



UNIVERSITY OF JAMMU

(NAAC ACCREDITED 'A' GRADE UNIVERSITY)
Baba Sahib Ambedkar Road, Jammu-180006 (J&K)

Academic Section

Email: academicsectionju14@gmail.com

NOTIFICATION

(23/April/Adp./14)

It is hereby notified for the information of all concerned that the Vice-Chancellor, in anticipation of the approval of the Academic Council, is pleased to authorize the adoption of the Syllabi and Courses of Studies in the subject of **Biochemistry** for Semester IIIrd and IVth of **Four Year Under Graduate Programme (FYUGP)** under the **Choice Based Credit System** as per NEP-2020 (as given in the annexure) for the examinations to be held in the years as per the details given below:

Subject	Semester	For the examinations to be held in the year
Biochemistry	Semester-III Semester-IV	December 2023, 2024 and 2025 May 2024, 2025 and 2026

The Syllabi of the courses is also available on the University website: www.jammuuniversity.ac.in

Sd/-

DEAN ACADEMIC AFFAIRS

No. F. Acd/II/23/1620-1640

Dated: 04/05/23

Copy for information and necessary action to:

1. Dean Faculty of Science
2. HOD/Convener, Board of Studies Biotechnology | Biochemistry
3. Sr. P.A. to the Controller of Examinations
4. All members of the Board of Studies
5. C.A. to the Controller of Examinations
6. Director, Computer Centre, University of Jammu
7. Deputy Registrar/Asst. Registrar (Conf. /Exams. UG. Exam. Non.Prof)
8. Incharge University Website for necessary action please

Sumitashano
4/5/23
Deputy Registrar (Academic)

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103/5/23

UNIVERSITY OF JAMMU

**SYLLABI AND COURSE OF STUDY IN
BIOCHEMISTRY**

**For the Examination to be held in Year 2023, 2024, 2025,
2026**

BIOCHEMISTRY COURSE

UG SEMESTER III & IV

UNDER NEP-2020

NSL

Dr. Anshu

S. Bhat

Dr. G. K. /

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UNIVERSITY OF JAMMU
SYLLABI AND COURSES OF STUDY IN BIO-CHEMISTRY
For the examination to be held in December 2023, 2024 & 2025
UG SEMESTER-III
UNDER NEP-2020

S. No.	Course Type	Course No.	Course Title	Credits (T+P)	Marks				Total Marks
					Theory		Practical		
1	Major	UMJB CHT-301	Chemical Foundation of Biochemistry	4 (3T+1P)	Mid Semester: 15 Marks	End Semester Exam: 60Marks	Daily Assessment: 10 Marks	Final Exam: 15 Marks	100
2	Major	UMJB CHT-302	Chemistry of Biomolecules	4 (3T+1P)	Mid Semester: 15 Marks	End Semester Exam: 60Marks	Daily Assessment: 10 Marks	Final Exam: 15 Marks	100
3	Minor	UMIB CHT-303	Biomolecules	4 (3T+1P)	Mid Semester: 15 Marks	End Semester Exam: 60Marks	Daily Assessment: 10 Marks	Final Exam: 15 Marks	100
4	Multidisciplinary	UMDB CHT-304	Nutrition and Health	3+0	Mid Semester: 15 Marks	End Semester Exam: 60Marks	NA	NA	75
5	Skill Enhancement	USEB CHT-305	Biochemical Diagnostics	2 (1+1)	Mid Semester: 10 Marks	End Semester Exam: 40Marks	10	15	50

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University of Jammu
Syllabi of Bio-Chemistry for FYUP under CBCS as per NEP-2020
Semester – III
(Examination to be held in May 2024, 2025 & 2026)
MAJOR COURSE

Course Code : UMJBCHT-301
Course Title : Chemical Foundation of Biochemistry
Credits : 4 (3Theory+1Practical)
Total No. of Lectures: Theory: 45 hours
Practical : 30 hours
Maximum Marks: 100
Theory : 75
Practical : 25

OBJECTIVES AND EXPECTED LEARNING OUTCOMES

The course will instil confidence and clarity of mind in students to understand the chemical structures of Biomolecules and Biological reactions. After successful completion of course, the students will be able to:

1. understand fundamental properties of elements, their role in formation of biomolecules and in chemical reactions within living organisms.
2. understand the concepts of mole, mole fraction, molarity, etc. and to apply them in preparations of solutions of desired strengths.
3. refresh fundamentals of chemical bonds, electronic configuration, theories of bond formation.
4. understand the fundamentals of chemical processes in biological systems.
5. appreciate the roles of metals, non-metals, transition metals and coordination compounds in biological systems.

Unit-1 Atomic structure and Chemical Bonding

Structure of an atom, electrons & Quantum numbers, orbitals, shapes of orbitals, s, p, d, and f sub shells, K, L, M, N, O, P, and Q shells. Illustration of Pauli's exclusion principle, Aufbau principle, and Hund's rule, electron configuration up to atomic number 20, octet rule. Formation and properties of non-covalent and covalent bonds, hydrogen bonds, ionic bonds, van der Waals interactions, dipole-dipole interactions, electrostatic interactions, and hydrophobic interactions. Sigma, pi and coordinate bonds, back bonding, corresponding energy associated, outline of theories of bonding: valence bond theory, molecular orbital theory and crystal field theory.

Unit-2 Electrochemistry and Redox Reactions

Scope of electrochemistry, electrochemical cells and types, electrode potential and its measurement, electrolysis, types of electrolytes, electrodes, half-cell reaction, standard electrodes. Laws of thermodynamics, entropy, enthalpy and their relation, Gibb's energy, free energy change, ion. Redox reactions: types, change in oxidation number and combination, redox potential, application of redox potential, energy linked to redox reactions, reduction of oxygen. Endergonic and exergonic reactions with examples, their importance in biological systems, oxidation and reduction of iron in haemoglobin, biologically active forms of zinc, calcium, nickel, molybdenum, selenium, and cobalt, NAD^+/NADH , $\text{NADP}^+/\text{NADPH}$, FAD/FADH^2 , FMN/FMNH^2 .

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Maximum Marks: 100
Theory : 75
Practical : 25

Unit 3: Organic Compounds and their Nomenclature

Organic compounds: classification, IUPAC nomenclature, compounds containing one, two functional groups with chains, homologous series. Stereochemistry, geometrical and structural isomerism, conformation and free rotation. Optical isomerism, symmetry of elements. Nomenclature of enantiomers, epimers, racemic mixture. Fischer and Newmann projection formulae, molecule with one and two chiral and achiral centres. Priority rules; E and Z (CIP rules), R and S, D and L notations, absolute (r and s) and relative (d and l) configuration. Role of stereochemistry in biological systems.

Unit 4: Inorganic Chemistry and Organometallic compounds

Inorganic molecules and coordination compounds: nomenclature and formula. Central metal ion, ligand, coordination number, sphere, complex ion, oxidation number of central atoms, homoleptic and heteroleptic complexes. Isomerism in complexes, structural, ionization, solvate (hydrate), linkage and coordination, Stereoisomerism, geometrical, optical isomerism with simple inorganic complexes. Applications of qualitative/quantitative analysis; photographic, metallurgy, medicine, catalysis and bio systems. Metal atom linked organic compounds. Porphyrins and Metal ions: Role of metal ions in biological systems, Fe, Cu, Zn, structure and functions of porphyrins, metalloporphyrins and iron-sulphur clusters with suitable examples and their role in biological systems.

Practicals

1. Calibration of volumetric glassware (Burette, pipette, standard flasks).
2. Concept of molarity, molality and normality. Calculation and preparation of molar solutions, normal solutions, percent solutions and dilute solutions.
3. Preparation of standard Sodium carbonate solution, standardization of HCl (Methyl orange) and estimation of NaOH in the given solution (Methyl orange or phenolphthalein).
4. Preparation of standard Potassium dichromate and estimation of ferrous/ferric mixture using diphenylamine indicator.
5. Preparation of buffers; phosphate, bicarbonate and acetate buffers.
6. Verification of Beer's Law. (i) Estimation of unknown concentration of a biomolecule by using colorimeter (ii) Determination of molar extinction coefficient.
7. Calibration of pH meter and determination of pH of few solutions.

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University of Jammu
Syllabi of Bio-Chemistry for FYUP under CBCS as per NEP-2020
Semester – III
(Examination to be held in May 2024, 2025 & 2026)
MAJOR COURSE

Course Code : UMJBCHT-301
Course Title : Chemical Foundation of Biochemistry
Credits : 4 (3Theory+1Practical)
Total No. of Lectures: Theory: 45 hours
Practical : 30 hours
Maximum Marks: 100
Theory : 75
Practical : 25

NOTE FOR PAPER SETTING

Examination Theory / Practical	Syllabus to be covered in the Examination	Time Allotted for Exam	% Weightage (Marks)
Mid Term Assessment test	50%	1 ½ Hours	15
External Theory End Semester	100%	3 Hours	60
Daily Practical Evaluation	-	-	10 (Based on Daily Performance only)
Final Practical Exam	-	-	15 (10 Marks Test & 5 Marks Viva)

A) Mid Term Assessment test: (15 Marks) Time Allotted 1 ½ Hours

B) External End Semester Examination: (60 Marks) Time Allotted 3 Hours

- a) External End Semester Theory Examination will have two sections (A & B).
- b) Section A shall be of 12 Marks and will comprise of 4 short answer type questions one question from each unit carrying 03 Marks each. A candidate will have to attempt all the questions.
- c) Section B shall be of 48 Marks and will comprise of 8 long answer type questions, two from each unit. A candidate will have to attempt four questions selecting one question from each unit. Each question will carry 12 marks.

Suggested Books:

1. Vogel's textbook of quantitative chemical analysis, Vogel, A.I., Mendhan, J., Denney, R.C. and Barnes, J.D., Prentice Hall, 6th Edition (2000).
2. Physical Chemistry, Atkins, P., de Paula, J. and Keeler, J., W.H. Freeman and Company, International Edition (2018).
3. Inorganic Chemistry: Principles of Structure and Reactivity, Huheey, J.E., Keiter, E.A., Keiter, R.L. and Medhi, K.O., Pearson Education India, 5th Edition (2022).
4. Stereochemistry: Conformation and Mechanism, Kalsi, P.S., New Age International Publications, 11th Edition (2022).
5. Introduction to Stereochemistry, Mislow, K., Dover Publications (2012).
6. A Text book of Organic Chemistry, Bansal, R.K., New Age International Publications, 6th Edition (2016).

University of Jammu
Syllabi of Bio-Chemistry for FYUP under CBCS as per NEP-2020
Semester – III
(Examination to be held in December 2023, 2024 & 2025)
MAJOR COURSE

Course Code : UMJBCHT-302
Course Title : Chemistry of Biomolecules
Credits : 4 (3Theory+1Practical)
Total No. of Lectures: Theory: 45 hours
Practical : 30 hours
Maximum Marks: 100
Theory : 75
Practical : 25

OBJECTIVES AND EXPECTED LEARNING OUTCOMES

The course provides detailed aspect of Biomolecules. After successful completion of course, the students will be able to:

1. understand the classification, properties of carbohydrates, amino acids, proteins, lipids, cholesterol, DNA, RNA, glycoproteins, glycolipids and their importance in biological systems.
2. understand the structure of Monosaccharides, Oligosaccharides, Polysaccharides, amino acids.
3. identify the various biomolecules in the laboratory.
4. understand the level of protein architecture i.e. Primary, Secondary, Tertiary and Quaternary.

Unit 1: Carbohydrates

Definition, importance, detailed classification of carbohydrates, isomerism in carbohydrates, structure of monosaccharides, anomeric forms, mutarotation, reaction of monosaccharides with special reference to glucose, reducing and non-reducing sugars. Disaccharides: classification, structure and functions of important disaccharides - maltose, lactose, sucrose, lactose intolerance. Polysaccharides: classification, structure and functions of storage and structural polysaccharides, sugars of bacterial cell wall, role of proteoglycans, glycoproteins and glycolipids (gangliosides and lipopolysaccharide).

Unit 2: Lipids

Lipids: Definition, importance and functions, classification of lipids: simple, complex, derived and miscellaneous lipids. Fatty acids: Nomenclature, structure and properties of fatty acids, Classification of Fatty acids: saturated and unsaturated fatty acids, essential fatty acids and non-essential fatty acids, odd chain and even chain fatty acids. Chemical properties and characterization of fats: hydrolysis, saponification value, Reichert-meissel number, iodine number, acid number, rancidity of fats. General structure and functions of major lipid subclasses: acylglycerol, phosphoglycerides, sphingolipids, terpenes, steroids, eicosanoids.

Unit 3: Proteins

Amino acids: structure & classification, properties of amino acids, structure of peptide bond. Organizational levels of protein structure, relationship between primary and higher order structures, supramolecular assemblies of proteins, solubility, denaturation, functional diversity and species specificity of proteins, protein classification, chemical synthesis of polypeptides. Conformation of

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Semester – III
(Examination to be held in December 2023, 2024 & 2025)
MAJOR COURSE

Course Code : UMJBCHT-302
Course Title : Chemistry of Biomolecules
Credits : 4 (3Theory+1Practical)
Total No. of Lectures: Theory: 45 hours
Practical : 30 hours
Maximum Marks: 100
Theory : 75
Practical : 25

proteins: Ramachandran plot, secondary, tertiary and quaternary structure; domains; motif and folds, stabilizing interactions: vander waals, electrostatic, H-bonding and hydrophobic interactions. **Unit 4: Unit 4: Nucleic Acids**

Nucleic acids, composition and importance in living system, types and structure of purine and pyrimidine bases, structure of nucleosides, nucleotides and deoxynucleotides, the binding of nucleotide components, structure of DNA, Chargaff's rules, features of Watson and Crick model, various form of DNA, structure and roles of different types of RNA, differences between properties of DNA and RNA, cot curves and cot value, T_m , hypo and hyper-chromicity.

Practicals:

1. Qualitative tests for carbohydrates.
2. Qualitative tests for reducing sugars.
3. Qualitative tests for Ketose sugar.
4. Qualitative tests for polysaccharides.
5. Scheme for identification of unknown carbohydrates.
6. Qualitative tests for amino acids.
7. Quantitative test for proteins.
8. Methods of precipitation of proteins.
9. Qualitative tests for lipids.
10. Qualitative tests for nucleic acids.

NOTE FOR PAPER SETTING

Examination Theory / Practical	Syllabus to be covered in the Examination	Time Allotted for Exam	% Weightage (Marks)
Mid Term Assessment test	50%	1 ½ Hours	15
External Theory End Semester	100%	3 Hours	60
Daily Practical Evaluation	-	-	10 (Based on Daily Performance only)
Final Practical Exam	-	-	15 (10 Marks Test & 5 Marks Viva)

A) Mid Term Assessment test: (15 Marks) Time Allotted 1 ½ Hours

B) External End Semester Examination: (60 Marks) Time Allotted 3 Hours

- a) External End Semester Theory Examination will have two sections (A & B).

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Semester – III
(Examination to be held in December 2023, 2024 & 2025)
MAJOR COURSE

Course Code : UMJBCHT-302
Course Title : Chemistry of Biomolecules
Credits : 4 (3Theory+1Practical)
Total No. of Lectures: Theory: 45 hours
Practical : 30 hours
Maximum Marks: 100
Theory : 75
Practical : 25

- b) Section A shall be of 12 Marks and will comprise of 4 short answer type questions one question from each unit carrying 03 Marks each. A candidate will have to attempt all the questions.
- c) Section B shall be of 48 Marks and will comprise of 8 long answer type questions, two from each unit. A candidate will have to attempt four questions selecting one question from each unit. Each question will carry 12 marks.

Suggested Books:

1. Leininger's Principles of Biochemistry, Nelson and Cox, W. H. Freeman and company, New York. 8th Edition (2021).
2. Biochemistry, Satyanarayana, U. and Chakrapani, U., Relx India Pvt. Ltd., 6th Edition (2021).
3. Biochemistry, John, M.B., Tymoczko, J.L., Gatto Jr., G.J. and Styrer, L., W. H. Freeman and company, New York. 9th Edition (2019).
4. Fundamentals of Biochemistry, Jain, J.L., Jain, S. and Jain, N., S. Chand. 7th Edition (2016).
5. Standard Methods of Biochemical Analysis, Thimmaiah, S. K., Kalyani Publisher. 2nd Edition (2016).
6. Principles of Biochemistry, Voet, D., Pratt, C.W. and Voet, J.G., John Wiley & Sons, Inc. 4th Edition (2012).
7. Biochemistry, Voet, D. and Voet, J.G., John Wiley & Sons, Inc. 4th Edition (2002).
8. Laboratory Manual of Microbiology and Biotechnology, Aneja, K. R., Medtech., 2nd Edition (2018).
9. Laboratory Manual of Biochemistry & Biotechnology, 2011, Rizvi, S. E. H., Mr. Books Fairdeal Shopping Complex Residency Road Srinagar. 1st Edition (2011)

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University of Jammu
Syllabi of Bio-Chemistry for FYUP under CBCS as per NEP-2020
Semester – III
(Examination to be held in December 2023, 2024 & 2025)
MINOR COURSE

Course Code : UMIBCHT-303
Course Title : Biomolecules
Credits : 4 (3Theory+1Practical)
Total No. of Lectures: Theory: 45 hours
Practical : 30 hours
Maximum Marks: 100
Theory : 75
Practical : 25

OBJECTIVES AND EXPECTED LEARNING OUTCOMES

The course provides detailed aspect of Biomolecules. After successful completion of course, the students will be able to understand:

1. the classification, properties of carbohydrates, amino acids, proteins, lipids, cholesterol, DNA, NA, glycoproteins, glycolipids and their importance in biological systems.
2. structure of Monosaccharides, Oligosaccharides, Polysaccharides, amino acids.
3. identify the various biomolecules in the laboratory.
4. level protein architecture i.e., Primary, Secondary, Tertiary and Quaternary.

Unit 1: Carbohydrates

Definition, importance, detailed classification of carbohydrates, isomerism in carbohydrates, structure of monosaccharides, pen and ring structure of aldoses and ketoses, anomeric forms, mutarotation, reaction of monosaccharides with special reference to glucose, reducing and non-reducing sugars, disaccharides: classification, structure and functions of important disaccharides - maltose, lactose, sucrose, lactose intolerance. Polysaccharides: classification, structure and functions of storage and structural polysaccharides, sugars of bacterial cell wall, role of proteoglycans, glycoproteins and glycolipids (gangliosides and lipopolysaccharide).

Unit 2: Lipids

Lipids: Definition, importance and functions, classification of lipids: simple, complex, derived and miscellaneous lipids, Fatty acids: Nomenclature, structure and properties of fatty acids, Classification of Fatty acids: saturated and unsaturated fatty acids, essential fatty acids and non-essential fatty acids, odd chain and even chain fatty acids. Chemical properties and characterization of fats: hydrolysis, saponification value, Reichert-meissel number, iodine number, acid number, rancidity of fats. General structure and functions of major lipid subclasses: acylglycerol, phosphoglycerides, sphingolipids, terpenes, steroids, eicosanoids.

Unit 3: Proteins

Amino acids: structure & classification, properties of amino acids, structure of peptide bond. Organizational levels of protein structure, relationship between primary and higher order structures, supramolecular assemblies of proteins, solubility, denaturation, functional diversity and species specificity of proteins, protein classification, chemical synthesis of polypeptides. Conformation of proteins: Ramachandran plot, secondary, tertiary and quaternary structure; domains; motif and folds, stabilizing interactions: Vander waals, electrostatic, H-bonding and hydrophobic interactions.

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University of Jammu
Syllabi of Bio-Chemistry for FYUP under CBCS as per NEP-2020
Semester – III

(Examination to be held in December 2023, 2024 & 2025)

MINOR COURSE

Course Code : UMIBCHT-303
Course Title : Biomolecules
Credits : 4 (3Theory+1Practical)
Total No. of Lectures: Theory: 45 hours
Practical : 30 hours
Maximum Marks: 100
Theory : 75
Practical : 25

Unit 4: Nucleic Acids

Nucleic acids, composition and importance in living system, types and structure of purine and pyrimidine bases, structure of nucleosides, nucleotides and deoxynucleotides, the binding of nucleotide components, structure of DNA, Chargaff's rules, features of Watson and Crick model, various form of DNA, structure and roles of different types of RNA, differences between properties of DNA and RNA, cot curves and cot value, T_m , hypo and hyper-chromicity.

Practicals:

1. Qualitative tests for carbohydrates.
2. Qualitative tests for reducing sugars.
3. Qualitative tests for Ketose sugar.
4. Qualitative tests for polysaccharides.
5. Scheme for identification of unknown carbohydrates.
6. Qualitative tests for amino acids.
7. Quantitative test for proteins.
8. Methods of precipitation of proteins.
9. Qualitative tests for lipids.
10. Qualitative tests for nucleic acids.

NOTE FOR PAPER SETTING

Examination Theory / Practical	Syllabus to be covered in the Examination	Time Allotted for Exam	% Weightage (Marks)
Mid Term Assessment test	50%	1 ½ Hours	15
External Theory End Semester	100%	3 Hours	60
Daily Practical Evaluation	-	-	10 (Based on Daily Performance only)
Final Practical Exam	-	-	15 (10 Marks Test & 5 Marks Viva)

a) Mid Term Assessment test: (15 Marks) Time Allotted 1 ½ Hours

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Semester – III
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MINOR COURSE

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Course Title : Biomolecules
Credits : 4 (3Theory+1Practical)
Total No. of Lectures: Theory: 45 hours
Practical : 30 hours
Maximum Marks: 100
Theory : 75
Practical : 25

b) External End Semester Examination: (60 Marks) Time Allotted 3 Hours

- a) External End Semester Theory Examination will have two sections (A & B).
- b) Section A shall be of 12 Marks and will comprise of 4 short answer type questions one question from each unit carrying 03 Marks each. A candidate will have to attempt all the questions.
- c) Section B shall be of 48 Marks and will comprise of 8 long answer type questions, two from each unit. A candidate will have to attempt four questions selecting one question from each unit. Each question will carry 12 marks.

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2. Biochemistry, Voet, D. and Voet, J.G., John Wiley & Sons, Inc. 4th Edition (2002).
3. Principles of Biochemistry, Voet, D., Pratt, C.W. and Voet, J.G., John Wiley & Sons, Inc. 4th Edition (2012).
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Semester – III
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MULTIDISCIPLINARY COURSE

Course Code: UMDBCHT-304

Course Title: Nutrition and Health

Credits: 3

Total No. of Lectures: Theory: 45 hours

Maximum Marks: 75

Theory: 75

OBJECTIVES AND EXPECTED LEARNING OUTCOMES

The course provides awareness about Life style diseases and their management. After successful completion of course, the students will able to understand:

1. Functions of food, food pyramid, concept of nutrition, RQ of food stuff, Basal Metabolic Rate, composition of balance diet, RDA for different age groups.
2. Nutritional significance of carbohydrates, amino acids, proteins, lipids, macro elements and trace elements in diet.
3. Principles of diet therapy, diet therapy for various life style disease and Protein energy malnutrition.
4. Knowledge on food safety and their implications on health

Unit 1: Introduction to Nutrition

Functions of food, food groups, food pyramid; Nutrition: Ideal, under and over nutrition; Nutrition and Energy supply; Nutrition utilization in man; Energy content of foods, Respiratory Quotient of foodstuffs; Basal Metabolic Rate (BMR), factors affecting BMR, significances of BMR; Energy requirements for different physical activities; Recommended Dietary allowances (RDA) for Infants, Children, Adolescent, Adult male, female, Pregnant, Lactating women and old age.

Unit 2: Elements of Nutrition

Dietary Carbohydrates; Composition, physiological functions, food sources, digestion, lactose intolerance, dietary requirements, Dietary fibre; types, Benefits and adverse effects.

Dietary lipids; Classification, sources, functions; Essential fatty acids (EFA): functions and their deficiencies, Cholesterol requirement in the body; Saturated and unsaturated fatty acids.

Dietary Proteins; Composition, physiological role of proteins in the body: Essential and nonessential amino acids; Food source and RDA of proteins for different age groups; Biological value of proteins; Nitrogen balance.

Unit 3: Dietetics

Dietetics and its principle; Therapeutic diet for anaemia, heart diseases, obesity, hypertension and diabetes; Protein Energy; Malnutrition (Kwashiorkor) and Under-nutrition (Marasmus): their preventive and curative measures; Balanced diet and its importance. Dietary requirements: sources and diseases; Impact of macronutrients and micronutrients on health: Deficiency and excess: Probiotics and prebiotics

Unit 4: Health & Food safety

Definition, components and factors affecting health; Health supplements, processed food, organic food; food guides for health promotion; Water: Importance, distribution in the body, functions of water, water intake and loss, dehydration, oedema; Electrolytes: sources, maintenance of electrolyte balance and imbalance.

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