UNIVERSITY OF MUMBAI

Syllabus for the F.Y.B.Sc.
Program: B.Sc.
Course : Biochemistry

(Credit Based Semester and Grading System with effect from the academic year 2011–2012)

F.Y.B.Sc. Biochemistry Syllabus
Restructured for Credit Based and Grading System
To be implemented from the Academic year 2011-2012
Semester I

Course Code	Title	Credits
USBC101	**Biomolecules and Nutrition**	**2 Credits (45 lectures)**

Unit I — **15 Lect**

1.1 Water
1.1.1 Water:Its effect on Biomolecules Structure and properties of water (hydrogen bonding)
1.1.2 Entropy and dissolution of solute
1.1.3 Effect of non polar compounds on the structure of water
1.1.4 Weak interactions of biomolecules in aqueous solutions
1.2 *Solutions*
1.2.1 Concepts of mole, molar, molar equivalent and normal, =Dalton
1.3 *Ionization of water, weak acids and weak bases*
1.3.1 pH : pH scale , H+ and OH- concentrations
1.3.2 Weak acids and bases and their dissociation constants Ka & Kb
1.3.3 Buffers- definition, action, physiological buffers -any 2 examples
(No derivations .Only simple problems on solutions

Unit II : *Amino acids and proteins* — **15 Lect**

2.1 *Amino acids*
2.1.1 Amino acid structure- D & L forms of all 20 amino acids
2.1.2 Detailed classification based on polarity
2.1.3 Physical and chemical properties- Chemical reactions of amino acids with Ninhydrin, Sanger's reagent, Edman's reagent and Dansyl chloride
2.2 *Peptides and Proteins*
2.2.1 ASBC- APS classification on the basis of shape and function
2.2.2 Primary structure -Formation and characterization of the peptide bond
2.2.3 Secondary structure -Alpha helix and beta sheet
2.2.4 Tertiary and Quaternary structures- an introduction with one example of each
2.2.5 Protein denaturation

Unit III: Carbohydrates. — **15 Lect**

3.1 Definition, Classification, and functions of carbohydrates (mono.oligo polysaccharides)
3.2 *Monosaccharides*
3.2.1 Classification in terms of aldoses and ketoses
3.2.2 Structures of glucose, fructose, galactose, mannose, and ribose
3.2.3 Properties:
a) Physical- isomerism D & L, optical; optical ; epimers: anomers
b) Chemical reactions –
i) oxidation to produce aldonic. Aldaric and uronic acids (with respect to glucose);
ii) reducing action in boiling alkali, enedi01 formation (with respect to glucose and fructose)
iii) osazone formation(with respect to glucose and fructose) .
iv) orcinol (with respect to ribose)
3.3 *Disaccharides*
3.3.1 Occurrence and structure of maltose , lactose and sucrose
3.3.2 Formation of glycosidic bonds
3.4 *Polysaccharides*
3.4.1 Classification based on function. storage and structure
a) Composition: homo & hetero. with examples
b) Storage: starch and glycogen - action of amylase on starch
c) Structural: cellulose. chitin and Components of peptidoglycan framework
(structure of NAG & NAMA not necessary)

Course Code	Title	Credits
USBC102	**Introduction to Cell biology, Physiology and Microbiology**	**2 Credits (45 lectures)**

Unit I : Origin of Life & Formation of cells 1.1 Big bang theory, Theories on the origin of life: Abiogenesis, Heterotroph hypothesis, RNA world, Miller's expt, Formation of the first cell, endosymbiont theory 1.2 Structural organization of cells 1.2.1 Prokaryotic, Eukaryotic (plant & animal) and yeast cells-a comparative overview	**15 Lect**
Unit II : Cell wall , cell membrane and transport processes across cell membrane, cytoskeleton **2.1** Cell wall structure (plant & microbial), cell membrane (fluid mosaic model) **2.2** Transport across cell membranes: Diffusion (simple & facilitated), Active transport (primary & secondary), Endo & Exocytosis **2.3** Cytoskeleton : microtubules & microfilaments	**15 Lect**
Unit III: Cell Organelles 3.1 *Mitochondrion:* Organization & function of the mitochondria, Genetic s stem of mitochondria 3.2 *Chloroplast* : Structure and function of the chloroplast. the chloroplast genome, other plastids 3.3 *Ribosome: ER: Golgi* Structure & Function of: Ribosome, ER, Golgi apparatus *Peroxisome* & *Lysosome:* Peroxisome function & assembly (in brief) and L so some structure and function	**15 Lect**

Course Code : USBCP1 SEMESTER I

PRACTICAL - I	**Hours**
1. Qualitative tests for Carbohydrates – monosaccharides, disaccharides and polysaccharides.	03
2. Qualitative tests for Nucleic acids	02
3. Qualitative tests for Functional groups	03
4. Lipid staining	01
5. Nucleic acid staining	01
6. Isolation of starch from potato	01
7. Quantitative estimation of Calcium	02
8. Quantitative estimation of Magnesium	02

PRACTICAL II	
1. Preparation & Standardisation of laboratory reagents	04
2. Preparation of buffers	03
3. MBRT Test	03
4. Effect of hypotonic, hypertonic and isotonic solutions on RBCs.	03
5. Permanent slides of bacilli, spirilla, Cocci, Rhizopus.	04
6. Motility Test	02

DEMONSTRATION EXPERIMENTS	
1. Microscopy	01
2. pH meter	01

Semester II

Course Code	Title	Credits
USBC201	**Biomolecules and Nutrition**	**2 Credits (45 lectures)**

Unit I : Lipids — **15 Lect**

1.1 Definition, classification (Bloor's) and functions of 1ipids

1.2 Fatty' acids and Triacylglvcerol

1.2.1 Classification &Chemistry',
Saturated fatty acids -classification of C2 to C20 : even carbon: Common and IUPAC names. Unsaturated fatty acids MUFA, PUFA (2.3.4 double bonds) Omega-3.6.9 fatty acids. Triacyl glycerol-simple and mixed-names and structure

1.2.2 Chemical Reactions of fats
Saponification. Iodination. Ozonolysis. Auto-oxidation. Action of heat on glycerol and choline. Rancidity Definition & significance-Acid no. Saponification no, Iodinc no, Reiehert-Meissel no

1.3 Compound Lipids
Structure & ftlnctiol1 of glycerophospholipids (PE.PC.PL)
Phosphosphingolipids (ceramidc. sphingomyelin) Glycolipids / Cerebrosidcs (gluco & galacto cerebrosidcs)

1.4 Steroids
Cholesterol structure and biochemical significance.

Unit II : Nucleic Acids — **15 Lect**

2.1 Structure- Purine & Pyramidine bases, ribose, deoxyribose, nucleosides and nucleotides (ATP , CTP, GTP, TTP, UTP) Formation of polynucleotide strand with its shorthand Representation

2.2 RNAs (various types in prokaryotes and eukaryotes) mRNA & rRNA -generl account, tRNA -clover leaf model

2.3 DNA

2.3.1 Physical evidence of DNA helical structure. Chargaff's rules (chemical evidence), Watson-Crick model of DNA & its features

2.3.2 Physical properties of DNA -Effect of heat on physical properties of DNA (viscosity. buoyant density. UV absorption). hypocorism. hyperchroism, denaturation of DNA.

Unit III : Nutrition — **15 Lect**

3.1 Definition: Calorie, Joule; Food calorimetry- calorific value determination by 130mb calorimeter. calorific values of proximate principles, concept of' BMI. BV and PER

3.2 BMR-definition. factors affecting BMR. Significance of BMR in clinical diagnosis

3.3 SDA/DIT -General concept and significance. energy requirement of individuals for various activities- sedentary. moderate and heavy

3.4 Nutritional significance of carbohydrates. protein. lipids. vitamins. minerals and water

3.5 Numerical problems based on above concepts

Course Code	Title	Credits
USBC202	**Introduction to Cell biology, Physiology and Microbiology**	**2 Credits (45 lectures)**

Unit I : Nucleus **1.1** Structure & function of the nucleus, nuclear envelope, nuclear pores, nuclear matrix and Nucleolus **1.2** Mitosis and Meiosis **1.3** Cell cycle	**15 Lect**
Unit II : Physiology **2.1** *Digestion of Carbohydrates. Proteins and ii ids* **2.1.1** Chemical digestion: enzymes involved and their activation, site of enzyme production and action. substrate & product of each. enzyme catalyzed reaction; Mechanical digestions: movements in the 'GI tract. Secretin, Gastrin and CCK-P2 2.1.2 Absorption; of glucose. amino acids and fatty acids in the intestine 2.2 *Excretion* 2.2.1 Structure of the nephron: Bowman's capsule & glomerulus – Structure & function, (ultrafiltration, pressures involved. GFR, regulation of GFR); Renal tubule -structure & function (proximal and distal convoluted tubules and Henle's loop 2.2.2 Urine formation: Reabsorption / Secretion of glucose, Na+, K+. HCO_3^-, Cl^- and H+ : renal threshold	**15 Lect**
Unit III: Introduction to Microbiology 3.1 Historical background (contributions or Leeuwenhoek. Pasteur ,etc) and General characteristics (size .shape. and structure) of Bacteria 3.2 Microbial Taxonomy: Microbial species and strains. classification of bacteria based on morphology (shape and flagella). staining reaction. nutrition and extreme environment 3.3 Staining methods (principles of staining & types or stains)and microscopic identification of bacteria 3.4 Microbial growth: definition of growth. mathematical nature and expression of growth. measurement of growth, growth curve. synchronous growth. growth yields and efficiency	**15 Lect**

Course Code : USBCP2 SEMESTER II

PRACTICAL I	**Hours**
1. Qualitative tests for Amino acids	03
2. Qualitative tests for proteins	04
3. Qualitative tests for lipids	03
4. Saponification value	02
5. Acid value	02
6. Qualitative tests for minerals	03
7. Permanent slides of mitosis and meiosis	02

PRACTICAL II

1. Quantitative estimation of normality of FAS	03
2. Adsorption of oxalic acid on activated charcoal	03
3. Gram staining	02
4. Capsule staining	02
5. Endospore staining	02
6. Digestive system	02
7. Excretory system	02

DEMONSTRATION EXPERIMENTS

1. Analytical balance	01

Scheme of Examination:

The performance of the learners shall be evaluated into two parts. The learner's performance shall be assessed by Internal Assessment with 40% marks in the first part & by conducting the Semester End Examinations with 60% marks in the second part.

The Course having Practical training will have Practical Examination for 50 marks at the end of Semester, out of which 30 marks for the Practical task assigned at the time of examination. The 20 marks are allotted as Internal Assessment.

The allocation of marks for the Internal Assessment and Semester End Examinations are as shown below:-

Internal Assessment: It is defined as the assessment of the learners on the basis of continuous evaluation as envisaged in the Credit based system by way of participation of learners in various academic and correlated activities in the given semester of the progamme.

Semester End Assessment : It is defined as the assessment of the learners on the basis of Performance in the semester end Theory/ written/ Practical examination.

Modality of Assessment :
Internal Assessment - 40% **40 marks.**

a) Theory **40 marks**

Sr No	Evaluation type	Marks
1	Two Assignments/Case study/Project	20
2	One class Test (multiple choice questions objective)	10
3	Active participation in routine class instructional deliveries(case studies/ seminars//presentation)	05
4	Overall conduct as a responsible student, manners, skill in articulation, leadership qualities demonstrated through organizing co-curricular activities, etc.	05

b) Practicals **20 marks**

Sr No	Evaluation type	Marks
1	Two best practicals	10
2	Journal	05
3	Viva	05

B) External examination - 60 %
Semester End Theory Assessment - 60% **60 marks**

i. Duration - These examinations shall be of two hours duration.
ii. Theory question paper pattern :-
1. There shall be four questions each of 15 marks. On each unit there will be one question & fourth one will be based on entire syllabus.
2. All questions shall be compulsory with internal choice within the questions. Each question will be of 20 to 23 marks with options.
3. Questions may be sub divided into sub questions a, b, c, d & e only & the allocation of marks depends on the weightage of the topic.

Practical External Assessment **30 marks**