



Dr. Ambedkar Veedhi, Central College Campus  
Bengaluru-560001

*Scheme and Syllabus*

*for I and II Semesters*

**B.Sc. (Hons.) degree in Biochemistry  
&  
Discipline specific open elective  
Course (CBCS) under NEP 2020**

*(With effect from 2021-22)*

**Department of Biochemistry,  
Central College Campus  
Bengaluru -560 001**

**October, 2021**



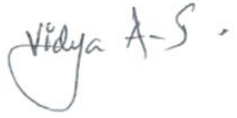



**Department of Biochemistry,  
Central College Campus, Bangalore -560001**

**Proceedings of the Meeting of Board of Studies in Biochemistry (UG),  
held on Tuesday the 28<sup>th</sup> September, 2021 in the chambers of the Chairman,  
Dept. of Biochemistry, Central College Campus, Bangalore -560001**

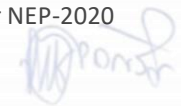
The meeting started with the Chairman welcoming the members to the meeting. The Charmin placed before the board, draft syllabus proposed by the syllabus committee constituted by the Karnataka State Higher Education Council and the panel of examiners for the ensuing semesters and proposed Board of Examiners in Biochemistry (UG) for 2021-2022 examinations. The proposed syllabus and scheme was discussed in length and the board approved the same with minor additions and deletions. Further, on verification of list of examiners, the board approved the panel of examiners and the BOE in Biochemistry (UG) for the 2021-2022. The meeting concluded with the chairman thanking the members for their valuable inputs and cooperation.

**Members Present**








		<b>Signature</b>
1. Prof. V. R. Devaraj, Chairman, Dept. of Biochemistry, Bangalore University.	Chairman	
2. Dr. S. Kantharaju Dept. of Chemistry, SJRC College, Ananda Rao Circle Bangalore -560004	Member	
3. Ms. Vidya, A.S. Dept. of Biochemistry, Seshadripuram College Yalahanka Bangalore -560064.	Member	
4. Dr. (Mrs.) Myrene D'souza Dept. of Biochemistry, Mount Carmel College # 58, Palace Road, Bangalore – 560052	Member	

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| 5. Dr. R. Nagesh Babu,<br>Dept. of Chemistry,<br>Maharani's Science College for women,<br>Palace Road, Bangalore-560001        | Member | <br>28/09/2021 |
| 6. Ms. Malini . M.R<br>Dept. of Chemistry,<br>M.S Ramaiah College of Arts, Science & Commerce<br>Bangalore-54                  | Member |                |
| 7. Dr. Rajeev Ramachandra Kolagi<br>Dept. of Biochemistry,<br>Nrupathunga University<br>Bengaluru-560001.                      | Member |                |
| 8. Dr. Kamala, A.<br>Dept. of Biochemistry,<br>MLA College for women<br>Malleswaram 18 <sup>th</sup> Cross<br>Bangalore-560004 | Member |                |
| 9. Mrs. Ramya Kumari B.S<br>Dept. of Biochemistry<br>M.S Ramaiah College of Arts, Science & Commerce<br>Bangalore-54           | Member |              |
| 10. Mrs. Madhukala. K.L.<br>Dept. of biochemistry<br>Acharya B School,<br>Magadi Road,<br>Bengaluru-560091                     | Member | <br>28/9/21  |
| 11. Dr. Bhagyalakshmi<br>Dept. of biochemistry<br>University College of Science<br>Tumkur University<br>Tumkur-572101          | Member | <br>28/9/21  |
| 12. Mrs. Savitha, K.R.<br>Dept. of biochemistry<br>University College of Science<br>Tumkur University<br>Tumkur-572101         | Member | Absent  |

## **B.Sc. BIOCHEMISTRY (Honors)**

### **Preamble**

As one of the basic science disciplines which lead to biotechnological advancement, Biochemistry is a branch of science that explores the chemical processes within and related to living organisms. It focuses on processes at cellular and molecular level. A trained biochemist employs chemical knowledge and bio-analytical skills, in order to unravel biological problems pertaining to physiological processes, diseases related to their malfunctions, diagnostics, prevention, therapy and prognostics. Considering far-reaching advances in modern biology in 21<sup>st</sup> century, it is imperative to incorporate emerging concepts of biochemistry in academic curriculum. The proposed pattern is designed for multi-faceted development of students, giving the freedom to choose a combination of courses of study from Biochemistry as well as from the allied disciplines. While 14 discipline Specific Courses with 70 credits (12 with practical components for 61 credits and 3 without practical for 9 credits), three discipline specific Electives (9 credits) provide fundamental and advanced courses in Biochemistry, two vocational courses for 6 credits, research project in VIII semester provides much needed orientation and exposure to experimental research. With the Biochemistry major, the candidate can choose a minor from other disciplines such as Botany, Zoology, Environmental science, physics, Electronics, Mathematic, and other allied disciplines for 34 credits, depending on the subject's expertise available in the respective College, University or Institutions.

Further, 24 credit courses shall be from ability enhancement courses (during first two years), and 4 credits shall be from compulsory environmental studies and Constitution of India. Skill enhancement courses for 8 credits earned over first six semesters include Digital fluency, Artificial intelligence, and Cyber security, and Professional communication. Value based courses of Physical education and health and wellness for 12 credits provide opportunities for personality development.

The curricular framework approved by the Karnataka State Higher Education Council and Govt. of Karnataka as part of National Education Policy (NEP-2020) programme shall thus provide understanding of fundamentals, acquiring practical training and application of the subject knowledge in diversified areas of Biochemistry equipping students with requisite knowledge, skill and personality.

## Programme Learning Outcomes

Broad outcomes that a student with B.Sc. (Honours) programme in Biochemistry should be able to demonstrate may involve academic, personal, behavioural as well as entrepreneurial and social competencies as follows;

- demonstrate an experiential learning and critical thinking of the structure and function of both prokaryotic and eukaryotic cells (including the molecular basis and role of sub-cellular compartmentalization)
- demonstrate an understanding of the principles, and have practical experience of, a wide range of biochemical techniques (e.g. basic molecular biology, cell biology and microbiology methods, spectrophotometry, the use of standards for quantification, enzyme kinetics; macromolecular purification, chromatography electrophoresis, etc.) and data analysis and competent interpretation.
- ability to use skills in specific areas related to biochemistry such as industrial production, technology development, clinical, health, agriculture, community development, etc.
- curiosity and ability to formulate biochemistry related problems and using appropriate concepts and methods to solve them.
- demonstrate skills to publish research findings, and awareness of IP rights, and scientific publication ethics and problems of plagiarism articulation of ideas, scientific writing and authentic reporting, effective presentation skills.
- having conversational competence including communication and effective interaction with others, listening, speaking, and observational skills.
- collaboration, cooperation and realizing the power of groups and community, ability to work in a group, community.
- ability to grasp ideas and to turn ideas into action related to biochemical mechanisms and processes related to industries, industrial production, health and agriculture, etc.
- creativity, innovation and risk-taking ability, and social skills to build great teams.

## **Graduate Attributes for B.Sc. (Honors) in Biochemistry**

Graduates with strong academic knowledge, discipline-specific and generic skills complemented with social responsibility are greatest asset of the country. The curriculum framework under NEP for Biochemistry graduates aims to build the following attributes;

### **Disciplinary Knowledge:**

- Ability to comprehend fundamental concepts of biology, chemistry and apply basic principles of chemistry to biological systems.
- Ability to relate various interrelated physiological and metabolic events.
- Ability to critically evaluate a problem and resolve to challenge blindly accepted concepts
- Ability to think laterally and in an integrating manner and develop interdisciplinary approach
- Good experimental and quantitative skills and awareness of laboratory safety
- A general awareness of current developments at the forefront in biochemistry and allied subjects.
- Awareness of resources, and their conservation.

### **Communication Skills**

- Ability to speak and write clearly in English and local language
- Ability to listen to and follow scientific viewpoints and engage with them.
- Ability to understand and articulate with clarity and critical thinking one's position.

### **Critical Thinking**

- Ability to conceptualize critical readings of scientific texts in order to comprehend.
- Ability to place scientific statements and themes in contexts and also evaluate them in terms of generic conventions.

### **Problem Solving**

- Ability to make careful observation of the situation, and apply lateral thinking and analytical skills.

**Analytical Reasoning**

- Ability to evaluate the strengths and weaknesses in scholarly texts spotting flaws in their arguments.
- Ability to use scientific evidences and experimental approach to substantiate one's argument in one's reading of scientific texts.

**Research Skills**

- Ability to formulate hypothesis and research questions, and to identify and consult relevant sources to find answers.
- Ability to plan and write a research paper.

**Teamwork and Time Management**

- Ability to participate constructively in class room discussions.
- Ability to contribute to group work.
- Ability to meet a deadline.

**Scientific Reasoning:**

- Ability to analyse texts, evaluating ideas and scientific strategies.
- Ability to formulate logical and convincing arguments.

**Reflective Thinking:**

- Ability to locate oneself and see the influence of location; regional, national, global on critical thinking.

**Self-Directing Learning**

- Ability to work independently in terms of organizing laboratory, and critically analysing research literature.

**Digital Literacy**

- Ability to use digital sources, and apply various platforms to convey and explain concepts of biochemistry.

**Multicultural Competence**

- Ability to engage with and understand cultures of various nations and respect and transcend differences.

**Moral and Ethical Values**

- Ability to interrogate one's own ethical values, and to be aware of ethical and environmental issues.

- Ability to read values inherited in society and criticism *vis-a-vis* the environment, religion and spirituality, as also structures of power.

**Leadership Readiness**

- Ability to lead group discussions, to formulate questions related to scientific and social issues.

**Life-long Learning**

- Ability to retain and build on critical thinking skills, and use them to update scientific knowledge and apply them in day-to-day business.



**Model Program Structures for the Under-Graduate Programs in Universities and Colleges in Karnataka**  
***Bachelor of Arts (Basic/ Hons.)/ Bachelor of Science (Basic/Hons.)/Bachelor of Commerce (Basic/Hons.)/***  
***Bachelor of Business Administration (Basic/Hons.)/Bachelor of Social Works (Basic/Hons.)/Bachelor of Computer Applications (Basic/Hons.) etc.***

*The Government of India has notified NEP-2020 on July 29, 2020 based on Dr.Kasturirangan Committee's Report. The objective is to bridge the gap between the current system of education and what is required in the 21<sup>st</sup> century. It is to have Holistic and Multidisciplinary Under-Graduate Education to produce employable graduates with integrated personality.*

*The Government of Karnataka had constituted a Task to suggest an Implementation Framework for NEP-2020. It had also constituted two sub-committees, one on Curriculum Reforms in Higher Education and the other on Governance and Regulations.*

*The Task Force has suggested NEP-2020 Implementation Framework for Karnataka. The State Government has accepted the action plan and taken steps to implement NEP-2020, as per the Implementation Roadmap suggested by the Task Force.*

*The Sub-committee on Curriculum Reforms in Higher Education had suggested a Draft Curriculum Framework for Undergraduate Programs in various disciplines. The State Govt. had also constituted Faculty-wise Committees to consider this draft framework to formulate program structures in their faculties. These Committees have submitted their reports. The latter were considered in the meetings of all the Vice Chancellors. The following Model Program Structures were designed for various Under-Graduate Programs in Arts, Science, Commerce and Management. The Subject Committees constituted to design and draft the curriculum in their subjects have to follow these Model Program Structures. The Terminology used in these Program Structures are.*

*Discipline Core (DSC) refers to Core Courses/Papers in a Core Discipline/Subject*

*Discipline Elective (DSE) refers to Elective Courses/Papers in the Core Subject or Discipline.*

*Open Elective (OE) refers to Elective Courses/Papers in a non-core Subject across all disciplines.*

*Program Structures also contain Ability Enhancement Compulsory Courses (AECC), Languages, Skill Enhancement Courses (SEC) (Both skills and value based). Pedagogy involves L+T+P model. Generally subjects with practical involve L+P, while the subjects without practical involve L+T model. The numbers in parentheses indicate credits allotted to various courses/papers as per definitions of Choice Based Credit System (CBCS). Generally 1 hour of Lecture or 2 hours of practical per week in a semester is assigned one credit. Generally core subject theory courses/papers will have 3 or 4 credits, while practical are assigned 2 or 3 credits.*

## ***Job opportunities in Biochemistry Core Course***

### **Exit After one year: *CERTIFICATE COURSE***

<i>Knowledge</i>	<i>Skill Acquired</i>	<i>Employability</i>
<p>Fundamental properties of elements, atoms, acids and bases, metals, non-metals, alloys and composites. Biological significance of elements. Understanding of chemical bonding, Physical properties of molecules, chemistry of toxic chemicals. Chemical kinetics, Colligative properties, Properties of matter and electro chemistry, fundamentals and applications of nuclear and radio chemistry.</p> <p>Classification, structure, reactivity and biological significance of major organic compounds.</p> <p>A general scientific spirit of inquiry</p>	<p><i>Numerical calculations, data generation and analysis, including the application of data transformations. laboratory, safety and precautions, proficiency in preparation of laboratory reagents, use of glassware, Demonstration of basic oxidation and reduction reactions, primary and secondary standards. Handling basic instruments.</i></p> <p><i>Communication interpersonal and leadership skills, and ability enhancements complementing the core biochemistry, Entrepreneurship</i></p>	<p>Small and medium size chemistry/pharma based laboratories; as Jr. laboratory assistant assisting chemists/scientists. QC assistants in Laboratories dealing with QC service.</p> <p>Toiletries, chemicals, perfumery, oil industries, distilleries/ textiles/ pollution control units</p> <p>Entrepreneurship</p>

### **Exit after two year: *Diploma COURSE***

<p>Basic chemistry of natural compounds, alkaloids, terpenes, heterocyclic compounds, drugs, stereochemistry, biological relevance of these compounds, outlines of Photochemistry and environmental chemistry. History of Biochemistry,</p> <p>Comprehensive knowledge and hand-on training in laboratory techniques of biochemistry. Analytical instrumentation and methodology</p>	<p><i>Acquaintance with analytical techniques that will permit them to study the biological system. Demonstrating skills of fractionating organic compounds.</i></p> <p><i>Hands on experience of handling instruments and analysis of data.</i></p> <p><i>Improving personality traits, team work, organizing abilities. Communication skills</i></p>	<p>Assistants in Health care/paramedical laboratories. Supervision and maintenance of laboratories. QC assistants in analytical laboratories dealing with biochemical/clinical/Food processing/pharma industrial settings. Marketing</p> <p>Entrepreneurial opportunities, Material safety data sheet maintenance, curation of chemical/drug stores, chemical store keeping</p>
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### Exit after three years: *B.Sc. degree*

<i>Knowledge</i>	<i>Skill Acquired</i>	<i>Employability</i>
<p>Comprehensive knowledge of biomolecules: higher order structures of proteins, nucleic acids and their functions. Bioenergetics, metabolism, enzyme kinetics, basic molecular biology, industrial microbiology, Immunology recombinant DNA technology. Understanding interrelated physiological and metabolic events.</p> <p>Overall knowledge of avenues for research and higher academic achievements in the field of biochemistry and allied subjects.</p>	<p><i>Basic skills in clinical laboratory techniques, Immunology and molecular biological experimental skills. Demonstrate the overall ability to independently design experiment and analyse data. Basic statistical handling of data.</i></p> <p><i>Oral and written skills to convey scientific experimental results. Ability to understand research findings and disseminate to common public. Teaching skills</i></p>	<p>Scientific assistants in biotech based industries. Chemical/pharma/animal feeds/scientific data mining, / Forensic science labs. Blood Banks, Public health support staff, Clinical research, Drug discovery R&amp;D, Medical coding, medical transcription, Medical content writing Teaching at secondary school level</p>
<b>B.Sc. (Hons.)</b>		
<p>Introduction to advanced concepts in Biochemistry; Molecular Biology, Recombinant DNA technology, Clinical Biochemistry/ Plant Biochemistry, Immunology, Nutrition and Dietetics, Biochemical Pharmacology, Research methodology, Bioinformatics skills, data analysis, Pharmacogenomics, Introduction to Intellectual property rights.</p> <p>A strong theoretical and practical knowledge of clinical and molecular setting, core research exposure.</p>	<p><i>Skills to isolate, identify and quantify biomolecules. Conducting independent research as part of project work. Hands-on training in modern techniques of Molecular biology. Recombinant DNA techniques, Computational skills, Prism, graph pad, Excel, Scientific writing skills: general articles, research reviews, Debating on scientific inventions and social implications.</i></p>	<p>Research staff in modern biology laboratories, Industries, Research Institutions. Clinical Biochemist, Forensic science technician, Biomedical scientist, Nutrition Dept. Pharma and Clinical research industries, R&amp;D divisions of Pharma industries, Vaccine industry. Medical coding, Bioinformatics, Medical content writing, Patent examiner, Toxicological asst. Medical Science Liaison officer,</p>

***IIA. Model Program Structures for the Under-Graduate Programs in Universities and Colleges in Karnataka  
Bachelor of Arts (Basic/ Hons.)/ Bachelor of Science (Basic/Hons.) insubjects with practical, with one major and one minor  
(Biochemistry major with suitable minor)***

Sem.	Discipline Core (DSC) (Credits) (L+T+P)	Discipline Elective (DSE) / Open Elective (OE) (Credits) (L+T+P)	Ability Enhancement Compulsory Courses (AECC), Languages (Credits) (L+T+P)	Skill Enhancement Courses (SEC)			Total Credits
				Skill based (Credits) (L+T+P)	Value based (Credits) (L+T+P)		
I	Biochem.1(4+2) Discipline B1(4+2)	OE-1 (3)	L1-1(3), L2-1(3) (4 hrs each)	SEC-1: Digital Fluency (2)(1+0+2)	Physical Education -Yoga (1)(0+0+2)	Health & Wellness (1) (0+0+2)	25
II	Biochem.2(4+2) Discipline B2(4+2)	OE-2 (3)	L1-2(3), L2-2(3) (4 hrs each)	Environmental Studies (2)	Physical Education - Sports (1)(0+0+2)	NCC/NSS/R&R(S&G)/ Cultural (1) (0+0+2)	25
<b>Exit option with Certificate (50 credits)</b>							
III	Biochem.3(4+2) Discipline B3(4+2)	OE-3 (3)	L1-3(3), L2-3(3)(4 hrs each)	SEC-2: Artificial Inte- lligence(2)(1+0+2)	Physical Education - Sports (1)(0+0+2)	NCC/NSS/R&R(S&G)/ Cultural (1) (0+0+2)	25
IV	Biochem.4(4+2) Discipline B4(4+2)	OE-4 (3)	L1-4(3), L2-4(3)(4 hrs each)	Constitution of India (2)	Physical Education - Sports (1)(0+0+2)	NCC/NSS/R&R(S&G)/ Cultural (1) (0+0+2)	25
<b>Exit option with Diploma (100 credits) OR Choose any one of the core subjects as Major and the other as Minor</b>							
V	Biochem.5(3+2) Biochem.6(3+2) Discipline B5(3+2)	Vocational-1 (3)		SEC-3: SEC such as Cyber Security(2) (1+0+2)	Physical Education - Sports (1)(0+0+2)	NCC/NSS/R&R(S&G)/ Cultural (1) (0+0+2)	22
VI	Biochem.7(3+2) Biochem.8(3+2) Discipline B6(3+2)	Vocational-2 (3) Internship (2)		SEC-4: Professional Communication (2)	Physical Education - Sports (1)(0+0+2)	NCC/NSS/R&R(S&G)/ Cultural (1) (0+0+2)	24
<b>Exit option with Bachelor of Arts, B.A./ Bachelor of Science, B.Sc. Basic Degree (with a minimum of 146credits) or continue studies with the Major</b>							
VII	Biochem.9(3+2) Biochem.10 (3+2) Biochem.11(3)	Biochem. E-1(3) Biochem. E-2(3) Res. Methodology (3)					22
VIII	Biochem.12(3+2) Biochem.13(3) Biochem.14(3)	Biochem. E-3(3) Research Project (6)*					20
<b>Award of Bachelor of Arts Honours, B.A. (Hons.)/ Bachelor of Science Honours, B.Sc. (Hons) degree in a discipline (with a minimum of 188 credits)</b>							

*\*In lieu of the research Project, two additional elective papers/ Internship may be offered.*

***II-C. Model Program Structures for the Under-Graduate Programs in Universities and Colleges in Karnataka  
Bachelor of Arts (Basic/Hons.)/ Bachelor of Science (Basic/Hons.) with one core subject with practical and the other without  
practical***

Sem.	Discipline Core (DSC) (Credits) (L+T+P)	Discipline Elective (DSI) / Open Elective (OE) (Credits) (L+T+P)	Ability Enhancement Compulsory Courses (AECC), Languages (Credits) (L+T+P)	Skill Enhancement Courses (SEC)			Total credits
				Skill based (Credits) (L+T+P)	Value based (Credits) (L+T+P)		
I	Discipline A1(4+2) Discipline B1(3), B2(3)	OE-1 (3)	L1-1(3), L2-1(3) (4 hrs each)	SEC-1: Digital Fluency (2)(1+0+2)	Physical Education - Yoga (1)(0+0+2)	Health & Wellness (1) (0+0+2)	25
II	Discipline A2(4+2) Discipline B3(3), B4(3)	OE-2 (3)	L1-2(3), L2-2(3) (4 hrs each)	Environmental Studies (2)	Physical Education - Sports (1)(0+0+2)	NCC/NSS/R&R(S&G)/ Cultural (1) (0+0+2)	25
<b>Exit option with Certificate (50 credits)</b>							
III	Discipline A3(4+2) Discipline B5(3), B6(3)	OE-3 (3)	L1-3(3), L2-3(3)(4 hrs. each)	SEC-2: Artificial Inte- lligence(2)(1+0+2)	Physical Education - Sports (1)(0+0+2)	NCC/NSS/R&R(S&G)/ Cultural (1) (0+0+2)	25
IV	Discipline A4(4+2) Discipline B7(3), B8(3)	OE-4 (3)	L1-4(3), L2-4(3)(4 hrs. each)	Constitution of India (2)	Physical Education - Sports (1)(0+0+2)	NCC/NSS/R&R(S&G)/ Cultural (1) (0+0+2)	25
<b>Exit option with Diploma (100 credits)/ Choose any one Discipline as Major, the other as the Minor</b>							
V	Discipline A5(3+2), Discipline A6(3+2) Discipline B9(3)	Discipline A, E-1(3) Vocational-1 (3)		SEC-3: SEC such as Cyber Security(2)(1+0+2)	Physical Education - Sports (1)(0+0+2)	NCC/NSS/R&R(S&G)/ Cultural (1) (0+0+2)	23
VI	Discipline A7(3+2), Discipline A8(3+2) Discipline B10(3)	Discipline A, E-2(3) Vocational-2 (3)		SEC-4: Professional Communication (2)	Physical Education - Sports (1)(0+0+2)	NCC/NSS/R&R(S&G)/ Cultural (1) (0+0+2)	23
<b>Exit option with Bachelor of Arts, B.A. /Bachelor of Science, B. Sc. Basic Degree (with a minimum of 146 credits) or continue studies with the Major</b>							
VII	Discipline A9(3+2), Discipline A10(3+2) Discipline A11(3)	Discipline A, E-3(3) Internship (2) Res. Methodology (3)					21
VIII	Discipline A12(3+2), Discipline A13(3), Discipline A14(3)	Discipline A, E-4(3) Research Project (6)*					20
<b>Award of Bachelor of Arts Honours, B.A. (Hons) /Bachelor of Science Honours, B.Sc. (Hons) degree in a discipline (with a minimum of 187 credits)</b>							

*\*In lieu of the research Project, two additional elective papers/ Internship may be offered.*

<b>Semester</b>	<b>1 (First)</b>
<b>Course title</b>	<b>Chemical foundation of Biochemistry -1</b>
<b>Course credits:</b>	<b>4</b>
<b>Total contact hours:</b>	<b>56</b>
<b>Duration of end semester assessment</b>	<b>02h</b>
<b>Formative assessment marks</b>	<b>40</b>
<b>Summative assessment marks</b>	<b>60</b>

### Course learning Outcome:

- Understanding of Biochemistry as a discipline and milestone discoveries in life sciences that led to establishment of Biochemistry as separate discipline.
- Fundamental properties of elements, their role in formation of biomolecules and in chemical reactions within living organisms.
- Understanding of the concepts of mole, mole fraction, molarity, etc. and to apply them in preparations of solutions of desired strengths.
- Revisit to fundamentals of chemical bonds, electronic configuration, theories of bond formation.
- Unique property of water as a universal solvent and its importance in biological system.
- Understanding of fundamentals of physical phenomena associated with Adsorption, Viscosity, Distribution law, Osmotic pressure, etc. and their importance in living organisms.
- Understanding of concepts of acids, bases, indicators, pKa values, etc. Acquiring numerical skills

### UNIT-1: Introduction to Biochemistry

14hrs

Origin of life, Miller's experiment, types of organisms, prokaryotes, eukaryotes, unicellular multicellular, compartmentalization of functions in lower and higher organisms, and common physiological events of organisms (RQ), chemical composition of living organisms, subcellular organelles: Structure, function and interrelationship.

SI units, Mass, volume, temperature, amount, length and time, an overview of the metric system, atomic weight, molecular weight, equivalent weight, basicity of acids, acidity of bases, Avogadro's number, molarity, normality, molality, Dalton concept, mole concept, concentration, mole to molar conversion, oxidation number and its significance, density and specific gravity, their significances.

### UNIT-2: Atomic structure and chemical bonds

14 hrs

Structure of an atom, electrons and 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, London forces, dipole-dipole interactions, electrostatic interactions, and hydrophobic interactions. Sigma, pi and co-ordinate bonds, back bonding, corresponding energy associated, outline of theories of bonding: Valence bond theory, Molecular orbital theory and crystal field theory.

### UNIT-3: Buffers and colligative properties

14hrs

Acids, bases, Arrhenius concept, Lowry and Bronsted concepts, Lewis concept. Buffers, composition, pH, pH scale, Henderson-Hasselbalch equation, titration curve of  $\text{H}_3\text{PO}_4$ , pK value, isoelectric pH, ionization of  $\text{HCl}$ ,  $\text{CH}_3\text{COOH}$ ,  $\text{NH}_4\text{OH}$ ,  $\text{H}_2\text{SO}_4$ . Colligative properties and anomalous colligative properties of solutions, structure of water based on VSEPR theory, ionic product of water, special properties of water, buffers in animal system. Solutions and types, ionizable solutes, non-ionizable solutes, vapor pressure and its application in distillation, Van't Hoff law – Boyle's and Charles' law, Rault's law of Relative lowering of vapour pressure (RLVP), boiling point, freezing point, de-icing, osmosis and osmotic pressure determination by Berkeley and Hardley's method, reverse osmosis.

### UNIT-4: Electrochemistry and redox reactions

14 hrs

Scope of electrochemistry, electrochemical cells, Daniel cell, galvanic cell, electrode potential and its measurement, electrolysis, types of electrolytes, primary and secondary batteries, electrodes, half-cell reaction, standard electrodes. Laws of thermodynamics, entropy and enthalpy, their relation, Gibb's energy, free energy change, ions, Redox reactions, types, Stock's notations, change in oxidation number and combination. Endergonic and exergonic reactions with examples, their importance in biological systems, redox potential, application of redox potential, energy linked to redox reactions, reduction of oxygen, oxidation and reduction of iron in hemoglobin, biologically active forms of zinc, calcium, nickel, molybdenum, selenium, and cobalt,  $\text{NAD}^+/\text{NADH}$ ,  $\text{NADP}^+/\text{NADPH}$ ,  $\text{FAD}/\text{FADH}_2$ ,  $\text{FMN}/\text{FMNH}_2$ .

### REFERENCES

1. Advanced Inorganic Chemistry: A comprehensive Text, 1999, Cotton and Geoffrey Wilkinson, 6<sup>th</sup> edition, Wiley publication
2. Inorganic Chemistry, 2014, Miessler GL, Paul Fischer PJ, and Tarr DA, 5<sup>th</sup> edition, Pearson Publication.
3. Inorganic Chemistry, 2004, Catherine E and Sharpe AG, ACS publication
4. Inorganic Chemistry, 2015, Overton, Rourke, Weller, Armstrong and Hagerman, Oxford Press.
5. Physical Chemistry: A molecular approach, 2019, Donald A, McQuarrie and Simon JD, Viva Books Publication.
6. Physical chemistry 2019, Atkins P, Paula JD, Keeler J, 11<sup>th</sup> edition, Oxford press
7. Biochemical Calculations, 1976, Irwin H. Siegel 2<sup>nd</sup> Ed. John Wiley and Sons.
8. A biologist's Physical Chemistry, 1976, 2<sup>nd</sup> Edition, J Gareth Morris, Edward Arnold Ltd.

*Pedagogy: Lectures/problem solving/ assessments/group discussions/industrial visits*

<b>Formative Assessment</b>	
<b>Assessment occasion</b>	<b>Weightage in marks</b>
<b>Continuous evaluation and class test</b>	<b>20</b>
<b>Seminars/Class work</b>	<b>10</b>
<b>Assignments/Discussions</b>	<b>10</b>
<b>Total</b>	<b>40</b>



## Semester-I: Practical-I

<b>Semester</b>	<b>1 (First)</b>
<b>Course title</b>	<b>Volumetric Analysis, Practical -1</b>
<b>Course credits:</b>	<b>2</b>
<b>Total contact hours:</b>	<b>4 hrs/week</b>
<b>Duration of end semester assessment</b>	<b>03h</b>
<b>Formative assessment marks</b>	<b>25</b>
<b>Summative assessment marks</b>	<b>25</b>

**Course Outcome:** The Course Objective is to provide experimental practice of quantitative and qualitative analysis. Also, it provides training in physical chemistry laboratory techniques. Upon successful completion, students should develop skills in handling instruments and understand its application in research work.

- Understanding Good laboratory practices in a chemistry/biochemistry laboratory.
- Learn safety and precautionary measures for working in a laboratory.
- Develop skill and proficiency in preparation of laboratory reagents.
- Use of handling of glass wares, minor equipment for conducting experiments.
- Develop skills to prepare standard chemical solutions and secondary standards.
- Demonstration of basic oxidation and reduction reactions.

### Experiments:

1. Calibration of volumetric glassware's (Burette, pipette, standard flasks).
2. Concept of molarity, molality and normality. Calculation and preparation of molar solutions (Problems to be given for exams). Calculation and preparation of normal solutions and 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 Oxalic acid. Standardization of NaOH and estimation of  $H_2SO_4$  in the given solution (phenolphthalein).
5. Preparation of standard Oxalic acid. Standardization of  $KMnO_4$  and estimation of  $H_2O_2$  in the given solution.
6. Preparation of standard  $K_2Cr_2O_7$ . Standardization of  $Na_2S_2O_3$  and estimation of  $CuSO_4$  in the given solution.
7. Preparation of  $ZnSO_4$ . Standardization of EDTA and estimation of total hardness of water using Eriochrome black-T indicator.
8. Preparation of standard potassium biphthalate. Standardization of NaOH and estimation of HCl in the given solution. (Phenolphthalein).
9. Estimation of sulphuric acid and oxalic acid in a mixture using standard sodium hydroxide solution and standard potassium permanganate solution.
10. Preparation of standard Potassium dichromate and estimation of ferrous/ferric mixture using diphenylamine indicator (Demonstration).

11. Preparation of standard oxalic acid solution. Standardization of NaOH solution and estimation of acidity in vinegar.
12. Preparation of standard potassium biphthalate solution, standardization of sodium hydroxide solution and estimation of alkalinity of antacids.
13. Preparation of standard Oxalic acid solution. Standardization of  $\text{KMnO}_4$  solution and estimation of calcium in milk.
14. Preparation of buffers; phosphate, bicarbonate and acetate buffers
15. Construction of Daniell Cell and measurement of emf.

## REFERENCES

1. Vogel's Qualitative Inorganic Analysis, 2012, Svehla, G. Pearson Education,.
2. Quantitative Chemical Analysis, 2009, Mendham, J. Vogel's Pearson,.
3. Practical Chemistry, O. P. Pandey, D. N. Bajpai, and S. Giri, S. Chand and Co. Ltd.
4. Principles of Practical Chemistry- M. Viswanathan
5. Instrumental Methods of chemical Analysis B.K Sharma.
6. Experiments in Physical Chemistry R.C. Das and B. Behra, Tata Mc Graw Hill
7. Advanced Practical Physical Chemistry J.B.Yadav, Goel Publishing House
8. Advanced Experimental Chemistry. Vol-I J.N.Gurtu and R Kapoor, S.Chand and Co.
9. Practical Chemistry K.K. Sharma, D. S. Sharma (Vikas Publication).
10. General Chemistry experiment – Anil J Elias (University press).
11. Vogel textbook of quantitative chemical analysis G.H. Jeffery, J. Basset.
12. Quantitative chemical analysis S. Sahay (S. Chand & Co.).
13. Practical Chemistry, O P Pandey, D N Bajpai, Dr S Giri. S. Chand Publication
14. College Practical Chemistry, V K Ahluwalia, Sunitha Dingra, Adarsh Gulati
15. Practical Physical Chemistry- B. Viswanathan, P S Raghavan, MV Learning Publication.

**Pedagogy:** *Lab work/ problem solving/ assessments/group discussions/industrial visits*

<b>Formative Assessment</b>	
<b>Assessment occasion</b>	<b>Weightage in marks</b>
<b>Continuous evaluation and class test</b>	<b>15</b>
<b>Record / viva voce</b>	<b>10</b>
<b>Total</b>	<b>25</b>

## Second Semester

Course Title	Chemical foundation of biochemistry -2
<b>Course credits</b>	<b>04</b>
<b>Total contact hours</b>	<b>56</b>
<b>Duration of End semester Assessment</b>	<b>02</b>
<b>Formative Assessment Marks</b>	<b>40</b>
<b>Summative assessment Marks</b>	<b>60</b>

### Course Outcome:

- These topics will enable students to understand the fundamentals of chemical processes in biological systems
- Appreciation of the roles of metals, non-metals, transition metals and coordination compounds in biological systems.

Course Outcomes/Program	1	2	3	4	5	6	7	8	9	10	11	12
Outcomes												
Aptitude	X	X										
Critical thinking	X	X										
Subject clarity	X	X										
Analytical Skills	X	X										

### Course content

#### UNIT-1: Chemical kinetics and colloids

**14 Hours**

Introduction, Rate of reactions, rate law or rate equation, molecularity and order of a reaction with examples, velocity constant or rate constant and half-life period expressions for zero, first and second order reactions with derivations ( $a=b$  and  $a \neq b$ ), rate constant of irreversible reaction, kinetics of reversible reaction (without derivation). Numerical problems. Effect of temperature, pressure and catalyst on rate of reaction, Arrhenius equation and Arrhenius interpretation of energy of activation. Transition state theory with brief explanation.

Colloids: true solutions, classification, peptisation, purification, ultrafiltration, Brownian movements, electric properties, coagulation, mutual, lyophilic sols, boiling, dialysis, electro- and persistent dialysis, addition of electrolytes, colloids in daily life and applications. Emulsion, types, micelles with biomolecules and its biological applications.

**UNIT-2: Nomenclature of Organic Compounds:****14 Hours**

Classification, naming- 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, plane polarized light and optical purity, calculations. Nomenclature of enantiomers, epimers, racemic mixture, resolution. Fischer and Newmann projection formulae, molecule with one and two chiral and achiral centers, spirines. 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-3: Organometallic Compounds****14 Hours**

Metal atom linked organic compounds. Preparation of Grignard reagents and structure, limitations, protonolysis and reactions. Organolithium compounds, preparation and reactions. Organozinc compounds. Organoboranes its mechanisms. Ferrocenes. Organomercury compounds: Methods of preparation and applications, reactions—mercuration of aromatic compounds, solvomercuration, oxymercuration- demercuration. Organosilicon compounds: Methods of preparations and applications, general reactions of trialkyl silyl halides with ethers, esters, carbamides, epoxides and acetals.

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.

**UNIT-4: Inorganic Chemistry****14 Hours**

Nomenclature of inorganic molecules and coordination compounds, formula. IUPAC nomenclature. 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 biosystems.

*Chemical toxicity:* Introduction, poisons, lead, mercury, aluminium, arsenic, corrosives, cyanide, irritants, phosphorus, CO<sub>2</sub>, SO<sub>2</sub>, SO<sub>3</sub>, NO<sub>2</sub>, halides and acid fumes, poisoning; sources, signs and symptoms. Free radicals: introduction, definition, generation and scavenger systems.

**REFERENCES**

1. Physical Chemistry, 2006, Peter Atkins. 8<sup>th</sup> edition, W.H. Freeman and Company
2. Inorganic Chemistry: 2006, Principles of structure and Reactivity, Huheey JE, Keiter EA, Keiter RL, Pearson Education India
3. Stereochemistry: Conformation and Mechanism, 2009, Kalsi PS, New Age International Publications
4. Introduction to Stereochemistry, 2012, Kurt Mislow, Dover Publications
5. A text book of Organic Chemistry, 2016, Raj K Bansal, 6<sup>th</sup> edition, New Age International Publications
6. Advanced Inorganic Chemistry, 1999, Cotton et.al, 6<sup>th</sup> edition, A Wiley-Bengaluru City University, Biochemistry syllabus for B.Sc. degree under NEP-2020

## International

7. Principles of physical Chemistry, Puri, Sharma and Pathania.
8. Physical Chemistry, R.L. Madan, G.D. Tuli. S. Chand and Co.
9. A Text Book of Physical Chemistry, K.L. Kapoor, Vol.2. McMillan Publisher, India Ltd.
10. Advanced Organic Chemistry, Bahl and Bahl.
11. Principles of organometallic Chemistry, 1991, P. Powell, 2<sup>nd</sup> Edition, ELBS.
12. Inorganic Chemistry, 1983, 3<sup>rd</sup> Edition, J.E. Huheey, Harper International.
13. Organic Chemistry, Claden J., Greeves, N., Warren, S. 2012, Oxford University Press.
14. Inorganic Chemistry, 1987, R.W. Hay, Ellis Harwood.
15. Bioinorganic Chemistry, 2002, R.M. Roat-Malone, John-Wiley.
16. Basic Organometallic chemistry, 2<sup>nd</sup> Edition, B.D. Gupta and A.J Elias.

***Pedagogy: Lab work/ problem solving/ assessments/group discussions/industrial visits***

<b>Formative Assessment</b>	
<b>Assessment occasion</b>	<b>Weightage in marks</b>
<b>Continuous assessment/Class test</b>	<b>20</b>
<b>Seminars/class work</b>	<b>10</b>
<b>Assignment/open discussion</b>	<b>10</b>
<b>Total</b>	<b>40</b>

### Practical-2

<b>Course title</b>	<b>Qualitative and quantitative analysis</b>
<b>Course credits</b>	<b>02</b>
<b>Total contact hours</b>	<b>4 Hours/Week</b>
<b>Duration of end semester assessment</b>	<b>03</b>
<b>Formative assessment marks</b>	<b>25</b>
<b>Summative assessment marks</b>	<b>25</b>

**Course Outcome:** The Course Objective is to provide experimental practice of quantitative and qualitative analysis. Also, it provides training in physical chemistry laboratory techniques. Upon successful completion, students should develop skills in handling instruments and understand its application in research work.

#### Experiments:

##### 1. *Systematic Semi-micro qualitative Analysis of Inorganic salt Mixtures*

(a) Systematic semi micro qualitative analysis of two acid and two basic radicals in the given inorganicsalt mixture. The constituent ions in the mixture to be restricted to the following (Any four binary mixtures shall be given)

**Anions:**  $\text{HCO}_3^-$ ,  $\text{CO}_3^{2-}$ ,  $\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{NO}_3^-$ ,  $\text{BO}_3^{3-}$ ,  $\text{SO}_4^{2-}$ , and  $\text{PO}_4^{3-}$

**Cations:**  $\text{Pb}^{2+}$ ,  $\text{Al}^{3+}$ ,  $\text{Fe}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Mn}^{2+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Sr}^{2+}$ ,  $\text{Ba}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{K}^+$ ,  $\text{Na}^+$  and  $\text{NH}^+$ .

(b) Qualitative analysis of NPK fertilizers

- Determination of density and viscosity of the given liquid using specific gravity bottle and Ostwald's viscometer.
- Determination of density and surface tension of the given liquid using specific gravity bottle and stalagmometer.
- Determination of molecular weight of non-volatile solute by Walker-Lumsden method.
- Determination of rate constant of decomposition of  $\text{H}_2\text{O}_2$  using  $\text{KMnO}_4$  by volumetric analysis method using ferric chloride as catalyst.
- Determination of distribution coefficient of benzoic acid between water and benzene or iodine between water and carbontetra chloride Separation of Two Components from given Binary Mixture of Organic Compounds Qualitatively. (Types of binary mixtures-Solid– Solid, Solid–Liquid, Liquid – Liquid)
- Verification of Beer's Law.
  - Estimation of unknown concentration of a biomolecule by using colorimeter
  - Determination of molar extinction coefficient
- Calibration of pH meter and determination of pH of aerated soft drinks.

#### REFERENCES

1. Vogel's Qualitative Inorganic Analysis, 2012, Svehla, G. Pearson Education,.
2. Quantitative Chemical Analysis, 2009, Mendham, J. Vogel's Pearson,.
3. Practical Chemistry, O. P. Pandey, D. N. Bajpai, and S. Giri, S. Chand and Co. Ltd.
4. Principles of Practical Chemistry, M. Viswanathan
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6. Experiments in Physical Chemistry R.C. Das and B. Behra, Tata Mc Graw Hill
7. Advanced Practical Physical Chemistry J.B.Yadav, Goel Publishing House
8. Advanced Experimental Chemistry. Vol-I J.N.Gurtu and R Kapoor, S.Chand and Co.
9. Practical Chemistry K.K. Sharma, D. S. Sharma (Vikas Publication).
10. General Chemistry experiment – Anil J Elias (University press).
11. Vogel textbook of quantitative chemical analysis G.H. Jeffery, J. Basset.
12. Quantitative chemical analysis S. Sahay (S. Chand & Co.).
13. Practical Chemistry, O P Pandey, D N Bajpai, Dr S Giri. S. Chand Publication
14. College Practical Chemistry, V K Ahluwalia, Sunitha Dingra, Adarsh Gulati
15. Practical Physical Chemistry- B. Viswanathan, P S Raghavan, MV Learning Publication.

**Pedagogy:** *Lab work/ problem solving/ assessments/group discussions/industrial visits*

<b>Formative Assessment</b>	
<b>Assessment occasion</b>	<b>Weightage in marks</b>
<b>Continuous evaluation and class test</b>	<b>15</b>
<b>Record / viva voce</b>	<b>10</b>
<b>Total</b>	<b>25</b>

## Biochemistry Open Elective for First Semester

Course title	<i>Biochemistry in Health and Disease</i>
<b>Course credits</b>	<b>03</b>
<b>Total contact hours</b>	<b>42</b>
<b>Duration of end semester examination</b>	<b>02</b>
<b>Formative assessment marks</b>	<b>40</b>
<b>Summative assessment marks</b>	<b>60</b>

**Course Outcome:** This open elective course offering to students of various streams gives knowledge about health and various terminologies used in health and disease conditions; Difference between communicable and non-communicable diseases; Health promotion and treatments for various diseases and disorders.

### ***UNIT-1: Health and wellness:***

***14hours***

WHO definition of health, Health and hygiene, General health care, Factors affecting health, Indices and evaluation of health, Disease patterns in developed and developing world; Classification of diseases-Endemic, Epidemic, Pandemic; Professional health hazards.

*Disease conditions:* Acute disease, chronic disease, Incurable disease, Terminal disease, Illness, disorders, Syndrome, Pre-disease.

Treatment: Psychotherapy, Medications, Surgery, Medical devices, and Self-care.

Dimensions of Health: Physical, Mental, Spiritual, Emotional, Environmental, and Philosophical.

### ***UNIT-2 Diseases and disorders***

***14 hours***

*Communicable diseases:* Tuberculosis, Cholera, Typhoid, Conjunctivitis.

Sexually transmitted diseases (STD): Information, statistics, and treatment guidelines for STD, Prevention: Syphilis, Gonorrhoea, AIDS.

*Non-communicable diseases:* Malnutrition Undernutrition, Overnutrition, Nutritional deficiencies; Anemia, Stroke, Rheumatic heart disease, Coronary heart disease, Cancer, blindness, accidents, mental illness, Iodine deficiency, Fluorosis, Epilepsy, Asthma.

Genetic disorders: Down's syndrome, Klinefelter's syndrome, Turner's syndrome, Thalassemia, Sickle cell anemia.

*Lifestyle disorders:* Obesity, Liver cirrhosis, Diabetes mellitus, Hypertension (Causative agents, symptoms, diagnosis, treatment, prognosis, prevention)



**UNIT-3 Health and awareness****14 hours**

Preventing drug abuse, Oral health promotion by tobacco control. Mental hygiene and mental health: Concepts of mental hygiene and mental health, Characteristics of mentally healthy person, Warning signs of poor mental health, Promotive mental health, strategies and services, Ego defense mechanisms and implications, Personal and social adjustments, Guidance and Counseling.

*Infection control:* Nature of infection, Chain of infection transmission, Defenses against infection transmission

**REFERENCES**

1. Modern Nutrition in Health and Disease, 2006, 10<sup>th</sup> Edition, Maurice E. Shils, Moshe Shike, A Catharine Ross.
2. Clinical Biochemistry and Metabolic Medicine, 2012, Eighth Edition, Martin Andrew Crook, CRC Press,
3. Nutrition and Health in Developing Countries, 2000, Editors: R. Semba and M.W. Bloem, Humana Press.

**Pedagogy:** Lectures/desk work/book chapter/problem solving/discussion/assignment

<b>Formative assessment</b>	
<b>Assessment occasion</b>	<b>Weightage in marks</b>
<b>Class test ( 2 class tests)</b>	<b>20</b>
<b>Seminars/class work</b>	<b>10</b>
<b>Assignment/open discussion</b>	<b>10</b>
<b>Total</b>	<b>40</b>

## Biochemistry Open Elective for Second Semester

Course title	<i>Nutrition and Dietetics</i>
<b>Course credits</b>	<b>03</b>
<b>Total contact hours</b>	<b>42</b>
<b>Duration of end semester examination</b>	<b>02</b>
<b>Formative assessment marks</b>	<b>40</b>
<b>Summative assessment marks</b>	<b>60</b>

### Course outcomes:

- Knowledge about energy requirements and the Recommended Dietary Allowances.
- understanding the functions and role of macronutrients, their requirements and the effect of deficiency and excess
- Understand the impact of various functional foods on our health
- To be able to apply basic nutrition knowledge in making foods choices and obtaining an adequate diet.
- Competence in connecting the role of various nutrients in maintaining health and learn to enhance traditional recipes.

### UNIT-1 Basic concepts of Nutrition:

14 Hrs

Introduction, Basic principles of a balanced diet to provide energy and nutrients. Composition of foods and proximate analysis of foods. Calorific value of foods and Basal metabolism. Basal Metabolic Rate (BMR), Factors affecting BMR, Energy requirements for different physical activities, Specific dynamic action of food, Nutritive value of proteins. Energy requirements and recommended dietary allowance (RDA) for infants, children, and pregnant women. Protein calorie malnutrition.

### UNIT-2 Macronutrients and Micronutrients

14 Hrs

Carbohydrates-Digestible and non-digestible, Dietary fibres, Essential fatty acids, lipoproteins and cholesterol. Essential amino acids, Fortification of foods, Protein requirement for different categories.

**Vitamins:** Sources, requirements, functions and deficiency symptoms of Vitamin-C, Thiamine, Riboflavin, Pyridoxine, Folic acid, VitaminB<sub>12</sub>. Absorption of fat-soluble vitamins- A, D, E and K.

**Micronutrients:** Source, Daily requirement, functions and deficiency disease symptoms of Macrominerals (Ca, P, and Cl) and microminerals/trace elements (I, Fe, Zn and Se).

**UNIT-3 Dietetics and Diet Therapy****14 Hrs**

*Food pyramid:* Diet planning and introduction to diet therapy. Nutritional requirements for different age groups, anemic child, expectant women, and lactating women. Diet planning for prevention and cure of nutritional deficiency disorders.

*Diet therapy:* Functional foods, Anthropometric measurements, dietary considerations during fever, malaria, and tuberculosis. Prevention and correction of obesity, underweight, and metabolic diseases by diet therapy. Dietary interventions to correct and/or manage the gastro-intestinal diseases (indigestion, peptic ulcer, constipation, diarrhoea, steatorrhoea, irritable bowel syndrome. Functional food-based diet therapy for diabetes, cardiovascular disease and cancer.

**REFERENCES:**

1. Clinical Dietetics and Nutrition, 2002, 4<sup>th</sup> Edition, Antia FP and Abraham P, Oxford University Press; ISBN-10: 9780195664157.
2. Oxford Handbook of Nutrition and Dietetics, 2011, Webster-Gandy J, Madden A and Holdsworth M. Oxford University Press, Print ISBN-13:9780199585823.
3. Krause's Food, Nutrition and Diet therapy, 2003, Mahan KL and Escott-Stump S., Elsevier, ISBN: 9780721697840.
4. Human Nutrition and Dietetics.1986, Passmore R. and Davidson S. Churchill Livingstone Publications, ISBN-10: 0443024863.
5. Rosemary Stanton's Complete Book of Food & Nutrition, 2007, Simon & Schuster Publishers, Australia, ISBN 10: 0731812999
6. Food Science and Nutrition, 2018, Roday S.Oxford University Press Publishers, ISBN: 9780199489084/0199489084.
7. Food Science, 2007, Srilakshmi S. New Age International (P) Limited Publishers, ISBN: 9788122420227/ 8122420222.

**Pedagogy: Mooc/Lectures/book chapter/problem solving/assignment**

<i>Formative Assessment</i>	
<b>Assessment occasion</b>	<b>Weightage in marks</b>
<b>Class test (2 class tests)</b>	<b>20</b>
<b>Seminars/class work</b>	<b>10</b>
<b>Assignment/open discussion</b>	<b>10</b>
<b>Total</b>	<b>40</b>

### Model question paper pattern for End semester Theory Examination

**Time: 2 h**

**Max. Marks: 60**

*Note: all sections are compulsory*

#### SECTION – A

1. Answer *any five* of the following; 5x2= 10
- a)
  - b)
  - c)
  - d)
  - e)
  - f)
  - g)

#### SECTION –B

- Answer *any five* of the following; 5x4=20
- 2.
  - 3.
  - 4.
  - 5.
  - 6.
  - 7.

#### SECTION – C

- Answer *any three* of the following; 3x10=30
- 8.
  - 9.
  - 10.
  - 11.
- *Note: Section C shall include sub questions a and b either for 5+5 or 6+4*

### Model question paper pattern for End semester Practical Examination

**Time: 3 h**

**Max. Marks: 25**

- |                                    |          |
|------------------------------------|----------|
| 1. Marks for procedure writing     | 5 Marks  |
| 2. Marks for Viva – Voce           | 5 Marks  |
| 3. Marks for performing experiment | 15 Marks |
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