

AC 7-4-2014
Item No. – 4.18

UNIVERSITY OF MUMBAI



SYLLABUS OF BRIDGE COURSE IN BIOCHEMISTRY

**Program: leading to M. Sc. in
BIOCHEMISTRY.**

(Credit Based Semester and Grading System with
effect from the academic year 2013–2014)

PREAMBLE

The B.Sc. (UG) and M.Sc. (PG) syllabi of university of Mumbai in the subject of Biochemistry are very competitive at State, National and International levels, and include basic as well as highly advanced current topics.

Students from many other Indian Universities aspire to pursue M.Sc. degree of Mumbai University in Biochemistry on the basis of their B.Sc. degree in Biochemistry or other subjects in Biological Sciences viz. Botany, Zoology, Micro-biology, Life Sciences and Biotechnology. However, it has been noted that the syllabi in Biochemistry studied by students from other Indian Universities may not be equivalent to the course contents of UG and PG syllabi in Biochemistry of Mumbai University. Such students may feel handicapped and disadvantaged to study the advanced contents of our UG and PG courses in Biochemistry. Further, such students may not be granted eligibility by our University to enroll for M.Sc. degree in Biochemistry.

With a view to helping such students, university of Mumbai has taken a pragmatic, proactive and progressive step to recommend **“Bridge Course”** for meritorious students from other Indian Universities. These students will be given **“Provisional Eligibility”** to enroll for M.Sc. degree of Mumbai University in Biochemistry. They will study the **“Bridge Course”** to upgrade their basic training in Biochemistry, They will study the **“Bridge Course”** to upgrade their basic training in Biochemistry parallelly alongwith Sem I to SemVI for M.Sc. degree.

OBJECTIVES

- 01) To bridge the gap between the course contents of syllabi in Biochemistry of Mumbai University and other Indian Universities.
- 02) To impart minimum basic training in Biochemistry to UG students from other universities.
- 03) To bring such students on par and equivalence with our UG students.
- 04) To strengthen the base of such students in basic and fundamentals of Biochemistry.
- 05) To train such students to become competitive with our PG students.

The Number of Modules, Course Code Number, Marks assigned and Credits earned for “Bridge Course” in Biochemistry.

Module No.	Unit	Title (Module & Unit)	Marks			Credits
			TE	IE	Total	
PSBRBCH 001		Chemistry & Function of Macromolecules	60	40	100	03
	I	Carbohydrate Chemistry				
	II	Chemistry Lipids				
	III	Chemistry of Proteins & Enzymes				
	IV	Nucleic Acid Chemistry				
PSBRBCH 002		Biophysical Chemistry and Instrumentation	60	40	100	03
	L	Centrifugation Techniques				
	II	Chromatographic Techniques				
	III	Electrophoretic Techniques				
	IV	Spectroscopic Techniques				
PSBRBCH 003		Concepts in Metabolism	60	40	1000	03
	I	Carbohydrate Metabolism				
	II	Protein Metabolism				
	III	Lipid Metabolism				
	IV	Nucleic Acid Metabolism				
PSBRBCH 004		Advanced Concepts in Biochemistry	60	40	100	03
	I	Recombinant DNA Technology				
	II	Immunology				
	III	Industrial Biotechnology				
	IV	Biostatistics, Bioinformatics and Research Methodology				
TOTAL			240	160	400	12
TE = Theory Examination			IE= Internal Evaluation			

Biochemistry bridge course Syllabus
Credit based and Grading system
To be implemented from the academic year 2014-2015

Course Code PSBRBCH001

Course Code	UNIT	TOPIC HEADINGS	L / Week
PSBRBCH 001	I	<p><u>1.1Carbohydrate Chemistry</u></p> <p>1.1.1General Functions, Classifications Structure of Glucose- features and Haworth Projection</p> <p>1.1.2Stereoisomers, chemical reactions of monosaccharide, oxidation, reduction, action of alkali, strong acid, osazones formation</p> <p>Derivatives of monosaccharide – Phosphoric acid esters, amino sugars, de-oxysugars and sugar alcohols.</p> <p>1.1.3Polysaccharides- structure and functions Homopolysaccharides- starch, glucagon, cellulose, insulin, chitin Heteropolysaccharides- Glycosamineglycans</p>	15
	II	<p><u>2.1Chemistry of Lipids</u></p> <p>2.1.1Classification and general functions of lipids Fatty acids saturated and unsaturated, clinical significance of PUFA</p> <p>2.1.2Simple lipids, Triglycerides, Cholesterol Chemistry, Different forms of chgolesterol and their significance, Rancidity of fat, characterization of fat, saponification number. Iodine</p>	15

		<p>number, acid number, Polanski number, Reichertmeissi Number, Acetylene Number</p> <p>2.1.3 Compound of lipid- Classification, functions, phospholipids, lipoproteins, Glycolipids, Sulpholipids, Amphiphatic nature of lipids- importance in membrane, micelle and liposome formation.</p>	
	III	<p><u>3.1 Chemistry of protein and enzymes</u></p> <p>3.1.1 Amino Acid- Classification, isoelectric pH, pKa value, titration of glycine, peptide bond formation</p> <p>3.1.2 Protein classification, functions, structural organization, denaturation of protein, protein separation techniques, slat precipitation, chromatography and electrophoresis.</p> <p>3.1.3 Enzyme – Classification, active site, energy of activation, specificity, models of enzyme actions, lock and key and induced fit model and co-enzymes.</p> <p>Factors affecting enzyme action</p> <p>MichaelisMenten (Km) and its derivation</p> <p>Enzyme inhibition in brief</p>	15
	IV	<p><u>4.1 Nucleic acid chemistry</u></p> <p>4.1.1 Building units, nucleosides, nucleotides, structure of ATP and its significance Structure and function- RNA type, DNA as genetic material, DNA replication, DNA polymerase transcription</p> <p>4.1.2 Characteristic of Genetic Code Protein bio-synthesis and its inhibitor</p> <p>4.1.3 Mutation and repairs</p>	15

		Regulation of Gene expression using lac operon model Recombinant DNA technology and its application	
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Course Code BRCBCH002

Course Code	UNIT	<u>TOPIC HEADINGS</u>	L / Week
PSBRBCH 002	I	<u>1.1Centrifugation techniques</u> 1.1.1 Principles Preparative Centrifugation Density Gradient Centrifugation 1.1.2 Preparative Centrifugation and their uses Rotor design and selection 1.1.3 Analysis of subcellular fractions Analytical ultra-centrifugation- Principles and applications	15
	II	<u>2.1Chromatographic techniques</u> 2.1.1 General Principles of Chromatography General Technique of Chromatography 2.1.2 Adsorption Chromatography Partition Chromatography Ion Exchange Chromatography 2.1.3 Exclusion Chromatography Affinity chromatography High Pressure Liquid Chromatography	15
	III	<u>3.1 Electrophoretic techniques</u> 3.1.1 Introduction Factors affecting Rate of Migration 3.1.2 General Techniques 3.1.3 Specific Techniques-High Voltage Electrophoresis, Discontinuous electrophoresis Isotachophoresis, Isoelectric focussing	15
	IV	<u>4.1 Spectroscopic techniques</u> 4.1.1 Basic Principles Visible and ultraviolet spectrometry Spectrophotometry 4.1.2 Infrared Spectrophotometry Flame Spectrophotometry Electron spin resonance Spectrophotometry 4.1.3 Nuclear Magnetic Resonance Spectrophotometry Mass spectrophotometry	15

		Tabular Summary of Spectroscopic Techniques	
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Course Code BRCBCH003

Course Code	UNIT	<u>TOPIC HEADINGS</u>	L / Week
PSBRBCH 003	I	<p><u>1.1 Carbohydrate Metabolism</u> 1.1.1 Digestion and absorption of Carbohydrates. Synthesis and breakdown of Glycogen Glycolysis: Reaction, Regulation, Importance, Significance of Lactate Production, Special features of Glycolysis in RBCs. 1.1.2 Blood Glucose- Sources, Regulation of Blood Levels, Diabetes Mellitus. Electron Transport Chain: Organization, Chemiosmotic Hypothesis, Oxidative phosphorylation, Pentose Phosphate Pathway (HMP Shunt) 1.1.3 Oxidation of Pyruvate to Acetyl-CoA: The tricarboxylic acid Cycle Reaction, Energy Production, Regulation and Significance – Anaplerotic Reaction, The Glyoxilic Acid Pathway</p>	15
	II	<p><u>2.1 Protein Metabolism</u> 2.1.1 Nitrogen Fixation, Nitrification, Utilization of Nitrate, Digestion and Absorption of Protein 2.1.2 Deamination, transamination, decarboxylation and amino acids, Fate of ammonia and Urea Cycle. 2.1.3 Metabolism of Phenylalanine and Tyrosine and related inborn errors. Amino acids as precursor for synthesis of important biological products</p>	15
	III	<p><u>3.1 Lipid Metabolism</u> 3.1.1 Digestion and absorption of lipids. Beta oxidation of fatty acids. Oxidation of unsaturated fatty acids. 3.1.2 Biosynthesis of saturated and unsaturated fatty acids. Role of HDL and LDL. Formation of Ketone</p>	15

		bodies. 3.1.3 Biosynthesis of Cholesterol. Adipose tissue metabolism. Fatty liver and atherosclerosis	
	IV	<u>4.1 Nucleic Acid Metabolism</u> 4.1.1 Overview of Purine and pyrimidine synthesis and their degradation. Biologically important free nucleotides, Gout. 4.1.2 Vitamins A, d, E, K and Thiamine, Niacin, Pyridoxine and Vitamin C- Sources, active Forms, Metabolic Role, Daily requirements, Deficiency manifestations. 4.1.3 Mineral metabolism: Study of Calcium, Phosphorus, Iron, and Iodine.	15

Course Code BRCBCH004

Course Code	UNIT	<u>TOPIC HEADINGS</u>	L / Week
PSBRBCH 004	I	<p><u>1.1 Recombinant DNA technology</u> 1.1.1Genetic Engineering: DMA Cloning, Cloning Vectors, DNA Probes, DNA amplification (PCR), Gene Library. 1.1.2Applications of RNA Technology in medicine (insulin) and agriculture (BT Cotton)</p>	15
	II	<p><u>2.1 Immunology</u> 2.1.1Definitions, Immunity, Antigen, antibody, Hapten Types of Immunity 2.1.2 Cells and organs of immune system 2.1.3Immunoglobulins – Basic structure, Class & Sub-class – their structures and functions. 2.1.4 Antigen-antibody reactions: Precipitation and agglutination</p>	15
	III	<p><u>3.1 Industrial Biotechnology</u> 3.1.1Fermentation Process: Basic components of a typical fermenter, factors affecting fermentation 3.1.2Plant Tissue Culture (PTC) and Animal Tissue Culture (ATC), Totipotency, Callus regeneration, Protoplast fusion, applications of PTC and ATC 3.1.3Industrial production of Alcohol, Acetic Acid and antibiotic.</p>	15
	IV	<p><u>4.1 Biostatistics, Bioinformatics and Research Methodology</u> 4.1.1 Biostatistics: Analysis of Biological data by measures of Central Tendency and measures of dispersion. 4.1.2Bioinformatics: Definitions of Genomics & Proteomics, Database and Sequence Analysis tools, Applications of Bio-informatics 4.1.3 What is Research? Research Design, Research Communication (How to Write research Paper), Funding agencies for Research, How to prepare research proposal.</p>	15

Scheme for Implementation of “Bridge Course” in Biochemistry

(BRC in Biochem):-

- 01) BRC in Biochemistry will consist of 04 Modules namely BRC BCH 001/002/003/004; each carrying 100 Marks and 03 Credits.
- 02) BRC in Biochem will have a total of 400 Marks and 12 Credits
- 03) Each module of 100 Marks will contain 60 marks for Theory Paper and 40 marks for internal evaluation.
- 04) Students, enrolled for MSc-Part I in Biochemistry with “Provisional Eligibility”, shall complete Modules 001 and 002 by the end of Sem I and SemII, such students shall have to complete the relevant module(s) by the end of Sem I or Sem V.
- 05) In case of failure in any one or more of the modules in Sem I and/ or SemII, such students shall have to complete the relevant modules (s) by the end of SemIII or SemIV
- 06) If any student fails to complete any one or more moldules by the end of Sem III then student shall be permitted to appear for sem IV University examination .However, the final result of such student shall be held **“in reseved”** ,till he/she completes all 04 modules by the end of sem IV or there after
- 07) Teaching of BRC in Biochemistry will be conducted in the respective colleges through contact hours for lectures and/ or self-study by students, as per the convenience of the Biochemistry Dept. and its staff.

Scheme for Examination for BRC in Biochemistry :-

I) General Instructions:-

- 01) 04 Modules of BRC in Biochem shall carry a total of 400 Marks comprising 240 Marks in theory papers and 160 Marks in Internal Evaluation.
- 02) Examination of BRC in Biochemistry (Theory Papers and Internal Evaluation) shall be conducted by the Dept. of Biochemistry of respective colleges.
- 03) Paper-setting, evaluation and declaration of results will be entrusted entirely internally to the Dept. of Biochemistry of respective college.
- 04) The result of the Bridge Course at the end of the given semester shall be communicated to the Controller of Examinations, PG Section and Eligibility Section by the College Principal/ Head of the Institution.
- 05) The Principal/ Head of the Institution shall issue the **“Certificate of Qualifying in Bridge Course”** to the successful candidates with copies of the same forwarded to controller of examinations, PG Section and Eligibility Section.

II) Scheme for Theory Examination (TE)

- 01) Theory Examinations under each Module shall carry 60 Marks.
- 02) Duration of Theory examination shall be of 2 ½Hours.
- 03) Each Theory Paper shall consist of 05 Questions of 12 Marks each, based on respective units as follows:-

Q. No.	Unit No(s)
I	Based on Unit I
II	Based on Unit II
III	Based on Unit III
IV	Based on Unit IV
V	Based on Unit I + II + III + IV

- 04) There shall be 100% internal option in each question.
- 05) Depending on the topic included in each unit, the sub-questions may be asked in different combination of marks such as (6+6), (4+4+4), (3+3+3+3) and (2+5+5) with 100% internal option for each sub-question.
- 06) Paper – setting of all 04 theory papers under 04 modules will be done by the Head of the Dept. of Biochemistry in respective colleges with the help of his or her colleagues.
- 07) The schedule of theory examination (Time Table) and results (Marks of TE & IE) shall be communicated to the Controller of Examination- PG Section and Eligibility Section by the respective Head of the Department . / Head of the Institution.
- 08) The records and documents pertaining to the above (including copies of Theory Papers, Answer Papers, Details of IE) shall be maintained by the Dept. of Biochemistry till the student clears all 4 modules under Bridge Course.
- 09) Under any circumstances, there shall be “No RE-EVALUATION” for TE and/ or IE.

- 010) There will be no class improvement applicable to bridge course in Biochemistry for TE and /or IE

III) **Scheme For Internal Evaluation (IE)**

- 01) Internal Evaluation under each module shall carry 40 Marks.
- 02) The Internal Evaluation shall rest with the concerned PG Teacher and/ or HOD.
- 03) Internal Evaluation can be any one of the following types:-
- 01 assignment of 40 Marks (Approx 20 Pages)
 - 02 assignment of 20 Marks each (Approximately 10 pages each)
 - Presentation / participation in at least 02 seminars/ workshops/ conferences/ symposia in the given semester
 - Participation in " Industrial Visit (IV) or educational Tours (ET)" organized by the Department of Biochemistry and report of IV and ET in the given semester.

IV) **Scheme for Practical Examination**

- 01) No practical examination shall be conducted for Bridge Course in Biochemistry as there are no practices prescribed herein.

V) **Passing Standards**

- 01) For passing Bridge Course in Biochemistry the candidate must score:-
- Minimum 40% in each "Head Of Passing" i.e. 24 marks out of 60 in theory paper and 16 marks out of 40 in internal evaluation and
 - Minimum 50% aggregate in each module i.e. total of 50 marks in theory paper and internal evaluation taken together out of 100marks.
- 02) Only the "Grade" (from O to E) and CGPA will be awarded to the successful candidate as per the Credit Based Grading System.

03) If he/ she desires, the candidate may be permitted to carry forward of work scored by him or her in heads in which he / she has scored minimum passing marks and above.

VI) **Fees:** As prescribed by University of Mumbai

References:

- 1 Principles of Biochemistry by Lehninger, Albert L, Nelson David and Cox.
- 2 Biochemistry by Voet, Donald and Voet, Judith g; John Wiley and Publishers.
- 3 Biochemistry by Zubey, Geoffrey L.; Wm. C. Brown Publishers
- 4 Biochemistry by Stryer, Lubert; W H Freeman Publishers.
- 5 A Biologist's Guide to Principles and Techniques in Practical Biochemistry by William, B. L. and Wilson, K; university Press Publishers
- 6 Principles and Techniques of practical biochemistry by Wilson, Keith and walker, John; Cambridge University Press Publishers
- 7 Outlines of Biochemistry by Conn, E E and stumpf, P K; Wiley Publishers.
- 8 Genetics by Russel, Peter J.; W H Freeman Publishers.
- 9 Immunology by Kubi, Janis; w H Freeman Publishers.
- 10 Fundamentals of Biotechnology by Patel, A H.
- 11 Methods of Biostatistics for Medcial Students and Research Workers by Mahajan, B K; Jaypee Brothers Publishers
- 12 Bio-informatics- Concepts, Skill and applications by Rustogi, C s; Mendiratta, Namita and Rastogi, Parag; CBS Publishers and Distributors.