: A Student Companion, I.K. International Pvt. Ltd., New Delhi.

4. Sawhney S.K. and Singh Randhir (2011) introductory practical Biochemistry, Narosa Publication House Pvt. Ltd.

5. Jayaraman J. (1981) Laboratory Manual in Biochemistry, New Age International Publishers

6. Aneja K.R. (2007) Experiments in Microbiology, Plant Pathology and Biotechnology, New Age International Publishers.

7. Kale V. and Bhusari K. (2010) Practical Microbiology: Principles and Techniques, Himalaya Publishing House.

8. Godkar P.B. and Godkar D.P. (2003) Textbook of Medical Laboratory Technology, Second Edition, Bhalani Publishing House.

9. Rajgopal G. and Toora B.D. (2005) Practical Biochemistry, 2nd edition, Ahuja Publishing House.

10. Maheshwari D.K. (2002) Practical Microbiology, S. Chand Publishing.

11. Rajan S. and Christy Selvi R. (2015) Experimental Procedures in Life Sciences, CBS Publishers and Distributors Pvt. Ltd.

M.Sc. Biochemistry
Second Year (Semester – III)
Lab course II
(BCHLC -22)

CREDIT 04

Lab course Drugs Metabolism and Hormonal Biochemistry

Objective(s): To understand varies technique and its application in biochemistry.

Course Outcome(s): The student will be able to

1.Gathering basic knowledge of drugs metabolism
2. Determine drug kinetic.
3. Analyse hormone.
4. Estimate bile pigment.
5.Performing antimicrobial activity

1. Isolation of plasmid DNA
2. Isolation of bacterial genomic DNA
3.Check the solubility of drug.
4.Drug kinetic by estimation by kill curve in bacteria/yeast
5.Breath test for drug abuse
6.Estimation of drug in urine sample.
7. Estimation of bile salt and bile pigment.
8.Estimation of SGOT and SGPT
9.Detection of HCG by pregnancy test
10.Estimation of T3 and T4, TSH

Reference Book

1. Plummer D. T. (2005) An Introduction to Practical Biochemistry, TATA McGraw-Hill.

2. Sadasivam S. and Manickam A. (2008) Biochemical Methods, 3rd edition, New Age International Publishers.

3. Rao B. S. and Deshpande V. (2005) Experimental Biochemistry: A Student Companion, I.K. International Pvt. Ltd., New Delhi.

4. Sawhney S.K. and Singh Randhir (2011) introductory practical Biochemistry, Narosa Publication House Pvt. Ltd.

5. Jayaraman J. (1981) Laboratory Manual in Biochemistry, New Age International Publishers

6. Aneja K.R. (2007) Experiments in Microbiology, Plant Pathology and Biotechnology, New Age International Publishers.

7. Kale V. and Bhusari K. (2010) Practical Microbiology: Principles and Techniques, Himalaya Publishing House.

8. Godkar P.B. and Godkar D.P. (2003) Textbook of Medical Laboratory Technology, Second Edition, Bhalani Publishing House.

9. Rajgopal G. and Toora B.D. (2005) Practical Biochemistry, 2nd edition, Ahuja Publishing House.

10. Maheshwari D.K. (2002) Practical Microbiology, S. Chand Publishing.

11. Rajan S. and Christy Selvi R. (2015) Experimental Procedures in Life Sciences, CBS Publishers and Distributors Pvt. Ltd.

M.Sc. Biochemistry
Second Year (Semester – IV)
Metabolmic
(BCH -23)

CREDIT 04 **Periods: 60**

Objective(s):
This course aims to give clear understanding of the basic concept of metabolite, extraction and isolation and purification.

Course Outcome(s): The student will be able to

1. Understand the basic concept of metabolite.
2. Know the different type of sample preparation
3. Understand the different separation method.
4. Know the purification of secondary metabolite.
5. Know the mechanism quenching.

Chapter	Contents & Name of the Topic	Hours
1	**Concept and Methodology** Metabolites and metabolism, Structural diversity of metabolite, Physical and chemical properties, metabolic abundance, primary and secondary metabolite. Occurrence of metabolite in biological system Controlling rates and level: Control by substrate level, feed back and feed forward control, control by 'Pathway independent' regulatory molecule. Allosteric control, control by compartmentalization Dynamic of metabolism: The mass flow, Control by hormone	20 hrs
2	**Sampling and Sample preparation** Quenching- Overview of metabolite turnover , different methods for quenching. Quenching microbial, plant and animal tissue. Isolation of metabolite from biological sample, Intracellular metabolite, Cell disruption method- mechanical and non mechanical disruption. Metabolite in the extracellular medium, metabolite in solution, metabolite in gas phase	20 hrs
3	**Tools of Metabolmic** Separation Method: Gas chromatography, HPLC, Capillary electrophoresis. Detection Method: Mass Spectrometry, NMR, Spectrophotometry.	10 hrs

4	**Application of Metabolmic** Application of metabolite analysis to Bioscience Metabolmic and Medical Science Metabolmic and Pharmaceutical Science	10 hrs

Reference Book

1. Metabolme analysis By Seetharaman.

2.Metabolme analysis By Silas G, Vilas Bous

M.Sc. Biochemistry
Second Year (Semester – IV)

Molecular basis of non-infectious human diseases (BCH -23)

CREDIT 04 **Section B** **Periods: 60**

Objective(s):

This course aims to give clear understanding the disease related nutritional disorder, metabolic and lifestyle.

Course Outcome(s): The student will be able to

1. Understand the basic concept noninfectious disease.
2. Know the students diseases due to misfolded proteins**.**
3. Understand the Obesity and eating disorders.
4. Know inborn error of metabolism.

Chapter	Contents & Name of the Topic	Hours
1	**Nutritional disorders** Overview of major and minor nutrient components in the diet. Balanced diet and the concept of RDA. Nutrient deficiencies; Kwashiorkor and Marasmus, Scurvy, beri beri, pellagra and B12 deficiency, Xerophthalmia and Night blindness, Vitamin D deficiency, Vitamin K deficiency. Discuss with relation to biochemical basis for symptoms.	10 hrs
2	**Metabolic and Lifestyle disorders** Obesity and eating disorders like Anorexia nervosa and Bullemia. Diabetes mellitus A metabolic syndrome and the relationship with hypertension, obesity, hypothyroidism and stress. Cardio vascular disorders and Atherosclerosis-defining the broad spectrum of ailments that fall in this category, understanding the factors that contribute to the syndrome, stages of disorder and the management of the condition. Irritable bowel syndrome- biochemistry behind the disorder and the influence of diet, stress and environment on the condition.	10 hrs

3	**Multifactorial complex disorders and Cancer** Understanding the definition of multifactorial diseases. Polygenic diseases and the relationship of environmental factors and genetic makeup in the onset of diseases. Cancer: characteristics of a transformed cell, causes and stages of Cancer, molecular basis for neoplastic growth and metastasis, Proto-oncogenes and tumor suppressor genes; Cancer causing mutations; Tumor viruses; Biochemical analysis of cancer; Molecular approaches to cancer treatment. Disorders of mood : Schizophrenia, dementia and anxiety disorders. Polycystic ovarian syndrome, Parkinson's disease, ALS.	10 hrs
4	**Diseases due to misfolded proteins** Introduction to protein folding and proteosome removal of misfolded proteins; etiology and molecular basis for Alzheimer's, Prion diseases, Huntington's Chorea, sickle cell anemia, Thalassemia	10 hrs
5	**Unit5** **05** **Monogenic diseases** In born errors in metabolism: PKU, Alkaptonuria, Maple syrup urine disease; Receptor and transport defects: Cystic fibrosis, Long QT syndrome, familial hypercholesterolemia, Achondroplasia. Hemoglobinopathies and clotting disorders	20 hrs

SUGGESTED READINGS

1. Textbook of Biochemistry with Clinical Correlations (2011) Devlin, T.M. John Wiley & Sons, Inc. (New York), ISBN: 978-0-4710-28173-4.

2. Introduction to Human Physiology (2013) 8th edition; Lauralee Sherwood. Brooks/Cole, Cengage Learning.

3. The World of the cell, 7th edition (2009)

4. Genetics (2012) Snustad and Simmons,

5. Cooper, G.M. and Hausman, R.E. 2009 The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.

M.Sc. Biochemistry
Second Year (Semester – IV)
Medical Biochemistry
(BCH -24)

CREDIT 04 **Periods: 60**

Objective(s):
This course aims to give clear understanding of the basic concept of health and disease.
Course Outcome(s): The student will be able to
1. Understand the basic concept of pathological condition.
2. Know the different type of diagnostic enzyme
3 Understand the composition in blood.
4 Know the liver, kidney disease.
5. Know the mechanism endocrinal disorder.

Chapter	Contents & Name of the Topic	Hours
1	Basic concept- Health and disease, Normal and pathological changes affecting cell in the body. Cell death and physiological causes- physical,chemical and biologically agent, nutritional deficiencies. Diogonstic enzymology- Mechanism of elevated enzyme activites such as alkaline phosphates creatine kinse, LDH, AST, ALT, Isoenzyme	10 hrs
2	Blood composition, Cell function. Function of plasma protein and lipoprotein in diseases. Disorder of hemoglobin- Thalassemia, Sickle cell anemias	10 hrs
3	Liver-Bile pigment- formation of bilurubin, urobilinogen bile acid, jaundice- prehepatic, hepatic and post hepatic. Diagnosis of liver function test, disese of liver- hepatitis, cholestasis, cirrhosis, Gallstones	10 hrs
4	Kideny- Assement of renal function test- creatine clearance, renal calculi, uremia, laboratory investigation of kidney disorder. Gastrointestinal disorder- fractional gastric analysis, hypo and hyper acidity, gastric ulcer, Malabsorption syndrome, steatorrhea, diarrhoea	10 hrs
5	Endocrine disorder- Laboratory diagnosis of function of pituitary, adrenal and gonads. Disorder- Graves disease, Addisons disease, hypo and hyper secretion of hormone	10 hrs

6	Metabolic disease- Disorder of carbohydrate metabolism- diabetes mellitus, classification, etiology, mangment, laboratory investigation-GTT, glycogen storage disease, galctosemia, lactose intolerance ,Disorder of amino acid metabolism	10 hrs

Reference Book

1. Pattabiraman R.N. Text book of Biochemistry, All India Publisher distribution.
2. Chatterjee M.N., Shinde, R. Text book of Medical Biochemistry, Jaypee Publishers.
3. Vasudevan, D.M., Sreekumari S., Text book of Biochemistry for Medical Students, Jaypee Publishers.
4. Berg, Jeremy M., Tymoczko, John L., Stryer Lubert. Biochemistry, W.H. Freemann, N. York.
5. David, L.N., Michael, M.C., Lehninger, Albert, Biochemistry, Kalyani Publications, N.
6. Murray, Robert K., Bender, David A., Botham Kathleen M. *et al.* Harper's Illustrated Biochemistry, Appleton & Lange.
7. Kaplan Lawrence A., Amadeo J. Clinical Chemistry: Theory, Analysis, Correlation, Mousby Publisher, Missouri.
8. Ranjna Chawla, Practical Clinical Biochemistry, Jaypee publishers
9. Harold Varley, Alam H. Guwnelock et al. Varley's Practical Clinical Biochemistry

M.Sc. Biochemistry
Second Year (Semester – IV)
Plant Biochemistry
(BCH -25)

CREDIT 04 **Periods: 60**

Objective(s):

This course aims to give clear understanding of the basic concept of plant cell, metabolism, plant hormone and biochemistry of plant growth.

Course Outcome(s): The student will be able to

1. Understand the basic concept of plant cell.
2. Know the different type metabolic pathway
3. Understand the different growth hormone.
4. Know the photosynthesis.
5. Know the mechanism hormonal regulation

Chapter	Contents & Name of the Topic	Hours
1	**Plant cell and Photosynthesis** Structure of plant cell (i) structure of plant cell membrane and cell wall.Photosynthesis – Structure & function of chloroplast of system, photosynthetic pigment and their functions, photosystem I & II.Photosynthetic electron transport and photophorylation. Calvin cycle (C3 plant) Hatch slack pathway (C4 plants)	15 hrs
2	**Plant tissue culture and Hormones** Plant tissue culture, plant cell organs & embryo culture, another culture somaclonal variation properties isolation fusion and culture of protoplasts, application of plant tissue culture transgenic plant.	15 hrs
3	**Plant Hormones** Plant hormones, Biosnthesis, structure and biochemical mode of action of auxins, gibberellins, ctokinins, absciisic acid and ethylene, other plant growth regualtior.	15 hrs

4	**Biochemistry of plant growth** Biochemistry of seed development, dormancy, Biochemical changes during germination of seeds, Biochemistry of fruit development and rip ending. Structure and function of phytochrome, hormonal regulation of flowering, phtoperiodism and vernilization**.**	15 hrs

Reference Book

1. Biochemistry – Zubey.
2. Biochemistry – Stryer.
3. Principal of microbiology- prescott
4. Fundamental of biochemistry- Voet and Voet
5. Molecular Biology of the cell- Bruce Albert

M.Sc. Biochemistry
Second Year (Semester – IV)
Seminar
(BCH -26)
CREDIT 01

M.Sc. Biochemistry
Second Year (Semester – IV)
Lab course III
(BCHLC -27)

CREDIT 04

Lab course Medical and Plant Biochemistry

Objective(s): To understand varies technique and its application in biochemistry.

Course Outcome(s): The student will be able to

1. Gathering basic knowledge of medical and plant biochemistry
2. Determine total blood cholesterol and explain is significance
3. Analyse abnormal constituent of urine
4. Estimate haemoglobin
5. Performing plant base enzyme activity

1. Estimation of lipoprotein
2. Glucose tolerance test
3. Estimation of bilirubin
4. Estimation of blood urea
5. Blood sugar determination by Folin – Wu method.
6. Estimation of creatine phospokinase.
7. Normal and abnormal constituents of urine.
8. Determination of blood cholesterol.
9. Changes in carbohydrate, protein content during germination.
10. Induction of proteinases, amylases, and lipase during germination.
11. Induction of vit. C synthesis during germination.
12. Isolation and characterization of tryps in inhibitor.
13. Assay of peroxidase, catalase, phenol oxidase, ascorbic acid oxidase.
14. Isolation of plant DNA & RNA.
15. Estimation of carotene, ascorbic acid phenols and tannins in fruits and vegetables.
16. Development of callus culture from meristems and leaves.
17. Isolation of chloroplast from Spinach Leaves.
18. Estimation of chlorophyll – a and - b from isolated chloroplast.

Reference Book

1. Plummer D. T. (2005) An Introduction to Practical Biochemistry, TATA McGraw-Hill.

2. Sadasivam S. and Manickam A. (2008) Biochemical Methods, 3rd edition, New Age International Publishers.

3. Rao B. S. and Deshpande V. (2005) Experimental Biochemistry: A Student Companion, I.K. International Pvt. Ltd., New Delhi.

4. Sawhney S.K. and Singh Randhir (2011) introductory practical Biochemistry, Narosa Publication House Pvt. Ltd.

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9. Rajgopal G. and Toora B.D. (2005) Practical Biochemistry, 2nd edition, Ahuja Publishing House.

10. Maheshwari D.K. (2002) Practical Microbiology, S. Chand Publishing.

11. Rajan S. and Christy Selvi R. (2015) Experimental Procedures in Life Sciences, CBS Publishers and Distributors Pvt. Ltd.

M.Sc. Biochemistry

Second Year (Semester – IV)

Lab course IV

(BCH -28)

CREDIT 04

Industry Based Project

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1. Problem related to plant, animal, microbe and industries.