ಡಾ. ಮನಮೋಹನ ಸಿಂಗ್
ಬೆಂಗಳೂರು ನಗರ ವಿಶ್ವವಿದ್ಯಾನಿಲಯ

Dr. MANMOHAN SINGH
BENGALURU CITY UNIVERSITY

Office of the Registrar, Central College Campus, Dr. B.R. Ambedkar Veedhi, Bengaluru – 560 001.
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No.MSBCU/BoS/Syllabus/Science/ 109 /2026-27 Date: 29.06.2026

NOTIFICATION

Sub: Syllabus for the V & VI Semester Under Graduate Courses in the Faculty of Science -reg

Ref: 1. Government Order No. ED 166 UNE 2023 Bengaluru dated. 08.05.2024
2. Recommendations of the Boards of Studies in the Faculty of Science
3. Approval of the Academic Council in its meeting held on 08.06.2026
4. Orders of Vice-Chancellor dated.29.06.2026

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The Syllabus prepared by the Boards of Studies for the different Subjects of V & VI semester Under Graduate Courses, in the faculty of Science based on the Guidelines and Curriculum Structure issued by the Government under ref(1) have been approved by Academic Council meeting held on 08.06.2026.

Accordingly, the CBCS Syllabus for the V & VI Semester UG Courses of Science Faculty in respect of following subjects are hereby notified for implementation from the academic year 2026-27.

Sl. No.	Subjects
1.	Botany– V & VI Semester
2.	Chemistry– V & VI Semester
3.	Zoology and Genetics– V & VI Semester
4.	BoS in Fashion and Apparel Design i. FAD – V & VI Semester ii. IDD– V & VI Semester
5.	Geography– V & VI Semester
6.	Mathematics– V & VI Semester
7.	Physics – V & VI
8.	BoS in Home Science i) Home Science – V & VI ii)Nutrition & Dietetics – V & VI iii)Clinical Nutrition & Dietetics – V & VI iv)Food Technology – I & II Sem

p.t.o

9.	Criminology and Forensic Science– V & VI
10.	Psychology– V & VI Semester
11.	Electronics – V & VI
12.	Statistics – V & VI
13.	Microbiology– V & VI
14.	Biotechnology– V & VI
15.	Environmental Science– V & VI

The detailed Syllabi for above subjects are notified in the University Website: www.bcu.ac.in for information of the concerned.

REGISTRAR

Copy to;

1. The Registrar(Evaluation), Dr. Manmohan Singh Bengaluru City University
2. The Dean, Faculty of Science, MSBCU.
3. The Principals of the concerned affiliated Colleges of MSBCU- through email.
4. The P.S. to Vice-Chancellor/Registrar/Registrar (Evaluation), MSBCU.
5. Office copy / Guard file / University Website: www.bcu.ac.in

ಡಾ. ಮನಮೋಹನ್ ಸಿಂಗ್
ಬೆಂಗಳೂರು ನಗರ ವಿಶ್ವವಿದ್ಯಾನಿಲಯ

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BE BOUNDLESS

DR. MANMOHAN SINGH
BENGALURU CITY UNIVERSITY

Department of Studies and Research in Chemistry

Jnana Jyothi Central College Campus

Bengaluru-560 001

SCHEME AND SYLLABUS

FOR

UNDER GRADUATE COURSE

IN

CHEMISTRY

(Bachelor of Science)

V and VI SEMESTERS

Framed as per

State Education Policy

(SEP-2024)

Effective from the Academic Year 2026 - 27

In accordance with the directive from Dr. Manmohan Singh Bengaluru City University, syllabus for the B.Sc. degree course (SEP-24) was revised. The Dr. Manmohan Singh Bengaluru City University has provided comprehensive guidelines to ensure the curriculum meets contemporary academic standards with applied component.

At the Department of Chemistry, Dr. Manmohan Singh Bengaluru City University, a collaborative effort was undertaken with the Chemistry Teachers Forum to form a Core Group comprising faculty from the University Department and affiliated colleges. The objective was to align the syllabus with the UGC Model Curriculum, which emphasizes interdisciplinary skills, integration of general studies with professional courses, and providing both vertical and horizontal mobility while addressing local educational needs. Faculty members specializing in Inorganic, Physical, Organic and Biochemistry conducted both separate and joint brainstorming sessions. These sessions were instrumental in developing a comprehensive draft syllabus for V and VI semesters of B.Sc. Chemistry. The committee designed this syllabus by ensuring diverse perspectives and educational requirements of the students. Notably, regularly updating the curriculum reflects the commitment to providing high-quality education, fostering a learning environment that promotes critical thinking, innovation, and excellence. Finally, the syllabus revision process not only enhances the academic framework but also ensures that students are equipped with relevant knowledge and skills to meet future challenges and opportunities in the field of Chemistry

I, sincerely, hope that the present syllabus will be a guiding force for the undergraduate students enrolled under Dr. Manmohan Singh Bengaluru City University Curriculum for years to come.

CHAIRPERSON
Department of Studies and Research in Chemistry
Dr. Manmohan Singh Bengaluru City University
Jnana Jyothi Central College Campus
Bangalore University Bengaluru-560 056

Proceedings of the meeting of the Board of Studies in Chemistry - UG held on 21th April 2026 at 10.30 am in the Department of studies and Research in Chemistry, Dr. Manmohan Singh Bengaluru City University, Jnana Jyothi Central College Campus, Bengaluru.

The Chairperson welcomed the members of the Board to the meeting and placed the agenda before them for discussion.

Agenda: *1. Scrutiny and approval of the Syllabus for* 5th and 6th semester of *B.Sc., Degree, Chemistry Course (SEP- 2024 Scheme).*

The Chairperson informed the members that, as per the directive from the Dr. Manmohan Singh Bengaluru City University, the Chemistry syllabus for the B.Sc., Chemistry degree for Vth and VIth Semester as per SEP - 2024 credit frame works.

Resolution: The syllabus has prepared with the help of the Chemistry Teachers' Forum by constituting a Core Group from the affiliated Colleges, for the year 2026-2027. In this connection, the Core Group of teachers participated in the First meeting held on 10.03.2026 prepared a Draft syllabus and again met on 25.03.2026 to modify the corrections suggested. The syllabus was then finalized in the BOS meeting conducted on 21.04.2026, in the presence of a wider group of Teachers offering Chemistry at UG level.

The Board of Studies (UG) approved the Syllabus after some modifications.

The meeting ended with the vote of thanks by the Chairperson.

The following members were present

Sl. No.	Name		Signature
1.	Dr. Sujatha M	Member	
2.	Dr. Prasanna Kumar S G	Member	
3.	Dr. Sanjeevarayappa C	Member	
4.	Dr. Chinnadevi C N	Member	
5.	Mrs. Jayashree P	Member	
6.	Mr. Harish K M	Member	
7.	Dr. Jyothi S G	Member	
8.	Dr. Shalini K.S.	Member	
9.	Dr. Yogesh	Member	
10.	Prof. Dr. V. R. Devaraj	Member (Co opt)	
11.	Prof. Dr. Shivashankar K	Member (Co opt)	
12.	Dr. S. Kantharaju	Member (Co opt)	
13.	Ms. Chandrima Datta	Member (Co opt)	
14.	Prof. Dr. Chetana P R	Chairperson	

Prof. Dr. P. R. Chetana
Senior Professor and Chairperson
DOSR in Chemistry, Central College Campus
Dr. Manmohan Singh Bengaluru City University
BENGALURU - 560001

V Semester B.Sc.

Chemistry Paper – V (Organic chemistry)

and

Chemistry Paper VI (Physical Chemistry)

Instructions per week	Total contact hours	Marks		Duration of Examination	Total marks	Credits
		Formative Assessment / Internal assessment	Summative Assessment / End Semester Examination			
4 Hours	52	20	80	3 Hours	100	3

Scheme of Internal Assessment Marks (Theory)

Sl No.	Particulars	I A Marks
1	Attendance	05
2	Internal Tests (Minimum of Two)	10
3	Assignments/Seminars	05
	Total Theory IA marks	**20**

Chemistry Paper – V
(Organic chemistry)

Unit	Chapters	No. of hours
I	Stereochemistry	13
II	Chemistry of Natural products	11
	Green Chemistry	2
III	Heterocyclic compounds	06
	Industrial organic chemistry	07
IV	Spectroscopy of simple organic compounds	13
	Total number of hours	**52**

UNIT – I

Stereochemistry. **13 hours**

Introduction: Elements of symmetry (plane of symmetry: 2, 3-dichrolobutane, tartaric acid, centre of symmetry: trans-2, 4-dimethyl-trans-1,3-cyclobutanedioic acid, axis of symmetry:1,2,3,4-tetramethylcyclobutane). Chiral molecules and achiral molecules (2- chloropropanol, 3-chloropentane). Chirality, stereogenic centre (example: lactic acid, tartaric acid and 2, 3-dichlorobutane). Fischer projection formulae (lactic acid, 2-chlorobutane, tartaric acid and 2, 3-dichlorobutane).

Meso compounds: Explanation with examples of tartaric acid and 2,3-dichlorobutane. Optical isomerism due to free rotation about single bonds: Enantiomers, optical activity (condition for optical activity), absolute configuration of enantiomers (use of +/–, d/l, D/L notations (Examples: glyceraldehyde and lactic acid). Cahn-Ingold-Prelog sequence rules (R and S system) of nomenclature with suitable examples, properties of enantiomers.

Diastereomers: Explanation with examples of tartaricacid, 2-bromo-3-chlorobutane and properties. Relative Configuration; threo and erythro and nomenclature (using above examples).

Racemisation: Definition and explanation using lactic acid as an example.

Resolution of racemic mixture: definition, explanation of resolution of racemic mixture of tartaric acid by chemical method and biochemical method.

Optical isomerism due to restricted rotation about single bonds in diphenyl systems:

Explanation using 6, 6'-dinitrodiphenic acid as an example.

Geometric isomerism in alkenes: Definition, conditions and explanation using 2-butene and 1,2-dichloroethene as examples. Determination of configuration of geometric isomers: cis and trans by (i) Physical methods (melting and boiling points, dipole moments, solubility) (ii) Spectroscopic methods (UV, IR evidences (iii) chemical methods (cyclisation method: Ex- maleic acid to maleic anhydride, pKa values: Ex maleic and fumaric acids).

E and Z system of nomenclature; rules with suitable examples.

Geometric isomerism in oximes: Nomenclature of syn and anti-isomers in oximes using benzaldoxime and acetophenone oxime as examples.

Alicyclic compounds: Conformations of four to eight membered cycloalkanes and disubstituted cyclohexanes (1,2-1,3 and1,4-dimethylcyclohexanes as examples).

Bicylic systems: cis and trans- nomenclature and conformations of decalins and norbornane.

UNIT – II

Chemistry of Natural products. 11 hours

Carbohydrates: Introduction and classification (based on number of monosaccharide units and sugars & non-sugars) with examples. Monosaccharides: Definition with examples, classification of mono saccharides (based on functional group).

Aldoses: Structures of D-aldohexoses (glucose, galactose and mannose). Open and Haworth structures. Epimers (Example: D-galactose and D-glucose, D-glucose and D-mannose). Elucidation of open chain structure of D-glucose. Limitations of open chain structure of glucose. Mechanism of mutarotation and anomeric effect.

Elucidation of ring structure and size of D-glucose by oxidation with HIO_4 and HNO_3. Ketoses: Structure of fructose; pyranose and furanose forms. Inter-conversion of glucose and fructose

Disaccharides: Definition with examples. Formation of glycosidic bond with examples. Haworth and conformational structures of maltose, lactose and sucrose.

Terpenes and terpenoids: Occurrence, isoprene rule and classification (on the basis of number of isoprene units, acyclic and cyclic). Elucidation of structure and synthesis of citral (from methyl heptenone).

Structure and uses of limonene, menthol, α-terpineol, camphor, β-carotene, Vitamin-A.

Alkaloids: Introduction, general characteristics, classification (based on heterocyclic ring present). Structural elucidation and synthesis of nicotine (from succinimde). Structures and

uses of ephedrine, caffeine, cocaine, atropine, quinine and morphine.

Steroids:

Introduction, classification, basic skeleton, Importance of Diel's hydrocarbons, structure of cholesterol and ergosterol.

Green chemistry: 2 hours

Introduction: Definitions of Green Chemistry. Brief introduction of twelve principles of Green chemistry with examples, special emphasis on atom economy, reducing toxicity, green solvents. Green Chemistry and catalysis. green energy and sustainability.

UNIT – III

Heterocyclic compounds 06 hours

Introduction, classification (based on size of heterocyclic ring; 5- and 6-membered) with examples, orbital structures, resonance and aromatic character (Huckel's rule) of furan, pyrrole, thiophene and pyridine.

Methods of preparation of pyrrole (from acetylene and from ammonium mucate), furan (from mucic acid and furfural), thiophene (from acetylene and butane).

General mechanism of electrophilic substitution reactions and nitration reaction of pyrrole, furan and thiophene. Preparation of pyridine (from acetylene and from nicotinic acid) and reaction with sodamide (Chichibabin reaction). Comparison of base strength of pyrrole, pyridine and piperidine (pKb).

Fused heterocyclic compounds (i) Indole - preparation by Fischer synthesis and properties - nitration reaction, (ii) Quinoline-preparation by Skraup synthesis and properties - nitration.

A brief review of heterocyclic compounds in biological systems.

Industrial organic chemistry 07 hours

Synthetic dyes: Introduction: Colour and constitution (Otto witt and modern theory). Classification (based on methods of application to the fibre): direct dyes, vat dyes, mordant dyes, azoic dyes and dispersive dyes with examples). Synthesis of congo red (from benzidine), malachite green (from benzaldehyde) and alizarin (from anthracene). Edible Dyes with examples.

Drugs: Chemotherapy – definition. Classification of drugs based on (i) drugs used for the treatment of diseases due to infection (antimalarial, sulpha drugs, anthelmentics, antileprotic, antitubercular, amoebicides, antibiotics and antiseptic drugs with examples) (ii) drugs used for the treatment of diseases not due to infection (antipyretics, analgesics, anesthetics,

tranquilizers and hypnotics, narcotics, anticonvulsants, cardiac or cardiovascular and diuretics drugs with examples). Synthesis of paracetamol and sulphanilamide.

Medicinal Chemistry: Definition and examples (with structure) of Pharamacodynamic agents, Pharmacophore, Metabolites and Anti-metabolites, Agonist, Anti-agonist, Lead compounds and Analogues, Generics, Prodrugs, Hard and Soft drugs, Isosterism and Biosterism. Drugs Toxicity testing- Infectious dose-50, Inhibitory capacity-50, Lethal dose-50 and Effective dose-50.

UNIT – IV

Spectroscopy of simple organic compounds **13 hours**

Introduction: Electromagnetic radiation, electromagnetic spectrum, advantages of spectroscopic techniques, basic principle of spectroscopy, types of spectroscopic techniques (UV-Visible spectroscopy, IR spectroscopy, NMR spectroscopy).

UV-Visible spectroscopy: Introduction - basic principles of UV-Visible spectroscopy. Types of electronic transitions with suitable examples. Chromophores and auxochromes (with suitable examples). Blue shift and red shift (with suitable examples). Influence of conjugation on λ - max absorption in UV - Visible region. Comparison of UV spectra of acetone and methyl vinyl ketone. Graphical representation of spectra of 1,3- butadiene, benzene and lycopene. Distinction between cis- and trans - isomers by UV. Advantages of UV-Visible spectroscopy.

IR spectroscopy: Introduction - Basic principles of IR spectroscopy. Conditions for IR active organic compounds. Vibrational transitions: Stretching and bending modes of vibrations. Factors affecting on position of IR absorption peak (atomic mass and force constant-electronic effects and hydrogen bonding). Types of IR region functional group region and finger print region -and its significance.

Explanation of Stretching frequencies of −OH (free and H-bonded), alkyl −C−H, C≡C, C=C, C−C, C=O and C−O groups (formaldehyde, acetaldehyde, acetone, ethanol, ethylene, benzene, acetylene, acetic acid and phenol). Graphical representation (interpretation) of IR spectra of benzoic acid and methyl benzoate in comparison with FTIR. Advantages of IR spectroscopy.

NMR spectroscopy: Basic principles of proton magnetic resonance: Nuclear magnetic spin quantum number, influence of the magnetic field on the spin of nuclei, spin population, saturation using radio frequency. Nuclear magnetic resonance. Chemical shift (δ values), uses of TMS as reference.

Nuclear shielding and deshielding effects. Equivalent and non-equivalent protons. Effect of

electronegativity of adjacent atoms on chemical shift values. Spin-spin splitting and spin-spin coupling (qualitative treatment only). Graphical representation (interpretation) of NMR spectra of simple organic compounds (i) methane (ii) CH_3-Cl (iii) CH_2Cl_2 and (iv) $CHCl_3$ using shielding and deshielding effects, (iv) Cl_2CHCHO (v) 1,1,2-trichloroethane and (vi) CH_3CH_2Cl using spin-spins plitting and spin-spin coupling. Applications of NMR in medical diagnostics.

Mass spectrometry: Theory, basic principles, isotope abundance, base peak, nitrogen rule, recognition of molecular ion, meta stable ions, calculation of apparent mass – significance.

Fragmentation pattern: general rules for predicting prominent peaks in mass spectra mass spectra and fragmentation pattern of the following classes of organic compounds: Aliphatic hydrocarbons (isobutane), aromatic hydrocarbons (toluene).

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Reference Books

1. Organic Chemistry, Vol. I & II I.L. Finar, ELBS, 1986, 1991, 2005.
2. Organic Chemistry, R.T. Morrison and R.N. Boyd, Prentice Hall,1991
3. Advanced Organic Chemistry, O. S. Bahl and A. Bahl, New Delhi, S. Chand & Company Pvt. Ltd., Multicolor edition, 2012.
4. Advanced Organic Chemistry J. March, John Wiley & Sons, 2008.
5. Organic Chemistry, M.K. Jain, Nagin & Co., 1987
6. Organic Spectroscopy, V. R. Dani, Tata Mc Graw Hill, 1998
7. Organic Spectroscopy, W. Kemp, ELBS IV Edition, 1998.
8. Synthetic Drugs, G. R. Chatwaal, Himalaya Publications, 2000.
9. Modern Organic Chemistry, M. K. Jain, S. C. Sharma Vishal Publishing, fourth reprint, 2009.
10. Reaction Mechanism in Organic Chemistry, S.M. Mukherji, and S.P. Singh, Macmillan India Ltd., third edition, 2009.
11. Stereochemistry of Organic Compounds, D. Nasipuri, New-Age International (1999).
12. P. S. Kalsi' 'Organic Reactions and their Mechanisms'' New Age International Publishers. 2010.

V Semester (SEP)

Question Paper Blue Print Chemistry Paper – V

(Organic Chemistry)

Unit	Topic	No. of teaching Hours	Marks allocated
I	Stereochemistry	13	28
II	Chemistry of Natural products	11	24
	Green Chemistry	2	4
III	Heterocyclic compounds	06	14
	Industrial organic chemistry	07	16
IV	Spectroscopy of simple organic compounds	13	28
	Total	52	114

QUESTION PAPER PATTERN

V Semester B.Sc. Degree Examination

CHEMISTRY – V (Organic Chemistry)

(SEP CBCS Scheme, 2026-27 onwards)

Time: 3 Hours **Max. Marks: 80**

Instructions to the candidates:

1. The Question paper has THREE parts. Answer ALL the parts.
2. Write equations and diagrams wherever necessary.

I. Answer any TEN of the following questions. Each question carries TWO Marks

(10X2 = 20)

1. Unit I
2. Unit I
3. Unit I
4. Unit II
5. Unit II
6. Unit II
7. Unit III
8. Unit III
9. Unit III
10. Unit IV
11. Unit IV
12. Unit IV

II. Answer any FOUR of the following questions. Each question carries FIVE Marks

(4X5 = 20)

13. Unit I
14. Unit I + Unit II
15. Unit II
16. Unit III
17. Unit III + Unit IV
18. Unit IV

III. Answer any FOUR of the following questions. Each question carries TEN Marks

(4X10 = 40)

19. Unit I
20. Unit I + Unit II
21. Unit II
22. Unit III
23. Unit III + Unit IV
24. Unit IV

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Chemistry Paper – VI

(Physical chemistry)

Unit	Chapters	No. of hours
I	Electrochemistry -II	10
	Surface chemistry	03
II	Analytical methods in chemistry	13
III	Spectroscopy – I	13
IV	Spectroscopy – II	08
	Physical properties and Molecular structure	05
	Total number of hours	**52**

UNIT – I

Electrochemistry -II **10 hours**

Galvanic cell; Conventions of representing galvanic cells-reversible and irreversible cells, requirements and examples for reversible cell (Daniel cell) and irreversible cells, representation, cell reaction. Electrode potential, Standard electrode potential, Derivation of Nernst equation for single electrode potential (free energy concept).

Numerical problems on single electrode potential of a metal and emf of cells.

Weston-cadmium cell; Diagram involving the representation of anode, cathode and the electrolyte. Requirements to decide Weston cadmium cell as standard cell. Construction and working of Weston cell and its numerical value of EMF. Determination of EMF of a cell by compensation method.

Determination of EMF of Zn/Zn^{2+} and Cu/Cu^{2+} electrodes. Liquid junction potentials, elimination of liquid junction potential using a salt bridge and conditions required for preparing a salt bridge.

Types of electrodes: (i) Metal and gas electrodes-Pt/H_2 and Pt/Cl_2 (ii) metal/metal insoluble salt electrodes-Ag/AgCl. (iii) redox electrodes-Pt/ Fe^{2+}/Fe^{3+}.

Reference electrodes: primary reference electrode; Standard hydrogen electrode. Secondary reference electrodes; Representation, construction and working of Calomel electrode, Quinhydrone electrode and glass electrode. Determination of pH using these electrodes.

Numerical problems involving the calculation of pH.

Concentration cells: (i) emf of concentration cells (ii) determination of solubility of sparingly soluble salt taking silver chloride as example. Numerical problems:

(i) calculation of emf (ii) solubility and solubility products. Redox electrodes: emf of redox electrodes. Potentiometric titration involving only redox systems. Example: Fe^{2+}/Fe^{3+}.

Surface chemistry **3 hours**

Review of surface phenomena. Theories of adsorption. Adsorption isotherms and BET equation (derivation included), Adsorption indicators.

Catalysis; Types and theories (intermediate compound theory and adsorption theory). Heterogeneous catalysis: surface reactions, unimolecular, bi-molecular surface reactions. pH dependence of rate constant of catalysed reactions. Autocatalysis.

UNIT – II

Analytical methods in chemistry **13 hours**

High Performance Liquid Chromatography **2 hours**

Basic Principle and types (i) Normal phase HPLC- Principle and Separation of the mixture containing Acetic acid, ethanol, ethyl amine, acetone, chloroform and carbon tetra chloride. (Stationary phase/Mobile phase- Silica gel/Hexane).

ii) Ion exchange HPLC- Principle and separation of a mixture of amino acids (acidic pH). (Stationary phase/Mobile phase- Charged surface (cation or anion)/Water, buffer.

Gas Chromatography: Basic principles, Instrumentation & Applications **1 hour**

Electro analytical Methods **4 hours**

Classification of electroanalytical methods, basic principle of pH metric, potentiometric and conductometric titrations. Techniques used for the determination of equivalence points. Techniques used for the determination of pKa values.

Voltammetry at a dropping mercury electrode (DME) - Types of current obtained at DME. Ilkovic equation and its applications. Current - potential relation for a cathodic process - half wave potential and its significance.

Cyclic Voltametry: Principles- Experimental set up- Quantitative analysis, determination of diffusion coefficients and its significance.

Thermal Analysis **2 hours**

Theory of thermogravimetry (TG), basic principle of instrumentation. Techniques for quantitative estimation of Ca and Mg from their mixture.

Flame Atomic and Absorption Spectrometry **4 Hours**

Simple atomization techniques: flame atomization and electrochemical atomization. Processes occurring during atomization. Basic principles of instrumentation (choice of source, monochromator, detector, choice of flame and burner designs). Single beam and double beam instruments. Sample introduction. Correction methods: two line and continuum source correction methods. Sources of chemical interferences and their method of elimination.

UNIT – III

Spectroscopy – I **13 hours**

Molecular Spectroscopy **4 hours**

Interaction of electromagnetic radiation with molecules (emission and absorption spectra, electromagnetic spectrum in terms of wave length/wave number, difference between atomic and molecular spectra and molecular energy levels) and various types of spectra (UV, IR, MW, Raman, and NMR and mention of the region), Born - Oppenheimer approximation (statement and explanation).

Rotational Spectroscopy **3 hours**

Expressions for energy of diatomic rigid rotor in terms of joule and m^{-1}, rotational constant, reduced mass, moment of inertia and spacing between rotational levels) Relationship between inter-nuclear distance and moment of inertia derivation. Numerical problems involving moment of inertia and bond length.

Selection rules [statement, expression for frequency for transition between J to (J+1), condition for absorption and spacing between spectral lines], Rotational energy for different quantum levels- J=0, J=1, J=2 etc.

Intensities of spectral lines (explanation based on population of energy levels), determination of bond lengths of diatomic molecules. Numerical problems.

Vibrational Spectroscopy **6 hours**

Classical equation of vibration (mention of expression for frequency/wave number for diatomic (SHO), computation of force constant (definition of force constant, significance and statement of Hooke's law), amplitude of diatomic molecular vibrations (potential energy curve for diatomic SHO), expression for vibrational energy (from solutions to Schrödinger

wave equation), Zero-point energy, definition, mathematical expression and its significance, selection rule, condition for absorption and fundamental vibrational frequency).

Numerical problems based on (i) zero-point energy(ii) wave number and (iii) force constant. Anharmonicity (difference in potential energy curves for SHO and others), Morse potential (energy expression for anharmonic oscillator, selection rules), dissociation energies, fundamental frequencies, overtones (compare the intensities), hot bands, degrees of freedom for polyatomic molecules (linear and non-linear – explanation taking suitable examples), modes of vibration (stretching and bending vibrations – types, comparison of frequencies, sketching of vibrational modes for CO_2 and H_2O), concept of group frequencies. Vibration-rotation spectroscopy – (pure vibrational spectra in liquids and mixing of vibration and rotational levels) diatomic vibrating rotator (expression for energy, selection rule and expression for energy change), P, Q, R branches explanation using diagram.

UNIT –IV

Spectroscopy – II **8 hours**

Raman spectroscopy **4 hours**

Raman scattering, Rayleigh scattering, polarizability and Raman shift, Qualitative treatment of rotational Raman effect (selection rule, expression for energy difference of a rigid diatomic rotor); Vibrational Raman spectra (selection rule), Stokes and anti-Stokes lines (explanation using diagram); their intensity difference, rule of mutual exclusion (explanation using molecules such as CO_2, O_2, N_2 etc.). Advantages of Raman spectroscopy over IR spectroscopy.

Electronic spectroscopy **4 hours**

Electronic spectroscopy: Potential energy curves for bonding and antibonding molecular orbitals. Electronic transitions - qualitative description of non-bonding orbitals and transitions between them. Selection rules and Franck-Condon principle.

Dissociation and pre-dissociation (chemical reactions and non-radiative transitions), calculation of electronic transitions of polyenes using free electron model, qualitative explanation of electronic spectra of conjugated systems using free electron molecular orbital theory and formula for calculation of frequency of electronic transition taking butadiene as an example.

Physical Properties and Molecular structure **5 Hours**

Dipole moment (a brief review), polarization and orientation of dipoles in an electric field.

Clausius – Mossotti equation (derivation). Electrical properties of solids: types of solids-

metals, insulators and semiconductors. Definition and examples for Pyroelectricity, piezoelectricity, ferroelectricity and inverse piezoelectricity. Thomson effect, Seebeck effect and Peltier effect - definitions with examples**.**

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2. Principles of Physical Chemistry, B. R. Puri, L. R. Sharma & M. S. Pathania, Vishal Publishing Co., 47th Edition, 2023.
3. An Introduction to Electrochemistry, Samuel Glasstone, East-West Press, Reprint Edition, 2002.
4. Electrochemistry, Philip H. Rieger, Springer, 2nd Edition, 1994.
5. Fundamentals of Molecular Spectroscopy, C. N. Banwell & E. M. McCash, Tata McGraw-Hill, 4th Edition (Reprint), 2017.
6. Principles of Instrumental Analysis, D. A. Skoog, F. J. Holler & S. R. Crouch, Cengage Learning, 6th Edition, 2007.
7. Instrumental Methods of Chemical Analysis, G. R. Chatwal & S. K. Anand, Himalaya Publishing House, 5th Edition, 2007.
8. Nanoscience and Nanotechnology, T. Pradeep, Tata McGraw-Hill, 1st Edition, 2007.
9. The Chemistry of Nanomaterials: Synthesis, Properties and Applications, C. N. R. Rao, A. Müller & A. K. Cheetham, Wiley-VCH, 1st Edition, 2004.
10. Vogel's Textbook of Quantitative Chemical Analysis, G. H. Jeffery, J. Bassett, J. Mendham & R. C. Denney, Pearson Education, 6th Edition, 2000.

V Semester (SEP)

Chemistry Paper – VI (Physical Chemistry)

Question Paper Blue Print

Unit	Topic	No. of teaching Hours	Marks allocated
I	Electrochemistry -II	10	22
	Surface chemistry	03	06
II	Analytical methods in chemistry	13	28
III	Spectroscopy – I	13	28
IV	Spectroscopy – II	08	18
	Physical structure and Molecular structures	05	12
Total		52	114

QUESTION PAPER PATTERN

V Semester B.Sc. Degree Examination

CHEMISTRY – VI (Physical Chemistry)

(SEP CBCS Scheme, 2026-27 onwards)

Time: 3 Hours **Max. Marks: 80**

Instructions to the candidates:

3. The Question paper has THREE parts. Answer ALL the parts.
4. Write equations and diagrams wherever necessary.

I. Answer any TEN of the following questions. Each question carries TWO Marks

(10X2 = 20)

1. Unit I
2. Unit I
3. Unit I
4. Unit II
5. Unit II
6. Unit II
7. Unit III
8. Unit III
9. Unit III
10. Unit IV
11. Unit IV
12. Unit IV

II. Answer any FOUR of the following questions. Each question carries FIVE Marks

(4X5 = 20)

13. Unit I
14. Unit I + Unit II
15. Unit II
16. Unit III
17. Unit III + Unit IV
18. Unit IV

III. Answer any FOUR of the following questions. Each question carries TEN Marks

(4X10 = 40)

19. Unit I
20. Unit I + Unit II
21. Unit II
22. Unit III
23. Unit III + Unit IV
24. Unit IV

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V - Semester Practicals

Chemistry Practical - V

1. Qualitative analysis of mono functional organic compounds (Performance)

Qualitative analysis of organic compound:

Identification of mono-functional organic compounds through functional group analysis.

Determination of physical constant. Preparation of a suitable derivative and characterization (MP) of the derivative.

Any one of the following organic compounds shall be given for analysis. Not more than two students in a batch should be given the same compound for analysis.

(1) Resorcinol	(2) Urea	(3) Aniline	(4) Nitrobenzene
(5) Benzoic acid	(6) Salicylic acid	(7) Benzaldehyde	(8) Acetophenone
(9) Ethyl benzoate	(10) cresol	(11) Chlorobenzene	(12) Benzamide
(13) glucose	(14) naphthalene		

2. Estimation of creatinine by Jaffe's method.
3. Estimation of inorganic phosphate by Fiske-Subbarow method.
4. Estimation of Reducing sugars by DNS (dinitrosalicylic acid) method.
6. Estimation of amino acids using ninhydrin.

Reference Books:

1. Vogel's quantitative Organic Analysis, G. Svehla, 7th Ed, Longman (2001).
2. Advanced Practical Chemistry, Jagadamba Singh, Pragathi, Publications (2017).
3. College Practical Chemistry: V K Ahluwalia, Sunitha Dhingra and Adarsh Gulati. University Press-2011.
4. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, V. K. Ahluwalia, R. Aggarwal, and Universities Press (India), (2000).
5. Advanced Practical Organic Chemistry, J. Mohan, and Vol. I and II, Himalaya Publishing House, (1992).
6. Vishnoi, N.K. Advanced Practical Organic Chemistry, 3rd ed., Vikas Publishing House, New Delhi, 2010.
7. Laboratory Manual in Organic Chemistry–R. K. Bansal (New Age, New Delhi) 1990.

Scheme of Internal Assessment Marks

Practicals:

Sl. No.	**Particulars**	**I A Marks**
1	Practical Test	05
2	Active participation in practical classes	05
	Total Practical IA marks	**10**

Scheme of Evaluation for Practical Examination

Sl. No.	Examination particulars	Marks allotted
1	Experimental performance	25
2	Procedure Writing	05
3	Record assessment	05
4	Oral performance (Viva-voce)	05
Total		**40**

Semester – V

COMPULSORY PRACTICALS

Skill – II

1. Handling of chemicals (solids/liquids/gases) – Storage of chemicals / solvents, Chemical spills and emergencies, Chemical wastes and disposal methods, Laboratory protocols: Chemical Hygiene Plan (CHP) etc.
2. Preparation of buffers. Measurement of the pH of buffer solutions and comparison of the values with theoretical values.
3. Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos, soaps etc., using a pH-meter.
4. Colorimetric estimation of reducing sugars/ phosphate/ copper/ iron.
5. Dye degradation studies using colometry.
6. Determination of acetic acid content in a commercial sample of vinegar.
7. Determination of moisture content in a soil/ coal sample.
8. Determination of acid value in oils and fats.
9. Determination of free chloride in a sample of water
10. Determination of COD in industrial effluents.
11. Determination of BOD in industrial effluents.
12. Industrial / field visit

VI Semester B.Sc.

Chemistry Paper – VII (Inorganic chemistry)

and

Chemistry Paper VIII (Biochemistry)

Instructions per week	Total contact hours	Marks		Duration of Examination	Total marks	Credits
		Formative Assessment / Internal assessment	Summative Assessment / End Semester Examination			
4 Hours	52	20	80	3 Hours	100	3

Scheme of Internal Assessment Marks (Theory)

Sl No.	Particulars	I A Marks
1	Attendance	05
2	Internal Tests (Minimum of Two)	10
3	Assignments/Seminars	05
	Total Theory IA marks	**20**

Chemistry Paper – VII
(Inorganic chemistry)

Unit	Chapters	No. of hours
I	Industrial materials	13
II	Industrial gases and Inorganic chemicals	06
	Energy & Environment	03
	Fertilizers	04
III	Analytical Chemistry	09
	Bio-inorganic chemistry	04
IV	Chemistry of newer materials	13
Total		**52**

UNIT – I

Industrial Materials **13 hours**

Refractories: Definition. Properties of a good refractory, classification, determination of PCE values.

Abrasives: Definition and classification with examples, applications, hardness-definition and magnitude of hardness, manufacture and importance of carborundum and tungsten carbide.

Glass: Properties, types, manufacture of soda glass. Composition and applications of borosilicate, metallic glass, optical glasses and polycarbonate glass, safety glass, fire and bullet proof glasses.

Ceramics: Raw materials and their roles, varieties of clay, production of ceramic ware, glazing, ceramic insulators.

Cement: Raw materials, manufacture of Portland cement (by wet process), setting of cement, grades, their significance.

Paints and Varnishes: Constituents of oil and emulsion paints and their role. Constituents of varnishes.

Fuels: Characteristics, calorific value - definition and its determination using bomb calorimeter.

Liquid fuels- Petrol and diesel- antiknocking properties, octane number and cetane number-

definition and significance.

Gaseous fuels- advantages, constituents and their significance, composition of LPG.

Coal – varieties, production of Coal gas,

Explosives: Classification, preparation of dynamite and TNT.

Propellants: Characteristics, classification and their applications.

UNIT – II

Industrial gases and Inorganic chemicals **06 hours**

Industrial Gases: Large scale production (only hydrogen, oxygen, nitrogen), uses storage and hazards in handling of the following gases: hydrogen, oxygen, nitrogen, helium, acetylene, carbon monoxide, fluorine and phosgene.

Inorganic Chemicals: Manufacture (sulphuric acid, caustic soda, nitric acid) application and hazards in handling the following chemicals: hydrochloric acid, sulphuric acid, nitric acid, caustic soda, bleaching powder, potash alum and potassium dichromate.

Energy & Environment **03 hours**

Sources of energy: coal, petrol, natural gas, nuclear energy, solar energy, hydrogen, geothermal, tidal and hydel, etc.

Nuclear Pollution: Disposal of radioactive solid, liquid and gaseous wastes. nuclear disaster and its management.

Treatment of sewage - primary and secondary processes. Industrial effluents from paper industry and sugar industries.

Fertilizers **4 hours**

Introduction: introduction, functions of essential plant nutrients (N, P, K). Classification of fertilizers -nitrogenous, phosphatic and mixed fertilizers with suitable examples. Manufacture of urea, ammonium nitrate, calcium ammonium nitrate and super phosphate of lime. Mixed fertilizers, potassium chloride, potassium sulphate and their uses. Fertilizer industries in India.

UNIT – III

Quantitative Analysis **11 hours**

Instrumental methods **6 hours**

Review of Beer-Lambert's law, evaluation procedures- standard addition, internal standard addition, validation parameters-detection limits, sensitivity, dynamic/linearity range, Instrumentation of single beam and double beam spectrophotometers, quantitative applications of colorimetry (determination of iron, copper and phosphate (PO_4^{3-})).

Nephelometry and Turbidimetry: Introduction, principle, instrumentations of nephelometry and turbidimetry; effects of concentration, particle size and wavelength on scattering; choice between nephelometry, applications of nephelometry and turbidimetry (determination of SO_4^{2-} and PO_4^{3-})

Separation techniques **5 hours**

Solvent Extraction-, types and efficiency of extraction, sequence of extraction process, distribution coefficient, Nernst distribution law, derivation, factors affecting the partition, factors affecting extraction; pH, oxidation state, modifiers, synergistic masking and salting of agents, techniques- batch, continuous extraction and counter current extraction, applications. Solvent extraction of iron and copper.

Ultracentrifugation- Centrifugation, centrifugal force, sedimentation, centrifugal decantation, centrifuges, sedimentation co-efficient, sedimentation velocity- application of the technique in biological separation; membrane separation- principles and applications.

Ultrafiltration- Zone refining techniques- Principles, instrumentation and applications.

Water Technology **2 hours**

Types of impurities present in water: Physical (suspended, colloidal), Chemical (high content of chlorine, calcium and magnesium salts) and biological (algae, fungi and bacterial). Causes for the hardness of water. Temporary hardness due to magnesium hydrogen carbonate and calcium hydrogen carbonate, permanent hardness due to calcium and magnesium sulphates. Permissible levels of ions present in water: F^-, Cl^-, NO_3^-, PO_4^{3-}, Ca^{2+}, Mg^{2+} and silicates.

Treatment of water for domestic and industrial purposes by (i) Demineralization of water by ion exchange method: principle and process. (ii) Reverse osmosis method: principle and the process.

UNIT – IV

Chemistry of Newer materials **13 hours**

Conducting polymers: Introduction, definition and examples- polyaniline, polyacetylene. Mechanism of conduction. Qualitative treatment of doping. Properties: elasticity with high electrical conductivities, Engineering and biological applications.

Superconductors: Introduction, definition, type-1, type-2 and atypical. Preparation of high temperature superconductor- YBCO. BCS theory (qualitative treatment only) and general applications of high temperature super conductors.

Nanomaterials: Introduction, definition and structure. Different methods of production: sol gel synthesis, inert gas condensation, mechanical alloying (ball milling), plasma synthesis,

electro deposition, and general applications. Nanofluids.

Fullerenes: Introduction, definition, preparation and isolation of C60. Structure and chemical reactions (redox reactions, electrophilic aromatic substitution and bromination) of C60.Commercial uses of C60. Carbon nanotubes (CNT) -definition, classification and applications- space crafts and race cars.

Photovoltaics; Solar cells - Principle, preparation and applications.

Application of AI Tools in Chemistry

Prediction of reactions, analysis of spectroscopic data, drug discovery and molecular design, retro synthesis and reaction optimization, analytical chemistry and spectroscopy.

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Reference Books

1. Advanced Inorganic Chemistry, 6th Edition F. A. Cotton, G. Wilkinson, C. A. Murillo and M. Bochmann-John Wiley & Sons, 1999.
2. Concise Inorganic Chemistry, 5th Edition J. D. Lee, Blackwell Science, 2001.
3. Inorganic Chemistry, 4th Edition J. E. Huhee, E. A. Keiter and R. I. Keiter, Pearson Education Asia, 2000.
4. Environmental Chemistry A. K. De, Wiley Eastern Ltd., 1999.
5. Nuclear and Radiation Chemistry Sharma B. K, Goel Publishing House, 1987.
6. Principles of Inorganic Chemistry, B. R. Puri and L. R. Sharma, Jauhar S. P-S. N. Chand & Co., 1998
7. University Chemistry, 4th Edition (ISE) B. H. Mahan & R. J. Myers, Addison Wesley, 1989.
8. Essential Trends in Inorganic Chemistry C. M. P. Mingos, Oxford Univ Press, 1998
9. Fundamental Concepts of applied Chemistry, Jayashree Ghosh, S Chand Publications, 1994.
10. Industrial Chemistry, B. K. Sharma, Goel Publishing House, 1995.
11. Vogel's Textbook of Quantitative Chemical Analysis, G. H. Jeffery, J. Bassett, J. Mendham & R. C. Denney, Pearson Education, 6th Edition, 2000.
12. Fundamentals of Analytical Chemistry, Douglas A. Skoog, Donald M. West, F. James Holler & Stanley R. Crouch, Cengage Learning, 9th Edition, 2014.
13. Quantitative Chemical Analysis, Daniel C. Harris, W. H. Freeman & Company, 9th Edition, 2016.
14. Standard Methods for the Examination of Water and Wastewater, APHA, AWWA & WEF, American Public Health Association, 24th Edition, 2022.
15. Experimental Organic Chemistry: A Small-Scale Approach, Donald L. Pavia, Gary M. Lampman, George S. Kriz & Randall G. Engel, Cengage Learning, 3rd Edition, 2014

VI Semester (SEP)

Chemistry Paper – VII (Inorganic Chemistry)

Question Paper Blue Print

Unit	Topic	No. of teaching Hours	Marks allocated
I	Industrial materials	13	28
II	Industrial gases and Inorganic chemicals	06	13
	Energy & Environment	03	07
	Fertilizers	04	10
III	Analytical Chemistry	09	18
	Bio-inorganic chemistry	04	10
IV	Chemistry of newer materials	13	28
Total		52	114

QUESTION PAPER PATTERN

VI Semester B.Sc. Degree Examination

CHEMISTRY – VII (Inorganic Chemistry)

(SEP CBCS Scheme, 2026-27 onwards)

Time: 3 Hours **Max. Marks: 80**

Instructions to the candidates:

1. The Question paper has THREE parts. Answer ALL the parts.
2. Write equations and diagrams wherever necessary.

I. Answer any TEN of the following questions. Each question carries TWO Marks

(10X2 = 20)

1. Unit I
2. Unit I
3. Unit I
4. Unit II
5. Unit II
6. Unit II
7. Unit III
8. Unit III
9. Unit III
10. Unit IV
11. Unit IV
12. Unit IV

II. Answer any FOUR of the following questions. Each question carries FIVE Marks

(4X5 = 20)

13. Unit I
14. Unit I + Unit II
15. Unit II
16. Unit III
17. Unit III + Unit IV
18. Unit IV

III. Answer any FOUR of the following questions. Each question carries TEN Marks

(4X10 = 40)

16. Unit I
17. Unit I + Unit II
18. Unit II
19. Unit III
20. Unit III + Unit IV
21. Unit IV

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Chemistry Paper – VIII
(Biochemistry)

Unit	Topics	No. of teaching hours
I	Introduction to Biochemistry	03
	Carbohydrates & carbohydrates metabolism	10
II	Enzymes	04
	Vitamins and Hormones	04
	Metal ions in Biological system	05
III	Lipids &lipid metabolism	07
	Amino acids, Proteins and Protein metabolism	06
IV	Bioenergetics and Biological oxidation	07
	Nucleic acids	06
Total		**52**

UNIT –I

Introduction to Biochemistry **03 hours**

Contributions of Emil Fischer, Embden, Meyerhof, Parnas, Hans Kreb, Michaelis and Menton, Watson and Crick, Chargaff, H.G. Khorana, Knoop, Pauling, Hopkins and Miescher. Elemental and biochemical composition of living organisms.

Biophysics of water- dielectric constant, surface tension, heat of vaporization, MP and BP & specific heat. Role of water in biological systems.

Carbohydrates & carbohydrates metabolism **10 hours**

Structure and biological importance of derivatives of monosaccharaides; Amino sugars - β-D-glucosamine, galactosamine and N-acetyl muramic acid (NAMA); N-acetyl neuraminic acid (NANA). Sugar acids - Structure and biological importance of D-gluconic acid, D-glucuronic acid and D-glucaric acid. Sugar phosphates – Structure and biological importance of Glucose-6-P, Fructose-6-P, β-D-ribose-5-P and deoxyribose-5-P.

Structure and biological importance of oligosaccharides- Isomaltose, cellobiose, trehalose.

Polysaccharides - source, comparative account of partial structure and biological function of starch, glycogen, cellulose, chitin.

Catabolism and anabolism: explanation with an example.

Carbohydrate metabolism: Glycolysis, fate of pyruvate (Pyruvate to lactate, acetyl CoA, OAA and ethanol). TCA cycle, energetics.

Gluconeogenesis: definition, synthesis of glucose from lactate.

UNIT –II

Enzymes **04 hours**

Introduction, holoenzyme (apo enzyme and co-enzyme). Active site, specificity (Group, absolute and stereo selectivity with examples).

Classification of enzymes (EC code number not required) with examples.

Enzyme substrate interaction- Fischer and Koshland models.

Enzyme kinetics - factors affecting rate of enzymatic reactions - enzyme concentration, pH, temperature and substrate concentration, (mention M.M. equation). Allosteric enzymes - definition and example

Enzyme inhibitions- Competitive and non-competitive with one example for each.

Vitamins and Hormones **04 hours**

Vitamins: Definition. Classification. Biological importance and deficiency symptoms of Vitamins A, Vitamin B1 (thiamine), Vitamin B6 (pyridoxine), folic acid, pantothenic acid, riboflavin, Vitamin C, Vitamin E (α-tocopherol), Vitamin H (biotin), Vitamins K1 and K2.

Hormones: Definition. Classification (i) amino acid derivatives (epinephrine and thyroxine) (ii) peptide (oxytocin and vasopressin) and polypeptide hormones (insulin and glucagon) (iii) Steroid hormones (progesterone, testosterone) with functions. Role of insulin and glucagon in glucose homeostasis. Mediators of hormone action- Ca^{2+} and cyclic AMP.

Metal ions in biological system **05 hours**

A brief introduction to bioinorganic chemistry - occurrence and availability of inorganic elements and ions in biological systems. Transport and storage of metals: Fe, Cu, Zn, and V storage and transport – metallothioneins. Sodium and potassium ion pumps - mechanisms of ion-transport across cell membranes – bleomycin - siderophores (e.g., enterobactin and desferrioxamine) -transport of iron by transferrin, storage of iron - ferritin, role of iron in haemoglobin, biochemistry of calcium as hormonal messenger, role of Ca^{2+} in blood clotting, role of Mn in nitrogen fixing. Basics of Biomineralization.

UNIT –III

Bioenergetics and Biological oxidation **07 hours**

Bioenergetics- Introduction, stages of energy transformation. Exergonic and endergonic reactions. Energy coupling in biological reactions. Relationship between ΔG^o and Keq.

Structural features of ATP as a high energy phosphate (electrostatic repulsion, opposing resonance, solvation of ATP). Examples of high energy phosphates other than ATP with their free energy values (PEP and creatinine phosphate).

Biological oxidation - comparison of oxidation with combustion using glucose as an example. Redox potentials of some biologically important half reactions. Calculation of energy yield for the oxidation of NADH by oxygen, reduction of acetaldehyde by NADH. Mitochondrial electron transport chain, oxidative phosphorylation and substrate level phosphorylation.

Nucleic acids **06 hours**

Types of nucleic acids, components of nucleic acids, bases, nucleosides and nucleotides with structures. Chargaff's rule of base equivalence. Polynucleotides - partial structure, structure of DNA (Watson-Crick model) and RNA. Biological roles of DNA and RNA. Tm of DNA. Protein-nucleic acid interaction - chromatin.

Central dogma of molecular biology, semi conservative replication and mechanism of DNA replication. Genetic code: general features. Transcription and Translation with mechanism. Mutation- Definition and types with example (Sickle cell anaemia).

DNA finger printing - Definition and its applications.

UNIT –IV

Lipids & their energetics **07 hours**

Introduction, Classification - simple, complex and derived with examples.

Fatty acids - Classification as saturated and unsaturated with examples and structure (lauric, myristic, palmitic, stearic, oleic, linoleic, linolenic and arachidonic acids). Essential fatty acids - definition with examples.

Triglycerides - Structure of simple and mixed glycerides, properties of triglycerides- acid and alkali hydrolysis, saponification number and its significance, iodine number and its significance, rancidity (Oxidative and hydrolytic), causes and prevention.

Biological importance of triglycerides.

Phosphoglycerides- General structure of 3-Sn–phosphatidic acid, lipid bilayer (as in cell membrane), micelles, liposomes and its applications, structure and biological importance of lecithin, cephalin, phosphatidyl serine, phosphatidylinositol.

Cholesterol- Structure and significance

Lipoproteins - definition, types (HDL, LDL and VLDL).

Sphingolipids- structure and biological significance of ceramide.

Lipids as signal molecules.

Fatty acid degradation: activation of fatty acids, role of carnitine, β-oxidation pathway (C16-Palmiticacid), energetics. Formation of ketone bodies, Starve-Feed cycle

Amino acids, Proteins and Protein metabolism 06 hours

α-amino acids: Introduction, structure (Glycine, Alanine, Valine, Cysteine, Aspartic acid, Lysine, Tyrosine and proline), classification on the basis of polarity of R-groups, essential and non-essential amino acids with examples, ionic properties and reactions of amino acids with alcohol, nitrous acid and Ninhydrin. Peptide bond – definition and features, oligopeptide and polypeptides.

Levels of organizations of Protein: Primary structure, Secondary structure (α-helix, β-pleated structure & triple helix-Collagen), tertiary structure (forces stabilizing it) and quaternary structure.

Denaturation and renaturation- Anfinsen's experiment with ribonuclease.

Classification of proteins based on structure, composition and biological function (enzymes, hormones, transport agents, structural & antibodies with examples).

Protein metabolism: Transamination, deamination and decarboxylation. Urea cycle. Integration of carbohydrates, lipids and protein metabolic pathways.

Reference Books:

1. Lehninger's Principles of Biochemistry: International Edition.
2. Harper's Illustrated Biochemistry; Rodwell et al.
3. Biochemistry: An Integrative Approach; John Tansey
4. Biochemistry by U. Satyanarayana and U. Chakrapani
5. Lippincott Illustrated Reviews: Biochemistry; Denise R. Ferrier.
6. A Text Book of Biochemistry A. V. S. S. Rama Rao, UBSPD
7. Fundamentals of Biochemistry J. L. Jain, S. Chand & Co.

VI Semester (SEP)

Chemistry Paper – VIII (Biochemistry)

Question Paper Blue Print

Unit	Topics	No. of teaching hours	Marks allocated
I	Introduction to Biochemistry	03	06
	Carbohydrates & carbohydrates metabolism	10	22
II	Enzymes	04	10
	Vitamins and Hormones	04	08
	Metal ions in biological system	05	10
III	Lipids &lipid metabolism	07	16
	Amino acids, Proteins and Protein metabolism	06	14
IV	Bioenergetics and Biological oxidation	07	16
	Nucleic acids	06	12
Total		**52**	**114**

QUESTION PAPER PATTERN

VI Semester B.Sc. Degree Examination

CHEMISTRY – VIII (Biochemistry)

(SEP CBCS Scheme, 2026-27 onwards)

Time: 3 Hours **Max. Marks: 80**

Instructions to the candidates:

1. The Question paper has THREE parts. Answer ALL the parts.
2. Write equations and diagrams wherever necessary.

I. Answer any TEN of the following questions. Each question carries TWO Marks **(10X2 = 20)**

1. Unit I
2. Unit I
3. Unit I
4. Unit II
5. Unit II
6. Unit II
7. Unit III
8. Unit III
9. Unit III
10. Unit IV
11. Unit IV
12. Unit IV

II. Answer any FOUR of the following questions. Each question carries FIVE Marks **(4X5 = 20)**

13. Unit I
14. Unit I + Unit II
15. Unit II
16. Unit III
17. Unit III + Unit IV
18. Unit IV

III. Answer any FOUR of the following questions. Each question carries TEN Marks **(4X10 = 40)**

19. Unit I
20. Unit I + Unit II
21. Unit II
22. Unit III
23. Unit III + Unit IV
24. Unit IV

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VI Semester Practicals

Practicals - VI

1. Conductometric titration of hydrochloric acid with sodium hydroxide.
2. Conductometric titration of acetic acid with sodium hydroxide
3. Determination of equivalent conductivity of 0.1 N sodium chloride and verification of DHO equation.
4. Determination of dissociation constant of monochloroacetic acid by conductivity method.
5. Determination of pKa of a weak acid by pH metric method.
6. Potentiometric titration of potassium dichromate with ferrous ammonium sulphate.
7. Estimation of Cu^{2+} colorimetrically and verification of Beer-Lambert's law.
8. Estimation of iron by colorimetric method.
9. Construction of phase diagram of two component system (Ex: diphenylamine benzophenone) by cooling curve method.
10. Estimation of calcium in lime stone.
11. Estimation of copper in brass.
12. Preparation and quantitative analysis of inorganic complex - Hexamminecobalt(III) chloride (analysis of cobalt)
13. Preparation and quantitative analysis of inorganic complex - Cis- and trans-potassium dioxalatodiaquachromium(III) complex (analysis of oxalate and chromium)

Semester – VI

COMPULSORY PRACTICALS

Skill – III

1. Isolation and characterization of natural products: Isolation of caffeine from tea dust.
2. Isolation and characterization of natural products: Isolation of casein from milk.
3. Isolation and characterization of natural products: Isolation of piperine from pepper.
4. Isolation and characterization of natural products: Isolation of lycopene from tomato.
5. Purification of the compounds using column chromatography and characterization of the compounds using spectroscopic techniques.
6. Separation of amino acids by TLC and paper chromatography.
7. Preparation of bio-diesel from waste cooking oil.
8. Quantification of chlorophyll content in leaves of various plants.
9. Microwave assisted synthesis of aspirin.
10. Synthesis and characterization of biodegradable polymer.
11. Synthesis and characterization of nanoparticles
12. Molecular Structure Drawing and Visualization 2D & 3D (Chemdraw); Structure cleaning and error.
13. Industrial / field visit.

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