Department – Science

Aishwarya College (Autonomous)

Affiliated to Jai Narain Vyas University, Jodhpur

NAAC "A" Grade, Recognised by UGC u/s 2(f) & 12 (B)

B.Sc.

COURSE SCHEME
&
SYLLABUS

AISHWARYA COLLEGE OF EDUCATION (AUTONOMOUS) Department of Science - Course Name and Credit Scheme (B.Sc. - CBZ)										
NCRF Level	**Sem**	**Course Type**	**Course Code**	**Course Name**	**H/W**	**Total Hours**	**Credits**	**CIA Marks**	**EoSE Marks**	**Max. Marks**
4.5	I	DCC	CHECC14001T	Basic Concepts of Chemistry - I	4	60	4	20	80	100
		DCC	CHECC14001P	Practical Chemistry-I	4	60	2	20	80	100
		DCC	BOTCC14001T	Microbiology, Fungi, Plant Pathology, and Algae	4	60	4	20	80	100
		DCC	BOTCC14001P	Practical for microbiology, fungi, Plant Pathology, and Algae	4	60	2	20	80	100
		DCC	ZOOCC14001T	Lower Invertebrate Zoology and Animal Diversity & Evolution	4	60	4	20	80	100
		DCC	ZOOCC14001P	Lower Invertebrate Diversity and Biochemical Techniques	4	60	2	20	80	100
		AECC	ENGAC14001T	General English	4	60	4	20	80	100
		SEC	xxxSC14001T	Student can select one SEC from Course list	3	45	3	20	80	100
		Total Credits					**25**			

AISHWARYA COLLEGE OF EDUCATION (AUTONOMOUS) Department of Science - Course Name and Credit Scheme (B.Sc. - PCM)										
NCRF Level	**Sem**	**Course Type**	**Course Code**	**Course Name**	**H/W**	**Total Hours**	**Credits**	**CIA Marks**	**EoSE Marks**	**Max. Marks**
4.5	I	DCC	CHECC14001T	Basic Concepts of Chemistry - I	4	60	4	20	80	100
		DCC	CHECC14001P	Practical Chemistry-I	4	60	2	20	80	100
		DCC	PHYCC14001T	Mechanics	4	60	4	20	80	100
		DCC	PHYCC14001P	Mechanics Lab	4	60	2	20	80	100
		DCC	MATCC14001T	Algebra	6	90	6	20	80	100
		AECC	ENGAC14001T	General English	4	60	4	20	80	100
		SEC	xxxSC14001T	Student can select one SEC from Course list	3	45	3	20	80	100
		Total Credits					**25**			

B.Sc. Semester: I (2025-26)

Discipline Centric Core Course (DCC)

CHECC14001T: Basic Concepts of Chemistry - I

(20 CIA + 80 EoSE. = Max. Marks: 100)

Course Credits	No. of Teaching Hours Per Week	Total No. of Teaching Hours
4 Credits	4 Hours	60 Hours

Course Outcomes: On successful completion of the course, the students will be able to-

CO1: Explain the concepts of covalent and ionic bonding using Valence Bond Theory, VSEPR theory, hybridization, Similarities and differences between Valence bond and Molecular orbital Theory.

CO2: Analyze molecular orbital diagrams for homonuclear and heteronuclear diatomic molecules and compare Molecular Orbital Theory with Valence Bond Theory.

CO3: Identify and interpret electronic effects, types of bond fission, reactive intermediates, and reagent types in organic chemistry reactions.

CO4: Apply principles of stereochemistry to understand conformations, isomerism, chirality, and nomenclature using various structural representations.

CO5: Describe the physical behavior of real gases using Van der Waals equation, Maxwell's distribution, and Joule-Thomson effect, and explain deviations from ideal behavior.

SYLLABUS

Unit-I:Chemical Bonding-I

Covalent Bond – Valence bond theory, shapes of some inorganic molecules and ions on the basis of VSEPR theory and hybridization (sp, sp^2 and sp^3) with suitable examples, bonding in diborane (3c-2e bonding).

Molecular Orbital theory – Postulates, Molecular orbital diagram of homonuclear (H_2, H_2^+,He_2^+, Li_2, Be_2, B_2, C_2, N_2, O_2, F_2, O_2+, O_2^-, O_2^{2-}, $O_2^{2+}$and heteronuclear (CO and NO) diatomic molecules.

Unit-II:Chemical Bonding-II

Ionic Bonding: General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy, solvation energy and their importance in the context of stability and solubility of ionic compounds. Born-Landé equation for calculation of lattice energy (statement only), Born-Haber cycle and its applications (for NaCl).

Radius ratio: Radius ratio effect and coordination number, Polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character.

Hydrogen Bonding: Types and impact of inter and intra molecular hydrogen bonding.

Unit-III:Basic Concepts of Organic Chemistry

Electronic displacements: inductive effect, electromeric effect, resonance, necessary conditions for resonance, contribution of resonationg structures, hyperconjugation and its effects. Types of fission: homolytic and heterolytic bond fission. Types of reagents- electrophiles and nucleophiles, Reactive intermediates- carbocations, carbanions, free radicals.

Stereochemistry: Conformations of ethane, butane and cyclohexane. Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations. Concept of chirality (upto two carbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds. Threo and erythro; D and L; cis- trans nomenclature; CIP Rules: R/S (for upto 2 chiral carbon atoms) and E/Z Nomenclature (for upto two C-C systems).

Unit-IV:Aliphatic Hydrocarbons

Functional group approach for the following-

Alkanes (Upto 5 Carbons)

Preparation: Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. Reactions: Free radical Substitution (halogenation).

Alkenes(Upto 5 Carbons)

Preparation: Elimination reactions,dehydration of alcohols and dehydrohalogenation of alkyl halides (Saytzeff's rule),cis alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction). Reactions: cis-addition (alk. $KMnO_4$) and trans-addition (bromination), Addition of HX (Markovnikov's and anti-Markovnikov's addition), Hydration, Ozonolysis, oxymecuration-demercuration, Hydroboration-oxidation.

Unit-V:Gaseous State

Deviation from ideal behavior, Vander Waals equation of state and its discussion. Critical Phenomena: PV isotherms of real gases, critical phenomenon continuity of states, relationship between critical constants and Vander Waals constants, the law of corresponding states, reduced equation of state. Molecular velocities: Root mean square, average and most probable velocities(no derivation). Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter. Liquification of gases (based on Joule-Thomson effect).

SUGGESTED READINGS

1. Fundamentals of Chemistry-I (Hindi) by Dr.Vikal Gupta, Dr.ArunArora, Dr.Sawai Singh Rathore, 2024, Associated Book Company, Jodhpur.
2. Fundamentals of Chemistry-II (Hindi) by Dr.Vikal Gupta, Dr.ArunArora, Dr.Sawai Singh Rathore, 2024, Associated Book Company, Jodhpur.
3. Chemistry-I (Hindi) by Dr. K. R. Genwa, 2024, RBD, Jaipur
4. BhotikRasayan-I (Hindi) by K. R. Genwa, 2023, RBD, Jaipur.
5. Chemistry (English) by Dr. K.R. Genwa, Dr.Minakshi Jonwal, Dr. R.L. Saini, 2025, RBD, Jaipur
6. Inorganic Chemistry by SatyaPrakash by G.D. Tuli, S.K. Basu& R.D. Madan, 19th Indian Edition, S. Chand & Company Ltd.
7. Inorganic Chemistry by R. C. Agarwal,8th Edition, Krishna Prakashan Media, S. Chand.
8. Inorganic Chemistry by P. L. Soni,20th Revised Edition, Sultan Chand & Sons.
9. Inorganic Chemistry by G. C. Shivhare& V. P. Lavania, 5th & 6th edition, Geeta Book Depot, Meerut.
10. Advanced Organic Chemistry by Mukherjee & Kapoor (Vol.I & II), New Central Book Agency (NCBA), Kolkata.
11. A Text Book of Organic Chemistry by R. K. Bansal,5th Edition,New Age International Pvt. Ltd.
12. Organic Chemistry by R. T. Morrison & R. N. Boyd (Prentice Hall), 6th Edition, Prentice Hall of India.
13. The Elements of Physical Chemistry — P. W. Atkins, 6th Edition,Oxford University Press.
14. Principles of Physical Chemistry — B. R. Puri, L. R. Sharma & M. S. Pathania, ShobhanLalNaginchand& Co.
15. Essentials of Physical Chemistry, Bahl & Tuli, S. Chand & Co., by S. Chand.

B.Sc. Semester: I 2025-26

Discipline Centric Core Course (DCC)

CHECC14001P: Practical Chemistry - I

(20 CIA + 80 EoSE. = Max. Marks: 100)

Course Credits	No. of Teaching Hours Per Week	Total No. of Teaching Hours
2 Credits	4 Hours	60 Hours

SUGGESTED LABORATORY EXERCISES

Exercise 1.

Qualitative analysis of inorganic mixture containing 5-radicals (anions and cations), separation and identification of (group 0, I, II, III, IV, V and VI) and anions including interfering radicals and special combination of acidic radicals (CO_3^{2-}, SO_3^{2-}, NO_3^-,NO_2^-, NO_3^-, Br^-,Cl^- , Br^- , I^-, S^{2-} , SO_3^{2-}, SO_4^{2-})

Exercise 2.

Organic Models (Using Ball and Stick Model Box): R and S configuration of optical isomers D and L configuration of optical isomers E/Z configuration of geometrical isomers Conformational isomerism of ethane and n-butane

SUGGESTED READINGS

1. Practical Chemistry by Dr. O.P. Pandey, Dr. S. Giri
2. Practical Chemistry - Ist Semesterby K.M. Gangotri
3. Practical Chemistry – Ist Semester by Dr. Vikal Gupta, Dr. Arun Arora

B.Sc.Semester: I (2025-26)

Discipline Centric Core Course (DCC)

BOTCC14001T: Microbiology, Fungi, Plant Pathology and Algae

(20CIA+80 EoSE.=Max.Marks:100)

Course Credits	No.ofTeachingHoursPerWeek	TotalNo.ofTeachingHours
4 Credits	4Hours	60 Hours

Course Outcomes: Onsuccessful completion of the course, the students will be able to-

CO1: Classify and characterize fungi on the basis of vegetative and reproductive features.

CO2: Discuss the Economic importance of Fungi.

CO3: Differentiate some plant diseases with special reference to the causative agents, symptoms, etiology and control measures

CO4: Identify and classify the structure, pigmentation, food reserves and methods of reproduction of Algae.

CO5: ExplaintheEconomic importance of algae and lichen.

SYLLABUS

Unit-I: Introduction of microbes:

Viruses:-General characters, structure and multiplication of viruses. Structure of Tobacco mosaic virus (TMV) and YellowVein Mosaic Virus (YVMV).Transmission of plant viruses. Bacteriophages. General account of Viroids and Prions. Economic importance of viruses.

Bacteria:

Discovery, general characteristics, types- archaebacteria, eubacteria, structure, nutrition, reproduction and economic importance of Bacteria .

Cyanobacteria–Important features and Life history of *Nostocand Oscillatoria*. Nitrogen fixation–by Cyanobacteria (Blue green algae).

Unit-II: General characters and classification of algae (Fritsch's classification) and economic importance.Structure and life history of *Volvox, Chara, Vaucheria, Ectocarpusand Polysiphonia*.

Unit-III:. General characters and classification of Fungi (Alexopoulos&Mim's 1979) Economic importance of fungi, . Important features of Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina. Structure and life history of *Albugo, Rhizopus, Aspergillus, Agaricus, Puccinia and Alternaria.*

Unit-IV:. Brief account of *Mycoplasma, Spiroplasma* and *Phytoplasma.* Symptoms,causal organism and disease cycle of plant diseases with special reference to greenear disease of Bajra, loosesmut of wheat, citrus canker, little leaf of brinjal and root knot nematode disease of vegetables

Unit-V:. Morphology, anatomy and reproduction of Lichens (Crustose, Foliose, Fructicose). Mycorrhizaand their significance. Economic Importance of Lichen.

SUGGESTED READINGS

1. Sharma, O.P. 1992. Text Book of Thallophytes.
2. McGraw Hill Pub.Co,
3. Sharma. P.D. 1991.
4. The Fungi. Rastogi& Co. Meerut Dube. H.C. 1990.
5. An Introduction of Fungi. Scientific Pub. House, Jodhpur Clifton A. 1985.
6. Introduction of the Bacteria. McGraw Hill & Co. New York.
7. Kumar HD (2017), Introductory Phycology, East West Pub.,
8. New Delhi Vashishtha BR et al. (2010) Algae,
9. S Chand&Comp.NewDelhi
10. LeeR(2008),Phycology,CambridgeUniv.Press
11. 4thEditionSharma,O.P.1992.TextBookofThallophytes.
12. Singh. Pande .Jain. A Text Book Of Botany
13. Trived .Sharma .Dhankhad .Devda

B.Sc.Semester:X (2025-26)

Discipline Centric Core Course (DCC)

BOTCC14001P : Practical: Microbiology, Fungi, Plant Pathology and Algae

(20CIA+80 EoSE.=Max. Marks:100)

Course Credits	No. of Teaching Hours Per Week	Total No. of Teaching Hours
2 Credits	4 Hours	60 Hours

LABORATORY EXERCISEs

1. Study of general included underMicrobiology, Fungi and Pathology.
2. Observation of disease symptoms in hosts infected by fungi, viruses, bacteria and phytoplasma.Sectioncutting of diseased material and identification of the pathogens as per the theory syllabus.
3. Studyof morphology, reproductive structures and anatomy of the examples cited in the theory under Algae, Lichens.
4. Gram Staining.

SUGGESTED READINGS

1. Bendre and Kumar

B.Sc. Semester: I (2025-26)

Discipline Centric Core Course (DCC)

ZOOCC14001T: Lower Invertebrate Zoology and Animal Diversity & Evolution

(20 CIA + 80 EoSE. = Max. Marks: 100)

Course Credits	No. of Teaching Hours Per Week	Total No. of Teaching Hours
4 Credits	4 Hours	60 Hours

Course Outcomes: On successful completion of the course, the students will be able to:

CO1: Understand the principles of taxonomy and classification.

CO2: Gain knowledge of the structure and function of invertebrates.

CO3: Describe evolutionary adaptations in non-chordates.

CO4: Correlate body plans with ecological roles.

CO5: Explain the significance of symmetry, coelom, segmentation in evolution.

SYLLABUS

Unit-I:Principles of Taxonomy and Classification

Introduction to Taxonomy and Systematics, Five Kingdom Concept, Levels of organization: Protozoa to Metazoa, Symmetry, Coelom, Segmentation, Embryogeny.

Unit-II:Protozoa and Porifera

General characters and classification up to classes of Protozoa and Porifera.

Paramecium: Locomotion, nutrition, conjugation.

Sycon: Canal system, reproduction, development.

Unit-III:Coelenterata, Ctenophora,Platyhelminthes and Aschelminthes

Classification and characters ofCoelenterata, Ctenophora, Platyhelminthes and Aschelminthes

Obelia: Polyp and medusa forms, life cycle.

Taenia: Structure of body wall, excretory and nervous systems, reproduction and developmental stages in life cycle.

Fasciola: Digestive, excretory and reproductive systems, developmental stages andlife cycle.

Unit-IV:Evolutionary Concepts

Origin of Life, Miller's experiment, Lamarckism and Darwinism, Natural Selection, genetic basis of evolution, speciation, Evidences of organic evolution.

Variations, Isolation and Adaptations, Geological time scale and animal distribution in different era

Unit-V: Introduction to Cell Biology

Interphase nucleus and cell-cycle including regulation.

Mitosis: Phases and process of mitosis, structure and function of spindle apparatus, Theories of cytokinese.

Meiosis: Phases and process of meiosis, synaptonemal complex, formation and fate of chiasmata recombination and significance of crossing ove

SUGGESTED READINGS

1. R. L. Kotpal – Modern Textbook of Zoology: Invertebrates
2. P. S. Verma& V.K. Agarwal–Cell Biology, Genetics, Molecular Biology, Evolution and Ecology
3. VeerBalaRastogi – Organic Evolution
4. EkambaranathaAyyar& T.N. Ananthakrishnan – Manual of Zoology, Volume I
5. E.L. Jordan & P.S. Verma – Invertebrate Zoology
6. Veer BalaRastogi – Cell Biology

B.Sc. Semester: I (2025-26)

Discipline Centric Core Course (DCC)

ZOOCC14001P: Lower Invertebrate Diversity and Biochemical Techniques

(20 CIA + 80 EoSE. = Max. Marks: 100)

Course Credits	No. of Teaching Hours Per Week	Total No. of Teaching Hours
2 Credits	4 Hours	60 Hours

SUGGESTED LABORATORY EXCERCISES

1. Study of permanent slides:
   - Paramecium (binary fission & conjugation), Euglena, Amoeba
   - Sponge spicules and gemmules, Obelia colony & medusa
   - Hydra sections,
2. Identification of museum specimens:

   Protozoa, Porifera, Coelenterata, Ctenophora, Platyhelminthes and Aschelminthes
3. Permanent preparations: Obelia colony
4. Study of permanentslides:
   - Fasciola/Taeniaproglottids, Cyclops, Daphnia, trochophore larva, Glochidium larva.
5. Cell biology:
   - Structure of typical animal cells (from charts/models)
6. Record submission

SUGGESTED READINGS

1. P.S. VERMA - Invertebrate Practical Zoology
2. S.S. LAL - Invertebrate Practical Zoology

B.Sc. Semester: I (2025-26)

Ability Enhancement Compulsory Course (AECC)

ENGAC14001T:General English

(20 CIA + 80 EoSE. = Max. Marks: 100)

Course Credits	No. of Teaching Hours Per Week	Total No. of Teaching Hours
4 Credits	4 Hours	60 Hours

Course Outcome: On successful completion of the course, the students will be able to:

- Students will gain a comprehensive understanding of basic sounds of English and identify key literary forms.
- Students will Interpret and appreciate selected poetic and literary texts by Shakespeare, Tagore, and R.K. Narayan, demonstrating a grasp of theme, tone, and literary techniques.
- Students will apply knowledge of English grammar structures such as form classes, articles, prepositions, modal auxiliaries, and the use of prefixes, suffixes, and connectives in context..
- Students will explore the concept of Using appropriate tenses, voice (active/passive), and speech (direct/indirect) so as to learn English effectively.
- Students will compose formal and informal letters, reports, and job applications with clarity, correct structure, and suitable vocabulary.

SYLLABUS

Unit-I: The Sounds of English: Consonants, Mono-thongs, Diphthongs.
An Acquaintance with Literary Forms:- Elegy, Ballad, and Sonnet. An Acquaintance with Figures of Speech:- Simile, Metaphor, Personification, and Irony

Unit-II: Poetry: William Shakespeare – All the World is a stage.Rabindranath Tagore – Where the Mind is without Fear.Act Play/Novel: R. K. Narayan – Vendor of Sweets.

Unit-III: Introduction to Form Classes, Tenses and its uses.Articles,Preposition and Modal auxiliaries.

Unit-IV: Active and Passive Voice, Direct and Indirect Speech, Prefixes and Suffixes, Connectives.

Unit-V:English Writing Skills: Formal &Informal Letters,Report Writing.

SUGGESTED BOOKS

1. W.H. Hudson "An Introduction to Literary Forms".
2. R.K. Narayan"The Vendor of Sweets" "English Verse: An Introduction" by David Kennedy
3. P.C. Wren & H. Martin "High School English Grammar and Composition".
4. M.A. Yadugiri & Geetha Rajeevan."Effective English Communication"

B.Sc. Semester: I (2025-26)

Discipline Centric Core Course (DCC)

PHYCC14001T: Mechanics

(20 CIA + 80 EoSE. = Max. Marks: 100)

Course Credits	No. of Teaching Hours Per Week	Total No. of Teaching Hours
4 Credits	4 Hours	60 Hours

Course Outcome: On successful completion of the course, the students will be able to:

CO1: Understand and analyze motion in inertial and non-inertial frames, including rotating systems, using concepts like Coriolis force and center-of-mass collisions.

CO2: Apply Lorentz transformations and relativistic principles to solve problems involving time dilation, length contraction, and energy-momentum relationships.

CO3: Explain and experimentally determine elastic constants, and analyze deformation in solids under bending and torsional stress.

CO4: Formulate and solve equations for simple, damped, forced, and coupled oscillators, interpreting resonance and energy dynamics.

CO5: Derive and apply wave equations to describe and analyze wave propagation, energy transfer, and phase/group velocities in different media.

SYLLABUS

Unit-I: Frames of Reference: Inertial frames, Galilean transformations, Non-inertial frames, fictitious forces, Displacement, Velocity and acceleration in rotating coordinate systems and their transformations, Coriolis force, Focault's pendulum, Motion relative to earth. Centre of Mass, collision of particles in laboratory and C.M. frame.

Unit-II:.Special Theory of Relativity: Invariance of c, Michelson-Morley Experiment, Lorentz transformations, addition of velocities, time dilation and length contraction, conservation of momentum in collision at relativistic speeds and variation of mass with velocity, relativistic energy, mass-energy equivalence, work and energy, transformation equations for momentum, energy and rate of change of momentum.

Unit-III:Elasticity: Young modulus, Bulk modulus and modulus of rigidity, Poisson ratio, relation between elastic constants, Theory of bending of a beam and torsion of a cylinder, experimental determination of Y by loading a beam in the middle and of η by static and dynamic methods, Searle's two bar experiment.

Unit-IV: Oscillations: Qualitative idea of oscillations in an arbitrary potential well, General differential equation for the harmonic motion, mass on a spring, oscillation of two masses connected by a spring, reduced mass, coupled oscillations, normal modes, normal coordinates of two linear coupled oscillators, damped harmonic motion, Forced oscillations and resonances, Resonance width and quality factor.

Unit-V: Waves: General differential equation of one dimensional wave motion and its solution, plane progressive harmonic wave, differential calculus methods for speed of transverse waves on a uniform string and for that of longitudinal waves in a fluid, energy density and energy transmission in waves, superposition of waves, group and phase velocity.

SUGGESTED BOOKS

1. J.C. Upadhyaya: Mechanics, Ram Prasad & Sons, Agra.
2. Berkeley: Physics Course, Vol. I, Mechanics, Tata McGraw Hill, New Delhi.
3. Berkeley: Physics Course, Vol. III, Waves and Oscillations, McGraw Hill, New Delhi.
4. A.P. French: Physics of Vibration and Waves.
5. R. S. Gambhir: Mechanics, CBS Publishers.
6. Mechanics, JPH Publishers.

B.Sc. Semester: I (2025-26)

Discipline Centric Core Course (DCC)

PHYCC14001P: Mechanics Lab

(20 CIA + 80 EoSE. = Max. Marks: 100)

Course Credits	No. of Teaching Hours Per Week	Total No. of Teaching Hours
2 Credits	4 Hours	60 Hours

Mechanics Lab

1. Determination of Young's modulus by bending of a beam.
2. Determination of Modulus of rigidity by dynamical method using Maxwell needle.
3. Determination of Elastic constants by Searle's method.
4. Determination of low resistance by Carey Foster Bridge.
5. Determination of Modulus of rigidity by statical method using Barton’s apparatus.(horizontal mode).
6. Determination of surface tension of water by Jagger's method.

Note: - New experiments may be added on availability of equipment’s.

SUGGESTED BOOKS

1. Practical Physics, S.L. Gupta and V. Kumar, PragatiPrakashan Meerut
2. B.Sc. Practical Physics, C.L. Arora, S. Chand Publisher, New Delhi
3. Advanced Level Practical Physics, M.Nelkon and Ogborn, Heinemann Education Books
4. Ltd., New Delhi
5. Practical Physics, S.S. Srivastava and M.K. Gupta, Atma Ram & Sons, Delhi

B.Sc. Semester: I (2025-26)

Discipline Centric Core Course (DCC)

MATCC14001T: Algebra

(20 CIA + 80 EoSE. = Max. Marks: 100)

Course Credits	No. of Teaching Hours Per Week	Total No. of Teaching Hours
6 Credits	6 Hours	90 Hours

Course Outcomes: On successful completion of the course, the students will be able to:

CO1: Understand and apply the concepts of matrix algebra including rank, inverse, linear dependence/independence, eigenvalues, eigenvectors, and the Cayley-Hamilton theorem.

CO2: Analyze and solve polynomial equations using root-coefficient relationships, symmetric functions, transformation techniques, and classical methods like Cardano's and Ferrari's.

CO3: Demonstrate knowledge of group theory including the definition and properties of groups, cyclic groups, permutation groups, subgroups, and their related theorems.

CO4: Apply advanced group theory concepts such as cosets, Lagrange's theorem, group homomorphisms, normal subgroups, quotient groups, and understand the basic structure of rings, fields, and integral domains.

CO5: Define and work with vector spaces and subspaces, evaluate linear combinations, spans, and test for linear dependence and independence of vectors.

SYLLABUS

Unit-I: Rank of a matrix. Inverse of a matrix. Linear dependence and independence of rows and columns of a matrix. Row rank and column rank of a matrix. Eigen values, eigen vectors and the characteristic equation of a matrix. Minimal polynomial of a matrix. Cayley-Hamilton theorem (without proof) and its use in finding the inverse of a matrix.

Unit-II: Relations between the roots and coefficients of general polynomial equations in one variable.Symmetric function of roots, Transformation of equations, Descarte's rule of signs, Solution of cubic equations (Cardon's method), Biquadratic equations (Ferrari's Method).

Unit-III Definition and general properties of groups, Order of an element of a group, Cyclic group, Permutation group, Subgroups, Index of a subgroup, Theorems on Subgroups of a cyclic group.

Unit-IV: Cosets, Lagrange's theorem, Group homomorphism, Cayley theorem, Normal subgroups, quotient Groups, Fundamental theorem of homomorphism, Basic concepts of Ring, Field and Integral domain.

Unit-V: Definition and examples of a vector space, subspace, Linear combination and linear span, Linear dependence and independence of vectors.

SUGGESTED READINGS

1. M. Ray: A Text Book of Higher Algebra, S.Chand& Co., New Delhi.
2. J.L. Bansal, S.L. Bhargva, & S.M. Agarwal: Algebra (Hindi Ed.), Jaipur Publishing House, Jaipur.
3. A.R. Vasishta and A.K. Vasistha: Matrices, Krishna Prakashan Ltd. Meerut.
4. G.C. Sharma: Modern Algebra; Ram Prasad & Sons, Agra.
5. R.S. Agarwal.: Text Book on Modern Algebra; S. Chand & Co., New Delhi.
6. D.C. Gokhroo&S.R.Saini: Abstract Algebra (Hindi Ed.); Jaipur Publishing House, Jaipur.

B.Sc. Semester: I (2025-26)

Skill Enhancement Course (SEC)

CHESC14001T: Chemical Safety and Laboratory Practices

(20 CIA + 80 EoSE. = Max. Marks: 100)

Course Credits	No. of Teaching Hours Per Week	Total No. of Teaching Hours
3 Credits	3 Hours	45 Hours

Course Outcome: On successful completion of the course, the students will be able to:

CO1: Apply Standard Operating Procedures (SOPs) to ensure consistent and safe laboratory practices.

CO2: Demonstrate understanding and implementation of Good Laboratory Practices (GLP) to maintain quality, reliability, and integrity of experimental work.

CO3: Identify, report, and document laboratory incidents and accidents in compliance with safety regulations and institutional protocols.

CO4: Administer appropriate first aid measures in response to chemical exposures or laboratory-related injuries.

CO5: Evaluate and respond effectively to emergency situations in laboratory settings, ensuring personal and environmental safety

SYLLABUS

Unit-I: Introduction to Chemical Safety

Importance of chemical safety in teaching and research laboratories

Types of hazards: chemical, physical, biological, mechanical

Routes of exposure: inhalation, ingestion, skin contact, injection

Unit-II: Personal Safety Measures

Personal Protective Equipment (PPE): gloves, goggles, lab coats, face shields

Lab ventilation: fume hoods, biosafety cabinets

Emergency equipment: eyewash stations, fire extinguishers, spill kits

Unit-III: Environmental Safety Measures

Good Housekeeping and Hygiene Practices, Safety signage and labels

Green Chemistry principles in laboratory safety

Unit-IV: Safe Handling, Storage, and Disposal of Chemicals

Safe handling practices: transport, pipetting, mixing, heating

Storage of chemicals based on compatibility (flammables, oxidizers, corrosives)

Chemical inventory management

Waste segregation and disposal methods (solid, liquid, hazardous)

Unit-V: Laboratory Practices and Emergency Preparedness

Standard Operating Procedures (SOPs), Good Laboratory Practices (GLP)

Incident and accident reporting, First aid in case of chemical exposure or injury

SUGGESTED READINGS

1. Handbook on Laboratory Safety – Directorate General, CSIR
2. Environmental Chemistry and Pollution Control by S.S. Dara – S. Chand Publishing
3. Laboratory Manual in Organic Chemistry by B.S. Furniss et al., adapted by Indian publishers
4. A Textbook of Practical Chemistry by Vishnoi, Malik &Narang – New Age International

B.Sc. Semester: I (2025-26)

Skill Enhancement Course (SEC)

VOWSC14001T: Vermiculture and Organic Waste Management

(20 CIA + 80 EoSE. = Max. Marks: 100)

Course Credits	No. of Teaching Hours Per Week	Total No. of Teaching Hours
3 Credits	3 Hours	45 Hours

Course Outcome: To equip students with practical knowledge of vermicomposting techniques, earthworm biology, and sustainable organic waste management to promote environmental protection and income generation.

SYLLABUS

Unit I: Unit I: Basics of Vermiculture

- Scope and importance
- Types of earthworms
- Role in soil fertility

Unit II: Earthworm Biology

- Morphology and anatomy
- Reproduction
- Common species used (e.g., Eiseniafetida)

Unit III: Vermicomposting Process

- Waste collection and segregation
- Methods (pit, bin, heap, tank)

Unit IV: Environmental Conditions

- Moisture, aeration, temperature
- Harvesting of vermicompost

Unit V: Applications and Benefits

- Nutrient content of vermicompost
- Comparison with traditional compost
- Environmental & economic significance

SUGGESTED READINGS

1. Edwards, C.A. & Bohlen, P.J. – Biology and Ecology of Earthworms
2. Ismail, S.A. – The Earthworm Book
3. Yadav, K.D. et al. – Vermicomposting of Organic Waste

B.Sc.Semester:I (2025-26)

Skill Enhancement Course (SEC)

BOTSC114001T: Nursery and Gardening

(20CIA+80EoSE.=Max.Marks:100)

Course Credits	No. of Teaching Hours Per Week	Total No. of Teaching Hours
4 Credits	4Hours	60 Hours

CourseOutcomes: Onsuccessfulcompletionofthecourse, thestudentswillbeableto-

CO1: Develop conceptual of nursery and gardening.

CO2: Gain knowledge about developing commercial enterprise of nursery.

CO3: On successful completion of this course, the students will be able to perform soil and plant nutrients management activities, make compost, perform nursery planning and management activities.

CO4: Perform communication and professionalism development activities.

CO5: Perform entrepreneurship development activities.

SYLLABUS

Unit-I: Nursery: definition, objectives and scope and building up of infrastructure fornursery, planning and seasonal activities- Planting-direct seeding and transplants.

Seed: Structureand types-Seeddormancy; causes and methods of breaking dormancy-Seed storage: Seed banks, factors affecting seed viability, genetic erosion – Seed production technology - seed testing and certification

Unit-II: Vegetative propagation: air- layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting medium and planting of cuttings –Hardening of plants–green house-mist chamber, shed root, shade house and glass house

Unit-III: Gardening: definition, objectives and scope –different types of gardening- landscape and home gardening - parks and its components - plant materials and design-computer applications in landscaping.

Unit-IV: Soillessmedia-Vermiculite, Soilrite, Cocopeat, Peatmoss Composting and composts- Vermicompost, Vermiwash, Leaf-Mold, Organic and chemical fertilizers, Integrated Fern management. Grafting and its types-Agrochemicals and PGRs in horticulture.

Unit-V: Gardening operations: soillaying, manuring, watering, management of pestsand diseases and harvesting. Sowing/raising of seeds and seedlings-Transplanting of seedlings- Study of cultivation of

different vegetables: cabbage, brinjal, lady's finger, onion, garlic, tomatoes and carrots - Storage and marketing procedures.

SUGGESTED READINGS

1. Bose TK. And Mukherjee, D. 1972 Gardening in India, Oxford & IBH Publishing Co.New Delhi.
2. Sandhu, M.K.1989, Plant Propagation, Wile Eastern Ltd., Bangalore, Madras.
3. Kumar, N., 1997, Introduction to Horticulture, Rajlaxmi Publications, Nagercoil.
4. Edmond Musser & Andres, Fundamentals of Horticulture, McGraw Hill Book Co. New Delhi.
5. Agrawal,P.K. 1993 Handbook of seed technology. Dept. of Agriculture and Co-operation, National Seed Corporation Ltd., New Delhi.
6. Janick Jules.1979 Horticultural Science (3rdEd.),W.H. Freeman and Co.San Francisco.

B.Sc. I Semester: (2025-26)

Skill Enhancement Courses (SEC)

MCTSC14001T : Mathematical & Computational Thinking and Analysis

(20 CIA + 80 EoSE. = Max. Marks: 100)

Course Credits	No. of Teaching Hours Per Week	Total No. of Teaching Hours
3 Credits	3 Hours	45 Hours

Course Outcome: On successful completion of the course, the students will be able to:

CO1: Understand the basic concepts of logic including statements, truth values, and logical connectives.

CO2: Understand and differentiate between number systems: decimal, binary, octal, and hexadecimal.

CO3: Understand the basic definitions and types of sets, elements, and subsets.

CO4: Collect and organize data for statistical analysis.

CO5: Compute measures of central tendency: Mean, Median, and Mode and basic understanding of Probability

SYLLABUS

Unit-I: Logic Statement, truth table, quantifiers, connectives and tautology, Mathematical induction.

Unit-II: Number System:Decimal system, binary system, octal system, hexadecimal system, arithmetic, conversion from binary to decimal and decimal to binary.

Unit-III: Set Theory,Sets, subsets, elements, and Venn diagrams, Set-builder and roster notation, Set operations: union, intersection, difference, complement, Power sets and Cartesian products

Unit IV: Statistics, Data collection and presentation using bar chart, column chart, line chart, pie chart, histogram, surface chart. Calculation of frequency. Measure of central tendency, Mean, Median and Mode, Definition of Probability, Elementary properties, addition.

Unit V: Statistics and Probability, Measure of central tendency, Mean, Median and Mode, Definition of Probability, Elementary properties, addition.

SUGGESTED READINGS

1. Edgar G. Goodaire and Michael M. Parmenter, Discrete Mathematics with Graph Theory, 3rd Ed., Pearson Education (Singapore) P. Ltd., Indian Reprint, 2005.
2. Kenneth Rosen Discrete mathematics and its applications McGraw Hill Education 7th edition.
3. J. L. Mott, A. Kendel and T.P. Baker: Discrete mathematics for Computer Scientists and Mathematicians, Prentice Hall of India Pvt Ltd, 2008.
4. Sancheti D.C. and Kapoor V.C.: Statistics Theory, Methods and Application Sultan Chand & Sons, New Delhi
5. Patri, Digambar Statistical Methods, Kalyani Publishers, Ludhiana

B.Sc. I Semester: (2025-26)

Skill Enhancement Course (SEC)

CAPSC14001T : Computer Applications

(20 CIA + 80 EoSE. = Max. Marks: 100)

Course Credits	No. of Teaching Hours Per Week	Total No. of Teaching Hours
3 Credits	3 Hours	45 Hours

Course Outcome: On successful completion of the course, the students will be able to:

CO1: Understand the fundamentals of computers, software, and operating systems.

CO2: Gain hands-on experience with productivity software like MS Office/Google Workspace.

CO3: Develop skills for document creation, data handling, and visual presentation.

CO4: Use the Internet responsibly and efficiently for research and communication.

CO5: Apply cyber safety principles to protect personal data and digital identity.

SYLLABUS

Unit I: Fundamentals of Computers and Operating Systems

Characteristics and types of computers, Input and Output devices, Primary and secondary storage, Software: System and Application software, Operating System: Functions and types (Windows, Linux overview),File management and system navigation.

Unit II: Word Processing (MS Word / Google Docs)

Creating and formatting documents ,Page layout and design, Tables, images, and charts insertion, Styles, templates, and referencing, Mail merge, spelling, grammar tools,Collaboration and sharing features.

Unit III: Spreadsheet Applications (MS Excel / Google Sheets)

Spreadsheet environment and data entry, Cell referencing and formula creation, Common functions (SUM, AVERAGE, COUNT, IF, etc.), Charts, graphs, and data visualization, Conditional formatting and data validation, Basic introduction to Pivot Tables.

Unit IV: Presentation Tools (MS PowerPoint / Google Slides)

Slide creation, themes, and layouts, Adding multimedia and animations, Transitions and custom slide shows, Notes and handouts,Effective presentation techniques, Sharing and exporting presentations.

Unit V: Internet, Email, and Cyber Security

Internet basics and browsing skills, Search engines and online research tips, Creating and managing email accounts, Email writing and etiquette, Introduction to cloud services (Google Drive, OneDrive)

SUGGESTED BOOKS

1. P.K. Sinha& P. Sinha (BPB Publications)— Excellent for understanding computer basics and applications.
2. Randy Nordell— A practical guide to Word, Excel, PowerPoint skills with examples.
3. YashavantKanetkar— Beginner-friendly text for programming logic using C.
4. Charles R. Severance— Best introductory Python book for science students (free online).
5. V. Rajaraman— Covers IT concepts in an academic and easy-to-understand manner.