

**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 2015-16)

SYLLABUS FOR M.Sc. PART- II EXAMINATION

M.Sc. BIOCHEMISTRY

(SEMESTER PATTERN)

JUNE- 2015

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	4	60
BCH-17	Drugs Metabolism	4	60
BCH-18	Hormonal Biochemistry	4	60
BCH-19 (Seminar)	(25 marks)	Credit : 1	
Title of the Practical Papers			
BCH-20	Lab course G.Engg and Industrial Biochemistry	4	60
BCH-21	Lab course Drugs Metabolism and Hormonal Biochemistry	4	60

M.Sc. Part – II Fourth Semester

Paper No.	Title of the Theory Papers	Credit	No. Periods
BCH-22	Metabolmic	4	60
BCH-23	Medical Biochemistry	4	60
BCH-24	Plant Biochemistry	4	60
BCH-25	Research Methodology	4	60
BCH-26 (Seminar)	(25 marks)	Credit : 1	
Title of the Practical Papers			
BCH-27	Lab course Clinical and Plant Biochemistry	4	60
BCH-28	Project	4	60

CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Post Graduate (PG) Programs under Faculty of Science

(Affiliated Colleges)

(w.e.f. Academic Year 2015-16)

Name of the faculty	Total credits	Average credits per semester
Science	100	25

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-V (BCH-19) (Seminar)	(25 marks)	Credits: 1 (25 marks)	Credits: 1
Semester III Credits: 17				Credits: 17
Sem IV	Paper-I (BCH-20)	(75 marks)(25marks)	(2 Test: 15 marks + Assignments:10 marks)	Credits: 4 (100 marks)
	Paper-II (BCH-21)	(75 marks)(25marks)	(2 Test: 15 marks + Assignments:10 marks)	Credits: 4 (100 marks)
	Paper-III (BCH-22)	(75 marks)(25marks)	(2 Test: 15 marks + Assignments:10 marks)	Credits: 4 (100 marks)
	Paper-IV(BCH-23)	(75 marks)(25marks)	(2 Test: 15 marks + Assignments:10 marks)	Credits: 4 (100 marks)
	Paper-V (BCH-24) (Seminar)	(25 marks)	Credits: 1 (25 marks)	Credits: 1
Semester IV Credits: 17				Credits: 17
Lab Course Work(Annual Practical)	LC- I (BCH-25)	(75 marks)	(25 marks)	Credits: 4 (100 marks)
	LC-II (BCH-26)	(75 marks)	(25 marks)	Credits: 4 (100 marks)
	LC-III (BCH-27)	(75 marks)	(25 marks)	Credits: 4 (100 marks)
	LC-IV (BCH-28)	(75 marks)	(25 marks)	Credits: 4 (100 marks)
	Total for Lab Course work (Annual)			
Total For M.Sc. II Year: Sem. III + Sem. IV + Lab Course work (Annual) Credit: 50				Credit: 50

**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

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, Northern and Western Blotting	10 hrs
4	Hybridization and immunological technique, Characterisation of recombinants gene- S1 Mapping, Sequencing, Restriction 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

Periods: 60

Chapter	Contents & Name of the Topic	Hours
1	<p>I Industrial bioreactor designs</p> <p>1. Fermenters: design of fermenters, types of fermenters.</p> <p>2. Fermentation process, maintenance of aseptic conditions, aeration and agitation.</p> <p>3. Fermentation: batch, fed-batch and continuous. Scale up and scale down. Solid state fermentation.</p> <p>4. Control of various parameters – online and offline monitoring, rheological properties of fermenter, computerization of fermenter operation.</p> <p>5. Downstream processing, recovery and purification of fermentation products.</p> <p style="padding-left: 20px;">Effluent treatment</p>	15 hrs
2	<p>II Food technology</p> <p>1. Characteristics of industrial microorganisms; strain improvement; use of auxotrophic mutants; Cultivation of microorganisms.</p> <p>2. Processed foods – cheese, cold meats</p> <p>3. Fermentations – wine, beer, vinegar.</p> <p>4. Oriental fermented foods: Soy sauce, tofu, tempeh</p> <p>5. Indian fermented foods: Idli, dosa, dikhla.</p> <p>6. Probiotics – yoghurt/ curd</p>	15 hrs
3	<p>III Industrial production of biochemically important products</p> <p>1. Production of protein/ carbohydrate/ lipids</p> <p>(a) Proteins from milk and SCP; Industrially important enzymes</p> <p>(b) Production of dextrans, glucose.</p> <p>(c) Preparation of fatty acids, lecithins; Production of essential oils and their fractionation</p>	15 hrs
4	<p>2. Production of pharmaceuticals/neutraceuticals/ biochemicals</p> <p>(a) Antibiotics: penicillins</p> <p>(b) Vitamins: B₁, B₆, B₁₂; A, D, E concentrates.</p> <p>(c) Amino acids: lysine.</p> <p>(d) Alcohol: ethanol</p> <p>(e) Organic acid: citric acid</p>	10 hrs

Reference Book

1. Food Microbiology by W.C Frazier
2. Industrial Microbiology by Prescott.
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)
Drugs Metabolism
(BCH -17)

CREDIT 04

Periods: 60

Chapter	Contents & Name of the Topic	Hours
1	<p>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</p>	15 hrs
2	<p>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, nonrenal routes of excretion & factors affecting excretion and enterohepatic circulation.</p>	30 hrs

	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 <i>A priori</i> and <i>a posteriori</i> 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

Chapter	Contents & Name of the Topic	Hours
1	<p>1.</p> <p>1. Introduction: History, endocrine glands, chemical messengers;</p> <p>2. Classification of hormones</p> <p>3. Receptor type, Intracellular receptors - Steroid hormone receptors, Thyroid hormone receptors, sensitisation & desensitization of receptors, short term regulation & Long term regulation.</p> <p>4. Stimulus of hormones, regulation of biosynthesis and release, feedback mechanism.</p> <p>5. Cell signalling and Mechanism of secretion of hormone, physiological and biochemical actions, pathophysiology – hyper- and hypo- secretion.</p> <p>1. Hypothalamic Hormones - CRH, TRH, GnRH, PRL/PRIH, GHRH/GHRIH.</p> <p>2. Pituitary Hormones - Anterior Pituitary hormones - Growth hormone, Prolactin, POMC peptide family, LH, FSH, TSH; Posterior Pituitary - Vasopressin, Oxytocin.</p> <p>3. Pancreatic Hormones - Insulin, Glucagon, Diabetes type I & II .</p> <p>4. GI tract Hormones - Gastrin, Secretin, CCK, GIP, Ghrelin.</p>	20 hrs
2	<p>2.</p> <p>1. Adrenal Cortex Hormones - Aldosterone (renin angiotensin system) & cortisol; Pathophysiology - Addisons disease, Conn’s syndrome, Cushings syndrome; Hormones of Adrenal Medulla, Epinephrine and norepinephrine.</p> <p>2. Hormones regulating Ca²⁺ Homeostasis - PTH, Vit D, Calcitonin; Pathophysiology - Rickets, Osteomalacia, Osteoporosis.</p> <p>3. Reproductive Hormones - Male and female Sex hormones, interplay of hormones during reproductive cycle, Pregnancy, Parturition and Lactation; Oral Contraceptives.</p> <p>4. Endocrine disorders: Gigantism, Acromegaly, dwarfs, pigmies; Pathophysiology - Diabetes insipidus, Thyroid Hormone (include biosynthesis) - Goiter, Graves’ disease, Cretinism, Myxedema, Hashimoto’s disease.</p> <p>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.</p>	20 hrs

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 diacylglycerol 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)
Lab course I
(BCH -20)
CREDIT 04
Lab course Genetic Engineering and Industrial Biochemistry

1. Fermentor:
 - (a) Designing of fermentor – stirred tank reactor
 - (b) Aeration efficiency using dissolved oxygen analysis
 - (c) Rheology of substrate solutions, culture broth and harvested cell suspension
2. Fermentation processes – production of ethanol
3. Production of biochemically important products
 - (a) Casein from milk
 - (b) Sugar from sugarcane
 - (c) Lecithin from egg yolk
4. Restriction mapping of bacterial plasmid
5. Transformation of bacteria with plasmid
6. Cloning of DNA fragment in pUC 19.
7. Demonstration of insertional inactivation marker

M.Sc. Biochemistry
Second Year (Semester – III)
Lab course II
(BCH -21)
CREDIT 04
Lab course Drugs Metabolism and Hormonal Biochemistry

1. Isolation of plasmid DNA
2. Isolation of bacterial genomic DNA
3. PCR amplification of a specific gene (target DNA sequence) from genomic DNA. Agarose Gel analysis of PCR product to check its size and purity and gel documentation.
4. Curing of plasmid DNA by acridine orange/SDS and determination of plasmid loss
5. Hydroxylation of drug by liver homogenate and spectrophotometric/ spectrofluorometric detection.
6. Therapeutic drug monitoring: detection of tricyclic antidepressants in serum.
7. Immunochromatographic assay for detection of drugs of abuse.
8. Thin layer chromatographic detection of drugs of abuse.
9. Breath Test for Alcohol Abuse.
10. Case study of incidence, effects and management of substance abuse at the individual and at the community level.

M.Sc. Biochemistry
Second Year (Semester – IV)
Metabolmic
(BCH -22)

CREDIT 04

Periods: 60

Chapter	Contents & Name of the Topic	Hours
1	<p>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</p>	20 hrs
2	<p>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</p>	20 hrs
3	<p>Tools of Metabolmic Separation Method: Gas chromatography, HPLC, Capillary electrophoresis. Detection Method: Mass Spectrometry, NMR, Spectrophotometry.</p>	10 hrs
4	<p>Application of Metabolmic Application of metabolite analysis to Bioscience Metabolmic and Medical Science Metabolmic and Pharmaceutical Science</p>	10 hrs

Reference Book

1. Metabolme analysis By Seetharaman. 2. Metabolme analysis By Silas G, Vilas Bous

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

CREDIT 04

Periods: 60

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. Diognostic 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 bilirubin, 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. Freeman, 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 -24)

CREDIT 04

Periods: 60

Chapter	Contents & Name of the Topic	Hours
1	<p>Plant cell and Photosynthesis</p> <p>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)</p>	15 hrs
2	<p>Plant tissue culture and Hormones</p> <p>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.</p>	15 hrs
3	<p>Plant Hormones</p> <p>Plant hormones, Biosynthesis, structure and biochemical mode of action of auxins, gibberellins, ctokinins, absciisic acid and ethylene, other plant growth regualtior.</p>	15 hrs
4	<p>Biochemistry of plant growth</p> <p>Biochemistry of seed development, dormancy, Biochemical changes during germination of seeds, Biochemistry of fruit development and rip ending. Structure and function of phytochrome, hormonal</p>	15 hrs

	regulation of flowering, photoperiodism and vernalization.	
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Reference Book

1. Biochemistry – Zubey.
2. Biochemistry – Stryer.
3. Principles of microbiology- Prescott
4. Fundamentals of biochemistry- Voet and Voet
5. Molecular Biology of the cell- Bruce Albert

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

CREDIT 04

Periods: 60

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.	10 hrs

	<p>(iii) Time management in experimental planning.</p> <p>7. Research design</p> <p>(i) Maintaining a laboratory note book</p> <p>(ii) Field trip: Sample collection; viewing and assessment of habitats/location.</p> <p>(iii) Experimental: Description of strategies to meet the objectives using state-of-the-art techniques and proper citation of established/recorded procedures.</p> <p>(iv) Instrumentation: Involves proper handling and correct usage:</p> <ul style="list-style-type: none"> - Maintaining proper record on log books. - Reporting duly any mishap/ malfunctioning - Maintaining cleanliness and care of the instrument during and after use. 	
4	<p>8. Experimental</p> <p>protocol</p> <p>(i) Flow-sheet</p> <p>(ii) Importance of date, time of individual steps</p> <p>(iii) Materials: chemicals and glassware – size and numbers required</p> <p>(iv) Significance of triplicate readings.</p> <p>9. Presentation of data</p> <p>(i) Record of observations : Importance of recording in the laboratory note book, every observation during the experimental process – intended/unintended; value of serendipity.</p> <p>(ii) Tabular presentations of results</p> <p>(iii) Graphical presentations</p> <p>(iv) Statistical and computational analysis where required</p> <p>10. Analysis and Conclusions</p> <p>(i) Analyzing the data</p> <p>(ii) Drawing an inference/conclusion from the analysis</p> <p>(iii) Planning the next experiment based on the conclusion of the previous.</p>	10 hrs
5	<p>11. Presentations</p> <p>(i) Seminar on research reports/ personal research findings</p> <p>(ii) Presentations at Conferences</p> <p>(a) Poster: Title, Authors and Affiliation; Abstract; Introduction; Methodology – Flow charts; Results – Graphical display; Conclusions; References significant to the presented data</p> <p>(b) Oral : Title with Authors and Affiliation; Introduction; Methodology and Results – Graphical display; Summary/Conclusions.</p> <p>12. Research manuscript writing</p> <p>(i) Choice of scientific journal – attention to ‘Aim and Scope’ of the journal with respect to the area of personal research, impact factor.</p> <p>(ii) Following explicitly the ‘Instructions to authors</p>	20 hrs

	<p>of the journal (iii) Reference to sample papers of the journal for proper layout and details.</p> <p>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</p> <p>14. Viva Voce</p> <p>Introduction Methodology Results & Discussion Conclusion/Summary Acknowledgements.</p>	
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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 – IV)
Lab course III
(BCH -27)
CREDIT 04

Lab course Medical and Plant Biochemistry

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 phosphokinase.
7. Normal and abnormal constituents of urine.
8. Determination of blood cholesterol.
9. Determination of glucose by glucose oxidase method.
10. Estimation of glycosylated hemoglobin.
11. Estimation of LDH and its isozymes.
12. Estimation of alkaline phosphatase from serum.
13. Estimation of total protein and albumin from serum.
14. Determination of SGPT and SGOT

15. Estimation of serum amylase. Absorption of water by live & dead seeds.
16. Changes in carbohydrate, protein content during germination.
17. Induction of proteinases, amylases, and lipase during germination.
18. Induction of vit. C synthesis during germination.
19. Isolation and characterization of tryps in inhibitor.
20. Assay of peroxidase, catalase, phenol oxidase, ascorbic acid oxidase.
21. Isolation of plant DNA & RNA.
22. Estimation of carotene, ascorbic acid phenols and tannins in fruits and vegetables.
23. Development of callus culture from meristems and leaves.
24. Isolation of chloroplast from Spinach Leaves.
25. Estimation of chlorophyll – a and - b from isolated chloroplast.
26. Separation of green plant pigment by columns chromatography.
27. Demonstration of presence of pectin in guava by jell formation.
28. Determination of Lignin (Klason's method).

M.Sc. Biochemistry
Second Year (Semester – IV)
Lab course IV
(BCH -28)
CREDIT 04
Project

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