

**SRI SANKARA ARTS AND SCIENCE COLLEGE**  
**(Autonomous)**  
**DEPARTMENT OF BIOCHEMISTRY**  
**BACHELOR DEGREE COURSE IN BIOCHEMISTRY**  
**CHOICE BASED CREDIT SYSTEM (CBCS)**  
(Effective from the academic year 2017 – 2018)

**REGULATIONS**

**1. ELIGIBILITY FOR ADMISSION:**

Candidate for admission to the first year of B.Sc. Degree Course in Bio-Chemistry shall be required to have passed the Higher Secondary Examination with Chemistry and Biology or Chemistry, Botany and Zoology or Biochemistry and Chemistry.

**2. ELIGIBILITY FOR THE AWARD OF DEGREE:**

A candidate shall be eligible for the award of the Degree only if he /she has undergone the prescribed course of study in a College for a period of not less than three academic years, passed the examinations all the Six-Semesters prescribed earning 140 Credits (in Parts-I, II, III, IV & V).

**3. DURATION:**

- a) Each academic year shall be divided into two semesters. The first academic year shall comprise the first and second semesters, the second academic year the third and fourth semesters and the third academic year the fifth and sixth semester respectively.
- b) The odd semesters shall consist of the period from June to November of each year and the even semesters from December to April of each year. There shall be not less than 90 working days for each semester.

#### **4. COURSE OF STUDY:**

The main Subject of Study for Bachelor Degree Courses shall consist of the following

PART – I TAMIL / OTHER LANGUAGES

PART – II ENGLISH

PART – III CORE SUBJECTS

ALLIED SUBJECTS

PROJECT/ELECTIVES WITH THREE COURSES

PART – IV

1. (a) Those who have not studied Tamil up to XII Std. and taken a Non-Tamil Language under Part-I shall take Tamil comprising of two course (level will be at 6<sup>th</sup> Standard).
- (b) Those who have studies Tamil up to XII Std. and taken a Non-Tamil Language under Part-I shall take Advanced Tamil comprising of two courses.
- (c) Others who do not come under a + b can choose non-major elective comprising of two courses.

2. SKILL BASED SUBJECTS (ELECTIVE) - (SOFT SKILLS)

3. ENVIRONMENTAL STUDIES

4. VALUE EDUCATION

PART – V EXTENSION ACTIVITIES

## **5. EXTENTION ACTIVITIES:**

A candidate shall be awarded a maximum of 1 Credits for Compulsory Extension Service.

All the Students shall have to enroll for NSS /NCC/ NSO (Sports & Games) Retract/ Youth Red cross or any other service organizations in the college and shall have to put in Compulsory minimum attendance of 40 hours which shall be duly certified by the Principal of the college before 31<sup>st</sup> March in a year. If a student LACKS 40 HOURS ATTENDANCE in the First year, he/she shall have to compensate the same during the subsequent years.

Students those who complete minimum attendance of 40 hours in One year will get HALF A CREDIT and those who complete the attendance of 80 or more hours in Two Years will ONE CREDIT.

Literacy and population Education Field Work shall be compulsory components in the above extension service activities.

## 6. SCHEME OF EXAMINATION:

### Model Scheme

Course Component Name of the course	Inst. Hour	Credits	Exam Hours	Max. Marks		
				Ext.mark	Int. mark	Total
<b>PART-I Language</b>				<b>75</b>	<b>25</b>	<b>100</b>
<b>PART-II English</b>				<b>75</b>	<b>25</b>	<b>100</b>
<b>PART-III Core subject :</b>				<b>75</b>	<b>25</b>	<b>100</b>
<b>Core Subject</b>				<b>75</b>	<b>25</b>	<b>100</b>
<b>Allied Subject</b>				<b>75</b>	<b>25</b>	<b>100</b>
<b>PART – IV</b> 1.(a) Those who have not studied Tamil up to XII Std. and taken a Non-Tamil Language under Part-I shall take Tamil comprising of two course (level will be at 6 <sup>th</sup> Standard). (b) Those who have studies Tamil up to XII Std. and taken a Non-Tamil Language under Part-I shall take Advanced Tamil comprising of two courses. (c) Others who do not come under a + b can choose non-major elective comprising of two courses.				<b>75</b>	<b>25</b>	<b>100</b>
<b>2*Skill based subjects(Elective) – (Soft Skill)</b>				<b>50</b>	<b>50</b>	<b>100</b>

**The following procedure should be followed for Internal Marks:**

**Theory Papers:**

**Internal Marks - 25**

Tests (2 out of 3)	= 10
Attendance	= 5
Seminars	= 5
Assignments	= 5
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	25 marks
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**Break-up Details for Attendance**

Below 60%	- No marks
60% to 75%	- 3 marks
76% to 90 %	- 4 marks
91% to 100%	- 5 marks

**Practical:**

Internal Marks	40 marks
Attendance	5 marks
Practical Test best 2 out of 3	30 marks
Record	5 marks

**Project:**

Internal Marks best 2 out of 3 presentations	20 marks
Viva	20 marks
Project Report	60 marks

## **7. REQUIREMENTS FOR PROCEEDING TO SUBSEQUENT SEMESTER:**

- i. Candidates shall register their names for the First Semester Examination after the admission in UG Courses.
- ii. Candidates shall be permitted to proceed from the First Semester up to Final Semester irrespective of their failure in any of the Semester Examination subject to the condition that the candidates should register for all the arrear subject of earlier semesters along the current (subsequent) Semester Subjects.
- iii. Candidates shall be eligible to go to subsequent semester, only if they earn sufficient attendance as prescribed therefore by the Syndicate from time to time.

Provided in case of a candidate earning less than 50% of attendance in any one of the Semesters due to any extraordinary circumstances such as medical grounds, such candidates who shall produce Medical Certificate issued by the Authorized Medical Attendant (AMA), duly certified by the Principal of the college, shall be permitted to proceed to the next semester and to complete the Course of study. Such Candidates shall have to repeat the missed Semester by rejoining after completion of Final Semester of the course, after paying the fee for the break of study as prescribed by the college from time to time.

## **8. PASSING MINIMUM:**

A candidate shall be declared to have passed:

- a) There shall be no Passing Minimum for Internal.
- b) For External Examination, Passing Minimum shall be of 40% (Forty Percentage) of the maximum marks prescribed for the paper for each Paper/Practical/Project and Viva-voce.
- c) In the aggregate (External + Internal) the passing minimum shall be of 40%.
- d) He / She shall be declared to have passed the whole examination, if he/she passes in all the papers and practicals wherever prescribed / as per the scheme of examinations by earning 140 CREDITS in Parts-I, II, III, IV & V. He/she shall also fulfill the extension activities prescribed earning a minimum of 1 Credit to qualify for the Degree.

## **9. CLASSIFICATION OF SUCCESSFUL CANDIDATES:**

### **PART- I TAMIL / OTHER LANGUAGES**

TAMIL/OTHER LANGUAGES: Successful candidates passing the Examinations for the Language and securing the marks (i) 60 percent and above and (ii) 50 percent and above but below 60 percent in the aggregate shall be declared to have passed the examination in the FIRST and SECOND class, respectively. All other successful candidates shall be declared to have passed the examination in the THIRD Class.

### **PART – II ENGLISH**

ENGLISH: Successful candidates passing the examinations for English and securing the marks (i) 60 percent and above and (ii) 50 percent and above but below 60 percent in the aggregate shall be declared to have passed the examination in the FIRST and SECOND Class, respectively. All other successful candidates shall be declared to have passed the examination in the THIRD class.

PART – III consisting of CORE SUBJECTS, ALLIED SUBJECTS, PROJECT / ELECTIVE with three courses:

Successful candidates passing the examinations for Core Courses together and securing the marks (i) 60 percent and above (ii) 50 percent and above but below 60 percent in the aggregate of the marks prescribed for the Core courses together shall be declared to have passed the examination in the FIRST and SECOND Class respectively. All other successful candidates shall be declared to have passed the examinations in the Third Class.

PART – IV (consisting of sub items 1 (a), (b) & (c), 2, 3 and 4) as furnished in the Regulations 4 Part-IV supra.

### **PART – V EXTENTION ACTIVITIES:**

Successful Candidate earning of 1 credit SHALL NOT BE taken into consideration for Classification/Ranking/ Distinction.

## 10. RANKING:

Candidates who pass all the examinations prescribed for the course in the **FIRST APPEARANCE ITSELF ALONE** are eligible for Ranking/ Distinction.

Provided in the case of Candidates who pass all the examinations prescribed for the Course with a break in the First Appearance due to the reasons as furnished in the Regulations. 7 (iii) supra are only eligible for classification.

## 11. TRANSITORY PROVISION:

Candidates who have undergone the course of study prior to the academic year 2008 – 2009 will be permitted to appear for the examinations under those Regulations for a period of TWO years i.e. up to and inclusive of April/May 2012 Examinations. Thereafter, they will permitted to appear for the examination only under the Regulations then in force.

### Question Paper Pattern

#### SECTION – A (30 words)

10 OUT OF 12 - 10 X 2 marks = 20 marks

#### SECTION – B (200 words)

5 out of 7 - 5 x 5 marks = 25 marks

#### SECTION – C (500 words)

3 out of 5 - 3x 10 marks = 30 marks

**TOTAL = 75 marks**

### Question Paper for Practicals

The external examiner will prepare a question paper on the spot with the help of the Question Bank supplied by the Controller's office.



**Scheme of Examinations:****I SEMESTER**

<b>Course Components/Title of the paper</b>	<b>Credits</b>	<b>MARKS</b>		
		<b>CIA</b>	<b>EXT</b>	<b>TOTAL</b>
<b>Part –I</b> - Language Paper -I	3	25	75	100
<b>Part –II</b> - English Paper -I	3	25	75	100
<b>Part-III</b> Core Paper-I: Nutritional Biochemistry	5	25	75	100
Allied Paper- I	3	25	75	100
<b>Part-IV</b> * Basic Tamil/Adv. Tamil/ Non Major Elective -I: Health and Nutrition	2	25	75	100
Soft Skills –I	3	50	50	100

## II SEMESTER

Course Components/Title of the paper	Credits	MARKS		
		CIA	EXT	TOTAL
<b>Part –I</b> – Language Paper -II	3	25	75	100
<b>Part –II</b> - English Paper –II	3	25	75	100
<b>Part-III</b> Core Paper -II: Cell Biology	5	25	75	100
Core Paper – III: Core Practical –I	4	40	60	100
Allied paper- II	3	25	75	100
Allied Practical –I &II	4	40	60	100
<b>Part-IV</b> * Basic Tamil/Adv. Tamil/  Non Major Elective -II: Human diseases and Preventive Aspects	2	25	75	100
Part-IV Soft Skills –II	3	50	50	100

\* (a) Non-Tamil Students up to XII Std must studied “Basic Tamil” comprising of two course in degree level

(b) Tamil Students up to XII Std, taken Non-Tamil Language under Part-I at degree level, shall be taken “Advanced Tamil” comprising of two courses.

(c) Tamil Students up to XII Std and taken Tamil under Part-I Language at degree level, shall be choose “Non- major Electives” at degree level

### III SEMESTER

Course Components/Title of the paper	Credits	MARKS		
		CIA	EXT	TOTAL
<b>Part –I</b> – Language Paper -III	3	25	75	100
<b>Part –II</b> – English Paper -III	3	25	75	100
<b>Part-III</b> Core paper-IV: Chemistry of Biomolecules I	5	25	75	100
Allied paper- III	3	25	75	100
<b>Part-IV</b> Environmental Studies	2	Exam in IV Semester		
Soft Skills –III	3	50	50	100

### SEMESTER – IV

Course Components/Title of the paper	Credits	MARKS		
		CIA	EXT	TOTAL
<b>Part –I</b> - Language Paper -IV	3	25	75	100
<b>Part –II</b> - English Paper -IV	3	25	75	100
<b>Part-III</b> Core paper-V: Chemistry of Biomolecules- II	5	25	75	100
Core Paper VI : Core Practical II	4	40	60	100
Allied paper- IV	3	25	75	100
Allied Practical –III & IV	4	40	60	100
<b>Part-IV</b> - Environmental Studies	2	25	75	100
Soft Skills-IV	3	50	50	100

### V SEMESTER

Course Components/Title of the paper	Credits	MARKS		
		CIA	EXT	TOTAL
<b>Part-III</b> Core Paper-VII: Enzymes	5	25	75	100
Core Paper -VIII: Metabolism	5	25	75	100
Core Paper-IX: Analytical Biochemistry	5	25	75	100
Core Elective Paper -I: Physiology	4	25	75	100
<b>Part-IV- Value Education</b>	2			

### VI SEMESTER

Course Components/Title of the paper	Credits	MARKS		
		CIA	EXT	TOTAL
<b>Part-III</b> Core Paper-X: Clinical Biochemistry	5	25	75	100
Core Paper -XI: Molecular Biology	5	25	75	100
Core Paper XII – Core Practical III	4	40	60	100
Core Paper XIII – Core Practical IV	4	40	60	100
Core Elective Paper II : Immunology	5	25	75	100
Core Elective Paper III: Biotechnology	4	25	75	100
<b>Part-V Extension Activity</b>	1			

Course content: The syllabus consists of theory and practical papers. The students are expected to present seminars on special topics.

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## **B. Sc DEGREE COURSE IN BIOCHEMISTRY**

### **SYLLABUS**

**(Effective from the academic year 2017 – 2018)**

### **SEMESTER-I**

#### **CORE PAPER - I - NUTRITIONAL BIOCHEMISTRY**

##### **UNIT-I**

Concepts of food and nutrition. Basic food groups- energy yielding, body building and functional foods. Units of energy. Calorific and nutritive value of foods. Measurement of calories by bomb calorimeter. Basal metabolic rate (BMR) - definition, determination of BMR and factors affecting BMR. Respiratory quotient (RQ) of nutrients and factors affecting the RQ. SDA- definition and determination.

##### **UNIT-II**

Physiological role and nutritional significance of carbohydrates, lipids and proteins. Evaluation of proteins by nitrogen balance method - Biological value of proteins - Digestibility Coefficient, Biological Value, Protein Energy Ratio and Net Protein Utilization. Protein energy malnutrition- Kwashiorkor and Marasmus. Clinical manifestations and management. Obesity (elementary details). Food adulteration.

##### **UNIT-III**

Balanced diet, example of a low and high cost balanced diet – for infants, children, adolescents, adults and elderly people. Role of dietary fiber. Vitamins- definition and types of vitamins. Sources, requirement, biological functions, deficiency symptoms of thiamine, riboflavin, niacin, pyridoxine, vitamins C and A. Hypervitaminosis.

## **UNIT-IV**

Minerals- sources, requirement, physiological functions, deficiency and toxicity of calcium, sodium, potassium, iron, magnesium.

## **UNIT-V**

Human rights – introduction- definition, scope and need for study of human rights and relations. Categories- civil and political rights, economic relations and social relations. Institutions : International and National- United Nations Human Rights Commission, State Human Rights Commission. International Convention on civil and political rights. International convention on economic and social rights. National Human Rights Act- National Commission for minorities, SC/ST and Women, Students activity-assignment, case study, term paper.

### **Books Recommended**

1. Garrow, JS, James WPT and Ralph A (2000). Human nutrition and dietetics (10th ed) Churchill Livingstone
2. Andreas M. Papas (1998). Antioxidant Status, Diet, Nutrition, and Health (1<sup>st</sup> ed) CRC Press
3. M.Swaminathan (1995). Principles of Nutrition and Dietetics. Bappco
4. Margaret Mc Williams (2012). Food Fundamentals (10th ed), Prentice Hall
5. Tom Brody (1998). Nutritional Biochemistry (2<sup>nd</sup> ed), Academic Press, USA
6. Aravind Kumar (1999). Human rights and social movements, Anmol publishers.
7. Piarey Lal Mehta, Neena Verma, P I Mehta (1999). Human Rights Under the Indian Constitution. Deep & Deep Publications Pvt. Ltd.

## **NON – MAJOR ELECTIVE PAPER- I - HEALTH AND NUTRITION**

### **UNIT – I**

Health – definition, Factors affecting human health. Importance of health care of children, adults and elderly people. Balanced diet.

### **UNIT – II**

Vitamins-definition, classification, sources, properties, functions and deficiency symptoms. Recommended daily allowances of pantothenic acid, folic acid, biotin, cyanocobalamine. Vitamin D, E and K.

### **UNIT – III**

Sources and functions of dietary fats, role of fats and lipids in health. Calorific value.

### **UNIT – IV**

Minerals- Role of minerals on human health, sources, biological functions, deficiency disorders with special reference to chromium, cobalt, copper, manganese, molybdenum, selenium, iodine and zinc.

### **UNIT - V**

supplementation programmes in India and their implications – Applied Nutrition Programme (ANP), Special Nutrition Programme (SNP), One Meal a Day Programme. Integrated Child Development Services (ICDS). Role of International Agencies, Health Based Nutrition Programme.

### **Books recommended**

1. S.Davidson and J.R.Passmore (1986). Human Nutrition and Dietetics, (8<sup>th</sup> ed), Churchill Livingstone
2. J. S. Garrow, W. Philip T. James, A. Ralph (2000). Human Nutrition and Dietetics (10<sup>th</sup> ed), Churchill Livingstone
3. M.Swaminathan (1995). Principles of Nutrition and Dietetics, Bappco
4. Margaret Mc Williams (2012). Food Fundamentals ( 10<sup>th</sup> ed) ,Prentice Hall



## **II SEMESTER**

### **CORE PAPER – II - CELL BIOLOGY**

#### **UNIT-I**

Cell theory, cell as basic unit of life. Classification of Viruses, Bacteria and Fungi. Structure and organization of prokaryotic and eukaryotic cells. Comparison between prokaryotic and eukaryotic cell. Comparison between plant and animal cells, General structure of cytoskeleton - structure, composition and functions of microfilaments, microtubules and intermediate filaments.

#### **UNIT-II**

Sub cellular organelles: The ultra structure of cell wall, nucleus, mitochondria, rough and smooth endoplasmic reticulum, Golgi apparatus, lysosome, ribosomes, peroxisome, chloroplast and glyoxisome and their function.

#### **UNIT-III**

Biomembrane – structure, organization and basic functions, fluid mosaic model, Transport across cell membrane – uniport, symport and antiport. Passive and active transport and water channel.

#### **UNIT- IV**

Organization of cells into tissue. Types of tissue. Cell – cell adhesion, cell matrix adhesion. Extracellular matrix– components and their biological role.

#### **UNIT-V**

Organisation of prokaryotic and eukaryotic genome, chromosomes, types, structure and function. Cell division, mitosis, meiosis, their significance. Cell cycle – phases of cell cycle.

### **Books recommended**

1. Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments (6<sup>th</sup> ed). John Wiley & Sons. Inc.
2. Bruce Alberts and Dennis Bray (2013). Essential Cell Biology, (4<sup>th</sup> ed), Garland Science.
3. De Robertis, E.D.P. and De Robertis, E.M.F. (2010). Cell and Molecular Biology. (8<sup>th</sup> ed). Lippincott Williams and Wilkins, Philadelphia.
4. Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. (5<sup>th</sup> ed). Sunderland, Mass. Sinauer Associates, Inc.
5. Wayne M. Baker (2008). The World of the Cell. (7<sup>th</sup> ed). Pearson Benjamin Cummings Publishing, San Francisco. Cell Biology
6. P.S.Verma and V.K.Agarwal (2004). Cell Biology, Genetics, Molecular Biology, Evolution and Ecology (14<sup>th</sup> ed), S.Chand and Company Ltd

## **CORE PAPER – III - CORE PRACTICAL – I**

### **I. Titrimetric procedures**

1. Estimation of Glycine by Sorenson's formal titration.
2. Estimation of calcium from milk.
3. Estimation of iron.
4. Estimation of oxalate.
5. Estimation of Vitamin C (Ascorbic acid)

### **II. Group experiments**

1. Stages of cell division.
2. Identification of plant, animal and bacterial cell.
3. Determination of BMI

### **III. Biochemical Preparation**

1. Preparation of starch from potatoes.
2. Preparation of casein from milk.
3. Preparation of albumin from eggs.
4. Preparation of hemoglobin from blood.

### **Books recommended**

1. Varley's practical clinical biochemistry, Alan. H. Gowen clock, 6<sup>th</sup> Edition, 1988, CBS publishers & distributors, India.
2. Practical manual of Biotechnology, Lab Manual, Dr.Ritu Mahajan, Dr.Jitender Sharma & Dr. R.K. Mahajan, 1<sup>st</sup> Edition, 2010, Vayu education of India, New Delhi.
3. Laboratory manual and Practical biochemistry, T.N.Pattabiraman, 4<sup>th</sup> Edition, 2010, All India Publisher's & Distributors limited, New Delhi.
4. Practical text book of biochemistry for MBBS students, D.M.Vasudevan, 1<sup>st</sup> Edition, 2007, Jaypee brothers, New Delhi.
5. An introduction to practical biochemistry, David. T. Plummer, 3<sup>rd</sup> Edition, 1998, Tata Mc.Grawhill education private limited, New Delhi.

## **NON –MAJOR ELECTIVE PAPER –II**

### **HUMAN DISEASES AND PREVENTIVE ASPECTS**

#### **UNIT-I**

Diseases – definition – Examples for bacterial, viral and fungal diseases. Endemic and epidemic diseases – causes and symptoms. Major diseases of young children with special reference to diarrhea, primary complex, whooping cough, Kwashiorkor and Marasmus and their preventive aspects.

#### **UNIT-II**

Cancer- differences between benign and malignant tumors. Growth characteristics of cancer cells. Agents causing cancer - physical, chemical, biological. Prevalence of cancer in South India. Cancer therapy - surgery, radiation and chemotherapy. Cancer prevention.

#### **UNIT-III**

Diabetes mellitus – causes and types. Type I and type II diabetes mellitus. Role of anti-diabetic drugs. Dietary prevention of diabetes mellitus. Examples for anti-diabetic medicinal plants. Kidney stones – causes – influence of diet.

#### **UNIT-IV**

Cardiovascular disease – causes and symptoms. Role of dietary lipids. HDL and LDL as risk factors. Dietary prevention of CHD. Hypolipidemic medicinal plants and their products. Liver diseases – jaundice, hepatitis – causes and symptoms. Dietary prevention of disease progression.

### **Books recommended**

1. M.N.Chatterjee and Rana Shinde (2007).Textbook of Medical Biochemistry (7<sup>th</sup> ed)
2. Ambika Shanmugam (2012). Fundamentals of Biochemistry for Medical Students (7<sup>th</sup> ed),
3. Tietz Fundamentals of Clinical Chemistry and Molecular Diagnostics (2014) (7<sup>th</sup> ed),  
Saunders
4. A.Catherine Ross (2012) Modern nutrition in health and diseases (11<sup>th</sup> ed). Lippincott  
Williams and Wilkins
5. Michael.G.Wohl, Robert.S.Goodhart, Maurice E.Shils (1999). Modern nutrition in  
health and disease (9<sup>th</sup> ed), Lippincott Williams and Wilkins
6. R.Ananthanarayan and C.K.Jayarane Paniker (2009). Text book of Microbiology (8<sup>th</sup>  
ed), Universities press private (India) Limited.

### **III SEMESTER**

#### **CORE PAPER – IV - CHEMISTRY OF BIOMOLECULES I**

##### **UNIT-I**

Carbohydrates - classification and biological significance, physical properties, stereo isomerism, optical isomerism and mutarotation. Configuration of aldo and keto trioses, tetroses, pentoses and hexoses. Reactions of monosaccharides due to the presence of hydroxyl, aldehyde and ketone groups. Structure and properties of reducing disaccharides (lactose & maltose), non-reducing disaccharide (sucrose). Identification of ketose, pentose, reducing and non - reducing sugars. Artificial or synthetic sweetener.

##### **UNIT-II**

Occurrence, structure and functions of polysaccharides- starch, glycogen and cellulose. (structural elucidation is not needed). Structure and biological significance of mucopolysaccharides - hyaluronic acid, chondroitin sulphate and heparin. Composition and functions of inulin, agar, pectin, chitin, dextran, gum arabic and alginic acid. (structures are not necessary). Structure of bacterial cell wall polysaccharides (peptidoglycan and teichoic acid), blood group polysaccharides and glycoprotein.

##### **UNIT-III**

Aminoacids - biological role. General structure of amino acids. 3- and 1-letter abbreviations. Classification of amino acids based on nature of R group (polar, non polar, acidic, basic, neutral). Modified amino acids in protein, non protein amino acids. Physical properties of amino acids, isoelectric point, titration curve (alanine, lysine, glutamic acid), optical activity. Chemical reactions due to carboxyl group, amino group and side chains. Colour reactions of amino acids.

## UNIT-IV

Composition and biological importance of peptides. Examples of peptide hormones. Solid state peptide synthesis. Structure of oligopeptides like glutathione, vasopressin and oxytocin, Peptidases – exo and endo peptidases. Classification of proteins based on composition, solubility, and functions. Properties of proteins- salting in and salting out, denaturation and renaturation, UV absorption. Estimation of protein by Biuret, Folin's phenol and UV methods.

## UNIT-V

Definition and biological significance of hydrogen bond, hydrophobic interactions and van der waals forces. Levels of organization of protein structure – primary structure – composition, peptide bond. Outline of protein sequencing, Secondary structure –  $\alpha$  helix (egg albumin),  $\beta$ -pleated sheath (keratin), triple helix (collagen). Tertiary structure – forces involved in maintenance of tertiary structure like hydrogen bond, hydrophobic interactions, van der waals force, disulphide linkage and ionic bonds with reference to myoglobin. Quaternary structure with reference to haemoglobin. Ramachandran plot.

### **Books Recommended:**

1. David L.Nelson and Michael M.Cox (2012) Lehninger Principles of Biochemistry (6<sup>th</sup> ed) W.H. Freeman.
2. Voet.D and Voet. J.G (2010) Biochemistry (4th ed), John Wiley & Sons, Inc.
3. Metzler D.E (2003). The chemical reactions of living cells (2<sup>nd</sup> ed), Academic Press.
4. Zubay G.L (1999) Biochemistry (4<sup>th</sup> ed), Mc Graw-Hill.
5. Lubert Stryer (2010) Biochemistry (7<sup>th</sup> ed), W.H.Freeman
6. Satyanarayan,U (2014) Biochemistry (4<sup>th</sup> ed), Arunabha Sen Books & Allied (P) Ltd, Kolkata.

## **IV - SEMESTER**

### **CORE PAPER – V - CHEMISTRY OF BIOMOLECULES II**

#### **UNIT-I**

Lipids- Chemical nature, biological functions and classification of lipids. Fatty acids – definition, classification – saturated, unsaturated, hydroxy and cyclic fatty acids, nomenclature, structure and properties of fatty acids. Simple and mixed triglycerides – structure and general properties, Isolation of fats (Folch method) and identification. Characterization of fats – iodine value, saponification value, acid number, acetyl number, Polensky number, Reichert-Meissl number.

#### **UNIT-II**

Sterols – structure of cyclopentanoperhydrophenanthrene nucleus. Animal sterol : cholesterol - properties and functions. Plant sterol: stigmasterol – Functions, Ergosterol: Functions. Lipoproteins: general structure, classification: chylomicrons, VLDL, LDL, IDL, HDL – composition and biological roles. Classification, structure, properties and biological functions of glycolipids, phospholipids and sphingolipids.

#### **UNIT-III**

Structure of purine and pyrimidine bases, nucleosides and nucleotides and their biological importance. Types of DNA : A, B, C, Z DNA, structure and biological significance, superhelicity. Isolation, purification, identification and estimation of DNA. Properties of DNA – hypochromic and hyperchromic effect, melting temperature, viscosity. Denaturation and annealing.

#### **UNIT-IV**

Isolation, purification, identification and estimation of RNA. Salient features of prokaryotic and eukaryotic RNA. RNA as a genetic material. Types of RNA: mRNA, tRNA, rRNA, hnRNA, snRNA- location and role. Secondary and tertiary structure of tRNA. Action of nucleases of pancreas, spleen and venom on RNA.



## UNIT-V

Heterocyclic rings of biological importance - pyridine, pyrrole, quinoline, pteridine, thiazole, imidazole, indole with examples. General structure of carotenoids, terpenes and heme. Bile salt, bile pigments – structure and functions. Identification and biological significance of terpenoids, carotenoids, alkaloids, flavonoids. Salient features and properties of penicillin, streptomycin, tetracycline.

### Books Recommended

1. David L.Nelson and Michael M.Cox (2012). Lehninger Principles of Biochemistry (6<sup>th</sup> ed), W.H. Freeman.
2. Voet.D and Voet. J.G (2010) Biochemistry (4th ed), John Wiley and Sons, Inc.
3. Metzler D.E (2003). The chemical reactions of living cells (2<sup>nd</sup> ed), Academic Press.
4. Zubay G.L (1999). Biochemistry (4<sup>th</sup> ed), Mc Graw-Hill.
5. Lubert Stryer (2010). Biochemistry (7<sup>th</sup> ed), W.H.Freeman
6. Satyanarayan,U (2014). Biochemistry (4<sup>th</sup> ed), Arunabha Sen Books and Allied (P) Ltd, Kolkata.

## CORE PAPER VI - CORE PRACTICAL – II

### I. Titrimetric methods

1. Determination of saponification value of an edible oil.
2. Determination of acid number of an edible oil.
3. Determination of iodine value of an edible oil.

### II. Qualitative analysis

1. Analysis of simple sugars- glucose, fructose, galactose, xylose, sucrose, lactose, maltose and starch.
2. Analysis of amino acids - tyrosine, tryptophan, arginine, cysteine and histidine
3. Tests for protein- Solubility, Biurette, Xanthoproteic, Million's tests. Denaturation by heat, pH change. Precipitation by heavy metals and by acidic reagents.

### III. Colorimetry

1. Estimation of Protein by Biuret method.
2. Estimation of inorganic phosphorus by Fiske and Subbarow method.
3. Estimation of amino acids by Ninhydrin method.
4. Estimation of DNA by Indole method
5. Estimation of RNA by Orcinol method
6. Estimation of carbohydrate by Anthrone method

### Books recommended

1. Varley's practical clinical biochemistry, Alan. H. Gowen clock, 6<sup>th</sup> Edition, 1988, CBS publishers & distributors, India.
2. Practical manual of Biotechnology, Lab Manual, Dr.Ritu Mahajan, Dr.Jitender Sharma & Dr. R.K. Mahajan, 1<sup>st</sup> Edition, 2010, Vayu education of India, New Delhi.
3. Laboratory manual and Practical biochemistry, T.N.Pattabiraman, 4<sup>th</sup> Edition, 2010, All India Publisher's & Distributors limited, New Delhi.

4. Practical text book of biochemistry for MBBS students, D.M.Vasudevan, 1<sup>st</sup> Edition, 2007, Jaypee brothers, New Delhi.
5. An introduction to practical biochemistry, David. T. Plummer, 3<sup>rd</sup> Edition, 1998, Tata Mc.Grawhill education private limited, New Delhi.

## **V SEMESTER**

### **CORE PAPER – VII - ENZYMES**

#### **UNIT-I**

Enzymes - definition and chemical nature of enzymes. General properties; Nomenclature and classification, enzymes as catalysts - Activation energy. Enzyme specificity- Active site. Lock and key hypothesis and Induced fit theory, Allosteric site, Regulatory enzymes- allosteric enzymes with reference to ATcase. Isoenzymes with reference to LDH and CK.

#### **UNIT-II**

Methods of isolation of enzymes: Homogenisation techniques, intracellular localization of enzymes; isolation of intracellular enzymes; separation procedure based on molecular size - dialysis, ultrafiltration, molecular exclusion chromatography. Methods based on solubility – isoelectric precipitation. Salting in and salting out – methods based on electric charge – electrophoresis, Ion exchange chromatography.

#### **UNIT-III**

Coenzymes, function and action of TPP, PLP, NAD / NADP, FMN, FAD, coenzyme A, lipoic acid and Biotin. Multienzyme complexes. Metallo enzymes, Industrial uses of enzymes – food and pharmaceutical industries. Biosensors and their applications, immobilized enzymes and methods of immobilization.

#### **UNIT-IV**

Enzyme Kinetics: Rate of enzyme catalyzed reaction, Derivation of Michaelis - Menten equation. Lineweaver Burk plot and Eadie Hofstee plot. Factors affecting enzyme activity - pH, temperature, activators, cofactors, concentration of enzyme and substrate. Determination of  $K_m$  value.

## **UNIT-V**

Enzyme inhibition – reversible and irreversible inhibition – types of reversible inhibitors: competitive, non competitive , uncompetitive inhibitors. (Derivation not required). Mechanism of enzyme activity, covalent catalysis. Mechanism of action of chymotrypsin.

### **Books recommended**

1. David L.Nelson and Michael M.Cox (2012). Lehninger Principles of Biochemistry (6<sup>th</sup> ed), W.H.Freeman
2. Voet.D and Voet. J.G (2010). Biochemistry, (4th ed), John Wiley & Sons, Inc.
3. Robert K. Murray, Darryl K. Granner, Peter A. Mayes, and Victor W. Rodwell (2012). Harper's Illustrated Biochemistry (29<sup>th</sup> ed), McGraw-Hill Medical
4. Trevor Palmer (1995). Understanding Enzymes (4<sup>th</sup> ed), Ellis Horwood Ltd

## **CORE PAPER VIII – METABOLISM**

### **UNIT-I**

Introduction to intermediary metabolism, the basic metabolic pathways, anabolic, catabolic and amphibolic pathways. High energy compounds – definition, structure and free energy of hydrolysis of high energy compounds. Lippman ATP cycle. Biological oxidation – Redox reactions, redox couples – redox potential – standard redox potential and its measurement. Electron transport in mitochondria – components of electron transport chain. Reactions, energetics and inhibitors of electron transport. Oxidative phosphorylation – mechanism of chemi-osmotic theory. Inhibitors of oxidative phosphorylation – uncouplers and ionophores. Substrate level phosphorylation.

### **UNIT-II**

Metabolism of carbohydrates – reactions, inhibitors and energetics of glycolysis, Cori cycle, citric acid cycle, glyoxalate cycle, gluconeogenesis and HMP shunt pathway. Glycogenolysis, glycogenesis and regulation of glycogen metabolism.

### **UNIT-III**

Metabolism of lipids. Degradation of saturated fatty acids. -  $\beta$  oxidation. Degradation of triglycerides, phospholipids (lecithin). Biosynthesis of saturated fatty acids, triglycerides, phospholipids (lecithin). Biosynthesis of cholesterol and ketone bodies.

### **UNIT-IV**

Metabolism of amino acids – Amino acid pool. Oxidative deamination – role of dehydrogenases and oxidases. Non-oxidative deamination – role of pyridoxal phosphate with reference to serine and cysteine. Ammonia detoxification. Transamination reaction – mechanism of Schiff's base formation and transpeptidation– urea cycle – compartmentation and enzymes of urea cycle.

## **UNIT-V**

Metabolism of nucleic acid - Introduction, fate of dietary nucleic acids, catabolism of purine and biosynthesis of purine nucleotides – Denovo synthesis and salvage pathways, regulation of purine biosynthesis. Catabolism of pyrimidines and biosynthesis of pyrimidine nucleotides - Denovo synthesis and salvage pathways, regulation of pyrimidine synthesis.

### **Books Recommended**

1. David L.Nelson and Michael M.Cox (2012). Lehninger Principles of Biochemistry (6<sup>th</sup> ed) W.H. Freeman.
2. Voet.D and Voet. J.G (2010). Biochemistry (4th ed), John Wiley & Sons, Inc.
3. Lubert Stryer (2010). Biochemistry (7<sup>th</sup> ed), W.H.Freeman.
4. Denise R Ferrier (2013). Biochemistry (Lippincott's Illustrated Reviews), (6<sup>th</sup> ed), Lippincott Williams and Wilkins.
5. Robert K. Murray, Darryl K. Granner, Peter A. Mayes, and Victor W. Rodwell (2012). Harper's Illustrated Biochemistry (29<sup>th</sup> ed), McGraw-Hill Medical.

## **CORE PAPER – IX - ANALYTICAL BIOCHEMISTRY**

### **UNIT-I**

Definition of Molality, Molarity, Normality, Osmolarity, Definition of pH, pOH, determination of pH- Glass electrode, Isoelectric pH, Zwitter ion, buffers, Henderson–Hasselbalch equation, Tonicity, Donnon membrane equilibrium and application. Buffers in body fluids, Red blood cells and tissues. Measurement of oxygen consumption - the Clark oxygen electrode

### **UNIT-II**

Basic principles of sedimentation, centrifugal force, centripetal force, sedimentation rate. Types of centrifuges, types of rotors – fixed angle, vertical, swinging bucket, zonal, elutriator rotors. Preparative centrifugation – differential centrifugation – fractionation of subcellular organelles, density gradient centrifugation – gradient preparation, separation and recovery of sample. Isopycnic centrifugation, Isodensity centrifugation, analytical centrifugation.

### **UNIT-III**

General principles of chromatography – partition and adsorption chromatography. Paper chromatography – principle, sample application, development – ascending, descending and radial, detection of amino acids and sugars. Thin layer chromatography – principle, instrumentation and applications (separation of alkaloids). Column chromatography – principle, factors affecting resolution. Basic principles and applications of affinity chromatography. High Performance Liquid Chromatography (HPLC).

### **UNIT-IV**

General principle of electrophoresis, factors affecting migration rate – electrical potential, nature of the sample, nature of buffer, nature of the supporting medium. Tiselius moving boundary electrophoresis. Principle, procedure and application of paper,



cellulose acetate, agarose and starch gel electrophoresis. Principle and applications of SDS-PAGE and Immuno electrophoresis.

## **UNIT-V**

Basic principles of electromagnetic radiation, energy, wavelength, wave number and frequency. Absorption and emission spectrum. Beer Lambert law – UV and Visible range. Colorimetry, Spectrophotometry- principle, instrumentation and applications. Spectrofluorimetry- principle, instrumentation and applications with reference to riboflavin. Flame photometry – atomic absorption and emission - principle, instrumentation and applications with reference to sodium and potassium analysis.

### **Books Recommended**

1. Keith Wilson , John Walker (2010). Principles and Techniques of Biochemistry and Molecular Biology (7<sup>th</sup> ed), Cambridge University Press
2. David Sheehan (2009). Physical Biochemistry: Principles and Applications (2<sup>nd</sup> ed), Wiley-Blackwell
3. David M. Freifelder (1982). Physical Biochemistry: Applications to Biochemistry and Molecular Biology, W.H.Freeman
4. Rodney F.Boyer (2012). Biochemistry Laboratory: Modern Theory and techniques (2<sup>nd</sup> ed), Prentice Hall
5. Kaloch Rajan (2011). Analytical techniques in Biochemistry and Molecular Biology, Springer

## **CORE ELECTIVE PAPER –I - PHYSIOLOGY**

### **UNIT-I**

Structure of digestive system, digestion and absorption of carbohydrates, lipids and protein, Mechanism of HCl formation in stomach, role of various enzymes and hormones involved in digestive process and defecation. Structure of microvillus and factions. Excretory system – structure and function of kidney, structure of a nephron, mechanism of urine formation.

### **UNIT-II**

Composition of blood cells, plasma components, lymph and blood groups. Bleeding and clotting time. Mechanism of blood clotting. Circulatory system- basic anatomy of heart. Systemic, pulmonary and portal circulation. Heart beat, cardiac cycle and pacemaker.

### **UNIT-III**

Nervous system – Brain (parts of brain and ventricles), spinal cord, central and autonomous nervous system (sympathetic and parasympathetic). Structure of a neuron, synaptic transmission. Reflex action and neurotransmitters. Muscular system- types of muscles, structure and composition of skeletal muscle, structure of a myofibril, mechanism of muscle contraction and theories of muscle contraction.

### **UNIT-IV**

Respiratory system- composition of air, significance of O<sub>2</sub>, carbon dioxide and nitrogen in biological system. Partial pressure of oxygen and carbon dioxide. Structure of lungs and alveoli. Gaseous exchange in the lungs, tissue, arterial and venal capillaries, Role of kidney and lungs in maintaining the pH of blood.

## **UNIT-V**

Hormones- classification of hormones, endocrine glands and their secretion. Insulin, thyroxine, growth hormone. Structure and function. Steroid hormones. Corticosteroids- sex hormones – testosterone and estrogen, menstrual cycle.

### **Books Recommended**

1. John E. Hall (2010). Guyton and Hall Textbook of Medical Physiology (12<sup>th</sup> ed), Saunders
2. Best and Taylor (1990). Medical Physiology (12<sup>th</sup> ed), Lippincott Williams and Wilkins
3. Walter F. Boron, Emile L. Boulpaep (2012). Medical Physiology (2<sup>nd</sup> ed), Saunders
4. Anne Waugh (2010). Ross and Wilson Anatomy and Physiology in Health and Illness. Elsevier

## **VI - SEMESTER**

### **CORE PAPER-X - CLINICAL BIOCHEMISTRY**

#### **UNIT-I**

Scope of clinical biochemistry. Blood glucose homeostasis. Maintenance of blood glucose by hormone with special reference to insulin and glucagon. Abnormalities in glucose metabolism. Diabetes mellitus-types, causes, biochemical manifestations, diagnosis and treatment, Inborn errors of carbohydrate metabolism. Galactosemia, fructosuria and Glycogen storage diseases.

#### **UNIT –II**

Liver function test, Tests based on bile pigment metabolism. Carbohydrate metabolism, plasma proteins and lipids. Detoxification and excretory functions of liver, Jaundice -classification, biochemical changes and differential diagnosis for jaundice.

#### **UNIT-III**

Inborn errors of amino acid metabolism-Phenyl ketonuria, Alkaptonuria, Tyrosinemia, cystinuria. Normal and abnormal constituents in urine. Kidney function tests - Inulin, urea and creatinine clearance tests. Concentration and dilution tests. Phenol red test. Levels of plasma protein and its significance related to kidney function. Proteinuria.

#### **UNIT-IV**

Disorders of lipid metabolism-normal levels of cholesterol, triglycerides, phospholipids, free fatty acids and lipoprotein in blood. Abnormal levels of these lipids in diseases. Lipidosis, Atherosclerosis, hyper and hypo lipoproteinemias, sphingolipidoses, Niemann-Pick disease, Gaucher's and Tay-Sach's disease – causes and pathology.

## **UNIT-V**

Hormonal disorders - Acromegaly, Cushing's syndrome, Addison's disease, Goitre, Grave's disease, Hyperparathyroidism - clinical features. Clinical enzymology - enzymes of diagnostic importance - LDH, creatine kinase, transaminases, phosphatases, pancreatic lipase, amylase and choline esterase. Isoenzymes of lactate dehydrogenase.

### **Books Recommended**

1. Thomas M.Devlin (2014). Textbook of Biochemistry with Clinical Correlations (7th ed), John Wiley and Sons.
2. Montgomery R, Conway TW, Spector AA (1996). Biochemistry: A Case-Oriented Approach (6<sup>th</sup> ed), Mosby Publishers, USA.
3. Tietz (2014). Fundamentals of Clinical Chemistry and Molecular Diagnostics (7<sup>th</sup> ed), Saunders.
4. Dinesh Puri, (2002). Text book of Biochemistry: A clinically oriented approach - Churchill Livingstone Inc., India.
5. M.N.Chatterjee and Rana Shinde (2007). Textbook of Medical Biochemistry (7<sup>th</sup> ed).

## **CORE PAPER – XI- MOLECULAR BIOLOGY**

### **UNIT-I**

DNA as the unit of inheritance. Griffith, Avery, McLeod, McCarthy, Hershey and Chase experiments and their significance. Definition of gene, organization of gene and non-coding sequence in prokaryotes, mitochondrial DNA, plasmid DNA. Viral genome-bacteriophages (M13 and  $\Phi$ X174), animal virus (influenza virus), plant virus (TMV).

### **UNIT-II**

Prokaryotic replication- model of replication - semiconservative mode of replication- replication forks, semi-discontinuous replication, Okazaki fragments. Bacteriophages M13 and  $\Phi$ X174 replication, rolling circle model of replication. Enzymology of replication- role of DNA polymerases I, II, III, gyrase, topoisomerases, helicase, ligases and SSB proteins. Theta replication in *E.Coli* - initiation events at Ori C, elongation events on the replication fork and termination - fidelity of replication - inhibition of replication.

### **UNIT-III**

Transcription- prokaryotic RNA polymerases - role of sigma factor. TATA box, promoter, closed and open promoter complexes- initiation, elongation and termination of transcription, post transcriptional modifications in prokaryotes (tRNA and rRNA). Inhibitors of transcription.

### **UNIT-IV**

Genetic code - characteristics of genetic code - Wobble hypothesis - protein biosynthesis - activation of amino acids, initiation, elongation and termination of translation in prokaryotes. Inhibitors of protein biosynthesis.

## UNIT-V

DNA damage, Mutation - types of mutation with examples, causes- physical and chemical agents, site - specific mutagenesis and mutational hot spots. DNA repair by direct reversal of damage, photoreactivation, excision repair, recombination repair, SOS repair.

### **Books recommended**

1. Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments (6<sup>th</sup> ed), John Wiley and Sons. Inc.
2. Bruce Alberts and Dennis Bray (2013). Essential Cell Biology (4<sup>th</sup> ed), Garland Science.
3. De Robertis, E.D.P. and De Robertis, E.M.F. (2010). Cell and Molecular Biology (8<sup>th</sup> ed), Lippincott Williams and Wilkins, Philadelphia.
4. James.D.Watson (2013). Molecular Biology of the Gene (7<sup>th</sup> ed), Benjamin Cummings.
5. Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach (5<sup>th</sup> ed), Sunderland, Mass. Sinauer Associates, Inc.
6. David Freifelder (1992). Essentials of Molecular Biology (2<sup>nd</sup> ed), Jones and Bartlett Pub.

## CORE PAPER – XII - CORE PRACTICAL III

1. Assay of salivary amylase
2. Effect of pH, temperature and substrate concentration on activity of salivary amylase.
3. Collection and preservation of urine sample.
4. Qualitative analysis of normal constituents of urine such as urea, creatinine, phosphorus, calcium and abnormal constituents such as calcium, sugar, protein, amino acid, ketone bodies and bile pigments with clinical significance.
5. Quantitative Analysis of Urine
  - a. Urea
  - b. Uric acid
  - c. Creatinine
  - d. Calcium
6. Paper chromatography: Separation and detection of amino acids and simple sugars
7. Separation of amino acids by thin layer chromatography.

### Books recommended

1. Varley's practical clinical biochemistry, Alan. H. Gowen clock, 6<sup>th</sup> Edition, 1988, CBS publishers & distributors, India.
2. Practical manual of Biotechnology, Lab Manual, Dr.Ritu Mahajan, Dr.Jitender Sharma & Dr. R.K. Mahajan, 1<sup>st</sup> Edition, 2010, Vayu education of India, New Delhi.
3. Laboratory manual and Practical biochemistry, T.N.Pattabiraman, 4<sup>th</sup> Edition, 2010, All India Publisher's & Distributors limited, New Delhi.
4. Practical text book of biochemistry for MBBS students, D.M.Vasudevan, 1<sup>st</sup> Edition, 2007, Jaypee brothers, New Delhi.
5. An introduction to practical biochemistry, David. T. Plummer, 3<sup>rd</sup> Edition, 1998, Tata Mc.Grawhill education private limited, New Delhi.



## CORE PAPER – XIII - CORE PRACTICAL – IV

1. Collection and preservation of blood sample
2. Haematological studies
  - a. RBC counting
  - b. Total and differential count of white blood cells
  - c. Packed cell volume
  - d. Erythrocyte sedimentation rate
  - e. Blood clotting time
  - f. Blood grouping
3. Quantitative estimation in blood
  - a. Haemoglobin
  - b. Glucose
  - c. Cholesterol
  - d. Urea
  - e. Creatinine
  - f. Protein by Lowry's method.
4. Enzyme assay
  - a. AST
  - b. ALT
  - c. Alkaline phosphatase

### **Books recommended**

1. Varley's practical clinical biochemistry, Alan. H. Gowen clock, 6<sup>th</sup> Edition, 1988, CBS publishers & distributors, India.
2. Practical manual of Biotechnology, Lab Manual, Dr.Ritu Mahajan, Dr.Jitender Sharma & Dr. R.K. Mahajan, 1<sup>st</sup> Edition, 2010, Vayu education of India, New Delhi.
3. Laboratory manual and Practical biochemistry, T.N.Pattabiraman, 4<sup>th</sup> Edition, 2010, All India Publisher's & Distributors limited, New Delhi.

4. Practical text book of biochemistry for MBBS students, D.M.Vasudevan, 1<sup>st</sup> Edition, 2007, Jaypee brothers, New Delhi.
5. An introduction to practical biochemistry, David. T. Plummer, 3<sup>rd</sup> Edition, 1998, Tata Mc.Grawhill education private limited, New Delhi.

## **CORE ELECTIVE PAPER – II – IMMUNOLOGY**

### **UNIT-I**

Types of immunity- innate and acquired. Humoral and cell mediated immunity. Immune system – functions and structural components – lymphoreticular system – lymphoid organs- primary and central lymphoid organs – structure and functions of lymphoid cells – types and functions of B, T and null cells. Role of phagocytes and mast cells.

### **UNIT-II**

Antigens – definition – types – haptens, isoantigens, neoantigens. Factors affecting antigenicity and immunogenicity of antigens. Antibodies – definition and classification. General structure and functions of IgM, IgD, IgA, IgG and IgE, Isohemeagglutinins and natural antibodies. Clonal selection theory of antibody formation. Complement – biochemical functions. Activation by classical and alternative pathways and lectin pathways.

### **UNIT-III**

Antigen – antibody interaction – types – precipitation and agglutination mechanism. Applications of agglutination reaction in diagnosis of diseases – Vidal test – complement fixation test. Blood grouping- major and minor blood groups. Erythroblastosis fetalis, Blood transfusion. Mismatched blood transfusion and its consequences, Principle and applications of RIA and ELISA.

## **UNIT-IV**

Immunization practices- passive and active immunization. Commonly used vaccines- killed and live attenuated. Vaccination schedule for children. Production of polyclonal and monoclonal antibodies- principle and applications.

## **UNIT-V**

Disorders of immune system – hypersensitivity – causes, types and pathology of type I, II, III and IV hypersensitivity – Auto immunity – causes and the pathology of Rheumatoid arthritis, systemic lupus erythematosus, Hashimotos thyroiditis, thyrotoxicosis, autoimmune hemolytic anemia. Immunodeficiency diseases – B-Cell and T-Cell and complement deficiency.

### **Books recommended**

1. Judy Owen, Jenni Punt Kuby (2013). Immunology (Kindt, Kuby Immunology) (7<sup>th</sup> ed), W. H. Freeman & Co.
2. Janis Kuby (1997). Immunology (3<sup>rd</sup> ed), W. H. Freeman & Co.
3. David Male (2012). Immunology, (Immunology (Roitt) (8<sup>th</sup> ed), Saunders
4. Ivan Roitt and Peter Delves (2001). Roitts Essential Immunology (10<sup>th</sup> ed).
5. Donald M. Weir (1998). Immunology (8<sup>th</sup> ed), Churchill Livingstone.
6. Janeway CA, Travers P, Walport M, and Shlomchik M (2001). Immunobiology (6<sup>th</sup> ed), Garland Publishing, New York.
7. Nandini Shetty (2005). Immunology: Introductory text book (1<sup>st</sup> ed), New Age International.

## **CORE ELECTIVE-III – BIOTECHNOLOGY**

### **UNIT-I**

Scope and importance of biotechnology. Recombinant DNA technology- Definition, restriction endonucleases - types, role, recognition sequences, cleavage pattern, modification of cuts ends, vectors- plasmid, cosmid, phage. Enzymes used in rDNA technology - DNA ligases, Alkaline phosphatase, polynucleotide kinase, linkers, homopolymer tailing, end labeling and construction maps of PBR322,  $\lambda$  bacteriophage.

### **UNIT-II**

Steps in genetic engineering - Construction of genomic library. Synthesis of cDNA Construction of cDNA library. Gene transfer methods- transformation, conjugation, transduction, microinjection and electroporation. Selection - selectable markers, selection of recombinants by blue-white selection method (chromogenic substrate) and screening of clones - colony hybridization, screening with antibodies. PCR - application in clinical diagnosis and forensic science. Southern blotting, Northern blotting.

### **UNIT-III**

Plant tissue culture - basic requirements for culture, MS medium, callus culture, protoplast culture. Vectors – Ti plasmid (cointegration vector and binary vector), Viral vectors- TMV, CaMV and their applications. Transgenic plants – agrobacterium mediated gene transfer, pest resistant, herbicide resistant and stress tolerant plants.

### **UNIT-IV**

Vectors for gene transfer in animal cells - SV 40 Vector. Basics of transfection methods- calcium phosphate precipitation, DEAE - dextran mediated transfection. Transgenic mice-retroviral transfer and stem cell mediated transfer, applications. Embryonic stem cell - definition, ES cell culture to produce differentiated cells, microinjection and applications.

## **UNIT-V**

Production and applications of ethanol and streptomycin (industrial Biotechnology), Proteases (Enzyme biotechnology), Biogas, Biodiesel (Fuel biotechnology), Waste water treatment (Environmental Biotechnology), Vaccines and monoclonal antibodies (Medical biotechnology).

### **Books Recommended**

1. David Freifelder (1992). Essentials of Molecular Biology (2<sup>nd</sup> ed), Jones & Bartlett Pub.
2. Click B.R. and Pasternark J.J (2010). Molecular Biotechnology: Principles and Applications of Recombinant DNA. (4<sup>th</sup> ed), American Society for Microbiology.
3. James D. Watson, Amy A. Caudy, Richard M. Myers, Jan Witkowski (2006). Recombinant DNA: Genes and Genomes - a Short Course (3<sup>rd</sup> ed), W.H.Freeman and Co.
4. Satyanarayana U (2008). Biotechnology, Books and Allied (P) Ltd.
5. Casida L (2007). Industrial Microbiology, New Age International.
6. Reed G (2004). Prescott and Dunn's Industrial Microbiology, CBS Publishers and Distributors.

## **ALLIED PAPERS FOR OTHER BRANCHES**

### **ALLIED BIOCHEMISTRY**

#### **PAPER –I**

##### **UNIT I**

Definition and classification of carbohydrates, linear and cyclic forms (Haworth projection) for glucose, fructose and mannose and disaccharides (maltose, lactose, sucrose).

##### **UNIT II**

General properties of monosaccharides and disaccharides. Occurrence and significance of polysaccharides. Physical properties – Stereoisomerism, Optical isomerism, mutarotation.

##### **UNIT III**

Amino acids, various classifications, amphoteric nature, isoelectric point. Reactions of carboxyl and amino groups.

##### **UNIT IV**

Proteins- classification - biological functions, physical properties - ampholytes, isoionic point, salting in and salting out, denaturation, nature of peptide bond. Secondary structure,  $\alpha$ -helix and  $\beta$ -pleated sheet, tertiary structure, various forces involved - quaternary structure. Deamination, transamination and urea cycle.

### **Books Recommended**

1. David L.Nelson and Michael M.Cox (2012). Lehninger Principles of Biochemistry (6<sup>th</sup> ed) W.H. Freeman.
2. Voet.D & Voet. J.G (2010). Biochemistry, (4th ed), John Wiley & Sons, Inc.
3. Lubert Stryer (2010). Biochemistry (7<sup>th</sup> ed), W.H.Freeman.
4. Satyanarayan,U (2014). Biochemistry (4<sup>th</sup> ed), Arunabha Sen Books & Allied (P) Ltd, Kolkata.
5. Jain J.L (2007). Fundamentals of Biochemistry, S.Chand publishers.



# **ALLIED BIOCHEMISTRY**

## **PAPER –II**

### **UNIT I**

Fats - function, classification, simple lipids, fatty acids (saturated and unsaturated), compound lipids, derived lipids, properties- saponification, rancidity, reduction, oxidation, halogenation. Functions of phospholipids, Cholesterol – biological importance, chemical properties.

### **UNIT II**

Purine and pyrimidine bases, nucleosides, nucleotides, polynucleotides, DNA structure, various types, properties- absorbance, effect of temperature. Different types of RNA structure and function, Genetic code.

### **UNIT III**

Enzymes - definition, units of enzyme activity, enzyme nomenclature, specificity, isoenzymes, factors affecting enzyme activity- substrate concentration, pH, temperature. Michaelis and Menten equation. Lineweaver- Burk plot, Enzyme inhibition, competitive, uncompetitive and non competitive inhibition

### **UNIT IV**

Vitamins, definition, classification, water soluble vitamins, B1, B2, B3, B6, B12 and Vitamin C. Deficiency diseases. Fat soluble vitamins - A, D, E and K- Deficiency diseases.

### **Books Recommended**

1. David L.Nelson and Michael M.Cox (2012). Lehninger Principles of Biochemistry (6<sup>th</sup> ed) W.H. Freeman.
2. Voet.D & Voet. J.G (2010). Biochemistry, (4th ed), John Wiley & Sons, Inc.
3. Lubert Stryer (2010). Biochemistry, (7<sup>th</sup> ed), W.H.Freeman
4. Satyanarayan,U (2014). Biochemistry (4<sup>th</sup> ed), Arunabha Sen Books & Allied (P) Ltd, Kolkata.
5. Jain J.L (2007). Fundamentals of Biochemistry,S.Chand publishers

## ALLIED BIOCHEMISTRY PRACTICALS

### FOR PAPERS I & II

1. Volumetric analysis
  - a. Estimation of ascorbic acid using 2, 6 – dichlorophenol indophenol as link solution.
  - b. Estimation of Glycine by formal titration.
2. Qualitative analysis
  - a. Qualitative analysis of carbohydrates- glucose, fructose, galactose, lactose, maltose and sucrose.
  - b. Qualitative analysis of amino acids – arginine, cysteine, tryptophan and tyrosine.
3. Quantitative analysis: (demonstration)
  - a. Colorimetric estimation of protein by Biuret method.
  - b. Colorimetric estimation of phosphorus.
4. Biochemical preparations
  - a. Preparation of casein from milk.
  - b. Preparation of starch from potato.

#### **Books recommended**

1. Varley's practical clinical biochemistry, Alan. H. Gowen clock, 6<sup>th</sup> Edition, 1988, CBS publishers & distributors, India.
2. Laboratory manual and Practical biochemistry, T.N.Pattabiraman, 4<sup>th</sup> Edition, 2010, All India Publisher's & Distributors limited, New Delhi.
3. Practical text book of biochemistry for MBBS students, D.M.Vasudevan, 1<sup>st</sup> Edition, 2007, Jaypee brothers, New Delhi.
4. An introduction to practical biochemistry, David. T. Plummer, 3<sup>rd</sup> Edition, 1998, Tata Mc.Grawhill education private limited, New Delhi.

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