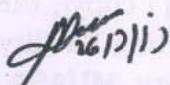


CIRCULAR:-

A reference is invited to the syllabi relating to the Bachelor of Science (B.Sc) Degree Course **vide** this office Circular No.UG/367 of 2011, dated 25th October, 2011 and the Principals of the affiliated Colleges in Science, are hereby informed that the recommendation made by Board of Studies in Biochemistry at its meeting held on 3rd December, 2016 has been accepted by the Academic Council at its meeting held on 11th May, 2017 **vide** item 4.190 and that in accordance therewith, the revised syllabus as per the (CBCS) for the F.Y.B.Sc. (Biochemistry) (Sem-I & II) which is available on the University's website (www.mu.ac.in) and that the same has been brought into force with effect from the academic year 2017-18.

MUMBAI- 400032
28th July, 2017
To


REGISTRAR

The Principals of the affiliated Colleges in Science.

A.C/4.190/11/05/2017

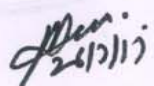
No. UG/121 -A of 2017

MUMBAI-400 032

28th July, 2017

Copy forwarded with Compliments for information to:-

- 1) The Co-ordinator, Faculty of Science,
- 2) The Offg. Director, Board of Examinations and Evaluation.
- 3) The Director, Board of Studies Development.
- 4) The Chairman/Chairperson, Ad-hoc Board of Studies in Life Science.
- 5) The Co-Ordinator, University Computerization Centre.


REGISTRAR

....PTO

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 2017 – 2018)

**F. Y. B.Sc. Biochemistry Syllabus
Restructured for Credit Based and Grading System
to be implemented from the Academic year 2017-2018**

SEMESTER I

| Course Code | Title | Credits |
|---|------------------------------------|-------------------------------------|
| USBCH101 | Bio molecules and Nutrition | 2 Credits (45 lectures) |
| <p>Unit I : Water</p> <p>1.1 <i>Water</i> : Its effect on Bio molecules, hydrogen bonding and structure, properties (surface tension, latent heat, specific heat, viscosity, dielectric constant, colligative properties) of water and their biological significance, water as a universal solvent.</p> <p>1.1.1 Entropy and dissolution of solute 1.1.2 Effect of non polar compounds on the structure of water 1.1.3 Weak interactions of bio molecules in aqueous solutions</p> <p>1.2 <i>Solutions</i> 1.2.1 Concepts of mole, molar, molar equivalent and normal, Dalton</p> <p>1.3 <i>Ionization of water, weak acids and weak bases</i> 1.3.1 pH : pH scale , H⁺ and OH⁻ concentrations 1.3.2 Weak acids and bases and their dissociation constants K_a & K_b 1.3.3 Buffers- definition, action, physiological buffers – phosphate and carbonate (No derivations .Only simple problems on solutions)</p> | | 15 Lectures |
| <p>Unit II : Amino acids and proteins</p> <p>2.1 <i>Amino acids</i> 2.1.1 Amino acid structure- D & L forms of all 20 amino acids 2.1.2 Detailed classification based on polarity, essential and non essential amino acid 2.1.3 Physical properties : zwitter ions, pI of amino acids amino acids as ampholytes, melting point, optical rotation, UV absorption and chemical properties: Chemical reactions of amino acids with Ninhydrin, Sanger's reagent, Edman's reagent and Dansyl chloride</p> <p>2.2 <i>Peptides and Proteins</i> 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(myoglobin) and Quaternary(hemoglobin) structures- an introduction with 2.2.5 Protein denaturation</p> | | 15 Lectures |
| <p>Unit III: Carbohydrates.</p> <p>3.1 Definition, Classification, and functions of carbohydrates (mono. oligo polysaccharides)</p> <p>3.2 <i>Monosaccharides</i> 3.2.1 Classification in terms of aldoses and ketoses 3.2.2 Occurrence, structures and significance 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, enediol formation (with respect to glucose and fructose) iii) Osazone formation (with respect to glucose and fructose). iv) Orcinol (with respect to ribose)</p> | | 15 Lectures |

- 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

| Course Code | Title | Credits |
|--|--|-------------------------------------|
| USBCH102 | Introduction to Cell biology, Physiology and Microbiology | 2 Credits (45 lectures) |
| Unit I : Origin of Life & Formation of cells | | 15 Lectures |
| <p>1.1 Big bang theory, Theories on the origin of life: Abiogenesis, Heterotroph hypothesis, RNA world, protein world, Miller's experiment, Formation of the first cell, endosymbiont theory</p> <p>1.2 Evolution - Darwinian theory, Modern synthetic theory of evolution and its factors: Gene mutations(recombination), heredity, natural selection and isolation Biological evidences: Fossil record, chemical and anatomical similarities of related life forms, geographic distribution of related species, genetic changes in living organisms over generations and Mechanism of evolution, Gene flow and genetic drift, Hardy-Weinberg principle</p> | | |
| Unit II : The cell- cell wall, cell membrane, cell organelles and cell division | | 15 Lectures |
| <p>2.1 <i>Structural organization of cells</i> 2.1.1 Prokaryotic, Eukaryotic (plant & animal) and yeast cells - a comparative overview</p> <p>2.2 Cell wall structure (plant), cell membrane (fluid mosaic model) Cytoskeleton : microtubules & microfilaments</p> <p>2.3 <i>Cell organelles:</i> 2.3.1 Mitochondrion: Organization & function of the mitochondria, mitochondrial genome 2.3.2. Chloroplast : Structure and function of the chloroplast. the chloroplast genome, other plastids 2.3.3 Ribosome: <i>ER: Golgi</i> Structure & Function of: Ribosome, ER, Golgi apparatus 2.3.4 Peroxisome & Lysosome: Peroxisome function & assembly (in brief) and Lysosome structure and function 2.3.5 Nucleus : Structure & function of the nucleus, nuclear envelope, nuclear pores, nuclear matrix and Nucleolus</p> <p>2.4 Mitosis and Meiosis</p> | | |
| Unit III: Microbiology I | | 15 Lectures |
| <p>3.1 Historical background (contributions of Leeuwenhoek. Pasteur ,etc) and general characteristics (size .shape. and structure) of Bacteria</p> <p>3.2 <i>Microbial Taxonomy:</i> Microbial species and strains. classification of bacteria based on morphology (shape and flagella). staining reaction. nutrition and extreme environment</p> <p>3.3 <i>Bacterial cell wall:</i> Structure and function, components of peptidoglycan framework(structures of NAG and NAMA not necessary)</p> | | |

3.4 *An introduction to extremophiles* : thermophiles, psychrophiles, halophiles, magnetotactic, radiation resistant- examples with their application

3.5 Staining methods (principles of staining & types or stains)and microscopic identification of bacteria

SEMESTER I

PRACTICAL – I

45 Lectures

1. Preparation & Standardisation of laboratory reagents
Primary standards - 0.1N oxalic acid
Secondary standards - 0.1N NaOH
0.1N HCl
2. Preparation of buffers-acetate and phosphate
3. Determination of pKa of acetic acid
4. Qualitative tests for Carbohydrates –
 - monosaccharides(glucose and fructose),
 - disaccharides(lactose ,maltose and sucrose)
 - polysaccharides(starch and dextrin)
 - unknown
5. Qualitative test for amino acids
6. Effect of heat, organic solvents and ammonium sulphate on proteins

DEMONSTRATION EXPERIMENT

pH meter – working of a pH meter

PRACTICAL – II

45 Lectures

1. Effect of isotonic, hypertonic and hypotonic solutions on cells – onion peel
2. Staining of bacterial yeast cells (negative staining)
3. Staining techniques-
 - gram staining,
 - endospore,
 - capsule and
 - lipids
4. Permanent slides/ diagrams or electron micrograph of organelles-nucleus, mitochondria and chloroplast
5. Study of stages of mitosis using onion root tips
6. Permanent slides of mitosis and meiosis

DEMONSTRATION EXPERIMENT

1. Microscopy – study of a compound microscope

Semester II

| Course Code | Title | Credits |
|---|------------------------------------|---|
| USBCH201 | Bio molecules and Nutrition | 2 Credits (45 lectures) 15 Lectures |
| <p>Unit I : Lipids</p> <p>1.1 Definition, classification (Bloor's) and functions of Lipids</p> <p>1.2 Fatty' acids and Triacylglycerol</p> <p>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</p> <p>1.2.2 Chemical Reactions of fats Saponification, Iodination, Ozonolysis, Auto-oxidation, Action of heat on glycerol and choline, Rancidity Definition & significance - Acid number, Saponification number, Iodine number, Reichert-Meissel number</p> <p>1.3 Compound Lipids Functions of glycerophospholipids (PE.PC.PL) Phosphosphingolipids (ceramide. sphingomyelin), Glycolipids / Cerebrosides (gluco & galacto cerebrosides)</p> <p>1.4 Steroids Cholesterol structure and biochemical significance.</p> | | 15 Lectures |
| <p>Unit II : Nucleic Acids</p> <p>2.1 Structure- Purine & Pyrimidine bases, ribose, deoxyribose, nucleosides and nucleotides (ATP, CTP, GTP, TTP, UTP) Formation of polynucleotide strand with its shorthand Representation</p> <p>2.2 RNAs (various types in prokaryotes and eukaryotes) mRNA & rRNA – general account, tRNA - clover leaf model, Ribozymes</p> <p>2.3 DNA</p> <p>2.3.1 Physical evidence of DNA helical structure. Chargaff's rules (chemical evidence), Watson-Crick model of DNA & its features</p> <p>2.3.2 Physical properties of DNA -Effect of heat on physical properties of DNA (Viscosity, buoyant density, UV absorption), Hypochromism, hyperchromism, denaturation of DNA.</p> <p>2.3.3 Reactions of nucleic acids (with DPA and Orcinol)</p> | | 15 Lectures |
| <p>Unit III : Nutrition</p> <p>3.1 Definition: Calorie, Joule, Food calorimetry - calorific value determination by 130mb calorimeter, calorific values of proximate principles, concept of BMI, BV and PER</p> <p>3.2 BMR – definition, factors affecting BMR, Significance of BMR in clinical diagnosis</p> <p>3.3 SDA/DIT - General concept and significance, energy requirement of individuals for various activities- sedentary, moderate and heavy</p> <p>3.4. Nutritional significance of carbohydrates, Protein, lipids, vitamins, minerals and water</p> <p>3.5 Formulation of balanced diet</p> <p>3.6 Numerical problems based on above concepts</p> | | 15 Lectures |

| Course Code | Title | Credits |
|---|--|---|
| USBCH202 | Introduction to Cell biology, Physiology and Microbiology | 2 Credits (45 lectures) 15 Lectures |
| Unit I : Physiology of digestion and absorption 1.1 Parts and Functions of gastro intestinal tract (GIT) 1.2 Organs and Glands associated with GIT Secretions and Juices of GIT (Saliva, Gastric juice, Intestinal juice, pancreatic and Bile juice) 1.3 Digestion and Absorption of carbohydrates 1.4 Digestion and Absorption of Lipids 1.5 Digestion and Absorption of Proteins 1.6 Disorders- Peptic ulcer, Lactose Intolerance | | 15 Lectures |
| Unit II : Physiology of respiration and excretion 2. Respiratory system, 2.1 Breathing – inspiration and expiration, 2.2 Composition of air and partial pressure of gases 2.3 Physical exchange of gases 2.3.1. Transport of oxygen 2.3.2. Transport of carbon dioxide Respiratory disorders – cyanosis, respiratory acidosis and alkalosis 2.4 <i>Excretion</i> 2.4.1 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 2.4.2 Urine formation: Reabsorption / Secretion of glucose, Na ⁺ , K ⁺ . HCO ₃ ⁻ -Cl ⁻ and H ⁺ : renal threshold Excretory disorder : Nephritis | | 15 Lectures |
| Unit III: Microbiology II 3.1 Microbial Growth- Growth Curve, Mathematical expression, Synchronous growth, Generation time 3.2 Culture media (N, C, Special requirements) Natural and Synthetic media 3.3 Sterilization and Disinfection techniques 3.4 Physical Agent of sterilization- Temperature- Pressure (Hot Air Oven, Autoclave), Radiations (UV, Gamma) (examples with mechanism) Chemical agents of sterilization –Alcohol, Halogens, Formaldehyde | | 15 Lectures |

SEMESTER II

PRACTICAL – I

45 Lectures

1. Qualitative tests for lipids
 - a) Miscibility test
 - b) Saponification test
 - c) Unsaturation test
 - d) Sudan black dye test
 - e) Salkowski test for cholesterol
2. Determination of SAP value of given oil sample
3. Determination of Acid value of give oil sample
4. Staining of DNA and RNA (methyl green : pyronine) using onion peel
5. Qualitative tests for DNA (DPA) & RNA (Orcinol) (Neumann's test for presence of phosphorus) - ?
6. Estimation of Calcium by oxalate method
7. Qualitative analysis for Proteins (albumin, peptone , gelatine and casein-any four proteins)

SEMESTER II

PRACTICAL – II

45 Lectures

1. Identification of organs / parts of digestive system
2. Identification of organs / parts of respiratory system
3. Identification of organs / parts of excretory system
4. Analysis of the action of salivary α - amylase action on starch
5. Concept of Dialysis: Ammonium sulphate precipitation \rightarrow Dialysis (Test with BaCl_2 for presence of sulphate in the buffer or water outside)
6. Estimation of total acidity of gastric juice
7. Urine analysis :
 - Inorganic constituents: SO_4^{2-} (BaCl_2), Cl^- (AgNO_3), Na^+ , K^+ (Flame test)
 - Organic constituents: Urea, Uric acid, Creatinine
 - Abnormal constituents – glucose by Benedicts method, proteins by Hellers ring test

Scheme of Examination:

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.

a) Theory 100 marks

- Question Paper Pattern for Semesters I & II (100 marks) 3hrs
- Q1) Objective questions based on all units with no internal options: 20 marks
- a) Define the following (10 marks) : (Provide 5 terms to be defined, each definition will carry 2 marks)
 - b) True or False with reasons (10 marks): (Provide 5 statements, for each the student has to state whether it is true or false and provide reasons.)
- Q2) Questions based on Unit I 20 marks
(either answer any 4 out of 8 sub - questions OR any 2 out of 4)
- Q 3) Questions based on Unit II 20 marks
(either answer any 4 out of 8 sub-questions OR any 2 out of 4)
- Q4) Questions based on Unit III 20 marks
(either answer any 4 out of 8 sub-questions OR any 2 out of 4)
- Q 5) Questions based on Units I, II, III 20 marks
(Answer 4 out of 6 sub-questions)

b) Practicals 50 marks

The Course having Practical training will have Practical Examination 20 marks
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.

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

Practical External Assessment

30 marks