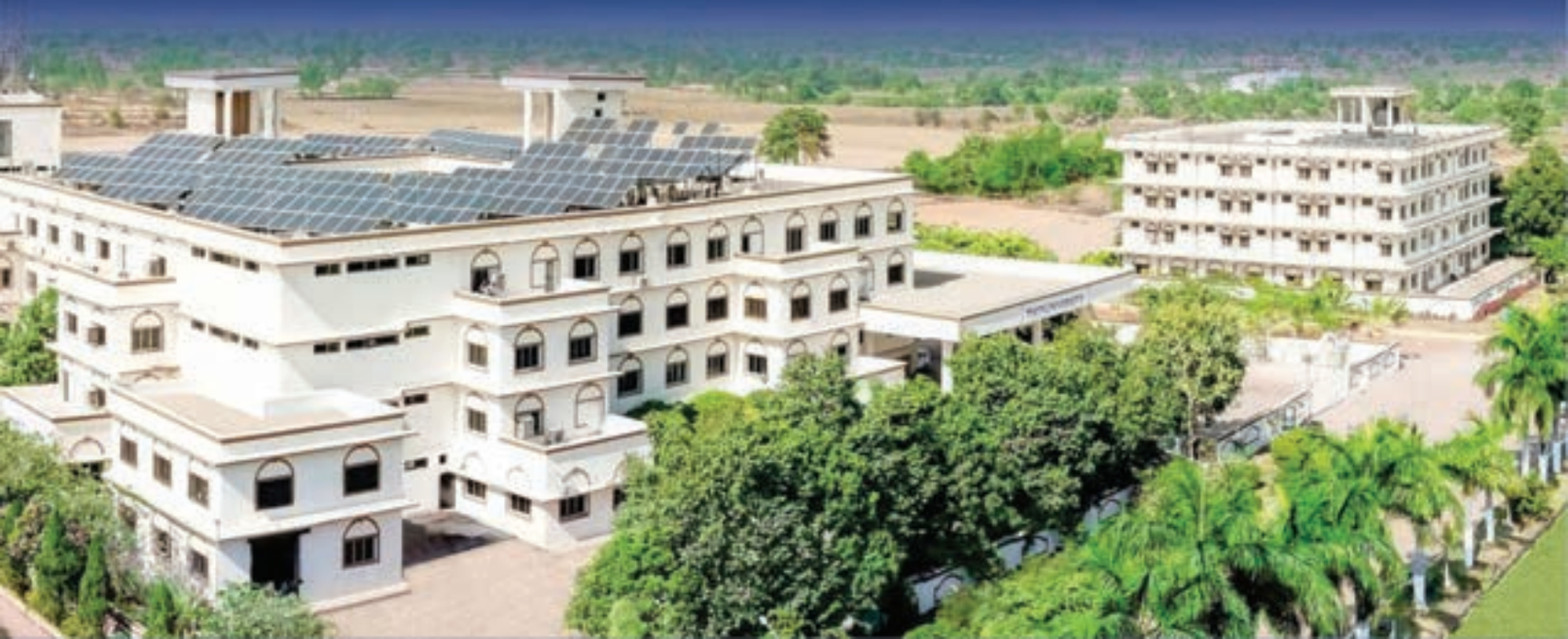
MATS UNIVERSITY

NAAC GRADE A+ ACCREDITED UNIVERSITY

PROGRAM PROJECT REPORT

Bachelor of Science (B.Sc. General)
(Combination of 3 Subjects)



PROGRAMME PROJECT REPORT (PPR)

BACHELOR OF SCIENCE (B. Sc. General)
(Combination of 3 Subject)

MATS Centre for Distance and Online Education (MCDOE) MATS University, Raipur, Chhattisgarh

MATS UNIVERSITY: VISION

To foster an intellectual and ethical environment in which the spirit and skills within MATS will thrive so as to impart high quality education, training, research and consultancy services with a global outlook and human values. To create and develop technocrats, entrepreneurs and business leaders who will strive to improve the quality of human life. To create truly world class schools of Management Sciences, Engineering Sciences, Information Technology, Life Science, Basic and Applied Sciences, Humanities & Social Sciences and Life Skills.

MATS UNIVERSITY: MISSION

To become a world-class center in providing globally relevant education. MATS will be the Global University, known for the quality academic programmes and outstanding faculty, products, and services to students and clients independent of place and time constraints. MATS University will be a bench mark institution for life long partnerships with students, the workforce and public and private enterprises. Building on its proud tradition, MATS University will extend educational opportunities to those who will make our state (Chhattisgarh), our nation, and global society a better place to live and work.

Dr. Ashish Saraf (HOD)

Dr. Meghna Shrivastava

Dr. Jasmeet Kaur Sohal

Dr. Prashant Mundeja

Dr. Snehlata Das

Dr. Vishwaprakash Roy

Dr. Bhagyashree Deshpande

MATS UNIVERSITY RAIPUR

A. Programme's Mission and Objectives:

Mission:

The objective of the Open and Distance Learning Bachelor of Science (B.Sc. General) (Combination of 3 Subjects) programme is to provide students with comprehensive theoretical knowledge and practical managerial skills via accessible, flexible, and creative online education. The curriculum aims to cultivate proficient science graduate's adept at addressing future challenges in a dynamic and growing scientific landscape.

Objectives:

Bachelor of Science (B. Sc. General) (Combination of 3 subjects) is the research-oriented science. This study includes a large variety of subjects including Cell biology & Genetics, Plant Diversity, Chemistry, Animal Sciences, Plant Sciences, Environmental Studies, Computer applications, Genetic Engineering, Inheritance Biology, Poultry Farming, Biostatistics, Research Methodology, Communication and IT Skills, Entrepreneurship, Languages English &Hindi, Principles of Management, Anatomy, Physiology& Reproductive Biology, Principles of Marketing Project work etc.

Key Objectives:

1. To impart basic knowledge and skills of various aspects of science.
2. To train the students for industrial need and to pursue further education.
3. To develop human resource and entrepreneurs in biology with the ability to independently start their own ventures.
4. Understand modern biology - practices and approaches with an emphasis in biology application in pharmaceutical, medical, industrial, environmental and agricultural areas.
5. Become familiar with issues related to biology nationally and globally
6. Gain experience with standard biological tools.
7. Develop skills in teamwork.

B. Relevance of the Programme with University's Mission and Goals:

The Open and Distance Learning Bachelor of Science (B. Sc. General) (Combination of 3 Subjects) programme aligns with MATS University's mission to cultivate a learning environment that encourages creativity, innovation and critical thinking. It is designed to offer a high quality education in chemical science, biological sciences, equipping students with the

The Program focuses on developing competent professionals capable of making meaningful contributions to industry and society. The Biological Industry is constantly growing and in the past 10 years, human resources in the field have grown drastically. The students will also be able to express proficiency in oral and written communications to appreciate innovation in research. understand the impact of chemicals in societal and environmental contexts, apply ethical principles and responsibilities while conducting animal studies, understand the biodiversity and apply the knowledge to conserve endangered species and develop industry-focused skills to lead a successful career.

C. Nature of Prospective Target Group of Learners:

This program is specifically tailored to address the needs of learners who cannot achieve their educational objectives using traditional educational methods. Our target group consists of learners who are working professionals, housewives, or residents of tribal or rural areas, and who are unable to participate in the normal program for various reasons. Individuals seeking to participate in this program must possess a degree in any discipline or an equivalent qualification.

D. Appropriateness of Programme:

The open and distance learning system of MATS University prioritizes the learner, predominantly delivering education through distance methods with only a limited element of in-person interaction. Students will own the autonomy to learn at their own pace. They can access course materials and tools online and advance through the program at their convenience. It enables students to participate in classes from any location, removing geographical constraints and providing enhanced opportunities for skill and competency acquisition. The Open and Distance Learning mode will offer students the opportunity to learn in a technology-driven environment, enabling access to online resources and materials, participation in virtual classrooms, engagement in online discussions, and interaction with peers and faculty through diverse collaborative tools. This offers an exceptionally immersive and dynamic educational experience, aiding students in cultivating critical thinking, analytical, and problem-solving abilities. The open and distant learning B.Sc. (General with combination of 3 subjects) programme is structured to offer flexibility, allowing students to study at their own pace while balancing work, family, and education. It provides extensive educational materials that encourage

autonomous, independent learning. The curriculum is facilitated by a comprehensive Learning Management System (LMS) that offers access to an extensive array of digital resources, including e-tutorials, study materials, assignments, quizzes, discussion forums for query resolution, assessment tools, progress tracking capabilities, and result displays.

E. Instructional Design:

Curriculum Design, Detailed Syllabi and Duration:

The Bachelor of Science programme at MATS Centre for Open and Distance Education spans Three years and is divided into Six semesters. This program is affiliated with the MATS School of Science. The B.Sc. (General with combination of 3 subjects) is a graduate degree aimed at imparting comprehensive knowledge of biology, encompassing both fundamental and advancedprinciples, strategies, and their applications in the field of science.

Credit Points:

All courses within this program provided by MATS Distance Learning Education assign "credit points," which represent a numerical value attributed to a course, indicating the requisite effort and study for successful completion, and are employed to determine if the conditions for an award have been met. A credit point denotes the number of learning hours necessary to complete a specific unit of a course. One credit point corresponds to 30 learning hours, which encompass self-study, contact classes, assignments, projects, and all activities associated with the program required to obtain the graduate degree.

Total credits of the B.Sc. (General with combination of 3 subjects) programme are 132. The Teaching & Examination Scheme is as follows:

Semester-wise distribution of Credits for Bachelor of Science (B.Sc.General) (Combination of 3 subjects):

Srl. No.	Semester	Number of Credits
1	Semester – 1	22
2	Semester – 2	22
3	Semester – 3	22
4	Semester – 4	22
5	Semester – 5	22
6	Semester – 6	22
	Total Credits	132

Programme: Bachelor of Science (B.Sc. General) (Combination of 3 subjects) Sem: I							
NHEQF Level: 5 | Courses				**Evaluation Scheme**			**Total Mark s**
Course Category	**Course Sub Category**	**Course Name**	**Code**	**Credits**	**CIA**	**ESE**	
Discipline Specific Core Course (DSCC)	Major	Botany I: Introduction to Plant diversity	ODL/MSS/BSCB/ 101	3	70	30	100
	Major	Zoology I: Diversity of Invertebrate	ODL/MSS/BSCB/ 102	3	70	30	100
	Major	Chemistry I: Fundamental Chemistry I	ODL/MSS/BSCB/ 103	3	70	30	100
Discipline Specific Core Course Practical (DSCCP)	Major	Botany I Lab	ODL/MSS/BSCB/ 104	1	35	15	50
	Major	Zoology I Lab	ODL/MSS/BSCB/ 105	1	35	15	50
	Major	Chemistry I Lab	ODL/MSS/BSCB/ 106	1	35	15	50
General Elective Inter/Multidisciplinary / Allied Courses (GEC)	GEC	Nutrition for Health	ODL/MSS/BSCB/ 107	4	70	30	100
Ability Enhancement Course (AEC)	AEC	Communication Skill	ODL/MSS/BSCB/ 108	2	35	15	50
Skill Enhancement Course (SEC)	SEC	Instrumentation and System Biology	ODL/MSS/BSCB/ 109	2	35	15	50
Value Added Course (VAC)	VAC	Yoga and Human Consciousness	ODL/MSS/BSCB /11 0	2	35	15	50
Total				**22**	**490**	**210**	**700**

Programme: Bachelor of Science (B.Sc. General) (Combination of 3 subjects) Sem: II							
NHEQF Level: 5 | Courses				**Evaluation Scheme**			**Total**
							Mark s
Course Category	**Course Sub Category**	**Course Name**	**Code**	**Credits**			
					CIA	**ESE**	
Discipline Specific Core Course (DSCC)	Major	Botany II: Cell Biology & Genetics	ODL/MSS/BSCB/201	3	70	30	100
	Major	Zoology II: Vertebrates Physiology	ODL/MSS/BSCB/202	3	70	30	100
	Major	Chemistry II: Fundamental Chemistry II	ODL/MSS/BSCB/203	3	70	30	100
Discipline Specific Core Course Practical (DSCCP)	Major	Botany II Lab	ODL/MSS/BSCB/204	1	35	15	50
	Major	Zoology II Lab	ODL/MSS/BSCB/205	1	35	15	50
	Major	Chemistry II Lab	ODL/MSS/BSCB/206	1	35	15	50
General Elective Inter/Multidisciplinary / Allied Courses (GEC)	GEC	Intellectual Property Rights	ODL/MSS/BSCB/207	4	70	30	100
Ability Enhancement Course (AEC)	AEC	Science commuication on Skills	ODL/MSS/BSCB/208	2	35	15	50
Skill Enhancement Course (SEC)	SEC	Vermicompostin g and Organic Farming	ODL/MSS/BSCB/209	2	35	15	50
Value Added Course (VAC)	VAC	Environmental Studies & Disaster Management	ODL/MSS/BSCB/210	2	35	15	50
Total				**22**	**490**	**210**	**700**

Programme: Bachelor of Science (B.Sc. General) (Combination of 3 subjects) Sem: III							
NHEQF Level: 5 | Courses				**Evaluation Scheme**			**Total**
							Marks
Course Category	**Course Sub Category**	**Course Name**	**Code**	**Credits**	**CIA**	**ESE**	
Discipline Specific Core Course (DSCC)	Major	Botany III: Diversity of Seed Plants & their Systematics	ODL/MSS/BSCB/301	3	70	30	100
	Major	Zoology III: Anatomy & Physiology	ODL/MSS/BSCB/302	3	70	30	100
	Major	Chemistry III: Inorganic & Physical Chemistry I	ODL/MSS/BSCB/303	3	70	30	100
Discipline Specific Core Course Practical (DSCCP)	Major	Botany III Lab	ODL/MSS/BSCB/304	1	35	15	50
	Major	Zoology III Lab	ODL/MSS/BSCB/305	1	35	15	50
	Major	Chemistry III Lab	ODL/MSS/BSCB/306	1	35	15	50
General Elective Inter/Multidisciplinary/ Allied Courses (GEC)	GEC	Food Toxicology & Adulteration	ODL/MSS/BSCB/307	4	70	30	100
Ability Enhancement Course (AEC)	AEC	Hindi	ODL/MSS/BSCB/308	2	35	15	50
Skill Enhancement Course (SEC)	SEC	Computational Biology and Bioinformatics	ODL/MSS/BSCB/309	2	35	15	50
Value Added Course (VAC)	IKS	Ayurvedic Biology	ODL/MSS/BSCB/310	2	35	15	50
Total				**22**	**490**	**210**	**700**

NHEQF Level: 5 | Courses	Programme: Bachelor of Science (B.Sc. General) (Combination of 3 subjects) Semester IV				Evaluation Scheme		Total Marks
Course Category	**Course Sub Category**	**Course Name**	**Code**	**Credits**	**CIA**	**ESE**	
Discipline Specific Core Course (DSCC)	Major	Botany IV: Structure Development & Reproduction in Flowering Plants	ODL/MSS/BSCB/401	3	70	30	100
	Major	Zoology IV: Chordates & Comparative Anatomy	ODL/MSS/BSCB/402	3	70	30	100
	Major	Chemistry IV: Organic & Physical Chemistry I	ODL/MSS/BSCB/403	3	70	30	100
Discipline Specific Core Practical (DSCP)	Major	Botany IV Lab	ODL/MSS/BSCB/404	1	35	15	50
	Major	Zoology IV Lab	ODL/MSS/BSCB/405	1	35	15	50
	Major	Chemistry IV Lab	ODL/MSS/BSCB/406	1	35	15	50
Discipline Specific Elective Course (DSEC)	Minor	Botany A (Plant Tissue Culture)/ Zoology A (Wild Life Conservation & Management)/ Chemistry A (Basic Analytical Chemistry)	ODL/MSS/BSCB/407	4	70	30	100
Ability Enhancement Course (AEC)	AEC	Society, Culture, and Human Behaviour	ODL/MSS/BSCB/408	2	35	15	50
Skill Enhancement Course (SEC)	SEC	Computer Application	ODL/MSS/BSCB/409	2	35	15	50
Value Added Course (VAC)	VAC	Presentation Skills	ODL/MSS/BSCB/410	2	35	15	50
Total				**22**	**490**	**210**	**700**

NHEQF Level: 5 | Courses	Programme: Bachelor of Science (B.Sc. General) (Combination of 3 subjects) Semester V				Evaluation Scheme		Total Marks
Course Category	**Course Sub Category**	**Course Name**	**Code**	**Credits**			
					CIA	**ESE**	
Discipline Specific Core Course (DSCC)	Major	Botany V: Plant Physiology and Biochemistry	ODL/MSS/BSCB/501	3	70	30	100
	Major	Zoology V: Cell biology and Histology	ODL/MSS/BSCB/502	3	70	30	100
	Major	Chemistry V: Organic and Inorganic- I	ODL/MSS/BSCB/503	3	70	30	100
Discipline Specific Core Practical (DSCP)	Major	Botany V Lab	ODL/MSS/BSCB/504	1	35	15	50
	Major	Zoology V Lab	ODL/MSS/BSCB/505	1	35	15	50
	Major	Chemistry V Lab	ODL/MSS/BSCB/506	1	35	15	50
Discipline Specific Elective Course (DSEC)	Minor	Botany A1 (Natural Resource Management) Zoology A1 (Insect Vector & Disease) Chemistry A1 (Spectroscopy-I)	ODL/MSS/BSCB/507	4	70	30	100
		Botany A2 (Microbiology and Phycology) Zoology A2 (Biochemistry) Chemistry A2 (Chemical Kinetic & Nuclear Chemistry)	ODL/MSS/BSCB/508	4	70	30	100
Skill Enhancement Course (SEC)	SEC	Pisciculture	ODL/MSS/BSCB/509	2	35	15	50
Total				**22**	**490**	**210**	**700**

NHEQF Level: 5 | Courses	Programme: Bachelor of Science (B.Sc. General) (Combination of 3 subjects) Semester VI				Evaluation Scheme		Total
							Marks
Course Category	**Course Sub Category**	**Course Name**	**Code**	**Credits**			
					CIA	**ESE**	
Discipline Specific Core Course (DSCC)	Major	Botany VI: Ecology and Biodeversity	ODL/MSS/BSCB/601	3	70	30	100
	Major	Zoology VI : Development biology	ODL/MSS/BSCB/602	3	70	30	100
	Major	Chemistry VI: Organic and Physical Chemistry II	ODL/MSS/BSCB/603	3	70	30	100
Discipline Specific Core Practical (DSCP)	Major	Botany VI Lab	ODL/MSS/BSCB/604	1	35	15	50
	Major	Zoology VI Lab	ODL/MSS/BSCB/605	1	35	15	50
	Major	Chemistry VI Lab	ODL/MSS/BSCB/606	1	35	15	50
Discipline Specific Elective Course (DSEC)	Minor	Botany A3 (Anlytical Tools & Techniques in Plant Sciences) Zoology A3 (Immunology) Chemistry A3 (Electrochemistry & Surface Chemistry)	ODL/MSS/BSCB/607	4	70	30	100
Ability Enhancement Course (AEC)	AEC	Leadership & Personality Development	ODL/MSS/BSCB/608	2	35	15	50
Internship	INT	Project Work Botany Based/ Zoology Based/ Chemistry Based	ODL/MSS/BSCB/609	4	70	30	100
Total				**22**	**490**	**210**	**700**

FIRST SEMESTER
BOTANY I: INTRODUCTION TO PLANT DIVERSITY

Credit: 3
Total Marks: 100 (70+30)

Course Objectives:
1. To impart basic knowledge of plant diversity.
2. To train the students to pursue further education.
3. Become familiar with bioscience tools.

Course Outcome:
Skills that students obtain after completion of the course:
1. Understanding of the fundamentals Plant Diversity and key principles of it.
2. Awareness of the major issue at the forefront of the discipline.
3. Good quantitative skills such as the ability to accurately and reproducibly prepare reagents for experiments.
4. Ability to dissect a problem in to its key features.

Module-I

Bacteria and Viruses: General account of bacteria structure; nutrition, reproduction and economic importance; general account of cyanobacteria. General account of viruses and mycoplasma.

Module–II

Fungi: General characters, classification, important features and life history of Mastigomycotina – Phytophthora; Zygomycotina – Mucor; Ascomycotina – Saccharomyces; Basidiomycotina – Puccinia; Deuteromycotina – Colletotrichum; general account of Lichens. Economic importance of fungi.

Module-III

Algae: General characters, classification, important features and life history of Chlorophyceae – Volvox, Oedogonium; Xanthophyceae – Vaucheria; Phaeophyceae – Ectocarpus; Sargassum Rhodophyceae – Polysiphonia. Economic importance of algae.

Module-IV

Bryophyta: Outlines of classification and importance of bryophytes. Structure, reproduction and classification of Hepaticopsida (e.g. Riccia Marchantia); Anthocerotopsida (Anthoceros), Bryopsida (Funaria).

Module-V

Pteridophyta: Important characteristics of Psilopsida, Lycopsida, Sphenopsida and Pteropsida; Structure, reproduction in Rhynia, Lycopodium, Selaginella, Equisetum and

Marsilea.

SUGGESTED READINGS

1. Introduction to Botany – Bendre & Kumar
2. Botany for Degree Students – Algae: Vashishtha et al.
3. Botany for Degree Students – Bryophyta: Vashishtha et al.
4. An Introduction to Pteridophyta – A. Rashid
5. Angiosperms: G. L. Chopra
6. Plant Taxonomy: O. P. Sharma

ZOOLOGY I: DIVERSITY OF INVERTEBRATE

Credit: 3

Total Marks: 100 (70+30)

Course Objectives:

1. To explain the basic structural & functional aspects of Animal diversity–Invertebrates
2. To increase expertise of the course

Course Outcomes:

Skills that students obtain after completion of the course:

1. To understand and appreciate the study of significance of animal biodiversity.
2. To remember the general characteristics of invertebrates.
3. To analyze the various adaptations in invertebrates.
4. To analyze the structural organization of the invertebrate body.

Module I

Brief history of Invertebrates- Kingdom Animalia; General characteristics of Invertebrates. Protozoa - General characters; Classification up to classes with examples; Type study– Paramecium, protozoa and diseases. Porifera -General characters; Classification of Porifera up to classes with examples, Type study–Types of Canal system in sponges and Spicules.

Module II

Coelenterate- General characteristics and Classification of Coelenterate up to classes with examples, Type study- Obelia; Polymorphism in hydrozoa; Corals and coral reef formation. Platyhelminthes- General characteristics and Classification of Platyhelminthes up to classes with examples; Life cycle and pathogenicity of Fasciola hepatica

Module III

Nemathelminthes- General characters; Classification of Nemathelminthes up to classes with examples; Type study – Dracunculus medinensis; Parasitic Adaptations in Helminthes. Annelida: General characters; Classification of Annelida up to classes with examples; Type study- Hirudinaria granulose; Evolutionary significance of Coelome and Coelomoducts; Metamorphism

Module IV

Arthropoda- General characters; Classification of Arthropoda up to classes with examples, Type study- Prawn; Mouth parts of Insects; Peripatus- Structure and affinities Mollusca- General characters; Classification of Mollusca up to classes with examples, Type study- Pila; Pearl formation; Torsion and detorsion in gastropods

Module V

Hemichordata - General characters; Classification of Hemichordata up to classes with examples; Balanoglossus - Structure and affinities

SUGGESTED READINGS:

1. L.H. Hyman „The Invertebrates" Vol I, II and V. – M.C. Graw Hill Company Ltd.
2. Kotpal, R.L. 1988 - 1992 Protozoa, Porifera, Coelenterata, Helminthes, Arthropoda, Mollusca, Echinodermata. Rastogi Publications, Meerut.
3. E.L. Jordan and P.S. Verma „Invertebrate Zoology" S. Chand and Company.
4. R.D. Barnes „Invertebrate Zoology" by: W.B. Saunders CO., 1986.
5. Barrington. E.J.W., „Invertebrate structure and Function" by ELBS.
6. P.S. Dhami and J.K. Dhami. Invertebrate Zoology. S. Chand and Co. New Delhi.
7. Parker, T.J. and Haswell „A text book of Zoology" by, W.A., Mac Millan Co. London.
8. Barnes, R.D. (1982). Invertebrate Zoology, V Edition"

CHEMISTRY I

FUNDAMENTAL CHEMSITRY I

Credit: 3

Total Marks: 100 (70+30)

Course Objectives:

1. To impart basic knowledge of chemistry.
2. To train the students to pursue further education.
3. Become familiar with chemical tools.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals Chemistry and key principles of it.
2. Awareness of the major issue at the forefront of the discipline.
3. Good quantitative skills such as the ability to accurately and reproducibly prepare reagents for experiments.
4. Ability to dissect a problem in to its key features.

Module I

Chemistry in Ancient India: Chemical techniques in ancient India: General Introduction
(b) Contribution of ancient Indian scientists in chemistry. e.g. Metallurgy dyes, pigments cosmetics, Ayurveda, Charak Sanhita. Ancient Indian Chemist: Their contribution and Books –Rishi Kanad, Acharya Nagarjuna, Vagbhatta, Govindacharya, Yashodhar Ramchadra, Somadava, Gopalbhatta. etc. Indian Chemistry of 19th centuary –Aacharya Prafulla Chandra RayHis Contribition and work for the Indian Chemistry.
(B) Atomic Structure and Periodic Properties: (i) Review of Bohr's theory and its limitation. Dual nature of particle and waves, de Broglie's equation, Heisenberg Uncertainty principle and its significance, (ii) Quantum numbers and its significance, Rules for filling electrons in various orbitals, Pauli Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau principle and its limitations, Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy. Relative energies of atomic orbitals. Anomalous electronic configurations (iii) Effective nuclear charge (ENC), shielding or screening effect, Slater rules, Atomic & Ionic radii. Ionization energy and factors affecting ionization energy. Electron affinity. Electronegativity----Pauling's /Milliken's

Module II

Chemical Bonding I

Ionic Bonding: General characteristics of ionic bonding. Ionic bonding& Energy: Lattice and solvation energies and their importance in the context of stability and solubility of ionic compounds, Born-Haber cycle and its Applications: Covalent character in ionic compounds, polarizing power & polarizability. Fajan's rules.

Covalent Bonding: Lewis structure, Valence bond theory, Hybridization, dipole moment and percentage ionic character, Valence shell electron pair repulsion (VSEPR).

Chemical Bonding II

MO Theory: LCAO method –criteria of orbital overlapping, types of molecular CHEMISTRY Theory orbitals σ-, π- and δ-MOs; formation of σ- and π- MOs and their schematic illustration: qualitative MO energy diagram of homo and hetro-diatomic molecules, magnetic properties, bond order and stability of molecules and ions.

Weak Chemical Forces: Vander Waals forces, ion- dipole forces, dipole-diploe interactions, ion-induced dipole interactions dipole–induced dipole interactions. Repulsive forces, Hydrogen bonding.

Module III

Chemical Properties of s-Block metals: Reaction with water, air, and nitrogen, Anomalous behaviour of Li and Be, Compounds of s- block metals: Oxides, Hydroxides, peroxides and superoxides. Complexes of s- block metals, Complexes with Crown ethers **Chemistry of p -Block Elements:** Boron group: Hydrides, Diboranes, Borazine, Carbon groups: Carbides, Silicates, Nitrogen Groups: Hydrides of Nitrogen, Structure of oxides of nitrogen, Structure of oxyacids of nitrogen, Nitrides, Structure of Oxides and oxoacids of Phosphorus. Halogen: Hydrides, Oxides and oxyacids of halogens - Interhalogen compounds and pseudo halogens

Module IV-Electronic Effects in Organic Compounds

Bond Cleavage: Homolytic and heterolytic cleavage, bond energy, bond length and bond angle. Electron Displacement Effects: Inductive, inductomeric, electrometric, mesomeric, hyper conjugation, and steric effects. Tautomerism. Reaction Intermediates: Formation and stability of carbocations, carbanions, free radicals, carbenes, nitrene and benzyne.

Stereochemistry of Organic Compounds

(i) Optical Isomerism: Elements of symmetry, chirality, enantiomers, and optical activity, Chiral and achiral molecules with two stereo genic centres, Erythro & Threo, Diastereomers and meso compounds, Inversion, retention and racemization, relative configuration (D/L), and absolute configuration (R/S) nomenclature: sequence rules). (ii) Geometrical Isomerism: Geometric isomerism (cis-trans isomerism) in alkenes, E/Z system of nomenclature.

SUGGESTED READINGS:

1. Basic Inorganic Chemistry, F.A Cotton, G. Wilkinson and P.L Gauss, Wiley.
2. Concise Inorganic Chemistry, J.D. Lee, ELBS.
3. Concepts of models of Inorganic Chemistry, B. Douglas, D. Mc Daniel and JAlexander, John Wiley.
4. Inorganic Chemistry, W. W. Porterfield, Addison▪ Wesley.
5. Inorganic Chemistry, A.G. Sharp, ELBS.
6. Inorganic Chemistry, G.L. Missiles and D.A. Tarr, Prentice Hall.
7. Advanced Inorganic Chemistry, Satyas Prakash.
8. Advanced Inorganic Chemistry, Agarwal & Agarwal.
9. Introduction to Organic Chemistry, Struiweisser, Heathock and Kosover, Macmillan.
10. Advanced Inorganic Chemistry, Satyas Prakash.

11. Advanced Inorganic Chemistry, Agarwal & Agarwal.
12. Advanced Inorganic Chemistry, Puri & Sharma, S. Naginchand.
13. Organic Chemistry, P.L. Soni.
14. Organic Chemistry, Bahl & Bahl
15. Organic Chemistry, EA. Carey, MC Graw HilI
16. Organic Chemistry, Vol. I, II & III, S.M. Mukherjee, S.P. Singh and R.P. Kapoor,Wiley-eastern (New-Age).

LAB COURSE: BOTANY I

Credit: 1 Total Marks:

50 (35+15)

BOTANY I: PLANT DIVERSITY LAB

1. Disease Symptoms/Gram's Staining
2. Study of different algae, with the help of permanent slides and also by cutting sections
3. Study of different Fungi, with the help of permanent slides and also by cutting sections
4. Study of different Bryophytes, with the help of permanent slides and also by cutting sections.
5. Study of different Pteridophyta, with the help of permanent slides and also by cutting sections.

LAB COURSE: ZOOLOGY I

Credit: 1
Total Marks: 50 (35+15)

ZOOLOGY I: DIVERSITY OF INVERTEBRATE LAB

1. Cytological Preparation- Onion root-tip "Squash Preparation" for mitosis/Grasshopper testis squash for meiosis.
2. Museum Specimen invertebrate
3. Slides

LAB COURSE: CHEMISTRY I
FUNDAMENTAL CHEMISTRY I

Credit: 1 Total Marks: 50 (35+15)

FUNDAMENTAL CHEMISTRY I LAB

1. Inorganic Chemistry
Semi micro Analysis-cations analysis separation and identification of ions from Pb2+, Bi3+, Cu2+, Cd2+, Sb3+, Sn2+,4+, Fe3+, AI3+, Cr3+. Ni2+, C02+, Zn2+, Mn2+, Ba2+, Sr2+, Ca2+, Mg2+, NH4+ and Anions CO2/ 3- , SO2/ 3- , S 2- , SO2/ 4- , NO2 - , NO3, CI- ,Br- ,I- , CH3COO- , C2O2/4- , BO3/ 5- , F- .

2. Organic Chemistry
i. Calibration of Thermometer 800-82° (Naphthalene), 113.50-1140 (Acetanilide), 132.50-1330 (Urea), 1000(Distilled Water)
ii. Determination of Melting Point 80° -82° (Naphthalene), Benzoic and 121.50 -122°, Urea 132.5° -133°, Succinic acid 184.50-1850, Cinnamic acid 132.50-1330, Salicylic acid 157.50-1580 Acetanilide 113.50-1140, m-Dinitrobenze 900, p-Dichlorobenzene 520Aspirin 1350.
iii. Determination of boiling points Ethanol = 780, Cyclohexane 81.40, To 110.60, Benzene 800
iv. Mixed meting point Determination- Urea- Cinnamic acid mixture of various compositions (1: 4, 1: 1, 4: 1)

SUGGESTED READINGS
1. Experimental Organic Chemistry, Vol. I & II, P.R. Singh, D.S. Gupta & K.S. bajpai, TataMc Graw Hill
2. Vogel's text book of practical organic chemistry, B.S. Furnis A.J. Hannaford, V. Rogers, P.W.G. Smith & Ar. Tatchel, ELBS
3. Experiments in general chemistry, CNR Rao & U.C. Agarwal
4. Experiments in physical chemistry, R. C. Das & B. Behara Tata Mc Graw Hill
5. Advanced practical physical chemistry, J.B. Yadav, Goel publishing house.

Generic Elective Course IA
Subject: Fundamentals of Entrepreneurship
Subject Code: ODL/BCOM/GE004

Credit 4
Total Marks 100 (70+30)

Course Objective: To understand the concept of Entrepreneur and its characteristics and functions involved in the growth of the Country Economy.

Course Outcomes:
After successfully completion of this course, the students will be able to: -
CO1: Explain the concept and theories of entrepreneurship.
CO2: Summarize the problems faced by a woman entrepreneur.
CO3: Apply a project idea.
CO4: Interpret the sources of institutional finance.

CO5: Demonstrate the importance of MSME industries and Government initiatives for their promotion.

COURSE CONTENTS:

Module I

The Entrepreneur: Definitions and Concept, Entrepreneurial Traits, Characteristics and Skills, Classification of Entrepreneurs, Growth of Entrepreneurs, Nature and Importance of Entrepreneurs, The Entrepreneurial Culture, Types of Entrepreneurs, Distinction between Entrepreneur and Manager.

Module II **12 Hours**

Entrepreneurship: Concept & Theories, Environment, Development, Training.

Women Entrepreneur: Concept, Functions, Growth and Problems faced by Women Entrepreneur.

Module III

Project: Concept and Classification Search for a Business Idea, Project Identification, Formulation, Project Design and Network Analysis, Project Report, Project Appraisal.

Module IV Institutional

Finance: Commercial Banks & Other Financial Institutions. Institutional Support to Small Entrepreneurs. Ownership Structures: Proprietorship, Partnership, Company, Co-operative, Selection of an Appropriate Form of Ownership Structure.

Module V

Micro Small Medium Scale Industries: Introduction of MSME, Classification: Micro Enterprises, Small Enterprises, Medium Enterprises, Ministry of MSME: Introduction, Various government schemes, Registration, difference between Start-up and MSME, Government Policy for MSME: Major MSME schemes, PMEGP(Prime Minister's Employment Generation Programme): Objectives, Benefits, Applicability, SRI(Self Reliant India) Fund: Fund Objectives, SRI fund structure, Applicability, SRI, Steps for starting a MSME Enterprise, Case Study

Textbook:

1. The Dynamics of Entrepreneurial Development and Management, Vasant Desai, Himalaya Publishing House, 6th edition, 2018.

Reference Book:

1. Entrepreneur Development, Satish Taneja, Himalaya Publishing House, 1st edition, 2015.
2. Entrepreneur Development, Dr. S.S. Khanka, S.Chand, 5 th Edition, 2012. Entrepreneur
3. Development, Kumar, latest edition, reprint 2003.

Generic Elective Course IB

Subject: Computer System Architecture and Digital Electronics

Credit 4

Total Marks 100 (70+30)

MODULE I: Computer Organization

Introduction of Computers, Characteristics of computers, Evolution of computer, Input unit, Output unit and Storage unit, Arithmetic Logic Unit (ALU), Control Unit (CU), Central Processing Unit(CPU), System concepts, Classification of computers, Types of Memory: RAM, ROM, PROM, EPROM, EEPROM, Cache

MODULE II: Digital System and Boolean Algebra

Overview of digital systems and their application, number system: representation and conversion, Binary coded decimal (BCD) representation, Boolean algebra fundamentals, Basic Theorem and properties of Boolean algebra, Boolean function, Canonical and standard forms

MODULE III: Gate-level Minimization

Introduction, The map method, Karnough maps(K-maps) for simplifying boolean expressions, product of sums simplification, Don't care condition, NAND and NOR implementation

MODULE IV: Computer Software

Introduction to Software, Relationship between Hardware and Software, Types of Software, Logical System Architecture, Firmware, Middleware, Pre-written Software, Customized Software, Developing Customized Software, Software development Life cycle, Software Engineering, Introduction to Operating System, Functions of an operating systems

MODULE V: Cyber Security

Cyber security: Introduction, Significance, Working of Cyber Security, Challenges, Cyber Laws. Types of cyber-attacks: malware, Phishing, DDoS, Password, Man in the middle, SQL Injections, Prevention from Cyber Attacks, Future Trends in Cyber security: Artificial Intelligence and Machine Learning, Cloud Security, Internet of Things (IoT) Security, Quantum Security, 5G Security, Emerging Trends in Digital Media: Influencer Marketing, Omnichannel Marketing, Artificial Intelligence, Deep fake videos, Video Marketing, Metaverse, Chatbots

TEXT BOOKS /REFERENCE BOOKS

- Pradeep K. Sinha, "Computer Fundamentals": **TB#1**
- E Balagurusamy , "FUNDAMENTALS OF COMPUTERS", Tata McGraw Hill : **TB#2**
- M. Morris Mano, "Computer System Architecture": **TB#3**

Generic Elective Course IC

Subject : छत्तीसगढ़ में पर्यटन

Credit 4

Total Marks 100 (70+30)

अनुक्रमणिका

माड्यूल– 4 छत्तीसगढ़ कापर्यटनमण्डल

इकाई– 11 कार्य
इकाई– 12 उपलब्धियाँ

इकाई– 13 रामगमनपथ

इकाई–14 महत्व

INSTRUMENTATION & SYSTEM BIOLOGY

Credit: 2
Total Marks: 50 (35+15)

Course objectives
1. To impart basic knowledge related to instrumentation.
2. To train the students to pursue further education.
3. Become familiar with the instrumentation.
4. Gain experience with standard tools.

Course Outcome:
Skills that students obtain after completion of the course:
1. Understanding of the fundamentals of instrumentation and key principles of its.
2. Awareness of the major issue at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.
4. Ability to design experiments and understand the limitations of the experimental approach.

MODULE I: An introduction to instrumental methods: Terms associated with Biochemical analysis, Classification of instrumental techniques, A review of important consideration in analytical methods, Basic functions of instrumentation.

MODULE II: Microscopy – Instrumentation, Technique & Principle of Light microscopy, Bright & Dark Field microscopy, Fluorescence microscopy, Phase contrast microscopy, TEM & SEM.

MODULE III: Chromatography - Concept of Chromatography (Partition Chromatography, Paper Chromatography, Adsorption Chromatography, TLC, GLC, Ion Exchange Chromatography, Gel Chromatography, HPLC, Affinity Chromatography).

MODULE IV: Electrophoresis - Instrumentation, Technique & Principle of Gel Electrophoresis & Paper Electrophoresis.

MODULE V: Spectroscopy - Absorption Spectroscopy: Simple theory of the absorption of light by molecules, Beer-Lambert law, Instrumentation for measuring the absorbance of visible light, Factors affecting the absorption properties of a Chromophore.

YOGA & HUMAN CONSCIOUSNESS

Credit: 2
Total Marks: 50 (35+15)

Course Objectives:

1. To increase the knowledge of the students about Yoga and to make students aware about the holistic development through Yoga.
2. To provide a practical knowledge on different yogic practices.
3. To give a glimpse of ancient Yoga Philosophy.
4. To impart some knowledge about the healing power of Yoga.
5. To increase the professional efficiency in the field of Yoga.

Course Outcomes:

Skills that students obtain after completion of the course:

1. Students gain good knowledge on the concept of yoga.
2. Students know about the scientific benefits of various yogic practices.
3. Students can perform practical skills proficiently.
4. Students gain an awareness about the value of health & wellness through yoga.
5. Makes the students more enthusiastic about further study/research in the field of Yoga.

Module I: Introduction to Yoga

i. Meaning and definitions of Yoga
ii. History of Yoga
iii. Importance of Yoga as art, science and philosophy
iv. Yogic Diet

Module II: Philosophical Perspective of Yoga

i. Yoga in Bhagavad Gita: Karma Yoga, Raja Yoga, Jnana Yoga and Bhakti Yoga
ii. The 'Yoga Sutras' in general; its significance in life.
iii. Limbs/parts of yoga (Astanga Yoga) according to the 'Yoga Sutras'
iv. Concept of Ishwara; Ishwara in Yoga Philosophy

Module III: Yogic Practices for Health & Wellness

i. Asana, its classification and effects
ii. Pranayama, its types and effects
iii. Kriya, Mudra and Bhandha: Procedure and Effects
iv. Yoga Vs Physical Exercise

Module IV: Human Consciousness & Meditation

i. Meaning & Definition of Human Consciousness.
ii. Need for Study of Human Consciousness.
iii. Current Crisis of Human Consciousness & Measures for meaningful solution.
iv. The Theory of Meditation- Japa Meditation, Ajapajapa Meditation, Yoga Nindra, Tratak.

PRACTICAL

i. Suryanamskara – (12 counts)

ii. Asana a) Standing: -Tadasana, Ardhakatichakrasana, Ardhachakrasana, Trikonasana, Vrikshasana.

b) Sitting: - Vajrasana, Padmasana, Goumukhasana, Paschimottanasana, Shashankasana.

c) Lying Supine Position: - Shavasana, Setubandhasana, Chakrasana, Sarvangasana, Halasana.

d) Lying Prone Position - Makarasana, Bhujangasana, Shalabhasana, Dhanurasana, Naukasana.

iii. Pranayama Nadishodhana, Suryabhedana, Chandrabhedana, Shitali, Bhastrika, Bhramari.

iv. Bandh & Mudra: Jalandharabandha, Uddiyanbandha, Moolabandha, Yogamudra, Viparitkarnimudra, Shambhavimudra.

v. Dhyana and its forms.

SECOND SEMESTER
BOTANY II: CELL BIOLOGY & GENETICS

Credit: 3
Total Marks: 100 (70+30)

Course Objectives:

1. To impart basic knowledge of Cell Biology & Genetics.
2. To train the students to pursue further education.
3. To be familiar with concepts of Cell Biology & Genetics.
4. To increase expertise of the course.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of Cell Biology & Genetics and key principles of it.
2. Awareness of the major issue at the forefront of the discipline.
3. Ability to dissect a problem in to its keyfeatures

Module-I The cell envelope: Plasma membrane; bilayer lipid structure; functions; the cell wall. Ultra structure and function of nucleus: nuclear membrane; nucleolus and other organelles: Golgi bodies, ER, peroxisomes, Vacuoles.

Module-II Chromosome organization: Morphology; centromere and telomere; chromosome alterations; deletions, duplications, translocations, inversions; variations in chromosome number aneuploidy, polyploidy; sex chromosomes. Cell division : Mitosis; meiosis

Module-III DNA the genetic material: DNA structure; replication; DNA- protein

interaction; the nucleosome model; genetic code; satellite and repetitive DNA. Extranuclear genome: Presence and function of mitochondrial and plastid DNA; plasmids.

Module-IV Gene expression: Structure of gene; transfer of genetic information; transcription, translation, protein synthesis; tRNA; ribosomes; regulation of gene expression in prokaryotes and eukaryotes; proteins, 1D, 2D and 3D structure.

Module-V Genetic Variations: Mutations, spontaneous and induced; transposable genetic,DNA damage and repair.

SUGGESTED READINGS:

- Cell & Molecular Biology : Gerald Karp
- Cell Biology : C.B. Powar
- Cell & Molecular Biology: SC Rastogi
- Cell & Molecular Biology: Robertis & Robertis
- Molecular Cell Biology: Lodish
- Genetics: Strickberger
- Genetics: From Genes to Genomes: Reynolds
- Stryer L (1995) Biochemistry, 4 th edition, W. H. Freeman & company, NewYork.
- Watson J. D., Hopkins, N. H., Roberts, J. W., Steitz, J. A. and Weiner, A. M. (1988) Molecular biology of the gene, 4th edition, The Benjamin/Cummings publishing companies, inc, California.
- Benjamin Lewin (1999) Genes VII, Oxford University Press, Oxford.
- Weaver R. F. (1999) Molecular biology, WCB McGraw-Hill companies, Inc,New York.
- Brown T A (1995) Essential molecular biology, vol. I, A practical approach,IRL press, Oxford.
- Genes and Genomes Maxine Singer and Paul Berg
- Principle of Genetics by Simmons

ZOOLOGY II: VERTEBRATES PHYSIOLOGY

Credit: 3

Total Marks: 100 (70+30)

Course Objectives:

1. To impart basic knowledge of Vertebrates & Embryology.
2. To train the students to pursue further education.
3. To be familiar with concepts of Vertebrates & Embryology.
4. To increase expertise of the course.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of Vertebrates & Embryology and key principles ofit.
2. Awareness of the major issue at the forefront of the discipline.
3. Ability to dissect a problem in to its keyfeatures

Module-I

Origin and classification of Chordates. Protochordata - type sutdy Amphioxus. A comparative account of Petromyzon & Myxine.

Module-II

Fishes - Skin and scales Migration in fishes Parental care Amphibia - Parental care Neoteny Reptilia - Poisonous & non poisonous shakes, Poison apparatus, snake venom.

Module-III

Aves - Flight adaptation in birds Discuss - Birds are glorified reptiles Mammals- comparative account of prototheria, metatheria & Eutheria and Affinities.

Module-IV

Gametogenesis, Fertilization & Parhenogenesis. Development of frog upto formation of three germ layers.

Module-V

Development of Chick upto formation of three germ layer, Extra embryonic membranes. Placenta in mammals. Embryonic induction organisers & differentiation.

References

- Biological Sciences: Taylor, Green & Stout.
- Concepts in Biology; Enger & Ross.
- Chordate Zoology: Dhami & Dhami.
- Modern Text Book of Zoology – Vertebrates: R. L. Kotpal.
- Zoology practical: S S Lal

CHEMISTRY II
FUNDAMENTAL CHEMISTRY-II

Credit: 3
Total Marks: 100 (70+30)

Course Objectives:

1. To impart basic knowledge of chemistry.
2. To train the students to pursue further education.
3. To be familiar with Chemical tools.
4. To gain experience with standard chemical tools.
5. To increase expertise of the course.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals Chemistry and key principles of it.
2. Awareness of the major issue atthe forefront of the discipline.
3. Ability to dissect aproblem in to its key features.
4. Ability to design experiments and understand the limitations of the experimental approach.

Module I Acid, Base and Solvent System

Theories of Acids and Bases : Arrhenius, Bronsted-Lowry, conjugate acids and bases, relative strengths of acids and bases, the Lux-Flood, solvent system and Lewis concepts of acids and bases.

HSAB Concept: Classification of Acids and Bases according to HSAB Theory (Hard, Borderline, Soft). Applications of HSAB Theory in Inorganic Reactions-Solubility, Selectivity, Redox Reactions.

Non-aqueous Solvents: Physical properties of a solvent, types of solvents and their general characteristics, Liquid ammonia as a solvent. Acid-base, precipitation and complex formation reactions.Solutions of alkali and alkaline earth metals in ammoniaapplication.

Module II Gaseous State Chemistry of C-C o-Bonding

Alkanes : Preparation (Wurtz reaction, reduction/hydrogenation of alkenes, Corey-House method). Reactions (mechanisms):halogenation, free radical substitution.

Cycloalkanes : Preparation (Dieckmann's ring closure, reduction of aromatic hydrocarbons), Reactions (mechanisms) : substitution and ring-opening reactions. Stability of cycloalkanesBaeyer's strain theory, Sachse and Mohr predictions, Conformational structures of ethane, n-butane and cyclohexane. Chemistry of C-C π-Bonding.

Alkenes: Preparation methods (dehydration, dehydrohalogenation,dehydrogenation, Hoffmann and Saytzeff rules, cis and trans eliminations), Reactions (mechanisms) : electrophilic and free radical addition (hydrogen, halogen, hydrogen halide, hydrogen bromide, water, hydroboration, ozonolysis, dihydroxylation with KMnO). Dienes : 1, 2- and 1, 4-additions, Diels-Alder reactions.

Alkynes: Preparation (dehydrohalogenation, dehydrogenation),

Reactions: Acidity, formation of acetylides, addition of water, hydrogen halides and halogens, oxidation, ozonolysis, hydroboration/oxidation.

Aromatic hydrocarbons: Aromaticity : Huckel's rule, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and FriedelCraft's alkylation/acylation with their mechanism. Directive effects of the groups.

Module III

Behavior of Ideal Gases : Kinetic theory of gases postulates and derivation of the equation, PV = 1/3 mnc and derivation of the gas laws, Maxwell's distribution of molecular velocities, effect of temperature, types of molecular velocities, degrees of freedom. Principle of equipartition of energy.

Behaviour of Real Gases: Deviation from ideal behavior, derivation of vander Waals equation of state and critical constants. Liquid State Chemistry : Structure of liquids (Eyring Theory),Properties of liquids, viscosity and surface tension.

Liquid State Chemistry: Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry, symmetry elements and symmetry operations, seven crystal systems and fourteen Bravais lattices; X-ray diffraction, Bragg's law, Crystal defects.

Module IV

Colloids and Surface Chemistry: Classification, Optical,Kinetic and Electrical Properties of colloids, Coagulation,Hardy-Schulze law, flocculation value, Protection, Gold number,Emulsion, micelles and types, Gel, Syneresis and thixotropy,Physical adsorption, chemisorption.

Chemical Kinetics: Rate of reaction, Factors influencing rate of reaction, rate law, rate constant, Order and molecularity of reactions, rate determining step, Zero, First and Second order reactions, Rate and Rate Law, Methods of determining order of reaction, Chain reactions. Temperature dependence of reaction rate, Arrhenius theory, Physical significance of Activation energy, Collision theory, demerits of collision theory, Non-mathematical concept of transition state theory.

Catalysis: Homogeneous and Heterogeneous Catalysis, types of catalyst, characteristics of catalyst, Enzyme catalyzed reactions,Industrial applications of catalysis.

SUGGESTED READINGS:

1. Physical chemistry, G. M. Barrow, International student edition, Mc Graw Hill
2. Basic programming with application, V. K. Jain, Tata Mc Graw-Hill.
3. Computers & Common sense., R Hunt & Shelly,Prentice-Hall
4. University general chemistry, C.N.R. Rao, Macmillan.
5. Physical Chemistry, R.A. Alberty, Wiley Eastern.
6. The elements of Physical Chemistry, P. W. Atkin, Oxford.
7. Physical Chemistry thought problems, S.K Dogra & Dogra, Wiley Eastern.
8. Physical Chemistry, B.D. Khosla
9. Physical Chemistry, Puri & Sharma
10. Basic Inorganic Chemistry, F.A Cotton, G. Wilkinson and P.L Gauss, Wiley.
11. Concise Inorganic Chemistry, J.D. Lee, ELBS.
12. Concepts of models of Inorganic Chemistry, B. Douglas, D. Mc Daniel and J Alexander, John Wiley.
13. Inorganic Chemistry, D.E. Shriver, P.W. Atkins and C.H.L. Angford, Oxford.

LAB COURSE: BOTANY II

Credit: 1

Total Marks: 50 (35+15)

The practical work will, in general be based on the syllabus prescribed in theory and thecandidates will be required to show knowledge of the following.

1. Cytology- Mitosis, Meiosis

2. Permanent Slides

LAB COURSE: ZOOLOGY II

Credit: 1

Total Marks: 50 (35+15)

The practical work will, in general be based on the syllabus prescribed in theory and thecandidates will be required to show a knowledge of the following.

1. Osteology-Frog & Rabbit

2. Museum Specimen invertebrate & Vertebrate, frog embryology.

3. Slides-Chick embryology, Cytology, Mammal Histology, Bird feather Slides.

LAB COURSE: CHEMISTRY II
FUNDAMENTAL CHEMISTRY II

Credit: 1

Total Marks: 50 (35+15)

Course Objectives:

1. To impart practical knowledge.
2. To train students to pursue further education.
3. Become familiar with chemical science tools.

Course Outcome:

Skills that students obtain after completion of the course:

1. Good quantitative skills such as the ability to accurately and reproducibly prepare reagents for experiments.
2. Ability to dissect a problem in to its key features.
3. Ability to design experiments and understand the limitations of the experimental approach.

1. Distribution Law

To study distribution of iodide between water & CCl_4

To study distribution of benzoic acid between benzene & water.

2. Colloids

To prepare arsenious sulphide sol & compare the precipitating power of mono- bi & tri valentanions.

3. Viscosity &. Surface Tension

To determine the of % composition of a given mixture (Non interacting system) by viscositymethod.

To determine the viscosity of amyl alcohol in water at different concentrations & calculate theexcess viscosity of these solutions.

To determine the % composition of a given binary mixture by surface tension method (acetone& ethyl methyl ketone).

4. Inorganic Chemistry

Semi micro Analysis-cations analysis separation and identification of ions from Pb^{2+}, Bi^{3+}, Cu^{2+}, Cd^{2+}, Sb^{3+}, $Sn^{2+,4+}$, Fe^{3+}, AI^{3+}, Cr^{3+}. Ni^{2+}, $C0^{2+}$, Zn^{2+}, Mn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+}, NH^{4+} and Anions $CO2/3^{-}$, $SO2/3^{-}$, S^{2-}, $SO2/4^{-}$, NO_2^{-}, NO_3, CI^{-} ,Br^{-},I^{-}, CH_3COO^{-}, $C_202/4^{-}$, $BO3/5^{-}$, F^{-}.

Generic Elective Course IIA
Subject: Organizational Theory and Behavior
Subject Code: ODL/BCOM/GE-018

Credit 4
Total Marks 100 (70+30)

Course Objective:

- To make aware of the basic concepts of organizational behavior
- To Familiarize the students to comprehend, perceive and understand dynamic nature of group

Module-I

Introduction to OB: Introduction, Historical Perspective, Approaches to and Importance, Framework for Learning OB, The Intricate Relation between MP and OB, Human Resources Management Relationship, Limitations of OB, Globalization and OB, Foundations of Individual Behavior, Disciplines contributing the field of Organizational Behavior-Case Study

Module-II

Personality types Factors influencing personality Theories Learning Types of learners The learning process Learning theories Organizational behavior modification. Misbehavior Types – Management Intervention. Emotions - Emotional Labour Emotional Intelligence – Theories. Attitudes – Characteristics – Components – Formation – Measurement- Values. Perceptions – Importance – Factors influencing perception – Interpersonal perception- Impression Management. Motivation – importance – Types – Effects on work behavior- Case Study

Module-III

Organization structure – Formation – Groups in organizations – Influence – Group dynamics – Emergence of informal leaders and working norms – Group decision making techniques – Team building

- Interpersonal relations – Communication – Control.Case Study

Module-IV

LEADERSHIP AND POWER:- Meaning – Importance – Leadership styles – Theories – Leaders Vs Managers – Sources of power – Power centers – Power and Politics.Case Study

Module-V

Organizational culture and climate – Factors affecting organizational climate – Importance.Job satisfaction – Determinants – Measurements – Influence on behavior. Organizational change – Importance – Stability Vs Change – Proactive Vs Reaction change – the change process – Resistance to change – Managing change.Stress – Work Stressors –

Prevention and Management of stress – Balancing work and Life.Organizational development – Characteristics – objectives –. Organizational effectiveness. Case Study .

Course Outcomes:

- To explain group dynamics and demonstrate skills required for working in groups (team building)
- To identify the various leadership styles and the role of leaders in a decision making process.
- To explain organizational culture and describe its dimensions and to examine various organizational designs
- To discuss the implementation of organizational change.

TEXT BOOKS

- Stephen P. Robins, Organisational Behavior, PHI Learning / Pearson Education, 11th edition, 2008.
- Fred Luthans, Organisational Behavior, McGraw Hill, 11th Edition, 2001.

Generic Elective Course IIB
Subject: IT Skills

Credit 4
Total Marks 100 (70+30)

Course Objective:

- To make aware of the basic concepts of IT Skills
- To Familiarize the students to IT Tools and Computer Fundamentals

Module-I: Word Processing

Working with Document: Opening, Saving and Editing Files, Inserting, Deleting Files, Margins: Converting Files to Different Format Using Tools Bar, Page Style, Alignment -Indents, Line Space, Border and Shading, Header and Footer Setting, Drawing: Inserting Clip Arts Pictures/Files Etc. Word Completion: Spell Checks, Mail Merging

Module-II: Spread Sheet

Spread Sheet and Its Applications, Working With Spreadsheet: Opening, Saving, File Setting, Spreadsheet Addressing: Rows, Columns and Cells, Referring Cells, Inserting Data: Insert Cells, Columns, Rows and Sheets, Inserting Data: Insert Cells, Columns, Rows and Sheets, External Files: Frames Clipart, Pictures etc. Formula Tab

Module-III : Presentation

Introduction To Presentation: Opening New Presentation, Selecting Presentation Layout, Adding Text To The Presentation, Header And Footer, Slide Layout, Adding Graphics To The Presentation, Setting Animation And Transition Effect

Module-IV HTML Basics

Introduction Of HTML, Elements Of HTML, Attributes, Headings, Paragraph, Styles Of HTML, CSS, Tables, HTML Class, Id, HTML Responsive, HTML Forms

Module-V: Web Designing

Introduction to Web Designing Tool, Admin and General Site Settings, Writing Post and Formatting Text, Publishing a Post, Adding Image and Managing Media Library and Creating Links

TEXT BOOKS

1. Top help topics - Microsoft Support
2. https://www.w3schools.com/html/
3. https://www.tutorialspoint.com/wordpress/index.htm

Generic Elective Course IIC
Subject: छत्तीसगढ़ जनजातिया संस्कृति

Credit 4
Total Marks 100 (70+30)

अनुक्रमणिका

माड्यूल विषय – छत्तीसगढ़ जनजातिया संस्कृति

माड्यूल– 1 छत्तीसगढ़ की जनजातियॉ

इकाई– 1

- परिभाषाए
- विशेषताए

इकाई– 2

- प्रमुख जनजातियों के नाम
- कला और संस्कृति

इकाई– 3

- छत्तीसगढ राज्य में अनुसूचित जनजातियों की सूची
- जनजातीय विकास एवं सरकारी याजेनाए

माड्यूल– 2 जनजातीय विकास

इकाई–4

- जनजातीय विकास के मुख्य पहलू
- जनजातीय विकास मेंचनुौतियाँ

इकाई–5

- जनजातीय विकास के लिए नीतियाँ और कार्यक्रम
- छत्तीसगढ़ में जनजातीय विकास

इकाई–6

- आद्यौगिकीकरणऔरशहरीकरणकाजनजातीयसमाजपरप्रभाव
- जनजातीय समाज के संरक्षण और संवर्धन की याजेनाए

माड्यूल– 3 जनजातीय सामाजिक

इकाई– 7

- जनजातीय सामाजिक संगठन का महत्व

इकाई–8

- जनजातीय समाज की संरचना और पारिवारिक व्यवस्था
- छत्तीसगढ़ में जनजातीय महिलाओं की स्थिति और उनकी भूमिका

इकाई–9

- जनजातियों में अंतर्जातीय और अंतरजातीय संबंध

माड्यूल– 4 छत्तीसगढ़ के आभूषण, वाद्ययत्रं व्यजंन

इकाई– 10

- आभूषण का सामान्य परिचय
- प्रमुख जनजातीय आभूषण

इकाई– 11

- छत्तीसगढ़केप्रमखु जनजातीय वाद्ययत्रं

इकाई– 12

- छत्तीसगढ़कापारंपरिकभाजेनऔरव्यजंन
- त्याहेार सेजुड़ेविशेष व्यजंन

माड्यूल– 5 छत्तीसगढ़ की लोककला एव संस्कृति

इकाई– 13

- छत्तीसगढ़ का जनजातीय हस्तशिल्प एक विस्तृत परिचय
- छत्तीसगढ़ की पारंपरिक वेशभूषा

इकाई– 14

- छत्तीसगढ़केलोकगीत ,कहानियाँ और मौखिक परपंराएँ
- आधुनिकसमयमेंजनजातीयसंस्कृतिपरपडत़ाप्रभाव

SCIENCE COMMUNICATION SKILLS

Credit: 2
Total Marks 50
(35 + 15)

1. Introduce the students to the norms of formal academic writing.
2. Develop in students the ability to comprehend and utilize various scientific information resourc

3. Train students to create original literature while avoiding plagiarism.
4. Enable students to plan and write various types of academic assignments

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the science communication skills and key principles of it.
2. Awareness of its major applications.
3. Will be able to create original literature, plan and write various types of academic assignments.

Module I: Norms of Academic Writing

1. Significance of scientific communication in academics and research
2. Choice of words in academic writing
3. Conventions in academic writing – tone, style, structure of an academic write-up
4. Assessing credibility of an information resource – facts versus opinions
5. Note-taking – methods and tools to aid note-taking in a class

Module II: Avoiding Plagiarism

1. Plagiarism – definition and types
2. Self-plagiarism
3. Methods to avoid plagiarism a. Summary writing b. Paraphrase c. Quotations d. Citations
4. Software for similarity and plagiarism checks – TURNITIN, VIPER

Module III: Types of Scientific Literature

1. Modes of scientific communication - news article, editorial, scientific report, review article, original research article, thesis, poster, oral presentation in a conference
2. Primary and Secondary Literature – Definition, distinguishing features and examples
3. Structure and format of specific examples – news article, review article, research paper, thesis, poster
4. Use of PUBMED, Google Scholar to conduct a literature search

Module IV: Planning and Writing Academic Assignments

1. Writing an experiment for lab journal
2. Project Report
3. Writing an essay/assignment
4. Constructing Statement of Purpose

Module V: References and Bibliography

1. In-text citations
2. Reference writing in APA style a. Textbook/book chapter as source b. Research paper/Journal article as source c. Websites d. Citations
3. Constructing a bibliography
4. Reference management tools – ZOTERO, ENDNOTE

SUGGESTED READINGS:

1. Day RA, Gastel B, (2012) "How to Write & Publish a Scientific Paper" 7 th Edition, Cambridge University Press. 2. Booth V, (2006) "Communicating in Science: Writing a Scientific Paper and Speaking at Scientific Meetings" 2 nd Edition Reprinted, Cambridge University Press.
3. Matthews JR., Matthews RW, (2008) "Successful Scientific Writing: A Step-By-step Guide for the Biological and Medical Sciences" 3 rd Edition, Cambridge University Press.
4. Yousuf A, Sidiq M, Acharya S, (2018) "Publish and Cherish – The Art and Craft of Publishing Scientific Research" 1st Edition, Sara Book Publication.

VERMICOMPOSTING AND ORGANIC FARMING

Credit: 2

Total Marks: 50 (35+15)

Course Objectives:

1. To impart basic knowledge related to vermicomposting & organic farming.
2. To train the students to pursue further education.
3. Become familiar with vermicomposting & organic farming.
4. Gain experience with standard tools.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of vermicomposting & organic farming and key principles of its.
2. Awareness of the major issue at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.
4. Ability to design experiments and understand the limitations of the experimental approach.

Module I

1. Organic farming: Introduction and status.
2. Organic farming and its components.
3. Organic farming - Concepts and principles.
4. SWOT Analysis of Organic Farming.

Module II

1. Sustainable Agriculture.
2. Key indicators of sustainable agriculture.
3. Organic farming and climate change.
4. Principles of compost production.

Module III

1 Vermicomposting : Introduction and Scope.
2 Types of Earthworm and Classification Epigeic, Endogeic, Diageic. 3
Life history of Earthworms (Earthworm Species Eisenia foetida).

Module IV

1 Objectives of Vermicompost.
2 Vermicompost Production : Establishment of Vermicomposting and Vermiwash unit.
3 Different Methods of Vermicomposting: Small and large scale Bed method, Pit method . 4
Harvesting the Compost.
5 Storing and packing of vermicompost.

Module V

1 Precautions while Vermicomposting.
2 Physico- chemical analysis of vermicompost. 3
Physical Parameters of vermicompost.
4 Nutrient content of vermicompost and their role in agriculture.
5 Benefits of vermicompost

ENVIRONMENTAL STUDIES & DISASTER MANAGEMENT

Course Objectives **Credit: 2**

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

1. Identify the historical origins of destructive attitudes and practices towards the natural environment.
2. Know the compatibility of human and environment/ecological values.
3. Know the nature resources available on earth and how to concern and manage them.
4. Understand the disaster and pandemic they are facing and empower the new generation to face the new challenges.

Module-I (Environment)

The Atmosphere, Lithosphere, Hydrosphere, Biosphere. Ecosystem: Energy flow in the ecosystem Biogeochemical Cycle: Water Cycle, Carbon Cycle, Nitrogen Cycle Pollution: Water Pollution, Air Pollution, Soil Pollution, Radiation Pollution, Industrial Pollution, Light Pollution, Sound Pollution. Environmental Laws: (Water Act 1974, Air act 1981, The Wildlife Protection Act 1972, The Environment Protection Act 1986), The Forest Conservation Act 1980.

Module-II (Climate Change & Sustainable Development)

Population Ecology: Individuals, Species, Population, Community (01 Period) Human Population Growth, Population Control Methods (01 period) Urbanization and its effect on society (01 Period) Climate Change: Cause, Effect, Global Warming, Carbon Footprint and environmental protection (05 Periods) Step taken towards Sustainable Development: Ban of single-use plastic automobile Scrapping Policy, Promotion of Electrical Vehicles, Brief idea on Sustainable Development Goals (SDGs), Agenda 21 of Rio Earth Summit.

Module -III (Disaster Management)

Disaster Management: Types of Disasters (Natural and Man-made and their cause and effect)Vulnerability Assessment and Risk Analysis: Vulnerability to various disasters (Flood, Cyclone,Earthquake, Heat waves and Lightning) Institutional Framework: Institutional arrangements for disaster management (National Disaster Management Authority (NDMA), Chhattisgarh State Disaster Management Authority (CSDMA), District Disaster Management Plan-(DDMP) Raipur. Preparedness Measure and Survival skills adopted during and after disaster

Module–IV (Public Health Management)

Brief idea on Epidemics and Pandemics Non-Communicable Diseases with special reference to cardiovascular diseases, Cancer, Hypertension and Obesity and their prevention.

Communicable Diseases with special reference to Covid-19, Flu, Hepatitis, AIDS and Tuberculosis and their transmission Dynamics of Disease Transmission: Mode of transmission (Direct/Indirect), Events after infection: Immunity (Active vrs Passive, Innate vrs Acquired, Herd Immunity), Incubation Period. Prevention of Epidemics/Pandemics Disease: Preventing Measures (Quarantine, Sanitization, Personal Protective measures such as Hand Washing and use of protective devices, Vaccination); Control Measures (Surveillance, Isolation, Contact Tracing) Life Style Management (Diet, Physical Exercise, Yoga and sleeping habit)

Suggested Readings:

1. Environment and Disaster Management Ecology Climate Change Biodiversity, 3rdEdition, by D.R Khullar
- An Introduction to Disaster Management Natural Disasters and Man Made Hazards, 3rd Edition by S. Vaidyanathan
1. Environment, Disaster Management Climate Change, by Dr. Y. K. Sharma & P. Jain.
2. Environmental Studies and Disaster Management by Rajneeta Soni

SEMESTER III
BOTANY III DIVERSITY OF SEED PLANTS & THEIR SYSTEMATICS

Credit: 3
Total Marks: 100 (70+30)

Course Objectives:

1. To impart basic knowledge of Diversity of seed plants and their systematics.
2. To train the students to pursue further education.
3. To be familiar with plant biology tools.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of Diversity of seed plants and their systematics.
2. Awareness of the major issue at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.
4. Ability to design experiments and understand the limitations of the experimental approach.

MODULE-I.

Characteristics of seed plants; evolution of the seed habit; seed plants with (angiosperms)and without (gymnosperms) fruits; fossil and living seed plants. General features of gymnosperms and their classification; evolution and diversity of gymnosperms; geological time scale, fossilization and fossil gymnosperms.

MODULE-II

Morphology of vegetative and reproductive parts; anatomy of roots, stem and leaf, reproduction and life cycle of Pinus, Cycas and Ephedra.

MODULE -III

Angiosperms: origin and evolution, some examples of primitive angiosperms. Angiosperms taxonomy: brief history, aims and fundamental components; identification, keys taxonomic literature. Botanical nomenclature: Principles and rules; taxonomic ranks; type concept; principle of priority.

MODULE -IV

Classification of angiosperms; salient features of the systems proposed by Bentham and Hooker and Engler and Prantl. Major contributions of cytology, phytochemistry and taximetrics to taxonomy.

MODULE -V

Diversity of flowering plants: General account of the families Ranunculaceae,

Brassicaceae, Malvaceae, Rutaceae, Fabaceae, Apiaceae, Acanthaceae, Apocynaceae, Asclepiadaceae, Solanaceae, Lamiaceae, Chenopodiaceae, Euphorbiaceae, Liliaceae and Poaceae.

SUGGESTED READINGS:

1. B P Pandey: Botany for Degree Students -II (B. Sc. II Year), 1/e S. Chand Publishing.
2. Dr Nupur Bhowmick *: Diversity of Seed Plants and Their Systematics.*
3. Michael G Simpson*: Plant Systematics* .
4. Dr. V. Singh, Dr. P.C. Pande & Dr. D.K. Jain: A Text *Book* of Botany *Diversity* AndSystematics of *Seed Plants*.
5. Esha Agarwal, S. B. Agarwal: B.Sc.. Practical Botany Second Year

ZOOLOGY III ANATOMY & PHYSIOLOGY

Credit: 3
Total Marks: 100 (70+30)

Course Objectives:

1. To impart basic knowledge of Anatomy & Physiology.
2. To train the students to pursue further education.
3. To be familiar with standard tools.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of Anatomy & Physiology.
2. Awareness of the major issue at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.
4. Ability to design experiments and understand the limitations of the experimental approach.

MODULE-I

Comparative Anatomy of various organ systems of vertebrates. Integument and its derivatives: structure of scales, hair and feathers. Alimentary canal and digestive glands invertebrates. Respiratory Organs Gills and lung, Air-Sac in bird.

MODULE -II

Endoskeleton-Limbs, girdles and vertebrae. Circulatory System - Evolution of heart andaortic arches. Urinogenital System - Kidney and excretory ducts.

MODULE -III

Nervous System- General plan of brain and spinal cord. Endocrine glands - classificationand histology. Gonads and genital ducts.

MODULE -IV

Digestion and absorption of dietary components. Physiology of heart, Cardiac cycle and ECG. Blood Coagulation. Respiration-Mechanism and control of breathing.

MODULE -V

Excretion-Physiology of excretion, Osmoregulation. Physiology of Muscle contraction. Physiology of nerve impulse, Synaptic transmission. Ear and Eye -

structure and function.

SUGGESTED READINGS:

1. Conn, Stumpy RK, Bruening and D.C.:Outlines of Biochemistry.
2. Gaviong : Review of Medical Physiology.
3. Eckest, R. : Animal Physiology (W.H. Freeman)
4. Hildbrand : Analysis of Vertebrate structure
5. Kingsley : Outlines of Comparative Anatomy (Central Book Depot)
6. Rouer & Parsons : The Vertebrate Body, (Saunders)
7. Walta & Gyles : Biology of the Vertebrates (Macmillan)

CHEMISTRY III INORGANIC & PHYSICAL CHEMISTRY I (Chemistry of d & f-block elements)

Credit: 3
Total Marks: 100 (70+30)

MODULE-I. Chemistry of d & f- block elements

A. d-block elements

(i) Chemistry of elements of first transition series: Characteristic properties of the elements of first transition series with reference to their: Electronic configuration, Atomic and ionic radi, Ionization potential, Variable oxidation states, Magnetic properties, Color, Complex formation tendency and catalytic activity.

(i) Chemistry of elements of second and third transition series: Electronic configuration of 4d and 5d transition series. Comparative treatment with their 3danalogous (Group Cr- Mo-W, Co-Rh-Ir) in respect of oxidation states and magnetic behavior.

B. f-block elements

Chemistry of Lanthanide & Actinides: Electronic structure, oxidation states, ionic radii, magnetic, and spectral properties. Lanthanide contraction and its consequences, complex formation, occurrence and isolation, Separation of lanthanides: solvent extraction and ion exchange method. General features and chemistry of actinides, Transuranic elements, chemistry of separation of Np, Pu and Am from uranium, similarities between the later actinides and the later lanthanides.

MODULE-II. Oxidation and reduction

Various definitions of oxidation and reduction, Balancing of redox reaction by ionelectron method, Latimer diagram of Chlorine and Oxygen, Frost diagram of Nitrogen and Oxygen, and Pourbaix diagrams of Iron. Predicting disproportionation and comproportionation phenomena.

Coordination Chemistry

A. Coordination compounds: Distinction among simple salts, double salts, andcoordination [compounds. Terminology and nomenclature of Coordination compounds. Types of ligands based on denticity. Werner's Coordination theory and its experimental verification. Sidgwicks electronic interpretation, EAN rule with examples. Electroneutrality principle, Valence Bond Theory of transition metal complexes. Determination of structures and magnetic properties of complexes

based on V'BT. Chelates: Classification and their application.

B. Isomerism in coordination compounds: Structural isomerism and Stereoisomerism (Geometrical and optical) in coordination compounds with four and six coordination numbers.

MODULE-III

Thermodynamics-I

A. Basic concept of thermodynamics: System, surrounding, types of system (closed, open & isolated). Intensive & extensive properties. Thermodynamic processes: isothermal, adiabatic, isobaric, isochoric, cyclic, reversible &irreversible. State function & path functions and their differentiation, concept of heat &work. Zeroth law of thermodynamics, First law of thermodynamics. Definition of internal energy & enthalpy. Concept of heat capacity, heat capacity at constant volume & at constant pressure, and their relationship.

Joule-Thomson experiment, Joule-Thomson coefficient (no derivation) & inversion temperature. Calculations of w, q, E & H for expansion of gases for isothermal &adiabatic conditions for reversible process.

B. Thermochemistry

Standard states, Heat of reaction, enthalpy of formation, enthalpy of combustion, enthalpy of solution, enthalpy of neutralization, Hess's law of constant heat of summation & its applications. Variation of enthalpy change of reaction with temperature (Kirchoffs equation).

C. Thermodynamics II

Second law of thermodynamics: Limitations of first law and need for the second law. Statements of second law. Carnot cycle & Efficiency of heat engine. Thermodynamic principle of working of a refrigerator (Carnot theorem). Concept of entropy: entropy change in a reversible and irreversible process; entropy change in isothermal reversible expansion of an ideal gas. Physical significance of entropy.Gibbs free energy, Gibbs -Helmholtz equation

D. Third law of thermodynamics

Statement of third law, Nernst heat theorem, Absolute entropy of solids, liquids, and gases.

MODULE-IV Electrochemistry-1

Electrolyte conductance: specific and equivalent conductance, measurement of equivalent conductance, effect of dilution on conductance, Kohlrausch law,application of Kohlrausch law in determination of dissociation constant of weak electrolyte, solubility of sparingly soluble electrolyte, absolute velocity of ions, ionic product of water, conductometric titrations.

Single electrode potential, standard electrode potential, electrochemical series and its applications. Concept of overvoltage.

Theory of strong electrolyte: limitation of Ostwald's dilution law weak and strong electrolyte, Debye-Huckel-Onsager's (DHO) equation for strong electrolytes, relaxation, and electrophoretic effect. Migration of ions; Transport number-

definition and determination by Hittorf method and moving boundary method. Electrochemical cells or Galvanic cells: reversible and irreversible cells, conventional Representation of electrochemical cells. EMF of a cell, effect of temperature on EMF of cell, Nernst equation calculation of AG, AH and A S for cell reaction, polarization, Over potential and hydrogen overvoltage.

SUGGESTED READINGS:

1. Moudgil, H. K. (2010). Textbook of physical chemistry. PHI Learning Pvt. Ltd.
2. Adamson, A. (2012). A textbook of physical chemistry. Elsevier.
3. Finglgkrmc61923). Practical physical chemistry. Longmans, Green.

Online Resources-

- e -Resources / e-books and e-learning portals
- https:/tech.chemistrydocs.com/Books/Physical/Advanced-Physical-Chemistry-
- Experiments-by-J-N-Gurtu-&-Amit-Gurtu.pdf
- https://byjus.com/chemistry/conductometric-titration/
- https://chem.libretexts.org/Courses/University_of Californin Davis/Chem 4B Lab%3A Ge
- neral Chemistry for Majors IV1%3A Thermochemistry (Experiment)
- https:/www.ulm.edu/chemistry/courses/manuals/chem1010/experiment 10.pdf

LAB COURSE: BOTANY III

Credit: 1
Total Marks: 50 (35+15)

ANGIOSPERMS

Embryology, Anatomy and Vegetative Propogation etc.

1. Study of commonly occuring dicotyledonous plant (for example ***Solanum nigrum*** or Kalanchoe) to understand the body plan and modular type of growth.

2. Life forms exhibited by flowering plants (by a visit to a forest or a garden), study of tree like habit in cycads, bamboos, banana, traveller's tree (*Ravenala madagasariensis*) or yucca and comparison with ture trees as exemplified by conifers and dicotyledons.

3. L.S. shoot tip to study the cytohistological zonation and origin of leafprimordia.

4. Monopodial and Sympodial types of branching in stems (especially rhizomes).

5. Anatomy of primary and secondary growth in monocots and dicots using hand sections (or prepared slides), structure of secondary phloem and xylem, Growth rings in wood,Microscopic study of wood in T.S., T.L.S. and R.L.S.

LAB COURSE: ZOOLOGY III

Credit: 1
Total Marks: 50 (35+15)

The practical work in general shall be based on the syllabus prescribed in theory.
Thestudents will be required to show the knowledge of the following.
1. Study of the representative examples of the different chordates (Classification andcharacter)
2. Simple microscopic technique through unstained or stained permanent mounts.
3. Study of prepared slides histological, as per theory papers.
4. Study of limb girdles and vertebrae of frog, varanus, fowl and Rabbit.

LAB COURSE: INORGANIC & PHYSICAL CHEMISTRY I

Credit: 1
Total Marks: 50 (35+15)

Transition Temperature

1) Transition temperature of a salt hydrate-determination of molecular weight.
2) Determination of the transition temperature of the given substance by thermometric dialometric method (eg. $SrBr_2$. $2H_2O$ or $MnCl_2$, $4H_2O$)

Thermochemistry
A. Determination of solubility:
1) To determine the solubility of benzoic acid at different temperatures and to determine ΔH of the dissolution processes
B. Calorimetry:
1) To determine the enthalpy of neutralization of hydrochloric acid (strong acid) by sodium hydroxide (strong base) solution.
2) (a) To determine the enthalpy of neutralization of a weak acid (acetic acid) versus strong hase (sodium hydroxide) and determine enthalpy of ionization of weak acid.
(b) To determine the enthalpy of neutralization of a weak base (ammonium hydroxide) versus strong acid (hydrochloric acid) and determine enthalpy of ionization of weak base.
3) To determine the enthalpy of solution of solid calcium chloride and calculate the lattice energy

Conductometry
1) Conductometry-Determination of limiting molar conductance of a strong Electrolyte (KCI).
2) To determine the strength of the given acid (HC) or CH3COOH) conductometrically using standard alkali (NaOH)solution.
3) To determine the strength of strong acid and a weak acid in the given mixture conductometrically against a standard alkali solution
4) To determine the ionization constant of weak acid conductometrically.

Solubility Product

1) To detertmine the solubility and solubility product of a sparingly soluble salt

conductometrically.
2) Potentiometry- Determination of solubility product of a sparingly soluble substance.

SUGGESTED READINGS:

1. Vishwanathan, B. & Raghavan, P. S. (2017). Practical Physical Chemistry. Viva books originals publishing.
2. Yadav, J. B. (2006). Advanced Practical Physical Chemisty. Krishna Prakashan Media.
3. Sahu, D. P.& Bapat, K. N. (2022) Unified practical chemistry, Navbodh Prakashan.

Generic Elective Course IIIA (Semester III)
Subject: Managerial Economics
Subject Code: ODL/BCOM GE-022

Credit 4
Total Marks 100 (70+30)

Course Objective: The objective of the course is to acquaint students with the basic principles of micro and macroeconomics for developing the understanding of theory of the firm, markets and the macro environment, which would help them in managerial decision making processes. Contents: Part A: Firm and Market.

Course Outcome:

At the end of this course students should be able to:

1. Use stylized examples; determine if a company is optimally employing available resource.
2. Calculate demand elasticity from demand equations.
3. Categorize economic costs.
4. Contrast the decision-making process across industries characterized by pure competition, monopolies, and oligopolies.

Module I:

Introduction : Meeting, definition nature and scope of managerial economics, significance of economic analysis in business decisions. Role and responsibilities of managerial economists, objectives of a business firm

Module II:

Cost: Production: Law of variable proportion. Returns to scale. Production function: Concept of productivity and technology. Producer's Equilibrium. Isoquants ridge lines, Isoclines, Isocost lines. Cost function: Classification of costs, Short run cost functions, Relationship between return to scale and return to a factor, Long run cost functions.

Module III:

Market and Pricing: Market forms: AR-MR. Price taker; Monopoly power. Oligopolistic behavior: Cournot and Stackelberg models. Factor Pricing: Demand and supply of factors of production. Euler's theorem. Part B: Macroeconomic environment.

Module IV:

Pricing Policies and Methods : Objectives of pricing policy, factors affecting on pricing policy, methods of pricing, cost plus pricing, going rate pricing, marginal cost pricing, skimming price, low penetration pricing, transfer pricing, price discrimination, international price discrimination and dumping.

ModuleV:

Aggregate Demand and Aggregate Supply: Modern aggregate demand function. Demand Management. Philips Curve. Aggregate supply and the price level, trade cycle, Business cycle.

Suggested Reading:

1. Koutsyiannis, A., Modern Microeconomics, Macmillan Press Ltd.
2. Varian, Micro-Economic Analysis , Norton.
3. Pindyck Robert S., Daniel L. Rubinfeld and Prem L. Mehta, Micro Economics, Pearson Education Asia, New Delhi.

Generic Elective Course III B (Semester III)
Subject: Fundamentals of Programming

Credit 4
Total Marks 100 (70+30)

Module I: Algorithm, Flow Chart and Programming languages

Introduction of algorithm and flowchart, Type of software and programming languages, Introduction to C : Program structure, Per processor Derivatives, Header files, Token, Data Type, Format Specifier, Operators, Variable and Scope of the variable

Module II: Control Statements , Array and String

Control Statements : Definition and types, Branching, Looping , Jumping Statement and its types, One dimensional, Two dimensional and Multidimensional Array, Character Array: Initialization, Reading , writing, String Manipulation functions

Module III: Function and Pointer

Function: Introduction, types of functions, Function: Nested function, Recursion, Passing array as a function parameter, Pointer and Array : Pointer Expression, pointer with array and string, Array of Pointer, Pointer and Function: Pointer as function parameter

Module IV: Structure and Dynamic Memory Allocation

Array of Structure, Array within Structure, Structure within structure, Structure and Function : Structure as a function parameter, Memory allocation concept, Dynamic memory allocation : malloc, calloc, free and realloc

ModuleV: File Handling

Introduction of file concept: Opening, closing, Input/output Operation in file, Error Handling during I/O Operation, Random Access file

Suggested Reading:

- E Balaguru Swami, " Programming in ANSI", Tata McGraw Hills: **TB#1**
- K R Venugopal and S R Prasad, "Mastering in C", Tata McGraw Hills: **TB#2**

Generic Elective Course III B (Semester III)
Subject: भारत के धार्मिकपर्यटनस्थल–III

Credit 4
Total Marks 100 (70+30)

अनुक्रमणिका

माड्यूल विषय–भारत के धार्मिक पर्यटन स्थल

माड्यूल– 1 चार धाम यात्रा

इकाई– 1 उत्तराखंड की चार धाम यात्रा

इकाई– 2 12 ज्योर्तिलिंग

इकाई– 3 कुम्भ

इकाई– 4 बुद्धिज्म, सारनाथ, वैशाली, कुशीनगर

माड्यूल– 2 इस्लाम और क्रिश्चनीयटि

इकाई– 5 अजमेर

इकाई– 6 हाजी अली दरगाह (मुबई)

इकाई– 7 हजरत बलश्रीन (श्रीनगर), गोवा

माड्यूल– 3 जैनिज्म

इकाई– 8 समवेद शिखर (झारखंड)

इकाई– 9 गिरनाथ गुजरात

इकाई– 10 पावापुरी बिहार , दिलबारा

माड्यूल– 4 सिखज्म

इकाई– 11 अमृतसर

इकाई– 12 भटिंडा

इकाई– 13 पटना

HINDI

Credit: 2
Total Marks: 50 (35+15)

पाठ्यक्रम का उद्देष्य–

1 विद्यार्थीयों में शुद्ध एवं परिष्कृत हिन्दी लिखने की योग्यता प्रदान करना।
2 विभिन्न अंग्रेजी पदनामों की हिन्दी में जानकारी।
3 शब्दों के विभिन्न रूप और उनके प्रयोग।
4 प्रसिद्ध साहित्यकारों की कविताओं और कहानियों का समावेष, जिससे विद्यार्थी साहित्य से कभी

उन्मुक्त न हों।

5 विद्यार्थीयों के मौखिक तथा लेखन में व्याकारण का मूलभूत प्रयोग।

मोडुल – 1

– स्वतंत्रता पुकारती
– संज्ञा, सर्वनाम
– पल्लवन
– अनेक शब्दों के लिए एक शब्द

मोडुल – 2

– बड़े घर की बेटी
– मुहावरे एवं लोकोक्तियाँ –
तत्सम, तद्भव
– पर्यायवाची

मोडुल – 3

– अब तो पथ यही है
– अशुद्धियां और उनका संशोधन
– उपसर्ग, प्रत्यय
– वाक्य के भेद

मोडुल – 4

– रीढ़ की हड्डी –
समास विग्रह
– विराम चिन्हों का प्रयोग
– संक्षिप्ति

मोडुल – 5

– मानक भाषा
– पदनाम –
पत्र लेखन
– अपठित गद्यांश

1. मौलिक हिन्दी भाषा – डॉ. सरस्वती वर्मा
2. रचनात्मक हिन्दी भाषा – डॉ. सरस्वती वर्मा
3. भारतीयता के अमर स्वर – डॉ. धनंजय वर्मा
4. हिन्दी व्याकरण – हरदेव वाहरी

COMPUTATIONAL BIOLOGY & BIOINFORMATICS

Credit: 2
Total Marks: 50 (35+15)

MODULE I

Scope of Biostatistics, variables in biology, collection, classification, tabulation of data. Frequency distribution, Diagrammatic and graphical presentation of statistical data, Sampling techniques.

MODULE II

Measures of central tendency: Mean, Median, Mode, Standard Deviation and Standard Error, probability

MODULE III

Concepts of Database, Biological Database: Introduction and Types; Sequence Database: Introduction and Types.

MODULE IV

Introduction to bioinformatics, Importance of Bioinformatics, Introduction to biological databases: EMBL, DDBJ, NCBI, Swiss Prot & PDB, Useful sites for researchers.

MODULE V

Introduction to sequence alignment, pairwise similarity searching, Introduction to BLAST and FASTA programmes.

SUGGESTED READINGS:

1. Bioinformatics: C. S. V. Murthy
2. Introduction to Bioinformatics: Indian Institute of Bioinformatics, New Delhi
3. Bioinformatics: Baxavanis
4. Bioinformatics: Higgins and Taylors.
5. Fundamentals Concepts of Bioinformatics: Dan E. Krane and Michael L. Raymer.
6. Fundamentals of Biostatistics by Khan and Khanum

- Fundamentals of statistical by S.P Gupta
- Statistical Methods by Snedecor and Cochran(8/e)
- Applied statistics by S.C Gupta and V.K Kapoor

AYURVEDIC BIOLOGY

Credit: 2

Total Marks: 50 (35+15)

MODULE I: History and development of Āyurveda

i. Vedic origin & chronological development of Āyurveda

ii. Āyurveda and various schools

iii. Understanding and relevance of aṣṭāṅga āyurveda

iv. Basic Texts and commentaries of Āyurveda

v. Contribution of commentators to Āyurveda

vi. Introduction to bṛhattrayī and its importance

vii. Introduction to laghutrayī and its importance

viii. Basic understanding of nighaṇṭu and kośa of Āyurveda

MODULE II: Philosophy and Fundamental Principles of Ayurveda

i. āyu - lakṣaṇa, paryāya, paribhāṣā and pramāṇa

ii. Definitions of śarīra, jñānendriya, karmendriya, mana, buddhi, citta, ahaṃkāra, ātmā

iii. Definitions of Ayurveda – hitāyu - ahitāyu, sukhāyu - dukhāyu, trisūtra āyurveda – hetu liṅga-auṣadha-jñāna svastha ātura

iv. svāsthya lakṣaṇa - - Dimensions of Health Corresponding to nature, prakṛti, ṛtucaryā, dinacaryā, svasthavṛtta

v. paṃcamahābhūta – ākāśa-vāyu-agni-jala-pṛthvī and their specific properties
vi. Theories of sāmānya and viśeṣa
vii. padārtha – theories of dravya-guṇa-karma-sāmānya-viśeṣa-samavāya
viii. doṣa – śarīrika and mānasika
ix. Introduction to dhātu, mala, agni and srotas

MODULE III: Disease Biology and Microbiology

Disease Biology: Definition of disease, Etiology and Pathology, Congenital and Acquired diseases

Communicable and Non-communicable diseases Autoimmune diseases and Lifestyle disorders

Deficiency and Metabolic diseases Psychological disorders, Benign tumors and various types of cancers

Microbiology: Historical perspectives of Microbiology, Microbial Diversity

MODULE IV: Biodiversity and IPR

Biodiversity: Biodiversity of Medicinal plants and animals, Pharmacological properties of secondary and active metabolites of medicinal plants used in Āyurveda Intellectual Property Rights (IPR): Protection of Traditional Knowledge System (TKS), prevention of bio-piracy and bioprospecting, The role of databases and registers in the legal protection of TKS - Traditional Knowledge Digital Library (TKDL) through World Intellectual Property Organisation (WIPO)

SUGGESTED READINGS:

1. Agnivesha, Charaka Samhita
2. Sushruta, Sushruta Samhita
3. Surapala, Vrikshayurveda, 1996, AAHF, Secunderabad.
4. Alikhan I; Khanum A. 2008. Role of Biotechnology in Medicinal and Aromatic Plants. UKAZ Publ.
5. Gupta AK; Sharma M. 2008. Reviews on Indian Medicinal Plants. ICMR
6. Chakrapani Mishra, VishvaVallabha, 2004, AAHF, Secunderabad.

FOURTH SEMESTER
BOTANY IV: STRUCTURE DEVELOPMENT & REPRODUCTION IN FLOWERING PLANTS

Credit: 3
Total Marks: 100 (70+30)

Course Objectives:

1. To impart basic knowledge of Structure, Development & Reproduction in flowering plants.
2. To train the students to pursue further education.
3. To be familiar with concepts of Structure, Development & Reproduction in flowering plants.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals Structure, Development & Reproduction in flowering plants and key principles of it.
2. Awareness of the major issue at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.

MODULE-I

The basic body plan of a flowering plant: modular type of growth. Diversity in plant form in annuals, biennials and perennials; convergence of evolution of tree habit in gymnosperms, monocotyledons and dicotyledons; trees-largest and longest-lived organisms.

MODULE-II

The shoot system : the shoot apical meristem and its histological organization; vascularization of primary shoot in monocotyledons and dicotyledons; formation of internodes, branching pattern; monopodial and sympodial growth; canopy architecture; cambium and its functions; formation of secondary xylem, a general account of wood structure in relation to conduction of water and minerals; characteristics of growth rings, sapwood and heart wood ; role of woody skeleton; secondary phloem- structure-function relationships, periderm.

MODULE-III

Leaf: origin, development, arrangement and diversity in size and shape; internal structurein relation to photosynthesis and water loss; adaptations to water stress; senescence and abscission.

The root system: the root apical meristem; differentiation of primary and secondary tissues and their roles; structural modification for storage, respiration, reproduction and for interaction with microbes.

MODULE-IV

Flower: a modified shoot ; structure, development and varieties of flower, functions, structure of anther and pistil, the male and female gemetophytes; types of pollination; attractions and rewards for pollinators; pollen-pistil inter-action, self incompatibility, double fertilization, formation of seed-endosperm and embryo; fruit development and maturation.

MODULE-V

Significance of seed: suspended animation; ecological adaptation; unit ofgenetic recombination and replenishment, dispersal strategies. Vegetative reproduction: vegetative propagation, grafting, economic aspects.

SUGGESTED READINGS:

1. V. Singh , P.C. Pande , D.K. Jain: A Textbook of Botany: Structure, Development andReproduction in Angiosperms
2. N. K. Soni: Fundamentals Of Botany:, Volume 2
3. B P Pandey:Botany for Degree Students -II (B. Sc. II Year), 1/e S. Chand Publishing.

Esha Agarwal, S. B. Agarwal: B.Sc.. Practical Botany Second Year

ZOOLOGY IV: CHORDATE & COMPARATIVE ANATOMY

Credit: 3

Total Marks: 100 (70+30)

MODULE-I: Origin of chordates- Fishes, Amphibia, Reptiles, Aves & Mammals. General characteristics and Classification of Fishes, Amphibia, Reptiles, Aves &Mammals.

MODULE-II: Pisces: Accessory respiratory organs, Parental care in fishes.Amphibia: Parental Care in Amphibia. Reptilia: Difference between Poisonous and Non-poisonous snakes. Aves: Migration of birds, Flight adaptation in birds.

MODULE-III: Vertebrate integument and its derivatives- Development, general structure and function of skin and its derivatives, glands, scales, horns, claws, feathers & hairs. General plan of circulation in various groups- Structure and function of blood, Evolution of heart, evolution of aortic arches and portal system.

MODULE-IV: Comparative account of digestive system in vertebrates**.** Respiratory system in Vertebrates- Comparative account of respiratory organs in vertebrates, Skeletal system- Comparative account of Skull, vertebrae, limbs and girdles. Evolution of Urinogenital system in vertebrates. Comparative account of urinogenital system in vertebrates.

MODULE-V: Sense organs- receptors, organs of olfaction and taste, lateral line system and electroreception. Nervous system- Comparative account of the brain in relation to its function, Comparative anatomy of spinal cord, Nerves- cranial, peripheral and Autonomic nervous system.

SUGGESTED READINGS:

1. Life of the vertebrate- J.Z. Young
2. Vertebrate body- A.S. Romer
3. Evolution of vertebrate-E.H. Colbert
4. Comparative anatomy of Vertebrate- C.G. Kent
5. Life of the mammals- J.Z. Young
6. Modern Text Book of Zoology – Vertebrates: R. L. Kotpal
7. Chordate Zoology: Dhami & Dhami.

CHEMISTRY IV
ORGANIC & PHYSICAL CHEMISTRY I

Credit: 3

Total Marks: 100 (70+30)

MODULE-I

A Halides

(i) Alkyl Halides: Preparation: from alkenes and alcohols. Reactions: Nucleophilic substitution reactions of alkyl halides (alcohol, ester, nitrile & isonitrile formation,Williamson's ether synthesis), mechanism and stereochemistry of nucleophilic substitution reactions (SN1 and SN2), factors affecting SNI and SN2 reactions.

(ii) Aryl Halides: Chlorobenzene: Preparation by aromatic halogenation and Sandmeyer reaction. Aromatic nucleophilic substitution involving Benzyne Mechanism: KNH_2/NH_3(or $NaNH_2/NH_3$). Reactivity and Relative strength of C- Halogen bond in alkyl and aryl,Vinyl halides.

B. Alcohols & Phenols

(i) Alcohols

(a) Monohydric-nomenclature, methods of formation, Properties & chemical reactions distinction between primary, secondary & tertiary alcohols.

(b) Dihydric alcohols: Nomenclature, methods of formation of ethylene glycol (from ethylene, epoxide, ethylene dibromide and ethylene diamine). Chemical reactions of vicinal glycols: with carbonyl compounds, dehydration, oxidative cleavage with Pb(OAc)4 and HIO4 and Pinacol-Pinacolone rearrangement (with mechanism).

(c) Trihydric alcohols: Nomenclature and methods of formation (from hydrolysis of fats and oils, propene and acrolein), chemical reactions of glycerol (with PCI5, HI, oxidation, and dehydration) and uses/applications.

(ii) Phenols

Nomenclature and methods of formation, physical properties, and acidic character. Resonance stabilization of phenoxide ion. Comparative acidic strength of alcohols and phenols. Electrophilic aromatic substitution, acetylation, and carboxylation. Mechanism of Fries rearrangement, Claisen rearrangement, and Reimer-Tiemann reaction.

MODULE-II Aldehydes/Ketones and acid/its derivatives

A. Aldehydes and Ketones

Nomenclature and structure of the carbonyl group, synthesis of aldehydes and ketones Acidity of alpha hydrogens and formation of enolate, Concept of reactive methylene group, Keto-enol tautomerisim in Acetoacetic ester. Oxidation of aldehydes by KMnO4, and Tollen's reagent, Reduction of aldehydes by $LiAlH_4$ and $NaBH_4$.

Mechanism of nucleophilic additions to carbonyl group with particular emphasis on aldol, Perkin, and Knoevenagel reactions. Wittig and Mannich reaction (without mechanism), Baeyer-Villiger oxidation of Ketones (without mechanism), Cannizaro reaction (with mechanism), MPV, Clemmensen, and Wolf-Kishner reaction.

B. Acid & its derivatives

(i) Carboxylic Acids

Nomenclature, structure, physical properties, acidity of carboxylic acids, effect of substituent on acid strength, method of preparation and chemical reaction. Hell-Volhard-Zeilinsky (HVZ) reaction, Reduction of carboxylic acids, Mechanism of decarboxylation. Di carboxylic acids: - Methods of formation and chemical reactions.effect of heat and Dehydrating agents.

(ii) Carboxylic Acid Derivatives

Structure, method of preparation & physical properties of acid chlorides, esters, amides

(Urea) and acid anhydrides. Relative stability of acyl derivatives.

MODULE-III. Equilibrium

A. Chemical Equilibria

Equilibrium in physical and chemical processes, dynamic nature of equilibrium, law of mass action, equilibrium constants and their quantitative dependence on temperature, pressure, and concentration, factors affecting equilibrium - Le Chatelier's principle.

B. Ionic Equilibria

lonization of acids and bases, Strong and weak electrolytes, degree of ionization, ionization constant and ionic product of water. lonization of weak acids and bases, pH scale, common ion effect and solubility product (with illustrative examples), Salt hydrolysis - calculation of hydrolysis constant and degree of hydrolysis for salt of strong acid and weak base, Buffer solutions - Introduction, Henderson-Hasselbalch equations for acidic and basic buffer.

C. Phase Equilibrium

(A)Gibbs phase (no derivation), phase, component and degree of freedom, Application of phase rule to one component system (water system and Sulphur systems), Reduced phase rule. Application of phase rule to two component systems: Pb-Ag system. CongruentFerric chloride system.

MODULE-IV. Photochemistry and liquid-liquid mixtures

A) Photochemistry

Interaction of radiation with matter, difference between thermal and photochemical reactions, Laws governing absorption of light, laws of photochemistry, Jablonski diagram depicting various processes, quantum yield, determination of quantum yield of reactions, reasons for low and high quantum yields. Some examples of photochemical reactions (e.g. Photochemical decomposition of Hydrogen iodide, Photosynthesis of HBr from H_2 and Br_2 and photosynthesis of HCI from H_2 and Cl_2). Photosensitization and Quenching,Photosensitized reactions.

B) Liquid-Liquid mixtures

Ideal liquid mixtures, Raoult's law of ideal solutions, Henry's law and its applications, Nernst distribution law, limitations, and applications (association and dissociation - No derivation).

BOTANY IV LAB COURSE

Credit: 1

Total Marks: 50 (35+15)

ANGIOSPERMS

1. Field study of diversity in leaf shape, size, thickness, surface properties, internal structure of leaf, structure and development of stomata (using epidermal peels of leaf).
2. Anatomy of the root, Primary and secondary structure.
3. Examination of a wide range of flowers available in the locality and methods of theirpollination.
4. Structure of anther, microsporogenesis (using slides) and pollen grains (using wholemounts), pollen viability using in vitro pollen germination.
5. Structure of ovule and embryo sac development (using serial sections)
6. Test of self-incompatibility (using Petunia axillaris, Brassica campestris, B. olderacea orsuitable available material) using field pollinations.
   a. Nuclear and cellular endosperm, embryo development in monocots and dicots (usingslides/dissections).
   b. Simple experiments to show vegetative propagation (leaf cuttings in Bryophyllum,Sansevieria, Begonia, stem cuttings in rose, salix, money plant, sugarcane and Bougainvillea).
   c. Germination of non-dormant and dormant seeds

ZOOLOGY IV LAB COURSE

Credit: 1
Total Marks: 50 (35+15)

1. Study of museum specimens of chordate (from protochordate to mammal).
2. Study of histological slide (from protochordate to mammal).
3. Osteology of Fishes, Amphibia, Aves, Reptiles and Mammals, skull of dog, cattle, and man.
4. Alternative methods of dissection- cranial nerves of vertebrates

CHEMISTRY IV LAB COURSE
ORGANIC & PHYSICAL CHEMISTRY I

Credit: 1
Total Marks: 50 (35+15)

Lab./Field - Organic Analysis
Systematic identification of organic compounds:

a) Test for aliphatic and aromatic nature of substances
b) Test for saturation and unsaturation.

c) Detection of elements (N, S, and halogens) in organic compounds.
d) Identification of functional groups:
i) Carboxylic acids ii) Phenols iii) Aldehydes iv) Ketones, v) Esters, vi) Carbohydrates vii) Amines vii) Amides, ix) Halogen compounds
e. Determination of melting and boiling points.
f. Preparation of solid derivatives.

pH determination

1. Determination of pH of soil, water.
2. To measure the pH of various solutions using pH indicators and pH meter.
3. To determine the value of Ka for an unknown acid.
4. To prepare and study the properties of buffer solutions.

Phase Equilibrium:

I) To determine the critical solution temperature of two partially miscible liquids (phenol-water systems).

2) To study the effect of solute such as (i) sodium chloride (NaCl), (i) succinic acid(HOOC-Ci-CH-COOH) on the critical solution temperature of two partially miscible liquids (e.g. phenol - water system).

B) To construct the phase diagram of two components (e. g. diphenylamine-benzophenone system) by cooling curve method.

Nernst Distribution Law

I) To determine the partition coefficient of iodine between water and carbon tetrachloride/Kerosene.

2) To determine the partition coefficient of benzoic acid between water and benzene.

3) To determine the equilibrium constant of the reaction, $KI + I_2 = KI_3$ by distribution method.

SUGGESTED READINGS:

1. Vishwanathan, B. & Raghavan, P. S. (2017). Practical Physical Chemistry. Viva books originals
publishing.
2. Yadav, J. B. (2006). Advanced Practical Physical Chemisty. Krishna Prakashan Media.
3. Sahu, D. P.& Bapat, K. N. (2022) Unified practical chemistry, Navbodh Prakashan.

BOTANY A PLANT
TISSUE CULTURE

Credit: 4

Total Marks: 100 (70+30)

COURSE OBJECTIVE:

- To equip the students to pursue a career in Agriculture or Environment Sector.
- Encourage students to carry out research related to Biotech industries and plant products.
- Enhance the knowledge of techniques required in Plant tissue culture.
- Comprehend beginning entrepreneurship ventures in plant-based products

COURSE OUTCOME:

Skills obtained on successful completion of this paper

- Understand basic terms and acquire a critical knowledge on sterilization techniques.
- Demonstrate skills related to callus culture through hands on experience
- Understand the biotransformation technique for production of secondary metabolites.
- To understand the possibility for the production of elite plants through protoplast culture.
- Comprehend the applications of plant tissue culture.

Module I

Plant Tissue Culture: Introduction, Terms and definitions. Types of culture, Aseptic Techniques, Tissue culture media and importance of growth regulators (Auxins, Cytokininis and Gibberellins)

Module II

Callus culture, cell suspension culture, Organogenesis and Somatic Embryogenesis – Techniques and applications: Micropropagation, axillary bud, shoot-tip and meristem culture.

Module III

Haploid Production- Ovary and Anther culture, Somaclonal variation and their significance, In-Vitro production of secondary metabolites (biotransformation)

Module IV

Protoplast Culture – isolation, regeneration and viability test, somatic hybridization, protoplast fusion, practical Introduction of somatic hybridization: Various methods for fusing protoplasts,chemical and electrical. Cybrids- definition and application.

Module V

Production of Transgenic plants: Technique of transformation – Physical, Chemical & Biological (Agrobacterium mediated) methods. Applications of plant tissue culture in horticulture, agriculture. Edible Vaccines.

Reference books:

- Kalyan Kumar De (2001) An Introduction to Plant Tissue Culture, New Central Book Agency (P) Ltd., Calcutta
- Razdan, M.K. (2005) Introduction to Plant Tissue Culture, Oxford & IBH Publishers, Delhi
- Bhojwani, S.S. (1990) Plant Tissue Culture: Theory and Practical (a revised edition). Elsevier Science Publishers, New York, USA.
- Vasil, I.K. and Thorpe, T.A. (1994) Plant Cell and Tissue Culture. Kluwer Academic Publishers, the Netherlands.

ZOOLOGY A
WILD LIFE CONSERVATION & MANAGEMENT

Credit: 4

Total Marks: 100 (70+30)

Course Objective:

1. To create awareness about Wildlife, its Conservation and Management.
2. To provide graduates in Biology a specialization in the field of Biodiversity, Conservation and Wildlife Management.
3. To generate skilled graduates who can undertake research in the field of Wildlife biology and Nature conservation.
4. To generate qualifiedgraduates who can be part professional organizations working in the fieldof conservation and environment protection.

Course Outcomes:

Skills obtained on successful completion of this paper

1. Students will have a basic understanding of wildlife and it's conservation in India.
2. Students will have basic idea about remote sensing and its application.
3. Students will be able to analyse and appraise wildlife threats
4. Students will able to apply scientific method in wildlife conservation issues.

MODULE-I: Ecological basis of wildlife management, concept of carrying capacity, home range and territory, Management of rangelands (Types of rangeland, Characteristics, Rangeland carrying capacity, Forests and wildlife corridors, rangeland conditions). Conservation Schemes: Project Tiger (Initiation, Finance, Objective, Management, Status, Threats), Gir Lion Sanctuary Project (Threats, Management, Work plan and achievements), Conservation of Sea Turtle in India.

MODULE-II: Introduction to Remote Sensing, Electromagnetic Spectrum, Radiation Laws (Plank's Law, Stefan Boltzman Law, Wien's Displacement Law), Types of Remote Sensors.

MODULE-III: Population genetics and conservation. Application of genetics for wildlife conservation; Genotyping; characterizing genetic difference between populations, importance of genetic diversity, Loss of genetic diversity, Resolving taxonomic uncertainties; Foundational population genetic concepts, population genetic information needed to manage threatened species, Genetic drift, Gene flow and the structuring of populations.

MODULE-IV: Environmental Impact Assessment (EIA): Aim, Types, Organizations Responsible, Contents, Prediction of changes and impacts (on air, water, soil, noise, biological, cultural and socio-economic environment), Factors. EIA in India, Components of EIA (Purpose, Screening and IEE, Scoping, Preparation of Terms of reference, EIA report, Assessment of methodologies, Review, Impact, Evaluation, Overall assessment).

SUGGESTED READINGS:

1. Introduction to Wildlife Management, by P.R.Krausman, Prentice Hall Pearson Educ. Inc. New Jersey.
2. Genetics: A Conceptual Approach by Benjamin A. Pierce
3. Wildlife Management, by R.H.Giles Jr. The wildlife scri.
4. Wildlife Ecology and Management, by W.L.Robinson & E.G.Bolen. Mc.Millan Publ. Comp. New York.
5. Managing Protected Areas in Tropics, by J.K. Mackinnon, Natraj Publ. Dehradun.
6. Environmental Impact Assessment and Management, Ed. By B.B. Hosetti and A. Kumar, Daya Publishing House, Delhi.

CHEMISTRY A
BASIC ANALYTICAL CHEMISTRY

Credit: 4

Total Marks: 100 (70+30)

Course Objectives:

1. To impart basic knowledge of Chemistry.
2. To train the students to pursue further education.
3. To be familiar with Chemical tools.
4. To gain experience with standard chemical tools.
5. To increase expertise of the course.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals Chemistry and key principles of it.
2. Awareness of the major issue at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.
4. Ability to design experiments and understand the limitations of the experimental approach.

MODULE-I: Introduction: Introduction to Analytical Chemistry and its interdisciplinary nature. Concept of sampling. Importance of accuracy, precision and sources of error in analytical measurements. Presentation of experimental data and results, from the point of view of Significant figures.

MODULE-II: Analysis of soil: Composition of soil, Concept of pH and pH measurement, Complexometric titrations, Chelation, Chelating agents, use of indicators. Determination of pH of soil samples. Estimation of Calcium and Magnesium ions as Calcium carbonate by complexometric titration.

Analysis of water: Definition of pure water, sources responsible for contaminating water, water sampling methods, water purification methods. Determination of pH, acidity and alkalinity of a water sample. Determination of dissolved oxygen (DO) of a water sample.

MODULE-III: Analysis of food products: Nutritional value of foods, idea about food processing and food preservationsand adulteration. Identification of adulterants in some common food items like coffee powder, asafoetida, chilli powder, turmeric powder, coriander powder and pulses, etc. Analysis of preservatives and colouring matter.

MODULE-IV: Chromatography: Definition, general introduction on principles of chromatography, paper chromatography, TLC etc.Paper chromatographic separation of mixture of metal ion (Fe^{3+} and Al^{3+}). To compare paint samples by TLC method.

Ion-exchange: Column, ion-exchange chromatography etc. Determination of ion exchange capacity of anion / cation exchange resin (using batch procedure if use of column is not feasible).

MODULE-V: Analysis of cosmetics: Major and minor constituents and their function. Analysis of deodorants and antiperspirants, Al, Zn, boric acid, chloride, sulphate. Determination of constituents of talcum powder: Magnesium oxide, Calcium oxide, Zincoxide and Calcium carbonate by complexometric titration.

SUGGESTED READINGS:

1. Willard, H. H. Instrumental Methods of Analysis, CBS Publishers.

a. Skoog & Lerry. Instrumental Methods of Analysis, Saunders College Publications, New York.
b. Skoog, D.A.; West, D.M. & Holler, F.J. Fundamentals of Analytical Chemistry 6th Ed., Saunders College Publishing, Fort Worth (1992).
c. Harris, D. C. Quantitative Chemical Analysis, W. H. Freeman.
d. Dean, J. A. Analytical Chemistry Notebook, McGraw Hill.
e. Day, R. A. & Underwood, A. L. Quantitative Analysis, Prentice Hall ofIndia.
f. Freifelder, D. Physical Biochemistry 2nd Ed., W.H. Freeman and Co., N.Y. USA(1982).
g. Cooper, T.G. The Tools of Biochemistry, John Wiley and Sons, N.Y. USA. 16 (1977).
h. Vogel, A. I. Vogel's Qualitative Inorganic Analysis 7th Ed., Prentice Hall.
i. Vogel, A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Prentice Hall.
j. Robinson, J.W. Undergraduate Instrumental Analysis 5th Ed., Marcel Dekker, Inc., New York(1995).

SOCIETY, CULTURE & HUMAN BEHAVIOUR

Credit: 2

Total Marks: 50 (35+15)

Course Objectives:

1. To explore the relationship between Society, Culture and Human Behaviour.
2. To analyse the impact of social norms, values and beliefs on individual and collective behaviour.
3. To examine the cultural diversity and its influence on social interactions and perceptions.

Course Outcomes:

Skills obtained on successful completion of this paper:

1. Students will be able to understand and demonstrate the interplay between society, culture and diversity.
2. To know about caste system, unemployment and poverty.
3. Critically assess theories and concept related to human behaviour.

MODULE-I

Indian Society and culture: Society and its types, Culture–Features, Characteristics and Diversity. Differences with Western Culture.

MODULE-II

Social Stratification: Caste System, Class System, Communities, Ethnic Groups, Weaker Section and Minorities, Constitutional Provisions for Scheduled Castes, Scheduled Tribes and other Backward Classes.

MODULE-III

Socio-Economic Problems: Poverty, Illiteracy, Unemployment, Housing, Child Labor, Migration, Occupational Diseases, Insurgency, Terrorism, Crime, Project Affected People, Social Destitute, Beggary, Aged Population, Juvenile Delinquency, Problems in Family Life.

MODULE-IV

Introduction to Human Behavior: Overview of human behavior, Importance of studying human behavior, determinants of human behavior.

SUGGESTED READINGS:

1. Schriver, J. M. (2010). Human Behavior and the Social Environment: Shifting Paradigms in Essential Knowledge for Social Work Practice. (5th ed.). Boston: Allyn and Bacon.

a. American Psychological Association. (2009). Publication manual of the American Psychological Association (6th ed.). Washington, DC:

b. Barker, Robert (Ed.). Social Work Dictionary. Washington, D. C.: National Association of Social Workers, Current edition or edition purchased for Introduction to Social Work.

COMPUTER APPLICATION

Credit: 2

Total Marks: 50 (35+15)

Course Objectives:

1. To impart basic knowledge of computer.
2. To be familiar with computer hardware and software.
3. To have experience of virtual world.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of Computer and key principles of it.

2. Awareness of its major application.
3. Ability to use Computer for biological applications or related problems.

MODULE-I

Computer basics (history, generation, components, I/O devices, memory of computer), Introduction to computer network (LAN, MAN, WAN), Network topologies.

MODULE-II

Internet and it's applications, Email, video conferencing, chatting, blogs, Usenet. Internet protocols (FTP,HTTP). Website, search engines. Advantages and threats in Internet communications.

MODULE-III

MS office, MS word (tools and menus, paragraph, alignment, font, editing). MS PowerPoint (tools and menus, creating slides, transition and custom animation). MS Excel (tools and menus, creating spreadsheet, use of function).

MODULE-IV

Database, Database management system (Introduction, types, functions and features). Introduction tocomputer graphics, color model, graphic file format.

MODULE-V

Use of computer in biological science, Introduction to bioinformatics, bioinformatics database,importance and use of bioinformatic.

SUGGESTED READINGS:

1. Chetan Shrivastava, Introduction to IT, Kalyani Publishers, Delhi.
2. Jaiswal, Fundamental of Computer IT Today, Wiley Dreamtech

PRESENTATION SKILLS

Credit:02 Total Marks:50 (35+15)

Course Objectives:

1. To let the students learn the importance of good presentation skills.
2. To make students understand the different dimensions of skilled presentation.
3. To inculcate the spirit of effective presentation in students and make them efficient enough.
4. To develop the skills of communication is a requirement for a good professional.

Course Outcomes:

1. Deal with nerves and think more positively about public speaking.
2. Consider ways of grabbing the listener's attention, holding their interest, and concluding strongly.
3. Use body language and tone of voice to enhance their presentations.
4. Use slides and visual aids effectively.
5. Deliver an enthusiastic and well-practiced presentation.

MODULE-I

Preparation of presentation – 1st part – what, how, for whom, structure, principles and presentation technique, business presentation specifications, Report Writing, Developing Effective Presentation Skills.

Oral Presentation: Principles of oral presentation, factors affecting presentation, sales presentation, training presentation, conducting surveys, speeches to motivate, effective presentation skills.

Slide Presentation: Craft your message, Make a visuals, Include proper Content of your presentation.

MODULE -II

Verbal communication – jawbreakers, argumentation, usable and unsuitable phrases Communication skills – listening, empathic reaction, how to question, stealing the show, opening door question Conflict situation solving, attack from the audience – communication skills as a work experience, vicious circle of attack and defense.

Nonverbal communication during presentation – how to manage stress, what to do with hands, legs, activating the audience with nonverbal communication, body language.

MODULE -III

Work with audience – ice-breaking, get them in the mood, work with emotions, visualization tools, nonstandard situations Improvisation and unprepared presentations Personal typology, professional typology, social aspect, man-woman view.

MODULE -IV

Feedback – appreciation and critique, Paradigm of human cooperation – why there could be problems to start the communication and what to do with it – Defense against manipulation, how to say NO, stress management, Image and etiquette.

SUGGESTED READINGS:

1. Effective Presentation Skills – Robert Dilts, Meta Publication

2. Business Communication Today - Bovee and Thill: Tata McGraw Hill,
3. Presentation Skills 2011

SEMESTER FIFTH

BOTANY V: PLANT PHYSIOLOGY AND BIOCHEMISTRY

Credit 3

Total Marks: 100 (70+30)

Course objectives:

1. To impart basic knowledge of Plant Physiology, Biochemistry & Biotechnology.
2. To train the students to pursue further education.
3. To be familiar with plant biology tools

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of Plant Physiology, Biochemistry & Biotechnology.
2. Awareness of the major issues at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.
4. Ability to design experiments and understand the limitations of the experimental approach

MODULE-I

Importance of water to plant life; physical properties of water; diffusion and osmosis; absorption, transport of water and transpiration; physiology of stomata. Mineral nutrition:Essential macro and micro-elements and their role; mineral uptake; deficiency and toxicity symptoms.

MODULE-II

Transport of organic substanc1es: Mechanism of phloem transport; sourcesink relationship; factors affecting translocation. Basic of enzymology: Discovery and nomenclature; characteristics of enzymes; concept of holoenzymeapoenzyme, coenzyme and cofactors; regulation of enzyme activity, mechanizm of action. Photosynthesis : Significance; historical aspects; photosynthetic pigments; action spectra and enhancement effects; concept of two photosystems; Z-scheme; photophosphorylation; Calvin cycle; C4 pathway; CAM plants; photorespiration.

MODULE-III

Respiration : ATP - the biological energy currency ; aerobic and anaerobic respiration; Kreb's cycle, electron transport mechanism (chemi-osmotic theory); redox potential; oxidative phosphorylation ; pentose phosphate pathway. Nitrogen and lipid metobolism : Biology of nitrogen fixation ;importance of nitrate reductase and its regulations; ammonium assimilation ; structure and function of lipids; fatty acid biosynthesis; Betaoxidation ; saturated and unsaturated fatty acids; storage andmobilization of fatty acids

MODULE-IV

Growth and development : Definitions; phases of growth and development; kinetics of growth, seed dormancy, seed germination and factors of their regulation; plant movements; the concept of photoperiodism; physiology of flowering; florigen concept; biological clocks; physiology of senescence, fruit ripening; plant hormones auxins, gibberellins, cytokinins, abscisic acid and ethylene, history of their discovery, biosynthesis and mechanism of action; photomorphogenesis; phytochromes and cryptochromes, their discovery, physiological role and mechanism of action.

ZOOLOGY V: CELL BIOLOGY AND HISTOLOGY

Credit 3

Total Marks: 100 (70+30)

Course Objectives:

1. To impart basic knowledge of Cell Biology & Genetics.
2. To train the students to pursue further education.
3. To be familiar with concepts of Cell Biology & Genetics.
4. To increase expertise of the course.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of Cell Biology & Genetics and key principles of it.
2. Awareness of the major issue at the forefront of the discipline.
3. Ability to dissect a problem in to its key features

MODULE-I

The cell envelope: Plasma membrane; bilayer lipid structure; functions; the cell wall. Ultra structure and function of nucleus: nuclear membrane; nucleolus and other organelles: Golgi bodies, ER, peroxisomes, Vacuoles.

MODULE-II

Chromosome organization: Morphology; centromere and telomere; chromosome alterations; deletions, duplications, translocations, inversions; variations in chromosome number aneuploidy, polyploidy; sex chromosomes. Cell division: Mitosis; meiosis.

MODULE-III

Concept of animal tissue. Cellular and extracellular components. Intercellular relationships: communication and coordination. Maintenance of tissue integrity. Classification of animal tissues.

MODULE-IV

Epithelial tissue. Differentiation of the surface of the epithelial cell. Cellular polarity and intercellular junctions. Basal lamina. Lining epitheliums: structural and physiological characteristics. Types of coating epithelia. Glandular epithelia: types of secretory cells. Classification and general properties of the exocrine glands. Integrative functions of the endocrine glands.

MODULE-V

Connective tissue. Extracellular matrix: fibers and fundamental substance. Fixed and free cells of connective tissue. Fibroblast and fibrogenesis. Mastocytes, plasmocytes, macrophages and mononuclear phagocytic system. Varieties of connective tissue. Epithelial- conjunctive relations.

CHEMISTRY V: ORGANIC & INORGANIC CHEMISTRY I

Credit 3
Total Marks: 100 (70+30)

MODULE-I Organic Compound of Nitrogen

Preparation of Nitroalkanes and Nitroarenes, Chemical properties of nitroalkanes.Mechanism of nucleophilic substitutions in nitroarenes, Reduction of nitroalkane in acidic, neutral, and alkaline medium. Picric acid

Amines: - Nomenclature, Structure and stereochemistry. Basicity, Structural feature effecting basicity of amines. separation of primary, secondary and tertiary ammines. Amine salt as phase transfer catalyst. Preparation of alkyl and aryl amines: - reduction of nitro compound, reductive amination of aldehydic and ketonic compounds. Gabriel Phthalimide reaction, Hoffimann Bromamide reaction. Physical and chemical properties of amine: electrophilic aromatic substitution in aryl amines, reaction of amines with nitrous acid, synthetic transformation of aryl diazonium salts, Azo-coupling reaction.

MODULE-II Spectroscopy: General introduction, electromagnetic radiation, region of spectrum, representation of spectral width and intensity of spectral transition.

(A) Rotational spectra of diatomic molecule as rigid rotor, selection rule, energy level, transition, spectra, Determination of bond length, Isotope effect, Qualitative description of non- rigid rotor.

(B) Vibrational Spectra: Fundamental vibrational bands and their symmetry. Diatomic molecule as harmonic oscillator. Selection rule, pure vibrational spectrum, Determination of force constant Anharmonic oscillator.

(C) Raman Spectra: introduction, concept of polarization, quantum theory, stoke and antistoke line, pure rotational and vibrational Raman spectra. Applications of Raman spectra.

MODULE-III

(A) Metal Ligand Bonding in Transition Metal Complex: postulate of CFT. Splitting of d orbitals in octahedral, tetrahedral complex, Spectro-chemical series, Calculation of CFSE, Factors affecting CFSE, Applications of CFSE, Jahn-Teller Distortion, Limitations of CFT.

(B) Thermodynaynic and Kinetic aspects of Metal Complexes: A brief introduction ofthermodynamic and kinetic stability of complex, Stepwise and overall stability constant.

(C) Magnetic properties: Types of magnetic behavior, Methods of determining magnetic susceptibility, Spin Only formula, L-S Coupling, Calculation of effective magnetic moment, Orbital contribution to magnetic moment.

MODULE-IV

(A) Organometallic Chemistry: Definition, nomenclature, and Classification of organometallic compounds. Preparation, properties, bonding and application of alkyls and aryls of Li, Al. A brief account of metal ethylenic metal complexes special reference to Zeisse's salt. Mononuclear carbonyls and nature of bonding in metal carbonyls. 18 electron rules (Effective Atomic Number Rule). Ziegler-Nata Catalyst for polymerization of alkene, Wilkinson Catalyst and Hydrogenation, Hydroformylation.

B) Bioinorganic Chemistry: Essentials and trace elements in biological system metalloporphyrins, with special reference to hemoglobin and myoglobin. Biological role of alkali and alkaline earth metals with special reference to $Na^{+}K^{+}$ Ca^{2+} and Mg^{+2} Nitrogen fixation.

SUGGESTED READINGS:

1. Svehla, G. (Ed.). (1978). A textbook of quantitative inorganic analysis (by A. I. Vogel). ELBS Publishers and Distributors. (Original work published 1968)
2. Henderson, W. A. (n.d.). Inorganic synthesis. Benjamin-Cummings Publishing Company.
3. Fernelius, W. G. (2009). Experimental inorganic chemistry (Adapted by R. K. Sharma & G. Panda). New Age International Publishers. (Original work published 1972)
4. Mendham, J., Donney, R. C., Barnes, J. D., & Thomas, M. (Eds.). (2000). Vogels textbook of quantitative chemical analysis (6th ed.). Pearson Education India. (Original work by A. I. Vogel)
5. Furniss, B. S., Hannaford, A.J, Smith, P. W. G. & Tatchell, A. R. (Eds.). (1989). vogel's textbookof practical organic chemistry (5th ed.). Longman Scientific & Technical. (Original work by A. I Vogel)

Online Resources:

- e-Resources / e-books and e-learning portals
- https://www.youtube.com/watch?v=s7pXbV9duml
- https://onlinelibrary.wilev.com/series/2146
- https://chem.libretexts.org/Ancill/ary Materials/Laboratory Experiments/Wet Lab Experi ments/General Chemistry Labs/Online Chemistry Lab Manual/Chem 11 Experiments/0 7%3A Gravimetric Analysis (Experiment)
- https://mas-iith.vlabs.ac.in/exp/beer-lambert-law/

LAB COURSE:
BOTANY V

Credit 1
Total Marks: 50 (35+15)

1. To study the permeability of plasma membrane using different concentrations of organic solvents.
2. To study the effect of temperature on permeability of plasma membrane.
3. To prepare the standard curve of protein and determine the protein content in unknown samples.
4. To study the enzyme activity of catalase and peroxidase as inflenced by pH and temperature.
5. Comparison of the rate of respiration of various plant parts.
6. Separation of chloroplast pigment by solvents method.
7. Determining the osmotic potential of vacuolar sap by plasmolytic method.
8. Determining the water potential of any tuber.

9. Separation of amino acids in a mixture by paper chromatography and their identification by comparison with standards.

10. Bioassay of auxin, cytokinin, GA. ABA and ethylene using appropriate plant material

LAB COURSE:
ZOOLOGY V

Credit 1
Total Marks: 50 (35+15)

1. Cytological Preparation- Onion root-tip "Squash Preparation" for mitosis/Grasshopper testis squash for meiosis.
2. Museum Specimen invertebrate
3. Slides

LAB COURSE: CHEMISTRY V

Credit 1
Total Marks: 50 (35+15)

1) To verify Beer-Lambert Law for $KMnO_4$/ $K_2Cr_2O_7$ and determine the Training/ concentration of the given solution of the substrate from absorbance measurement.
2) To Determine the strength of the given acid conductometrically using standard alkali solution.
3) Gravimetric estimation of Ba as $BaSO_4$ from given solution of $BaCl_2$.
4) Inorganic compound synthesis:
   i. Synthesis of sodium trioxalato ferrate (III) $Na_2[Fe(C_2O_4)_3]$ and determination of its composition by permangnometry.
   ii. Synthesis of Ni-dimethylglyoxime complex [Ni(dmg)2]
   iii. Synthesis of Tetraamine copper (II) sulphate $[Cu(NH_3)_4]SO_4$
   iv. Synthesis of Cis- and Trans-bisoxalateochromate (lII) ion.

SUGGESTED READINGS:

1. Chatwal, G. R., & Sharma, A. (n.d.). Instrumental methods of chemical analysis. Himalaya Publishing House.
2. Raj, G. (2009). Advanced Practical Inorganic Chemistry. Krishna Prakashan

BOTANY A1
NATURAL RESOURCE MANAGEMENT

Credit 4
Total Marks 100 (70+30)

MODULE-I

Introduction to Natural Resource Bases: Concept of resource, classification of natural resources. Factors influencing resource availability, distribution and uses.

Interrelationships among different types of natural resources. Concern on

Productivity issues. Ecological, social and economic dimension of resource management.

MODULE-II

Forest resources: forest vegetation, status and distribution, major forest types and their characteristics. Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people, forest management. Developing and developed world strategies for forestry.

Land resources: Land as a resource. Dry land, land use classification, land degradation, man induced landslides, soil erosion and desertification. Landscape impact analysis, wetland ecology & management. Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams- benefits and problems.

Water ecology and management. Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources.

Food resources: World food problems, changes caused by agriculture and over- grazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case-studies. Fish and other marine resources: Production, status, dependence on fish resource, unsustainable harvesting, issues and challenges for resource supply, new prospects.

MODULE-III

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. Resource Management Paradigms: Resource management the evolution and history of resource management paradigms. Resource conflicts: Resource extraction, access and control system. Approaches in Resource Management: Ecological approach; economic approach; ethnological approach; implications of the approaches; integrated resource management strategies. Poverty and implications in Resource Management in developing countries – Poverty in developing countries, causes and link with resources scarcity and poverty.

MODULE-IV

Management of Common International Resources: Ocean, climate, International fisheries and management commissions; Antarctica: the evolution of an international resource management regime.

BOTANY A2 (MICROBIOLOGY AND PHYCOLOGY)

Credit 4

Total Marks 100 (70+30)

Course Objectives:

1. To impart basic knowledge of microbiology.
2. To train the students to pursue further education.
3. To be familiar with microbiological tools
4. To increase expertise of the course.

Course Outcome:

skills that students obtain after completion of the course:

1. Understanding of the fundamentals microbes and key principles of it.
2. Awareness of the major issue at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.

MODULE-I

Introduction to Microbiology: Historical Background and Scope of Microbiology, Structure of Prokaryotic cells, Morphology and ultra-structure of Bacteria (Flagella, Pili, Cell-wall, spores and nuclear material) Sterilization techniques: Dry heat, wet heat, radiation, filtration and chemicals. Growth: Measurements, dry weight, colony count, packed cell volume, turbidometry.

MODULE-II

Classification of Bacteria: Basic principle and techniques used in bacterial classification. General classification and reproduction of bacteria Culture media: Types and preparation. Culture Technique: Isolation of pure culture (spread plate, streak, pour plate). Staining techniques. Different techniques for Isolation of Microbes.

MODULE-III

Microbial metabolism: Role of ATP in metabolism, aerobic and anaerobic respiration, Assimilation of ammonia, nitrate, molecule Nitrogen and sulphate, Fermentation. Microbial Ecology: Microbial flora of soil, Interaction among soil microorganisms.

MODULE-IV

General characters, classification and current trends in classification of algae, habitats, habit and thallus organization, reproduction and life cycle in algae, evolutionary trends in algae, economic importance algae.

MODULE-V

Comparative account of cell structure, thallus organization, reproduction and life cycle of Cyanophyta, Chlorophyta, Phaeophyta, Rhodophyta, Bacillariophyta.

ZOOLOGY A1 INSECT
VECTOR & DISEASE

Credit 4
Total Marks 100 (70+30)

COURSE OBJECTIVE:

- To equip the students about the insects that are vectors of plant pathogens.
- To explore various aspects of vector-plant pathogen interactions.
- To foster the ability of management of vectors for controlling diseases.

COURSE OUTCOME:

Skills obtained on successful completion of this paper
1.Understanding of the basics of vector and vector borne diseases.
2. Understand their biology, and the transmission of pathogens.
3. Effective vector control and disease prevention efforts.
4. Ability to dissect a problem in to its key features.

MODULE-I Introduction to Insects

General Features of Insects, Morphological features, Head – Eyes, Types of antennae, Mouth parts w.r.t. feeding habits Concept of Vectors: Brief introduction of Carrier and Vectors (mechanical and biological vector), Reservoirs, Host-vector relationship, Vectorial capacity, Adaptations as vectors, Host Specificity

Insects as Vectors: Classification of insects up to orders, detailed features of orders with insects as vectors – Diptera, Siphonaptera, Siphunculata, Hemiptera

MODULE-II Dipteran as Disease Vectors

Dipterans as important insect vectors – Mosquitoes, Sand fly, Houseflies; Study of mosquito-borne diseases – Malaria, Dengue, Chikungunya, Viral encephalitis, Filariasis; Control of mosquitoes Study of sand fly-borne diseases – Visceral Leishmaniasis, Cutaneous Leishmaniasis, Phlebotomus fever; Control of Sand fly Study of house fly as important mechanical vector, Myiasis, Control of house fly

MODULE-III: Siphonaptera as Disease Vectors

Fleas as important insect vectors; Host-specificity, Study of Flea-borne diseases Plague, Typhus fever; Control of fleas

MODULE-IV: Siphunculata as Disease Vectors

Human louse (Head, Body, and Pubic louse) as important insect vectors; Study of louse-borne diseases –Typhus fever, Relapsing fever, Trench fever, Vagabond's disease, Phthiriasis; Control of human louse

MODULE-V: Hempitera as Disease Vectors

Bugs as insect vectors; Blood-sucking bugs; Chagas disease, Bed bugs as mechanical vectors, Control, and prevention measures

Reference books:

- Imms, A.D. (1977). A General Text Book of Entomology. Chapman & Hall, UK
- Medical Entomology for Students" – Mike Service
- WHO Guidelines on Vector Control
- CDC Resources on Vector-Borne Diseases
- A General Text Book of Entomology. Chapman & Hall

ZOOLOGY A2
BIOCHEMISTRY

Credit 4
Total Marks 100 (70+30)

Course Objectives:

1. To impart basic knowledge of biochemistry.
2. To train the students to pursue further education.
3. Become familiar with biochemical tools.
4. Gain experience with standard molecular tools

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals Biochemistry and key principles of Biochemistry.
2. Awareness of the major issue at the forefront of the discipline.
3. Good quantitative skills such as the ability to accurately and reproducibly prepare reagents for experiments.
4. Ability to dissect a problem in to its key features.

Module I

Carbohydrates: General Properties, Types (Monosaccharide, Oligosaccharide and Polysaccharide) and Biological Importance. Monosaccharide: Structure, Occurrence, Reactions and Biological importance of Monosaccharide. Isomerism: Stereoisomerism and Optical isomerism, Ring Structure and Anomeric forms, Mutarotation. Derivatives: Derivatives of Monosaccharide, Di and Tri-saccharide. Important Polysaccharide: Glycogen, Starch and Cellulose.

Module II

Lipids: General Properties and Classification. Fatty acids: Nomenclature, Classification, Structure and Properties of Saturated and Unsaturated fatty acids. Essential Fatty Acids. Triacylglycerols: Properties and Characterization of Fats, Hydrolysis, Saponification value, Acid value, Rancidity of fats and Functions. Biological Significance of Glycerophospholipids, Sphingomyelins and Glycolipids.

Module III

Amino acids: Definition, Classification and Properties of Amino acids. Peptide bond: Definition, Structure, Solid phase Protein Synthesis in brief, C – terminal and N – terminal Amino acid determination. Protein: Structure, Types (Primary, Secondary, Tertiary and Quaternary) and Functions

Module IV

Nucleic Acids: Definition, Structure, Phosphodiester bond and Properties. Purine and Pyrimidine Bases: Structure and Types, Composition of DNA and RNA, Nucleosides and Nucleotides.

DNA double helix: Watson - Crick Model, Complementary base- pairings, Base staking, Chargaff's rule. Different forms of DNA structure (A, B & Z DNA), Major and Minor groove, Denaturation and Annealing of DNA RNA: Types of RNA, Secondary and Tertiary structure of t-RNA.

Module V

Porphyrin: General Properties, Structure of Nucleus and Classification. Metalloporphyrins: Structure of Haemoglobin, Myoglobin, Chlorophyll, Cyanocobalamin and their Biological Importance.

CHEMISTRY A1
SPECTROSCOPY I

Credit 4

Total Marks 100 (70+30)

Course Objectives:

1. To impart basic knowledge of Spectroscopy.
2. To train the students to pursue further education.
3. To be familiar with Spectroscopy tools.
4. To increase expertise of the course.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of spectroscopy and key principles of it.
2. Awareness of the major issue at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.

Module I

Unifying Principles: Electromagnetic radiation, interaction of electromagnetic radiation with matter absorption, emission, transmission, reflection, dispersion, polarization and scattering. Uncertainty relation & natural line width and natural broading, transition probability, results of the time dependent perturbation theory, transition moment, selection rules, intensity of spectral lines. Born-Oppenheimer approximation, rotational, vibration & electronic energy levels.

Microwave Spectroscopy: Classification of molecules, rigid rotor model, effect of isotopic substitution on the transition frequencies, non- rigid rotor, stark effect, nuclear & electron spin interaction and effectof external field. Applications.

Module II

Atomic Spectroscopy: Energies of atomic orbitals, vector representation of momenta and vector coupling spectra of hydrogen atom and alkali metal atoms.

Molecular Spectroscopy: Energy levels, molecular orbital, vibronic transitions, vibrational progressions and geometry of the excited states, Frank - Condon principle, electronic spectra of polyatomic molecules. Emission spectra, radiative and

non-radiative decay, internal conversion, and spectra of transition metal complexes, charge- transfers spectra, Electronic spectra and application.

Photoelectron Spectroscopy: Basic principles, photo- electric effect, ionization process, Koopmans theorem, Photoelectron spectra of simple molecules. ESCA, chemical information from ESCA. Auger electron spectroscopy –basic idea.

Module III

Infrared Spectroscopy: Review of linear harmonic oscillator, vibrational energies of diatomic molecules, Zero point energy, force constant and bond strengths, anharmonicity, Morse potential energy diagram. Vibration- rotational spectroscopy, P, Q, R, Branches. Breakdown of Oppenheimer approximation. Vibrations of polyatomic molecules. Selection rules, normal modes of vibration, group frequencies.overtones, hot bands, factors affecting the band and band positions intensities, far IRregion. Metal- ligand vibrations, normal co-ordinate analysis, Overtones, combinations and Fermi resonance. Finger print and group frequencies. Introduction to instrumentation and FT-IR.

Module IV

Photoacoustic Spectroscopy: Basic principles of photoacoustic spectroscopy (PAS), PAS-gasses and condensed system chemical and surface applications.

Raman Spectroscopy: Classical and quantum theories of Raman effect, Pure rotational, vibrational and vibrational - rotational Raman spectra, Selection rules, mutual exclusion principles. Resonance Raman Spectroscopy, coherent anti Stokes Raman spectroscopy (CARS).

Module V

Nuclear Magnetic Resonance Spectroscopy: Nuclear spin resonance, saturation, shielding of magnetic nuclei, chemical shifts and its measurements, factors influencing chemical shifts, de- shielding, spin-spin interactions, factors influencing coupling constant 'J" Classification (ABX, AMX, ABC, A2B2,etc). Spin decoupling basic ideas about instrument, Advantages of FT NMR use of NMR medicinal diagnostics, double resonance, NOE.

SUGGESTED READINGS:-

1. Modern Spectroscopy J. M. Hollas, John Willey.
2. Spectroscopy, H. Kaur, Pragati, Prakashan
3. Molecular Spectroscopy, Banwall.
4. Molecular Spectroscopy, P. S. Sindhu, New Age International.
5. NMR, NQR, EPR, and Mossbauer Spectroscopy in Inorganic Chemistry, R. B. Perish, EllisHorwood.
6. An Introduction to Spectroscopy, S. S. Kalra, Anusandhan Prakashan
7. Introduction to Photo electron spectroscopy by P K Ghosh,John Willey
8. Spectrosocpy by P S Kalsi

CHEMISTRY A2
CHEMICAL KINETIC & NUCLEAR CHEMISTRY

Credit 4
Total Marks 100 (70+30)

Course Objectives
1. To impart basic knowledge of Chemical Kinetic & Nuclear Chemistry.
2. To train the students to pursue further education.
3. To be familiar with tools of nuclear chemistry.

Course Outcome:
Skillsthat students obtain after completion of the course:
1. Understanding of the fundamentals of nuclear and solid state Chemistry and key principles ofit.
2. Awareness of the major issue at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.

UNIT I

Chemical Kinetics and Catalysis Chemical kinetics and its scope, rate of reaction, factors influencing, the rate of reactionconcentration, temperature, pressure, solvent, light, catalyst. Concentration dependence of rate, mathematical characteristics of simple chemical reactions-Zero order, first order, second order, pseudo order, half-life and mean life. Determination of the order of the reaction-differential method, method of integration, method of half-life period and Isolation method. Radioactive decay as a first order phenomenon.

UNIT II

Experimental methods of chemical kinetics: Conductometric, Potentiometer, Optical methods, Polarimetry, and Spectrophotometer. Theories of chemical, kinetics: Effect of temperature on rate of reaction, Arrhenius equation concept of activation energy. Simple collision theory based on hard sphere model, transition.

Module III:

Systematic of alpha, beta and gamma decays : Electronic structure of atom, Radio activity ,Decay, Alpha decay, energy curve, spectra of alpha particles, Giger-Nuttal law, theory of alpha decay, penetration of potential barrier, beta decay, range of energy relationship, beta spectrum, sergeants curve, Fermi theory of beta decay, matrix elements, allowed and forbidden transitions, curie plots, gamma decay, Nuclear energy levels,selection rule, isomeric transitions, Internal conversion, Auger effect.

Module IV:

RadiactiveEquiliberia – Types of Neclear reactions – Nuclear fision Nuclear Reactors – Atomic Power Project in India – Radiation hazards – Radiation desimetry – Nuclear fusion – Stellar Energy. Radio active Isotopes, Methods of separation of Isotopes Application of Radioactivity – Tracer Techniques – Neutron - Activation analysis – Isotope Dilution Analysis – Application of Radioisotopes in biological and industrial field

Suggested Readings:

1. Introduction of Solids L.V Azaroff , Tata McGraw Hill
2. Principles of the solid state H. V. Keer, Wiley Eastern (1993)
3. Selected topics in solid state physics Vol. 12, The growth of crystals from liquids –J. C. Brice, North Holland/American Elsevier (1973)
4. Defects and diffusion in solids. S. MrowecElseivier publ.(1960)

PISCICULTURE

Credit 2
Total Marks 50 (35+15)

Course Objectives:

1. Provide hands on training for the preparation of fish farms.
2. Give the students exposure to the experiences of experts and functioning fish farms.
3. Help the students to learn a means of self employment and income generation.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of Pisciculture.
2. Awareness of the major issues at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.
4. Ability to design experiments and understand the limitations of the experimental approach.

Module I

General Description of Fish, Classification of Fishes (Upto Classes), Classification of Fishes Based on Feeding Habits, Classification of Fishes Based on Habitat and Manner of Reproduction Types of Fish Fins and their Modifications, Locomotion in Fishes, Fish Hydrodynamics, Types of Fish Scales and Uses of Scales Gills and Gas Exchange in Fishes Swim Bladder, Types and Buoyancy in Fishes.

Module II

Osmoregulation in Fishes, Reproductive Strategies in Fishes, Electric Organs in Fishes, Bioluminescence in Fishes, Mechanoreceptors in Fishes Schooling, Parental Care and Migration in Fishes.

Module III

Inland Fisheries, Marine Fisheries, Environmental Factors influencing the Seasonal Variations in Fishes, Fishing Crafts and Gears Depletion of Fisheries Resources.

Module IV

Application of Remote Sensing and GIS in Fisheries, Fisheries Laws and Regulations, Sustainable Aquaculture, Induced Breeding of Fish, Management of Finfish Hatcheries Preparation and Maintenance of Fish Aquarium.

Module V

Preparation of Compound Diets for Fish and Role of Water Quality in Aquaculture, Fish Diseases, Preservation and Processing of Harvested Fish, Fishery By-Products, Transgenic Fish and Zebrafish as a Model Organism in Research

SEMESTER SIXTH
BOTANY VI: ECOLOGY & BIODIVERSITY

Credit 3
Total Marks 100 (70+30)

Course objectives:

1. To impart basic knowledge of Ecology and Utilization of Plants.
2. To train the students to pursue further education.
3. To be familiar with concepts of Ecology and Utilization of Plants.

Course Outcome:

Skills that students obtain after completion of the course:
1. Understanding of the fundamentals of Ecology and Utilization of Plants.
2. Awareness of the major issues at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.
4. Ability to design experiments and understand the limitations ofthe experimentalapproach.

UNIT-I

PLANTS AND ENVIRONMENT : Atmosphere (gaseous composition), water (properties of water cycle), light (global radiation, photosynthetically active radiation), temperature, soil (development, soil profiles, physico-chemical properties), and biota. Morphological, anatomical and physiological responses of plants to water (hydrophytes and xerophytes), temperature (thermoperiodicity), light (photoperiodism, heliophytesandsciophytes) and salinity.

UNIT-II

COMMUNITY ECOLOGY: Community characteristics, frequency, density, cover,life forms biological spectrum ; ecological succession. Ecosystems : Structure, abiotic and biotic components ; food chain, food web, ecological pyramids, energy flow ; biogeochemical cycles of carbon, nitrogen and phosphorus.

UNIT-III

POPULATION ECOLOGY: Growth curves; ecotypes; Ecads. Biogeographical regions ofIndia. Vegetation types of India : Forests and grasslands.

UNIT IV

BIOLOGICAL DIVERSITY :- Concepts and levels, status in India, Utilization and concerns, role of biodiversity in ecosystem functions and stability, speciation and extinction, IUCN categories of threat, distribution and global patterns, terrestrial biodiversity hot spots, inventory.

UNIT V

CONSERVATION STRATEGIES:Principles of conservation, extinctions, environmental status of plants based on International union for conservation of Nature. In situ conservation, International efforts and Indian initiatives, protected areas in India sanctuaries, national parks, biosphere reserves, Wetlands, Mangroves and coral reefs for conservation of wild biodiversity. Ex situ conservation: Principles and practices, botanical gardens, field gene bank, seed banks, in vitro repositories, cryo banks.

REFERENCE BOOKS:

1. Smith, R.L. 1996. Ecology and field biology, Harper Collins, New York.
2. Odum, E.P. 1971. Fundamentalsof Ecology, Saunders, Philadelphia.
3.Paroda, R.S. and Arora R.K. 1991. Plant resources conservation and management, IPGRIP USA Campus, New Delhi.
4. Heywood, V.H. and Watson, R.T.1995. Global biodiversity assessment.
5. P.D. Sharma: Ecology

ZOOLOGY VI: DEVELOPMENT BIOLOGY

Credit 3

Total Marks 100 (70+30)

MODULE-I: Spermatogenesis, Oogenesis and vitellogenesis, Fertilization: Biological role

of fertilization, Cleavage: Characteristics and mechanism of cleavage, Formative movements: Fate maps.

MODULE-II: Organizer concept. Multiple ovulation and embryo transfer technology (IVF and IVET), super ovulation, embryo sexing and cloning.

MODULE-III: Potency, Commitment, Specification, and Determination, Primary embryonic induction, Regional specificity in induction; Differentiation of Vertebrate lens.

MODULE-IV: Metamorphosis- Hormonal control of metamorphosis in amphibians; Neuro endocrine control of insect metamorphosis; Biochemistry and mechanism of action of hormones during metamorphosis, Teratology-teratogenesis.

MODULE-V:
Regeneration: Epimorphic regeneration of reptile (salamander) limb; Morphollaxis regeneration in hydra; Programmed cell death: apoptosis, autophagy and necrosis.

SUGGESTED READINGS:
1. Developmental Biology- S.F. Gilbert
2. Reproduction in animals- Auston& Short
3. Embryology- N.J. Berril

CHEMISTRY VI: ORGANIC & PHYSICAL CHEMISTRY II

Credit 3

Total Marks 100 (70+30)

I Quantum Chemistry I: -Black body radiation, plank's radiation law, photoelectric effect, Compton effect, de-Broglie's idea of matter and waves and its experimental verification. Heisenberg's uncertainty principle, operators: Hamiltonian operator, angular momentum operator, Laplacian operator, postulates of quantum mechanics, Eigen values, Eigen function, Schrodinger time independent wave equation, physical significance of ψ andψ^2. Application of Schrodinger wave equation to Particle in one dimensional box. Quantum Chemistry I: - Quantum mechanical approach of molecular orbital theon, basic idea, criteria of forming Molecular orbitals, LCAO (Linear combination of atomic orbital) approximation, formation of Ha" ion, calculation of energy of energy levels from wave functions, bonding and antibonding wave functions, concept of sigma bonding sigma antibonding, pi bonding and pi anti-bonding M.Os. and their characteristic Comparison of M.O. theory and V.B. Model.
II (A)Carbohydrate: Introduction and classification of carbohydrate, monosaccharide. Open chain and cyclic structure of glucose and fructose, epimer and ionomers of glucose. Relative and absolute configuration of carbohydrates, Specific rotation and mutarotation of glucose. Determination of ring size in glucose. Chemical properties of glucose: Osazone formation, oxidation, reduction, Reaction with HIO., Interconversion or Glucose and fructose, Chain lengtheningand chain shortening. Structure of Disaccharide Sucrose, Lactose and Maltose, Structure of polysaccharide: Starch, Cellulose.
(B) Amino Acid & Protein: amino acid types of amino acid, isoelectric point, structure

of protein primary, secondary and tertiary structure.
(C) Nucleic Acid: components of nucleic acid, types of nucleic acid, nucleoside, nucleotide, structure of nucleic acid.

II (A)Organometallic compound:

Preparation, Structure, and chemical reactions of organomagnesium (Grignard Reagent). Organozinc compound, Organolithium compound, Organosulphur compound

(B) Synthesis of organic compound via enolates: Active methylene compound, Keto-enol tautomerism, Alkylation of diethyl malonate and açetoagetic ester. Claisen ester condensation and Robinson anealation. Synthesis of monoalkyl and dialkyl derivative, fatty acids, dibasic acid, a, β unsaturated acid, valeric acid, monoketone, diketone, heterocyclic compounds etc.

IV Spectroscopy II(Organic)

(A) Infra red Spectroscopy: Basic principle and instrumentation, introduction, Modes of vibrations, fundamental band of different bond and functional groups, identification of band for compound and IR spectra of different compounds. Applications of IR spectroscopy.

(B)Principle and instrumentation of UV-visible spectroscopy, Introduction, wavelength maxima, Beer Lambert's Law, Shifts in UV-visible spectra, Chromophore -Auxochrome theory, Effect of conjugation on wavelength maxima. Types of electronic transitions Applications of UV-visible spectroscopy. Woodward Fischer rule for polyenewavelength maxima calculation.

(C) NMR Nuclear Magnetic Resonance): Introduction to NMR, Basic principle and Instrumentation, No. of signal in PMR (proton Magnetic Resonance), Chemicalshift, Shielding and deshielding effect, Splitting of signal or spin-spin interaction, Intensity of Signal and peak height and peak ratio. Coupling Constant J. Proton NMR of some compound like ethanol, propanol, toluene, acetaldehyde, ketone,1,2-dibromoethylene etc.

LAB COURSE: BOTANY VI

Credit 1

Total Marks 50 (35+15)

1. To determine minimum number of quadrants required for reliable estimate of biomass in grasslands.
2. To study the frequency of herbaceous species in grassland and to compare the frequency distribution with Raunkair's Standard Frequency Diagram.
3. To estimate importance Value Index for grassland species on the basis of relative frequency, relative density and relative biomass in protected and grazed grassland.
4. To measure the vegetation cover of grassland through point frame method.
5. To determine diversity indices (richness, Simpson, Shannon-Wiener) in grazed and protected grassland.
6. To determine moisture content and water holding capacity of grassland and wood land soil.
7. To estimate transparency, pH and temperature of different water bodies.
8. To measure dissolved oxygen content in polluted and unpolluted water samples.
9. To estimate salinity of different water samples.

LAB COURSE: ZOOLOGY VI

Credit 1
Total Marks 50 (35+15)

1. Study of histological slides of gonads.

2. Alternative to dissection and display the reproductive system of vertebrates.
3. Study of embryological slides of frog and chick.
4. Study different cleavage patterns and formation of blastula and gastrula.

LAB COURSE: CHEMISTRY VI

Credit 1
Total Marks 50 (35+15)

1) To determine the solubility and solubility product of Sparingly soluble salt using Training/conductometer.
2) To titrate potentiometrically the given ferrous sulphate solution using $KMnO_4$ Contents $K_2Cr_2O_7$ as titrant and calculate redox potential of Fe^{2+} /Fe^{3+} system on the hydrogen of scale.

Organic mixture analysis

Separation and Identification of two solid organic compounds from given binary organic mixture by H_2O, $NaHCO_3$, NaOH for separation and preparation of suitable derivative.

Synthesis of one organic compound: -

a) Synthesis of m-dinitrobenzene from nitrobenzene.
b) Synthesis of acetanilide from aniline
c) Preparation of iodoform from ethanol and acetone
d) Preparation of p-bromoacetanilide
e) Preparation of 2,4,6-tribromophenol.

a. Preparation of methyl orange and methyl red.
b. Preparation of benzoic acid from toluene.
c. Preparation of aniline from nitrobenzene.

BOTANY A3
ANALYTICAL TOOLS & TECHNIQUES IN PLANT SCIENCES

Credit 4
Total Marks 100 (70+30)

MODULE-I IMAGING AND RELATED TECHNIQUES: Principles and application of microscopy; Light microscopy; Fluorescence microscopy; Confocal microscopy; Transmission and Scanning electron microscopy – sample preparation and staining techniques.

MODULE-II CELL FRACTIONATION AND RADIOISOTOPES: Introduction, Basic Principle of Sedimentation, components and different types of centrifuges -

Differential and density gradient centrifugation, analytical centrifugation, ultracentrifugation. Basic concept of radio isotope, GM and scintillation counter, autoradiography, Applications in biological science.

MODULE-III CHROMATOGRAPHY: Basic principle and biological applications. Paper chromatography; Column chromatography, TLC, GLC, HPTLC, Ion-exchange chromatography; Size exclusion chromatography; Affinity chromatography.

MODULE-IV: SPECTROPHOTOMETRY: Properties of Electromagnetic radiations; Beer Lambert's Law, Extinction Coefficient, Principle and Applications of UV-Visible light Spectroscopy. Atomic absorption and Flame emission spectroscopic techniques. Mass spectrometry: X-ray diffraction; X-ray crystallography; Principle & biological applications of IR & NMR.

MODULE-V: ELECTROPHORESIS: Characterization of proteins and nucleic acids; Electrophoresis: AGE, PAGE, SDS-PAGE. Immunoelectrophoresis, Isoelectrofocussing, Capillary Electrophoresis, Polymerase Chain Reaction, DNA sequencing.

SUGGESTED READINGS:

1. Ruzin, S.E. (1999). Plant Microtechnique and Microscopy, Oxford University Press, New York. U.S.A.
2. Willard, H.H., Merritt L.L. Dean J.A. and Settle F.A., "Instrumental Methods of Analysis", 7th Ed., Wadsworth Publishing Co., 1986.
3. Campbell, I.D. and Dwek, R. A., "Biological Spectroscopy", Benjamin Curmmings Publication Co. Inc., 1984.
4. Glasel, J. and Deutscher, M. B., "Introduction to Biophysical Methods for Protein and Nucleic acid Research", Academic Press, 1995.

ZOOLOGY A3
IMMUNOLOGY

Credit 4
Total Marks 100 (70+30)

Course Objectives:

1. To impart basic knowledge of Immunology.
2. To train the students to pursue further education.
3. To be familiar with Immunology tools.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of Immunology and key principles of it.
2. Awareness of the major issues at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.
4. Ability to design experiments and understand the limitations of the experimental approach.

Module I:

History and Development of Immunology. Types of Immunity. Cells, Tissues and Organs of

reactivity. Antibody- Structure, Types, Properties, Classification and their biological functions. Antigen-Antibody interaction. Clinical assays involving Antigen- Antibody interactions.

Module II:
Humoral mediated immune response – B cells; Response of B cells to antigens. Plasma cells, Memory cells. Cell- mediated immune response – T cell Receptors, Role of T helper cells and cytotoxic T cells; Function of MHC complex, Monoclonal antibodies – Production and Function.

Module III:
Antimicrobial drugs - synthetic antimicrobial drugs, naturally occur antimicrobial drugs: antibiotics, β lactum antibiotics, antibiotics from prokaryotes, antiviral drugs, antifungal drugs, antimicrobial drug resistance.

Module IV:
Immune system in Health disease, Immune response to infectious disease, Immune response in cancer, Pathophysiology of parasitic infection, Viral infections, Bacterial infection, Helminths infection, AIDS.

CHEMISTRY A3
ELECTRO CHEMISTRY & SURFACE CHEMISTRY

Credit 4
Total Marks 100 (70+30)

COURSE OBJECTIVE:
1. To impart in-depth knowledge of Electrochemistry.
2. To train the students to pursue further education.
3. To be familiar with Chemical tools.
4. To gain experience with standard chemical tools.
5. To increase expertise of the course.

COURSE OUTCOME:
Skills obtained on successful completion of this paper

- Electro kinetic phenomenon, electro- osmosis, streaming potential and sedimentation potential.
- The chemical basis of biological phenomenon, cellular structure and donnanmembrane equilibrium.
- The concept of physics and physical chemistry for the study of biological systems e.g. core conductor model, limiting current in semi conductors etc**.**

Unit I: Electrokinetic Effects, Electrokinetic potential/Zeta potentials, Determination of zeta potential, influence of ions on electrokinetic phenomena, Electro-Osmosis, Streaming potential, Sedimentation potential. Theoretical and quantitative treatment of electrokinetic phenomena, Electrophonetic Mobility and Bound hydrogen ion.

Unit II:
Threshold phenomena, Donnan Membrane Equilibrium, Membrane Potential, Application of DonnanMembrane Equilibrium, Hodges-Huxely Equation, Core conductor model. Quantum

Aspects of Charge transfer at electrode-solution interfaces, quantization of charge transfer tunneling. Semiconductor Interfaces: Theory of double layer semiconductor solution interfaces, Limiting current in semiconductor electrode.

Unit III:
Fuel Cells and Batteries Fuel cell and its theory, different types of fuel cell, Solid oxide fuel cells(SOFC), Polymer electrolyte fuel cell(PEM), Direct Electrolyte Fuel Cell(DAFC), Super Capacitors. Theory Measurements and importance. Theories of Batteries: Solid state batteries.

Unit IV:
General principles of semiconductivity and semiconductors, Temperature dependence of electrical resistances, Coherent Length, Piezoelectric effect, Piezoelectric and pyroelectric materials. Fullerenes-Doped conductors. Brief idea of Electrochemistry of molten electrolytes and non-aqueous solvents.

Unit V:
MACROMOLECULES: Polymer – Definition, types of polymers, electrically conducting, fire resistant, liquid crystal polymers, kinetics of polymerization, mechanism of polymerization. Molecular mass, average molecular mass, molecular mass determination (Osmometry, Viscometry, diffusion and light scattering methods), Sedimentation, chain configuration of macromolecules, calculation of average dimensions of various chain structures.

Reference books:

- ModernElectrochemistry,Vol.1&2,J.M.Bockrisand A.K.N Reddy.Plenum
- Introduction to electrochemistry, S.Glasston,VanNostrand.
- Electro-Analytical Chemistry,J.J. Lingane,WilleyInterscience.
- Polarography, D.R.Crow.J.V. Westwood, Methuen and Co. Principle of Polarography, J. Heyrovsky, P>Zuman and L. Kuta Solid state Electrochemistry, Haldil, Academis Press.

LEADERSHIP & PERSONALITY DEVELOPMENT

Credit 2

Total Marks 50 (30+15)

COURSE OBJECTIVE:

1. To help students in enhancing their self-awareness, interpersonal skills, and overall personal grooming
2. To foster personal growth and development by focusing on self-awareness, communication skills, emotional intelligence and goal setting
3. To explore various aspects of personality enhancement and leadership qualities for improving their confidence, firmness and relationships with others

COURSE OUTCOME:
Skills obtained on successful completion of this paper

1. To comprehend the role of confidence and self-esteem in personal development
2. To create a comprehensive action plan for personality enhancement and leadership development
3. To cultivate personality and leadership qualities in Diverse and Inclusive Environments

MODULE-I Leadership: Definition and meaning, Importance, Leadership and Management, Leader vs Manager, Essential qualities of an effective leader.

MODULE-II Theories of Leadership: Trait theory, Behavioral theories, Contingency theory.

MODULE-III Types of Leaders, Leadership styles: Traditional, Transactional, Transformational, Inspirational and servant leadership and Emerging issues in leadership: Emotional Intelligence and leadership, Trust as a factor, Gender and Leadership

MODULE-IV Personality: Concept and Definition, Determinants of personality, Personality traits, Personality characteristics in organizations: Self-evaluation, Locus of control, Self-efficacy, Self-esteem, Self-monitoring: Positive and negative Impact. Organizational Context of Leadership and Personality, Contemporary Business Leaders.

SUGGESTED READINGS:

1. Organisational Behaviour ,M.Parikh and R.Gupta , Tata McGraw Hill Education Private Limited.
2. Organisational Behavior, D. Nelson, J.C Quick and P. Khandelwal, Cengage Publication.

PROJECT WORK BOTANY BASED/ZOOLOGY BASED/CHEMISTRY BASED

Credit 4

Total Marks 100 (70+30)

Selection of organization/ institution / industries for project

When selecting a research organization for your project work, prioritize access to relevant resources, a supportive and conductive research environment, and a strong faculty/mentor with expertise in your program area.

- Ensure the organization has access to the necessary data, equipment, and facilities for your researchproject.
- Relevant databases and online resources is crucial for literature reviews and research.
- Assess if the organization provides access to the software and tools required for data analysisand research tasks.
- Seek out organizations with faculty members whose research interests align with yourdissertation topic and who can provide guidance and mentorship.

- Look for opportunities to connect with other intern or students and attend conferences orworkshops within the organization.

Practical Considerations:
Evaluate the time commitment required for research and ensure it aligns with your project/dissertation timeline and other academic commitments.

TOPIC OF THE PROJECT: This should be explicitly mentioned at the beginning of the synopsis. Since the topic itself gives a peep into the project to be taken up, candidate is advised to beprudent on naming the project. This being the overall impression on the future work, the topic should corroborate the work.

OBJECTIVE AND SCOPE: This should give a clear and specified idea and image of the project. Objectiveshould be clearly written and justifying the title of project. What the project ends up to and in what way this is going to help the end user must be mentioned.

INTRODUCTION: The introduction establishes the framework for your research byoffering context, delineating your topic and scope, articulating your research questions oraims, andsuccinctly summarising the structure of your project/ dissertation.

REVIEW OF LITERATURE: In the context of a dissertation, a literature review is acomprehensive and critical summary of existing research and scholarly work relevant toyour project/ dissertation topic, demonstrating your understanding of the field andestablishing the contextfor your own research and at the closer of review research gapshould be clearly mentioned.

MATERIAL AND METHODS: In this section details how the research was conducted,including the specific materials, techniques, and procedures used, ensuring the study can bereplicated and evaluated by others.

RESULT AND DISCUSSION: The "Results" section presents the findings of your research objectively, it should present the findings of your research in a clear, concise, and unbiasedmanner including statistical data, tables, figures, or qualitative data summaries. "Discussion" section should include the meaning of the results, explaining what they mean and why theyaresignificant interprets the findings of results, placing them in context, and drawingconclusions and implications.

CONCLUSION: The write-up must end with the concluding remarks-briefly describing innovation in the approach for implementing the Project, main achievements and also anyother importantfeature that makes the system stand out from the rest.

The following suggested guidelines must be followed in preparing the Final project Report: Good quality white executive bond paper A4 size should be used for typing and duplication.Care should be taken to avoid smudging while duplicating the copies.

Page Specification: (Written paper and source code)

- Left margin - 3.0 cms
- Right margin- 2.0 cms
- Top margin 2.54 cms
- Bottom margin 2.54 cms
- Page numbers - All text pages should be numbered at the bottom center of the pages.

Normal Body Text: Font Size: 12, Times New Roman, Double Spacing, Justified. 6 pointabove and below para spacing
Paragraph Heading Font Size: 14, Times New Roman, Underlined, Left Aligned. 12 point above & below spacing.
Chapter Heading Font Size: 20, Times New Roman, Centre Aligned, 30 point above andbelow spacing.
Binding: The project report should be book binding (Spiral binding and other forms ofbindings are not permitted)
Submission of Project Report to the MATS: The student will submit his/her project reportin the prescribed format. The Project Report should include:
1. One copy of the summary/abstract.
2. Two hard Copy of the Project Report.
3. Soft copy of project on CD in a thick envelope pasted inside of the back cover of the project report.
4. The Project Report may be about 75 pages.

FORMAT OF THE STUDENT PROJECT REPORT ON COMPLETION OF THEPROJECT

- Cover Page as per format
- Acknowledgement
- Certificate of the project guide as at Annexure III
- Certificate of the Company/Organization
- Synopsis of the Project
- Main Report
- Objective & Scope of the Project
- Theoretical Background Definition of Problem
- Methodology adopted,

Annexure:
1. List of abbreviations, Figures, Tables
2. References

Bibliography
Website
3. Soft copy of the project on CD

Formats of various certificates and formatting styles are as follows:
1) Certificate from the Guide

Guide Name &Designation
Full Address

CERTIFICATE

This is to certify that this project entitled "xxxxxx xxxxx xxxxx xxxx xxxx xxx" submitted for partial fulfillment of the degree of Bachelor of Science to the MATS, University Raipur,done by Mr. /Ms._____, Roll No._____is and is an authentic work carried out by him/her at_____ under my guidance.The matterembodied in this project work has not been submitted earlier for award of any degree or diploma to the best of my knowledge and belief.

Signature of the student Signature of the Guide

2) Project Report Cover Page Format:

Title of the thesis/report (Times New Roman, Italic, Font size = 24)

Submitted for the partial fulfilment for the award of the degree of Bachelor of Science (Bookman Old Style, 16 point, center)

Guided by:
(Guide Name)

Submitted by:
(Student's name)
Roll No.:

SUBMITTED TO MATS UNIVERSITY
LOGO

3) Declaration by the students

This is to certify that the dissertation/project report entitled" _____" is done by me is an authentic work carried out for the partial fulfilment of the requirements for the award of the degree of Bachelor of Science under the supervision of _____ _____. The content and matter embodied in this project work has not been submitted earlier for award of any degree or diploma to the best of my knowledge and belief.

Signature of the student
Name of the Student
Roll No.....

ACKNOWLEDGEMENTS

In the "Acknowledgements" page, the writer recognizes his indebtedness for guidance and assistance of the thesis adviser and other members of the faculty. Courtesy demands that also recognize specific contributions by other persons or institutions such as libraries and research foundations. Acknowledgements should be expressed simply, tastefully, and tactfully.

Project Seminar

Credit 2
Total Marks 50 (15+35)

Part of the scientific supervision carried out by the dissertation supervisor and is aimed at ensuring student autonomy in the writing of their dissertation. It allows students to evaluate their progress in their research and enables the supervisor to make comments and offer advice.

Viva Voce

Credit 2
Total Marks 50 (15+35)

In the context of a Project/ dissertation thesis, a 'viva voce" (often shortened to "viva") is a formal oral examination where a student defends their research before the examiner appointed by university. It's essentially the final assessment, determining if the student has met the requirements for their degree.

Duration of the Programme:

The minimum duration of the programme is 03 years and maximum duration is 06 years.

Medium of the Programme:

English is the medium and the examination may be written in English or Hindi as per the learner's choice of the medium.

Requirement of Faculty and Supporting Staff:

Supporting staff will be deputed at the learner supported Centre as per the need of course curriculum.

Category	Existing
Professor	00
Associate Professor	00
Assistant Professor	02

Instructional Delivery Mechanism and Usage of Media:

As the programme will offer in MATS Centre of Open and Distance Education mode, the there are various instructional delivery mechanisms and media will be used to effectively deliver content to the learners. The programme delivery mechanism used by MCDOE follows a multimedia approach for instructions, which are as follows:

- The printed self-learning material (SLM) which covers all the metrics of the programme will be deliver to the learners for every course.
- Learning Management System (LMS) is an online platform that provides a centralized location for students to access learning content, engage in discussions, submit assignments, and take assessments. The LMS provides a user-friendly interface that is accessible on multiple devices, such as desktops, laptops, tablets, and smartphones.
- Discussion forums can be used to facilitate group discussions, peer-to-peer learning, and to provide feedback and support. Online and face-to-face counselling will be provided by academic counsellors appointed for the programme.
- The counseling sessions are held as per schedule drawn by the MCDOE. These counselling sessions are held in non-working hours for the learners so they can attend the counselling session properly and regularly to enhance their learning skills.
- Programmes which have industrial training/practical/ project component are held at University's learners support centers and Attendance of the leaner in this part of the courses is compulsory. As per guidelines Project Work of the programme will be done by the learners and regarding this a complete guide will be deliver to the learner along with study material.
- The SLM will be dispatched periodically to the enrolled learners for each course of the programme. These SLM's will be very helpful to the learners in effective learning. The assignment for internal assessment of learner's shall be deliver to the learners along with the SLM. Online modules are also available in the University's website for some programme.
- The contact classes and counselling schedule will be of 30 days in a year which will be divided as 15 days in each semester. The schedule of contact classes of the programme shall be communicated to the student through the various medium.

Learner Support Services:

MATS Centre for Open and Distance Education has a fully-fledged Learner Support Services to provide guidance and help to its learners. All the necessary information has been provided to all the learner via various medium like website, helpdesk, email and by person-to-person interaction via teleconferencing and calling.

Learning Management System (LMS) to Support Course Delivery for ODL Mode:

The Learning Management System (LMS) is designed to facilitate the students to have a Global learning experience. LMS has user friendly interface approach through which the learning is made easy, interesting and meeting the global standards of learning. The audio-visual mode of teaching, the self-learning materials, discussion forums and evaluation patterns are unique and meeting the requirements of the industry and as per UGC guidelines of four quadrants approach.

The students can experience uninterrupted learning 24x7 through web and mobile at the pace chosen by them. The user interface will be simple and easy to navigate through the e-learning modules; the LMS will provide seamless accessibility with all the learning tools designed as per standard norms for an easy and interesting learning experience.

Nature of Contact Classes:

Based on the course material, the counsellors are expected to guide and talk with the learners during the contact class sessions. By talking with their coworkers and the counsellor during contact sessions, the learners can work through their problems and this will help them to understand the programme objectives to learn with ease. In addition to these contact sessions, learners must participate in various training programs run by the relevant learner support system provided by the University which also including practical training approach as per Programme's structure.

Counseling Session & Structure of Study in ODL Mode:

Delivery in ODL Mode:

Course Name	Credit	Total Hours of Study	SEM I: Counseling and Study Structure (Hours)			
			Face to Face Counseling	Self-Study	Practical	Assignments
Botany I: Introduction to Plant diversity	3	90	12	48	0	30
Zoology I: Diversity of Invertebrate	3	90	12	48	0	30
Chemistry I: Fundamental Chemistry I	3	90	12	48	0	30
Botany I Lab	1	30	4	0	18	8
Zoology I Lab	1	30	4	0	18	8
Chemistry I Lab	1	30	4	0	18	8
Nutrition for Health	4	120	20	60	0	40
Communication Skill	2	60	10	30	0	20
Instrumentation and System Biology	2	60	10	30	0	20
Yoga and Human Consciousness	2	60	10	30	0	20

Course Name	Credit	Total Hours of Study	SEM II: Counseling and Study Structure (Hourse)			
			Face to Face Counseling	Self Study	**Practical**	**Assignments**
Botany II: Cell Biology & Genetics	3	90	12	48	0	30
Zoology II: Vertebrates Physiology	3	90	12	48	0	30
Chemistry II: Fundamental Chemistry II	3	90	12	48	0	30
Botany II Lab	1	30	4	0	18	8
Zoology II Lab	1	30	4	0	18	8
Chemistry II Lab	1	30	4	0	18	8
Intellectual Property Rights	4	120	20	60	0	40
Science commuication Skills	2	60	10	30	0	20
Vermicomposting and Organic Farming	2	60	10	30	0	20
Environmental Studies & Disaster Management	2	60	10	30	0	20

Course Name	Credit	Total Hours of Study	SEM III: Counseling and Study Structure (Hourse)			
			Face to Face Counseling	Self Study	**Practical**	**Assignments**
Botany III: Diversity of Seed Plants & their Systematics	3	90	12	48	0	30
Zoology III: Anatomy & Physiology	3	90	12	48	0	30
Chemistry III: Inorganic & Physical Chemistry I	3	90	12	48	0	30
Botany III Lab	1	30	4	0	18	8
Zoology III Lab	1	30	4	0	18	8
Chemistry III Lab	1	30	4	0	18	8
Food Toxicology & Adulteration	4	120	20	60	0	40
Hindi	2	60	10	30	0	20
Computational Biology and Bioinformatics	2	60	10	30	0	20
Ayurvedic Biology	2	60	10	30	0	20

Course Name	Credit	Total Hours of Study	SEM IV: Counseling and Study Structure (Hourse)			
			Face to Face Counseling	Self Study	Practical	Assignments
Botany IV: Structure Development & Reproduction in Flowering Plants	3	90	12	52	0	36
Zoology IV: Chordates & Comparative Anatomy	3	90	12	52	0	36
Chemistry IV: Organic & Physical Chemistry I	3	90	12	52	0	36
Botany IV Lab	1	30	4	0	18	8
Zoology IV Lab	1	30	4	0	18	8
Chemistry IV Lab	1	30	4	0	18	8
Botany A (Plant Tissue Culture)/ Zoology A (Wild Life Conservation & Management)/ Chemistry A (Basic Analytical Chemistry)	4	120	20	60	0	40
Society, Culture, and Human Behaviour	2	60	10	25	0	25
Computer Application	2	60	10	25	0	25
Presentation Skills	2	60	10	25	0	25

Course Name	Credit	Total Hours of Study	SEM V: Counseling and Study Structure (Hours)			
			Face to Face Counseling	Self-Study	Practical	Assignments
Botany V: Plant Physiology and Biochemistry	3	90	12	52	0	36
Zoology V: Cell biology and Histology	3	90	12	52	0	36
Chemistry V: Organic and Inorganic- I	3	90	12	52	0	36
Botany V Lab	1	30	4	0	18	8
Zoology V Lab	1	30	4	0	18	8
Chemistry V Lab	1	30	4	0	18	8
Botany A1 (Natural Resource Management) Zoology A1 (Insect Vector & Disease) Chemistry A1 (Spectroscopy- I)	4	120	20	60	0	40
Botany A2 (Microbiology and Phycology) Zoology A2 (Biochemistry) Chemistry A2 (Chemical Kinetic & Nuclear Chemistry)	4	120	20	60	0	40
Pisciculture	2	60	10	30	0	20

Course Name	Credit	Total Hours of Study	SEM VI: Counseling and Study Structure (Hours)			
			Face to Face Counseling	Self-Study	Practical	Assignments
Botany VI: Ecology and Biodeversity	3	90	12	52	0	36
Zoology VI : Development biology	3	90	12	52	0	36
Chemistry VI: Organic and Physical Chemistry II	3	90	12	52	0	36
Botany VI Lab	1	30	4	0	18	8
Zoology VI Lab	1	30	4	0	18	8
Chemistry VI Lab	1	30	4	0	18	8
Botany A3 (Anlytical Tools & Techniques in Plant Sciences) Zoology A3 (Immunology) Chemistry A3 (Electrochemistry & Surface Chemistry)	4	120	20	60	0	40
Leadership & Personality Development	2	60	10	30	0	20
Project Work Botany Based/ Zoology Based/ Chemistry Based	4	120	20	60	0	40

F. Procedure for Admission, Curriculum Transaction and Evaluation:

The eligibility for the admission is passed in 10+2 examination or equivalent. Learners have the convenience of accessing all the information related to admission procedure and other information through the University's website or by contacting the helpdesk number. They can download the admission form from the university website and send it through either online or offline mode. Upon receipt, the University will scrutinize the documents and process the payment of fees. Once the fees are cleared, the admission will be confirmed, and an enrollment number will be issued to the learner.

- **Fee Structure:**

The fee structure of the program is as follows:

Programme	Semester Tuition Fees	Semester Examination Fees	Registration Fees (One Time)
B. Sc. Biology	10000	1500	1500

- **Examination and Evaluation System:**

Evaluation shall be based on continuous assessment, in which sessional work and the terminal examination shall contribute to the final grade. Sessional work shall consist of class tests, mid-semester examination(s), homework assignments, etc., as determined by the faculty in charge of the courses of study. Progress towards achievement of learning outcomes shall be assessed using the following: time-constrained examinations; closed-book and open-book tests; problem-based assignments; practical assignment laboratory reports; observation of practical skills; individual project reports (case-study reports); team project reports; oral presentations, including seminar presentation; viva voce interviews; computerized adaptive assessment, examination on demand, modular certifications, etc.

Each course shall correspond to an examination paper comprising of external and internal evaluations. The semester end theory examinations for Major, Minor, Open/Generic and DSC (Discipline specific Course) vocational, value added, SEC (Skill Enhancement Course) and AEC (Ability Enhancement Course) shall be of a duration as promulgated through the examination's regulations approved by the Academic Council of the University. The credit structure for theory/Practical/tutorial, internal, external examinations and total marks for an examination shall

be as per the programme structure approved by the Academic Council of the University as per UGC norms. Students shall acquire a minimum passing mark in internal and external examinations separately to be declared as pass in the respective courses, as prescribed by the Academic Council.

1. The academic performance of a candidate shall be evaluated in respect of
2. the courses of study prescribed for each semester through the evaluation. The evaluation of students admitted in the programme shall be based on:

End Semester Examinations - 70% marks of total marks and

Continuous Internal Assessment - 30% of total marks

3. The End Semester examinations shall be held as per the academic calendar notified by the University and the duration of end semester examination shall be of three or two hours.
4. The minimum percentage of marks to pass the programme in each semester shall be 40% in each course comprising of end semester examinations and continuous evaluation.
5. A programme shall have a specified number of credits in each semester. The number of credits along with grade points that the student has satisfactorily cleared shall measure the performance of the student.
6. Semester examination results shall have following categories:

Passed, i.e., those who have passed in all courses of the semester examination in internal and external examination separately.

Promoted (ATKT), i.e., those who have earned minimum 50% of credits in a particular year including both the semesters (even and odd) or those who have earned any number of credits in odd semester.

Detained, i.e., those who are not promoted as per the above provisions shall be detained. Such students have to appear in the examination of next academic session to earn required credits (excluding the credits already earned) as per the provisions of this ordinance and only then he/she may continue the programme within stipulated period as per the provisions of this ordinance.

7. However, a student of any semester who has been detained/ not appeared in examination due to less attendance/ not applied for examination/ applied but not appeared shall be out from the programme. Such a student has to take admission in the next session as an ex-student through the procedure adopted/notified by the University.

- **Continuous Internal Assessment:**

1. Continuous Internal Assessment shall be of 30% marks of total marks allotted for the course.
2. The components for continuous internal assessment for each course shall be decided by the Board of Studies of concerned subject.
3. Continuous Internal assessment shall be carried forward in case of ATKT students, there shall not be any provision of conducting internal assessment tests for ATKT students at any circumstances.

- **Evaluation and Certification of MOOCS and Vocational Courses:**

The guidelines of the University/SWAYAM portal/UGC shall be followed for evaluation and certification of MOOCs, Vocational Courses, Field Projects/ Internship/ Apprenticeship/ Community engagement and service/ Honours with Research Project.

- **Letter Grades and Grades Point:**

The Semester Grade Point Average (SGPA) is computed from the grades as a measure of the student's performance in a given semester. The SGPA is based on the grades of the current term, while the Cumulative GPA (CGPA) is based on the grades in all courses taken after joining the programme of study.

The University may also mention marks obtained in each course and a weighted average of marks based on marks obtained in all the semesters taken together for the benefit of students.

Grading System

Letter Grade	Grade Points	Description	Range of Marks (%)
O	10	Outstanding	>90 to <=100
A+	9	Excellent	>80 to <=90
A	8	Very Good	>70 to <=80
B+	7	Good	>60 to <=70
B	6	Above Average	>50 to <=60
C	5	Average	>40 to <=50
P	4	Pass	=40
F	0	Fail	<40
Ab	0	Absent	Absent

- **Computation of SGPA and CGPA:**

UGC recommends the following procedure to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

I. The SGPA is the ratio of the sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.

$$SGPA\ (Si) = \sum (Ci \times Gi) / \sum Ci$$

Where Ci is the number of credits of the ith course and Gi is the grade point scored by the learner in the ith course.

Example of Computation of SGPA

Semester	Course	Credit	Letter Grade	Grade point	(Credit x Grade)
1	Course 1	3	A	8	3 x 8 = 24
1	Course 1	4	B +	7	4 x 7 = 28
1	Course 1	3	B	6	3 x 6 = 18
1	Course 1	3	O	10	3 x 10 = 30
1	Course 1	3	C	5	3 x 5 = 15
1	Course 1	4	B	6	4 x 6 = 24
		20			139
SGPA					139/20=6.95

II. The Cumulative Grade Point Average (CGPA) is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.

$$CGPA = \sum(Ci \times Si) / \sum Ci$$

where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

Example of Computation of CGPA

Semester 1	Semester 2	Semester 3	Semester 4
Credit 20 SGPA 6.9	Credit 20 SGPA 7.8	Credit 20 SGPA 5.6	Credit 20 SGPA 6.0
CGPA= (20 x 6.9 + 20 x 7.8 + 20 x 5.6 + 20 x 6.0)/80 = 6.6			

The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts. On completing all requirements for the award of the undergraduate certificate/ diploma/ degree, the CGPA shall be calculated, and this value shall be indicated on the

certificate /diploma/degree. The 3-years (6 semester) and 4-years (8 semester) undergraduate degrees should also indicate the Division obtained as per following Table:

Distribution of Divisions

Division	**Criterion**
First division with distinction	The candidate has earned minimum number of credits for the award of the degree with CGPA of 7.5 or above
First division	The candidate has earned minimum number of credits required for the award of the degree with CGPA of 6.0 above but less than 7.5
Second division	The candidate has earned minimum number of credits required for the award of the degree with CGPA of 4.5 or above but less than 6.0
Third Division	The candidate has earned minimum number of credits required for the award of the degree with CGPA of 4.00 or above but less than 4.5

Note: The conversion of CGPA into percentage shall be as followed to facilitate its application in other academic matters.

Equivalent Percentage = CGPA×10. The percentage shall be rounded off up to the second decimal point.

The candidate shall be awarded a certificate/diploma/degree when he/she successfully earns the minimum required credits for the certificate/diploma/degree.

- **Issue of Transcript:**

Based on the recommendations on Letter grades, grade points and SGPA and CGPA, the university shall issue the transcript for each semester and a consolidated transcript indicating the performance in all semesters.

- **Credit Transfer:**

1. The credit transfer shall be implemented as per the policy of the University framed in accordance with the guidelines issued by the UGC from time to time.
2. The member institutions of the Academic Bank of Credit established vide University Grants Commission (Establishment and Operation of Academic Bank of Credits in Higher Education) Regulations 2021 shall accept and transfer the credits as per the

provisions of this regulation as amended from time to time.

3. Except for the cases of provisional promotions, the university shall facilitate credit transfer of students between them however, the student may be required to fulfil some eligibility criteria, drawing parity for a course, framed by the University in which the student seeks admission.

G. Requirement of the Laboratory Support and Library Resource:

In open and distance learning Bachelor of Science (B.Sc. General) (Combination of 3 subjects) programme,laboratory support will be provided through various means such as virtual labs, cloud-basedlabs, or remote access to physical labs.Simulations and virtual labs will be used to providestudents with a virtual environment in which they can perform practical tasks. In some cases, it may be possible to provide students with remote access to physical labs. Moreover, Instructors will record practicaldemonstrations and provide students with access to these videos. Students can watch thesevideos and practice the tasks on their own computers. Instructors will use video conferencingtools to demonstrate practical tasks and answer students' questions.

H. Cost Estimates of the Programme and the Provision:

This programme was already designed and developed in the conventional mode. In this process of overall development according to the current scenario, the cost estimate of all the metrics, components, equipment, advanced lab & maintenance cost for this programme comes to amount of Rs. 2957600 and provision is made of Rs. 300000.

I. Quality Assurance Mechanism and Expected Programme Outcomes:

The programme structure of open and distance learning Bachelor of Science (B.Sc. General) (Combination of 3subjects) programme is developed under theguidance of the expert committee and Board ofStudies and Faculty Board. It is developed as per theguideline of statutory bodies. It is approvedby Board of Studies, Faculty Board and AcademicCouncil of the University. Every year thecurriculum of the course will be reviewed as per the needof forwarded to the Board of Studies,Faculty Board and Academic Council with suggestions. Thechanges in the course curriculum asper the needs and requirements from time to time. TheUniversity will help the passed-outstudents in their placement in different industries through thetraining and placement cell.

Expected Outcome of the Programme:

- Students will be able to gain fundamental knowledge of sciences
- Students will be able to demonstrate and apply the principles of biological sciences
- Graduate holders will have ability to analyze and derive valid conclusions with fundamental knowledge in their respective subjects.
- Graduate holders upon the needs of environment and society, will be able to fulfill the same in the form of solutions within the safety limit of prevalent rules and guidelines
- Graduate will have ability to design, conduct experiments, analyze and interpret data for investigating problems in their respective fields
- Graduate will have ability to select and apply appropriate tools and techniques.
- Graduate will have knowledge for assessing societal, health, safety and legal aspects and the duties as responsible citizen of country.

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