

**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 2014-15)

SYLLABUS FOR M.Sc. PART- I EXAMINATION

M.Sc. BIOCHEMISTRY

(SEMESTER PATTERN)

JUNE- 2014

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.

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

M.Sc. Part – I First Semester

Paper No.	Title of the Theory Papers	Credit	No. Periods
BCH-01	Enzymology	4	60
BCH-02	Microbial Biochemistry	4	60
BCH-03	Bioenergetics and Metabolism	4	60
BCH-04	Immunology	4	60
BCH-05 (Seminar)	(25 marks)	Credit : 1	
Title of the Practical Papers			
BCH-06	Lab course Enzymology and Microbial Biochemistry	4	60
BCH-07	Lab course Bioenergetics and Metabolism and Immunology	4	60

M.Sc. Part – I Second Semester

Paper No.	Title of the Theory Papers	Credit	No. Periods
BCH-08	Principal of Mol. Biology	4	60
BCH-09	Biostatistics	4	60
BCH-10	Bioinformatic and Computational Technique	4	60
BCH-11	Biophysical Technique	4	60
BCH-12 (Seminar)	(25 marks)	Credit : 1	
Title of the Practical Papers			
BCH-13	Lab course Mol.Biology and Biophysical	4	60
BCH-14	Lab course Bioinformatic and Biostatistic	4	60

CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Post Graduate (PG) Programs under Faculty of Science

(Affiliated Colleges)

(w.e.f. Academic Year 2014-15)

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 I	Paper-I (BCH-01)	(75 marks)(25marks)	(2 Test: 15 marks + Assignments:10 marks)	Credits: 4 (100 marks)
	Paper-II (BCH-02)	(75 marks)(25marks)	(2 Test: 15 marks + Assignments:10 marks)	Credits: 4 (100 marks)
	Paper-III (BCH-03)	(75 marks)(25marks)	(2 Test: 15 marks + Assignments:10 marks)	Credits: 4 (100 marks)
	Paper-IV(BCH-04)	(75 marks)(25marks)	(2 Test: 15 marks + Assignments:10 marks)	Credits: 4 (100 marks)
	Paper-V (BCH-05) (Seminar)	(25 marks)	Credits: 1 (25 marks)	Credits: 1
Semester I Credits: 17				Credits: 17
Sem II	Paper-I (BCH-08)	(75 marks)(25marks)	(2 Test: 15 marks + Assignments:10 marks)	Credits: 4 (100 marks)
	Paper-II (BCH-09)	(75 marks)(25marks)	(2 Test: 15 marks + Assignments:10 marks)	Credits: 4 (100 marks)
	Paper-III (BCH-10)	(75 marks)(25marks)	(2 Test: 15 marks + Assignments:10 marks)	Credits: 4 (100 marks)
	Paper-IV(BCH-11)	(75 marks)(25marks)	(2 Test: 15 marks + Assignments:10 marks)	Credits: 4 (100 marks)
	Paper-V (BCH-12) (Seminar)	(25 marks)	Credits: 1 (25 marks)	Credits: 1
Semester II Credits: 17				Credits: 17
Lab Course Work(Annual Practical)	LC- I (BCH-06)	(75 marks)	(25 marks)	Credits: 4 (100 marks)
	LC-II (BCH-07)	(75 marks)	(25 marks)	Credits: 4 (100 marks)
	LC-III (BCH-13)	(75 marks)	(25 marks)	Credits: 4 (100 marks)
	LC-IV (BCH-14)	(75 marks)	(25 marks)	Credits: 4 (100 marks)
	Total for Lab Course work (Annual)			
Total For M.Sc. I Year: Sem. I + Sem. II + Lab Course work (Annual) Credit: 50				Credit: 50

**SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY,
NANDED**

Paper setting Pattern

M.Sc. Biochemistry Part I (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
First Year (Semester – I)
Enzymology
(BCH -01)

CREDIT 04

Periods: 60

Chapter	Contents & Name of the Topic	Hours
1	Historical aspect : Remarkable properties cofactors Nomenclature and classification, isoenzymes, multienzyme. Extraction, purification, criteria's purity.	10 hrs
2	Enzymes kinetics : One substrate reactions, effect of pH, temperature and inhibitions. Two substrate reactions. Mechanism of enzymes action : Acid-base catalysis, proximity and orientation effects, covalent catalysis, strain or distortion and change in environment. Experimental approaches of determination of enzymes mechanism : Kinetics studies, detection of intermediates. X-ray crystallographic studies. Examples of chymotrypsin, triose phosphate isomerases, aldolase etc.	10 hrs
3	Control of enzyme activity : control of activities of single enzyme : inhibitor molecules, availability of substrate or cofactor. Product inhibition. Control by changes in covalent structure of enzymes : a) Reversible Change b) Irreversible change	10 hrs
4	Zymogen activation and phosphorylation dephosphorylation ligand induced changes : Allosteric enzymes. Significance of allosteric and cooperative behavior in enzymes.	10 hrs
5	Multienzyme complex : Properties, pyruvate dehydrogenase system. (E. coli and mammalian), multienzyme complex from E.coli, fatty acid synthetase.	10 hrs

6	Enzymes as industrial catalysts Methods for enzyme immobilization, supports and their selection Properties of immobilized enzymes, methods and applications, industrial stabilization of enzymes Industrial applications of immobilized enzymes	10 hrs
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Reference Book

1. Fundamental of enzymology by Price and Stevens
2. Enzymology by Dixon and Webb.
3. Enzyme by Palmer.

M.Sc. Biochemistry
First Year (Semester – I)
Microbial Biochemistry
(BCH -02)

CREDIT 04

Periods: 60

Chapter	Contents & Name of the Topic	Hours
1	General character and Classification of microorganism bacteria, fungi, and viruses. Structure of Prokaryotic and eukaryotic cells. Viruses structure, viral replication and cultivation. Staining of bacteria, gram staining and spore staining.	10 hrs
2	Cultivation and growth of bacteria nutritional types of bacteria, bacteriological media, physical condition required for growth, bacterial growth curve and measurement of growth and control of growth, sterilization and disinfection	15 hrs
3	Microbes as component of the environment- nutrient cycle, carbon, nitrogen sulphur and phosphorus cycles. Degradation of industrial waste, petroleum hydrocarbon, pesticide, befouling and corrosion. Bacterial photosynthesis, symbiotic and non symbiotic nitrogen fixation	15 hrs
4	Microbiology of fermented food – dairy products, meat, and fish. Alcoholic beverages-beer, wine. Food spoilage and preservation process. Microbes as source of food. Application of microbes in industries production of antibiotic, amino acid ,organic acid. Bioconversion process, Microbial insecticides.	10 hrs
5	Antimicrobial agents- Structure of antibiotics antibacterial and antiviral (Function and Mechanism of action	10 hrs

Reference Book

4. Food Microbiology by W.C Frazier
5. Industrial Microbiology by Prescott.
6. Microbiology by Noel R. Krieg.

M.Sc. Biochemistry
First Year (Semester – I)
Bioenergetics and Metabolism
(BCH -03)

CREDIT 04

Periods: 60

Chapter	Contents & Name of the Topic	Hours
1	Use of mutants and isotope in the study of metabolism. Compartmentation, food chain and energy flow. Cell bioenergetics: First and second law of thermodynamic, internal energy, enthalpy, entropy, concept of free energy, Standard free change of chemical rection, redox potential ATP and high energy phosphate compounds	10 hrs
2	Glycolysis: Anaerobic pathway of glucose metabolism, two phases of glycolysis. Detailed study of the all reaction. Entry of other carbohydrates in Glycolytic path way, energy balance sheet regulation of glycolytic sequence by enzymes and hormone alcoholic fermentation	10 hrs
3	Citric acid cycle: Aerobic pathway og glucose metabolism, historical background, detail of the cycle .use of isotope for the study of citric acid cycle, interconversion of hexoses, Pasteur effect	10 hrs
4	Lipid Metabolism: Fatty acid metabolism, Beta oxidation of saturated and unsaturated fatty acid, the phase of fatty acid oxidation, energetic of beta oxidation. Oxidation of Fatty acid with odd number of carbon atoms formation of ketone bodies. Integration of carbohydrate and lipid metabolism. Biosynthesis of Lipid : requirement of carbon dioxide and citrate biosynthesis, fatty acid syntheses' complex, Regulation of biosynthesis	15 hrs
5	Electron transport chain and oxidative phosphorylation	5 hrs

6	Glycogen Metabolism: Biosynthesis and degradation of glycogen and its regulation. Starch and cellulose biosynthesis. Gluconeogenesis	05 hrs
7	Nitrogen Metabolism: Oxidative degradation of amino acid. Trans amination, Oxidative deamination, decarboxylation urea cycle Ammonia excretion Purine pyrimidine degradation. Biosynthesis of Purine and Pyrimidine Nucleotides	05

Reference Book

7. Biochemistry by Lehninger
8. Metabolic pathway by Greenberg.
9. Biochemistry by Zubay
10. Biochemistry by Stryer.

M.Sc. Biochemistry
First Year (Semester – I)
Immunology
(BCH -04)

CREDIT 04

Periods: 60

Chapter	Contents & Name of the Topic	Hours
1	Historical development and milestones in immunology. Definition-antigenicity, immunogenicity, primary and secondary lymphoid organ, self and non self discrimination, innate and acquired immunity.	6 hrs
2	Cellular basis of immunity immunological memory, specificity, diversity, discrimination between self and nonself, primary and secondary lymphoid organ, Cell mediated and humoral immunoresponse. T and B lymphocytes .autoimmunorection	10 hrs
3	Antigen and antibody: antigen , antigenic, determinant, immunopotency, structure of antibody, constant and variable region, Fab, F (ab2) and Fc fragment, different classes of antibodies and their function, fine structure of antibodies X ray diffraction Studies, isotype allotypes and idiotypes.	10 hrs
4	Measurement of antigen- antibody interaction, diffusion, immunodiffusion, immunoelectrophoresis, radioimmunoassay, immunoflorescence. ELISA, Western blotting	10 hrs
5	Clonal selection theory of antibody production, monoclonal and polconal antibodies, poly reactive antibodies, Catalytic antibodies, abzymes. Complement system : Classical and alternative pathway	10 hrs
6	T lymphocytes and cell mediated immunity, T cell sub populations, immune response gene, MHC gene complex, polymorphism. Transplantation: Autograft, isograft, allograft and xenograft. Graft rejection vs host rection, Hypersensitivity immunodeficiency diseases vaccine, interferon disorder of immunity blood antigen blood goup substances and Rh factor	10 hrs

Reference Book

11. Immunology by Kuby
12. Essental Immunology by Roit

M.Sc. Biochemistry
First Year (Semester – I)
Lab course I
(BCH -06)
CREDIT 04
Lab course Enzymology and Microbial Biochemistry

1. Detection of enzyme amylase/ invertase/ urease.
2. To measure amylase activity and specific activity from the given sample.
3. To measure invertase activity and specific activity from the given sample.
4. To measure urease activity and specific activity from the given sample.
5. To determine the effect of temperature on amylase enzyme activity.
6. To determine the effect of time on amylase enzyme activity.
7. To determine the effect of PH on amylase enzyme activity.
8. To determine the effect of substrate concentration on amylase enzyme activity.
9. To determine the effect of enzyme concentration on amylase enzyme activity.
10. To study the effect of Immobilization of enzyme activity
11. To study the effect of Inhibitor on enzyme activity
12. To study the effect of activator (metal ion) on enzyme activity
13. Purification and isolation of enzyme (β amylase from Sweet potato)
14. Sampling, observation and staining of microorganism
15. Replica plate technique

M.Sc. Biochemistry
First Year (Semester – I)
Lab course II
(BCH -07)
CREDIT 04

Lab course Bioenergetics and Metabolism and Immunology

1. Demonstration of Ag and Ab interaction by Ouchterlony test.
2. Demonstration of Agglutinations reaction.
3. Demonstration of immunofluorescence technique.
4. Purification of Bovine serum immunoglobulin G fraction by ammonium sulphate precipitation.
5. Antibody capture assay.
6. Estimation of reducing sugar by DNS method..
7. Estimation of carbohydrate by phenol sulphuric acid method.
8. Blood grouping and Rh typing.
9. Rf factor determination test or RA test.
10. Widal Test
11. PRP Test
12. ASO Test
13. CRP Test
14. HBS
15. Estimation of Protein by folin lowary method.

M.Sc. Biochemistry
First Year (Semester – II)
Principal of Molecular Biology
(BCH -08)

CREDIT 04

Periods: 60

Chapter	Contents & Name of the Topic	Hours
1	DNA Replication: DNA Polymerase I, II, III. Origin of locus, Okazaki fragment, replication fork. DNA repair : Substitution, deletion and insertion mutation pyrimidine dimer, uracil DNA glycosidase	10 hrs
2	Gene rearrangements recombination, Holiday structures, rec A, B, C, D. SOS response. Mobile genetic element.	10 hrs
3	Transcription and recombination: polymerase, promoter, sigma and Rho factor, initiation, elongation, and termination of Transcription. Post transcriptional modification of tRNA and r RNA, Inhibitors of transcription , RNA pol I II III, enhancer 5' capping, 3' poly A tailing, splice site Mechanism of splicing. ribozymes	10 hrs
4	Protein Synthesis, Protein targeting, Intracellular protein targeting. Signal hypothesis, signal sequences, glycosylation, Targetting of protein to mitochondria, lysosomes, ER, Plasma Membrane, perxiosomes, chloroplast. Destruction of protein	10 hrs
5	Potein folding and protein motif. Gene expression	10 hrs
6	Eukaryotic chromosomes and gene expression	10 hrs

Reference Book

13. Biochemistry by Stryer
14. Gene by Benjamin.
15. Cell by Albert.

M.Sc. Biochemistry
First Year (Semester – II)
Biostatistics
(BCH -09)

CREDIT 04

Periods: 60

Chapter	Contents & Name of the Topic	Hours
1	Introduction to biostastics as common term and notation, application. Method of sampling: representative sample, sample size, samplings bias and sampling technique	10 hrs
2	Data collection and Presentation: Types of data, method of collection of primary and Secondary data. Method of data presentation graphical presentation by histogram, polygon pie diagram	10 hrs
3	Central Tendancy: Measures of central tendancy, mean. Mode, and median. Measures of variability, Standard deviation, Standard error, Range mean deviation, coefficient of variation.	10 hrs
4	Correlation and Regression: Positve or negative correlation, calculation of correlation coefficient and regression coefficient. Regression, linear regression and regression equation. ANOVA one and two way classification	10 hrs
5	Test of significance: F test, Z test, T test and chi-square test, probability. Distribution- Binomial,poisson and normal distribution, computer based stastical technique, frequency table of single discreate variable, bubble short computation variance and std. deviation, t-test, correlation coeffericent	10 hrs
6	Report Writing: introduction,review of literature, material and method results discussion summary and conclusion	10 hrs

Reference Book

1. Biostatics by nee
2. Biostatics by Mathur.

M.Sc. Biochemistry
First Year (Semester – II)
Bioinformatics and Computational Technique
(BCH -10)

CREDIT 04

Periods: 60

Chapter	Contents & Name of the Topic	Hours
1	Introduction to hardware and software, binary and decimal number, constant and variables, assignment statement, flow chart and their use if and go statement, Do loops input, output and format statements. Subroutine and function sub programs. Introduction to programming in Basic/fortran/C.	10 hrs
2	Computer awareness, Basic programming	10 hrs
3	Writing a few Basic programs related to Biochemistry	10 hrs
4	Writing a few Basic programs to plot graphs of enzyme kinetics data by variety of linear transform and the Michalies menton hyperbolic plots	10 hrs
5	Write a basic program to calculate the PH of a dilute salt solute, write a basic program for the analysis of amino acid sequences	10 hrs
6	Use of packaged statistical computer program for the statistical analysis. Use of computer program to analyze DNA sequences to find complementary sequences, search repeat, restriction sites coding sequences codon usage	10 hrs

Reference Book

1. Computer and common sense by Hunt
2. Computer programming by Rajaraman.
3. Microcomputer in biochemical education.

M.Sc. Biochemistry
First Year (Semester – II)
Biophysical Technique
(BCH -11)

CREDIT 04

Periods: 60

Chapter	Contents & Name of the Topic	Hours
1	UV and visible Spectrophotometers , IR and NMR Spectrophotometers Principal and application	10 hrs
2	Membrane filtration and dialysis: Nitrocellulose, fiber glass, poly carbonate filter Dialysis and concentration reverse dialysis freeze drying, lyophilization.	10 hrs
3	Chromatography: partition and adsorption chromatography- Paper, TLC, GLC, GCMS. Gel filtration – theory material ,advantage mol.wt.determination and other application. Ion exchange chromatography- properties of ion exchanger, choice of technique and application. Amino acid analyzer. HPLC, HPTLC affinity chromatography	10 hrs
4	Electrophoresis: Theory, types moving boundary electrophoresis, Zone electrophoresis, paper, cellulose acetate, gel electrophoresis. Native PAGE, disc PAGE, Gradient PAGE, SDS PAGE. Agarose gel electrophoresis, Southern, northern and western transfer. Isoelctrofocussing	10 hrs
5	Interaction of radiation with matter, passage of neutron through matter. Interaction of gamma rays with matter, units of measuring radiation absorption, radiolysis of water, free radical	10 hrs
6	Autoradiography	10 hrs

Reference Book

1. Physical Biochemistry by freifelder
2. Biophysical Tech by Nath.

M.Sc. Biochemistry
First Year (Semester – II)
Lab course III
(BCH -13)
CREDIT 04
Lab course Mol. Biology and Biophysical

1. Isolation of DNA from E.coil.
2. Isolation of DNA from Yeast.
3. Isolation of plasmid.
4. Isolation of mitochondrial DNA.
5. Estimation of DNA.
6. Isolation of RNA.
7. Estimation of RNA.
8. Separations of DNA fragment by Agarose gel electrophoresis.
9. Demonstration of Beer'law.
10. Determination of pka of amino acid
11. Separation of amino acid by thin layer chromatography
12. Separation and identification of sugar by thin layer chromatogaphy
13. Separation of amino acid by Paper chromatography
14. Polyacrylamide gel electrophoresis to obtain different frgment serum potein
15. Separation of serum protein by ion exchange chromatography.

M.Sc. Biochemistry
First Year (Semester – II)
Lab course IV
(BCH -14)
CREDIT 04

Lab course Bioinformatics and Biostatistics

1. Retrieval Sequence from NCBI.
2. Retrieval Sequence from RCSB.
3. Retrieval of protein sequence information from uniprot, Swiss port.
4. Sequence analysis of DNA.
5. Estimation of DNA.
6. Similarity search tool.
7. Protein structure prediction.
8. Splice predictor.
9. BLAST.
10. FLAST
11. Measure the central tendency mean, mode and median
12. Standard deviation
13. Standard deviation
14. Standard error
15. One way analysis.