

CIRCULAR :-

A reference is invited to the Ordinances, Regulations and syllabi relating to the Master of Science (M.Sc.)(Parts-I & II) degree course vide Pamphlet No.175 and to this office Circular No.UG/379 of 2002 dated 6th September, 2002 and the Directors /Heads of the recognized Science Institutions concerned and the Principals of the affiliated colleges in Science are hereby informed that the recommendation made by the Joint meeting of the Board of Studies in Bio-Chemistry and syllabus Advisory Committee for the M.Sc. (By Paper and By Research) degree course in Bio-Chemistry at its meeting held on 3rd February, 2007 has been accepted by the Academic Council at its meeting held on 9th February, 2007 vide item No.4.36 and that in accordance therewith the syllabus in the subject of Bio-Chemistry at the M.Sc. (By Research) degree is revised as per Appendix and that the same has been brought into force with effect from the academic year 2007-2008.

MUMBAI-400 032
7th April, 2007

for I/c REGISTRAR

To,
The Directors /Heads of the recognized Science Institutions concerned and the Principals of the affiliated colleges in Science

A.C/4.36/09.02.2007

No.UG/ 137-A of 2007 MUMBAI-400 032, 7th April, 2007

Copy forwarded with compliments to

- 1) The Dean, Faculty of Science
- 2) The Chairperson, Board of Studies in Bio-chemistry,

for I/c REGISTRAR

Copy to :-

The Director, Board of College and University Development, the Deputy Registrar (Eligibility and Migration Section), the Director of Students Welfare, the Personal Assistants to the Vice-Chancellor, the Pro-Vice-Chancellor, the Registrar and the Assistant Registrar, Administrative sub-center, Ratnagiri for information.

The Officer on Special Duty and Controller of Examinations (10 copies), the Finance and Accounts Officer (2 copies), Record Section (5 copies), Publications Section (5 copies), the Deputy Registrar, Enrolment, Eligibility and Migration Section (3 copies), the Deputy Registrar, Statistical Unit (2 copies), the Deputy Registrar (Accounts Section), Vidyanagari (2 copies), the Deputy Registrar, Affiliation Section (2 copies), the Director, Institute of Distance Education, (10 copies) the Director University Computer Center (IDS Building), Vidyanagari, (2 copies) the Deputy Registrar (Special Cell), the Deputy Registrar, (PRO) . the Assistant Registrar, Academic Authorities Unit (2 copies) and the Assistant Registrar, Executive Authorities Unit (2 copies) . They are requested to treat this as action taken report on the concerned resolution adopted by the Academic Council referred to in the above Circular and that no separate Action Taken Report will be sent in this connection. the Assistant Registrar, Constituent Colleges Unit (2 copies), BUCT (1 copy), the Deputy Account, Unit V (1 copy), the In-charge Director, Centralize Computing Facility (1 copy), the Receptionist (1 copy), the Telephone Operator (1 copy), the Secretary MUASA (1 copy), the Superintendent, Post-Graduate Section (2 copies), the Superintendent, Thesis Section (2 copies)

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9/12/07

UNIVERSITY OF MUMBAI



Revised syllabus of M.Sc. Degree

(BY RESEARCH)

in the subject of

BIOCHEMISTRY

(With effect from the academic year 2007-2008)

Revised syllabus for M.Sc Research in Biochemistry
Paper I Section I

Unit no	Topic No	Topic	Marks
IA	1.0	<u>Cell: 1</u>	5
	1.1	Structural and functional organization of a cell and its sub-cellular components.	
	1.2	Comparison of prokaryotic and eukaryotic cell.	
	1.3	Composition and structure of different types of biomembranes & their specialized function.	
	1.4	Various types of transport mechanisms.	
IB	2.0	<u>Cell: 2</u>	5
	2.1	Signal transduction, Receptors	
	2.2	Cell cycle in brief, apoptosis.	
	2.3	Cell-cell interaction.	
IIA	3.0	<u>Chemistry of Carbohydrates and Lipids:</u>	5
	3.1	<u>Chemistry of Carbohydrates</u>	
	3.1.1	Classification and biochemical importance,	
	3.1.2	Chemistry and functions of Monosaccharides, Disaccharides and polysaccharides including Glycosaminoglycans ((Mucopolysaccharides)	
	3.2	<u>Chemistry of Lipids:</u>	
	3.2.1	Classification of lipids. Biochemical importance of Triacylglycerols, phospholipids.	
	3.2.2	Classification and functions of fatty acids.	
	3.2.3	Lipoproteins- Classification and functions.	
	3.2.4	Steroids with special reference to cholesterol.	
	3.2.5	Prostaglandins, Thromboxanes and leukotrienes.	

Unit no	Topic No	Topic	Marks
IIB	4.0	<u>Chemistry of Proteins and Protein separation:</u>	5
	4.1	<u>Chemistry of Proteins</u>	
	4.1.1	General nature of amino acids various ways of classification of amino acids.	
	4.1.2	Biologically important peptides. Classification, properties and biochemical importance of proteins.	
	4.1.3	Structural organization of proteins. Plasma proteins and their functions.	
	4.2	<u>Protein separation</u> using salt precipitation, solvent precipitation, desalting of proteins by dialysis, desalting by gel filtration, acid and alkaline hydrolysis of proteins.	
IIIA	5.0	<u>Enzymes I and II:</u>	5
	5.1	<u>Enzymes I</u>	
	5.1.1	Classification, general properties	
	5.1.2	Enzyme-specificity and Enzyme inhibition	
	5.1.3	Factors affecting rate of enzyme-catalyzed reaction.	
	5.1.4	Enzyme kinetics- 1 st order reaction, Michaelis Menten equation, Line Weaver Burke plot.	
IIIB	5.2	<u>Enzyme II</u>	5
	5.2.1	Allosteric Enzymes. Isoenzymes.	
	5.2.2	Diagnostic and therapeutic applications of enzymes	
IVA	6.0	<u>Vitamins</u>	5
	6.1	Fat-soluble Vitamins: Sources, recommended daily allowance, functions and deficiency manifestations	
	6.2	Water soluble Vitamins: Sources, recommended daily allowance, functions and deficiency manifestations	
IVB	7.0	<u>Hormones</u> . General characteristics and Mechanism of action Second messengers— C-AMP, calcium, phosphatidyl inositol	5
	8.0	<u>Minerals and Trace elements</u> : Sources functions and deficiency manifestations (in brief) Calcium, phosphorus, sodium, potassium, chlorides, magnesium, sulphur, copper, iodine, iron, manganese.	

Unit No	Topic No	Topic	Marks
9.0 9.1 9.2	9.0	Bioenergetics: Enthalpy, entropy free energy, standard free energy, laws of thermodynamics as applied to biochemical systems, Role of high energy phosphates in bioenergetics and energy capture. Electron transport chain – constituents and their redox potentials; Inhibitors and uncouplers mechanism of oxidative phosphorylation	5
	9.1		
	9.2		
10.0 10.1 10.2	10.0	Biophysics:- Structure and properties of water, pH, buffers, Acids Bases, strength of acids and bases. . Colligative properties and their physiological application:- Adsorption, Viscosity, Surface Tension.	5
	10.1		
	10.2		

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Revised syllabus for M.Sc. by Research in Biochemistry
Paper- I Section: II

Unit No	Topic No	Topic	Marks
IA	1.0	Nucleic Acids	5
	1.1	DNA	
	1.1.1	Composition and structure of Nucleotide	
	1.1.2	DNA structure and properties	
	1.1.3	DNA organization, Eukaryotic chromosomes. DNA	
	1.1.4	supercoiling and topoisomerases	
	1.1.5	Replication and DNA polymerases	
IB	1.2.	RNA-	5
	1.2.1	Structure and properties	
	1.2.2	Process of Transcription	
	1.2.3	RNA polymerases— types and functions	
	1.2.4	RNA Processing: tRNA, mRNA and rRNA in prokaryotes and eukaryotes	
	1.2.5	Regulation of transcription— lac operon	
IIA	2.0	Translation	5
	2.1	Process of Translation	
	2.2	Genetic code, codons, degeneracy, wobble base, codon usage and Shine Dalgarno sequences.	
IIB	3.0	Genomic Recombination (genomic rearrangement)	5
	3.1.	Homologous,	
	3.2.	Site specific,	
	3.3.	Transposition,	
	3.4	Transformation,	
	3.5	Transduction,	
	3.6	Conjugation	
IIIA	4.0	Techniques in molecular biology	5
	4.1	Restriction Endonucleases, Vectors, cloning techniques, Plasmids, genomic library and cDNA library	
	4.2	DNA Sequencing—Sanger's method, Maxim-Gilbert method	
	4.3	Oligonucleotide sequencing	
	4.4	PCR	

III	5.0	Techniques in Molecular Biology:	5
	5.1	RFLP	
	5.2	Southern hybridization	
	5.3	Northern hybridization	
	5.4	Western hybridization	
	5.5	Colony hybridization	
IVA	5.6	Native PAGE, SDS-PAGE, 2- dimensional PAGE, Protein sequencing	5
	6.0	Industrial Biochemistry	
	6.1	Techniques in cell and tissue culture:- Principle, techniques and applications of Cell and tissue culture Cell and tissue disintegration, cell fractionation.	
IVB	6.2	Fermentation Technology: Principle, design and types of fermenters, bioreactors, sterilization.	5
	7.0	Diagnostic kits: Manufacturing principles of different diagnostic kits used in clinical biochemistry	
IVB	8.0	Environmental Biochemistry:	5
	8.1	Introduction- environmental segments	
	8.2	Atmosphere composition : air pollution –natural and man made	
	8.3	Hydrosphere:- hydrological cycle; water for human and industrial use , water pollution. Waste-water treatment including the concept of dissolved oxygen. COD and BOD.	
VA	9.0	Chromatography:-	5
	9.1	General principle of chromatography,	
	9.2	Principle , methodology and applications of:	
	9.2.1	Ion exchange chromatography,	
	9.2.2	Molecular sieve chromatography	
	9.2.3	Affinity chromatography,	
	9.2.4	Paper chromatography	
	9.2.5	TLC,	
	9.2.6	GLC,	
	9.2.7	HPLC,	
	9.2.8	HPTLC	
VB	10.0	Electrophoresis :	5
	10.1	Principles of separation of biomolecules under electric field,	
	10.2	Principle methodology and applications of	
	10.2.1	Paper and agar gel electrophoresis ,	
	10.2.2	Native PAGE,	
	10.2.3	SDS- PAGE,	

10.2.4
10.2.5

Two dimensional gel electrophoresis.

Isoelectric focusing

Revised syllabus for M Sc Research in Biochemistry
Paper II Section I

Unit no	Topic no	Topics	Marks
I A	1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7	Metabolism of carbohydrates : Metabolism of glycogen and its control, Glycolysis Gluconeogenesis, TCA cycle, Rapoport Leubering cycle, Hexose monophosphate shunt, Blood glucose level and its regulation.	5
I B	2.0 2.1 2.2 2.3 2.4	Plant Biochemistry, Ultra structure of chloroplast , Cyclic and noncyclic photophosphorylation , Z- Scheme , C 3 , C4 cycles Nitrogen metabolism –Conversion of inorganic nitrogen to organic nitrogen.	5
II A	3.0 3.1 3.2 3.3 3.4 3.5 3.6 3.7	<u>Metabolism of Lipids: -</u> Beta oxidation of saturated even and odd chain fatty acids, De novo synthesis of even carbon fatty acids, Ketogenesis and ketosis, . Metabolism of phosphoglycerides Biosynthesis, catabolism & transport of cholesterol, Metabolism of white adipose tissue, Metabolism of lipoproteins	5
II B	4.0 4.1 4.2 4.3	<u>Metabolism of Proteins: -</u> General reactions of amino acids transamination, oxidative & non-oxidative deamination decarboxylation, transmethylation Glucose-alanine cycle, Metabolism of individual amino acids :- Glycine, sulfur containing amino acids, aromatic amino acids, Branched chain amino acids.	5
III A	5.0 5.1 5.2	<u>Nucleoprotein Metabolism</u> Metabolism of purines and its regulation , Metabolism of pyrimidines and its regulation	5
III B	6.0 6.1 6.2 6.3 6.4 6.5 6.6	<u>Nutrition:</u> Proximate Principles of food, Balanced diet, B.V., PER of dietary proteins Anthropometry in brief Nitrogen balance, Protein Energy malnutrition, Kwashiorkor and Marasmas, malabsorption syndrome.	5

IV A	7.0	<u>Clinical Biochemistry:</u>	5
	7.1	Acid base balance	
	7.2	Metabolic & Respiratory acidosis and alkalosis and their compensation,	
	7.3	Structure and functions of hemoglobin Hemoglobinopathies in brief -	
	7.4	Liver function tests	
	7.5	Renal function tests,	
IV B	8.0	<u>Biochemistry of tissues:-</u>	5
	8.1	Biochemistry of muscle contraction and relaxation,	
	8.2	Nerve impulse propagation,	
	8.3	Bone formation	
V A	9.0	<u>Immunology:-</u>	5
	9.1	Cellular and humoral immunity T and B cells.	
	9.2	Antigen and antigenic determinants, haptens, valence and affinities.	
	9.3	The Immunoglobulins: Structure of immunoglobulins, different classes	
	9.4	of immunoglobulins,	
	9.5	Idiotypes, isotype and allotypic determinants,	
V B	10.0	<u>Immunological techniques:</u>	5
	10.1	Production of antibodies against proteins and haptens.	
	10.2	Methods for determining the antibody titer in the immunized serum.	
	10.3	Antigen- antibody reaction,	
	10.4	RIA, ELISA, Immunoblotting and immuno- fluorescence microscopy	

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Revised syllabus for M Sc Research in Biochemistry
Paper II Section II

Unit no	Topic no	Topics	Marks
I A	1.0 1.1 1.2 1.3	Spectroscopic studies: Principles, methodology and applications of UV, IR, Fluorescence,	5
I A	2.0 2.1 2.2 2.3	Centrifugation: Forces applied during centrifugation, Hydrodynamic methods for the determination of size and shape of macromolecules, Principles methodology and applications of: differential centrifugation, ultra centrifugation, density gradient centrifugation	
I B	3.0 3.1 3.2 3.3 3.4 3.5	Radio isotopic techniques: Electromagnetic radiations and its interaction with matter, The different radioisotopes used in biological research. Measurement of radiation using ionizing counters, photochemical and scintillation methods. Handlings of radioisotopes and safety measures.	5
I B	4.0 4.1 4.2 4.3	Microscopy and diffraction techniques: Principle and methodology of light microscopy and electron microscopy Application of microscopy in biology. X-rays in crystallography	5
II A	5.0 5.1 5.2 5.3 5.4 5.5	What Is Research? Meaning of research, Types and significance of research, Research and scientific methods, Criteria for good research, Selecting and defining a research problems.	5
II A	6.0 6.1	Research Design: Meaning, features of good design, different research designs, basic principles of experimental designs	5

II B-	7.0	Methods of Data collection	5
	7.1	Meaning	
	7.2	Features of good design	
	7.3	Different research designs	
	7.4	Basic principles of experimental designs	
II B	8.0	Report writing and Presentation	
	8.1	Significance of report writing	
	8.2	Different steps in report writing	
	8.3	Layout of research paper	
	8.4	Types of reports	
	8.5	Mechanics and precautions of writing research reports for Scientific journals Popular magazines Seminars Symposia Conference and poster session	
III A	9.0	Introduction to statistical principle	5
	9.1	Need of statistical calculation, the key concept	
	9.2	Sampling techniques, Confidence interval null hypothesis,	
	9.3	P-value one vs two tailed p values	
	9.4	Hypothesis testing and statistical significance Type I and Type II errors The Gaussian distribution	
III A	10.0	Descriptive statistics	
	10.1	Mean	
	10.2	Median	
	10.3	Mode	
	10.4	Standard deviation	
	10.5	Standard error	
III B	11.0	One sample test	5
	11.1	Introduction to t test	
	11.2	Introduction to one sample tests, choosing the one sample t test	
	11.3	Comparing two groups (t test)	
	11.4	Choosing a test to compare two columns	
	11.5	Unpaired t test, paired t test	
	11.6	Comparing three or more groups (one way ANOVA): Introduction of ANOVA one	

IV A	12.0 12.1 12.2 12.3 12.4 12.5	Linear regression and correlation Introduction to linear regression and correlation, Choosing linear regression or correlation. Results of correlation, Results of linear regression Analysis choices for multiple regression and correlation	5
IV B	13.0 13.1 13.2 13.3 13.4	Chi- Square test: Test of goodness of fit, Calculation of chi-Square, Restrictions in application of chi-square. Yates's correction	
VA	14.0 14.1 14.2 14.3 14.4 14.5 14.6	Bioinformatics Unit Representation of sequences and structures. Use of computers in scientific research, survey of scientific web-sites for surfing and collecting relevant information. Computer- aided molecular designing Prediction of structure-function relationships, Computer, software programs for analyzing macromolecular sequences, The Protein Data Ban (PDB), Genomic Data Bank (G DB i.e. DNA libraries), Information retrieval from biological data base	5
VB	15.0	Details of Sequence analysis, Sequence alignment, multiple sequence alignment, Phylogenetic analysis	

Guidelines to frame the Syllabus of M. Sc. degree (By Research)
in Biochemistry.

- 1) There shall be 2 Theory Papers of 100 marks each for 3 hours duration.
2. Each Paper shall contain 2 Section of 50 marks each.
3. Each Section shall comprise 5 Units of 10 marks each.
4. Each Unit shall consist of 2 Topics A and B of 5 marks each.

Paper I or Paper II:

Section - I (50 Marks) 20 topics

		Lectures	Marks
Unit 1.	Topic A	5	5
10	Topic B	5	5
Unit 2.	Topic A	5	5
	Topic B	5	5
Unit 3	Topic A	5	5
	Topic B	5	5
Unit 4	Topic A	5	5
	Topic B	5	5
Unit 5	Topic A	5	5
	Topic B	5	5
	(a)	50	50

Section - II (50 Marks)

Unit 6.	Topic A	5	5
	Topic B	5	5
Unit 7.	Topic A	5	5
	Topic B	5	5
Unit 8	Topic A	5	5
	Topic B	5	5
Unit 9	Topic A	5	5
	Topic B	5	5
Unit 10	Topic A	5	5
	Topic B	5	5
	(b)	50	50
	Total (a) + (b)	100	100

Question Paper Setting

- 1) A Theory Question Paper shall contain 10 questions of 10 marks each is Q. 1 to Q. 5 based on Units 1 to 5 respectively in Section - I, and Q. 6 to Q. 10 based on Units 6 to 10 respectively in Section - II.
- 2) All questions shall be compulsory with the internal options provided as per the details given in Sr. No. 3 below :-
3. Paper I or II

Section	Q. No	Based on	Details of Sub Qs A to D for each main Q.	Marks
I.	1	Unit 1	(A) Based on Topic A for 5 marks each, (B) Candidate to attend any one	5
	2	Unit 2		
	3	Unit 3		
	4	Unit 4		
	5	Unit 5		
II	6	Unit 6	(C) Based on Topic B for 5 marks each, (D) Candidate to attend any one.	5
	7	Unit 7		
	8	Unit 8		
	9	Unit 9		
	10	Unit 10		
				10

(Note : Sub-questions A to D may be a single question of 5 marks or may be split up into 2 parts viz. (i) and (ii) of 2 marks and 3 marks respectively)

M.SC. RESEARCH SYLLABUS REFERENCES :

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- 5) Fundamentals of Cilical Chemistry; Norbert W. Tidz 3rd Edition. W. B. Savnder Company 1987. ISBN 0-7216-8862-46.
- 6) Harper's Biochemistry; Robert K. Mutray. Daryi K. Gramer Peter A. Mayes, Victor. W. Rodwell 25th edition. Appleton and lange; 2000. ISBN 0-8385-3684-07)
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- 8) Biochemistry, Fourth Edition, Lubert Stryer, W. H. Freeman and Co., New York, 1995. ISBN 0-7167-2009-4
- 9) Principles of Biochemistry by Geoffrey Zubay, William W. Parson and Dennis E. vance, William C. Brown Publishers Dubuque IA 1995 ISBN. 0-697-14275-2
- 10) Principles of Biochemistry 3rd Edition by Albert L. Lehninger, David L. Nelson and Michel M. Cox, Worth Publishers, New York 2000 ISBN : 1-57259
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- 12) Basic Medical Biochemistry, A clinical approach, by Dawn B. Marks, Allan E. Marks and Colleen M. Smith, Williams and Wilkins, Baltimore, 1996. ISBN 0-683-05595-X
- 13) Textbook of Biochemistry with Clinical Correlation 4th edition, Thomas M. Devlin Ed, Wiley-Liss, Inc. New York, 1997. ISBN 0-471-15451-2
- 14) ✓ Biochemistry by Donald Voet and Judith Voet, Wiley-Liss, Inc., New York, 1995 ISBN 0-471-58651-X
- 15) Biochemistry, 2nd edition, by Pamela C. Chamee and Richard A. Harvey. J. B. Lippincott Co. Philadelphia, PA, 1997. ISBN - 0-397-51091-8 useful as a review for the NBME and other parts of the course.
- 16) Clinical Chemistry by William J. Marshall, 3rd edition, 1995 Mosby Publishers, ISBN 072-3421900
- 17) ✓ Biochemistry by Voet and Voet by John Wiley and Sons., 1990
- 18) Bio informatics-methods and protocols, edited by Stephen Meneses and Stephen Krawtex, Humana Press, Totowa, New Jersey ISBN 0-89603-732-0.
- 19) Bioinformatics - A practical guide to analysis of Genes and Proteins by Andreas P. Baxevanis and BF Francis Guellette. (or 0-471-38891 0 for new edition)
- 20) Research methods by Ram Ahuja, Rawat Publication, Jaipur and New Delhi.