SURESH GYAN VIHAR UNIVERSITY

Accredited 'A' Grade by NAAC

SCHOOL OF APPLIED SCIENCES

SYLLABUS

I, II& III Year

B. Sc.
(Chemistry, Botany and Zoology)

SEMESTER SYSTEM

(Session 2018-19)

Program Aims and Objectives:

The B.Sc. program of Suresh Gyan Vihar University, Jaipur is designed keeping in view the latest trends in the field of Chemistry, Botany & Zoology. The students are given an overview of the various subjects of all the three disciplines during the tenure of their program. The various papers that are put to study during the program include study of plants, animals and physical, organic and inorganic chemistry in details. Therefore after completion of the biology program, the students are well versed with the entire area of all the three disciplines and their application in the current scenario.

Undergraduate Programmes:

Undergraduates majoring in Biological Sciences will develop a broad base of general knowledge, focused primarily in the biological sciences, and capped with in-depth knowledge specific to their particular major program.
Biological Sciences majors will also obtain broad knowledge in mathematics, Biological sciences, and natural sciences, coupled with analytical, oral and compositional skills, to promote good citizenship and the capacity for life-long learning.
Our students are expected to demonstrate a breadth of knowledge across the sub-disciplines that comprise Biological Sciences. The curriculum for biology majors meets the needs of students with three post-graduation ambitions: graduate school, professional school, or work in industry or government without further training.

Learning Objectives:

As Biological Sciences is an integrative discipline, students are required to demonstrate appropriate proficiency in Chemistry, Mathematics and Physics in order to apply this knowledge to the study of Biology (Botany/Zoology).
Students will acquire a breadth of knowledge in Biology (genetics, physiology, anatomy, ecology, evolution, cell- or biochemistry, and microbiology).
Students will acquire a broad knowledge in mathematics, biological sciences, and natural sciences, coupled with analytical, oral and compositional skills, to promote good citizenship and the capacity for life-long learning.
Students will develop and apply oral and written skills, problem-solving skills in developing experimental design and analysis, and participate in individualized hands-on field and laboratory exercises.
Students will be prepared with a sufficient depth of knowledge in their specific major program to assure their admission to graduate or professional school or be prepared for entry-level employment.
The study of biology can have a multitude of aims and objectives. Largely, it is studied to allow a person to enter a specific field of employment. Other aims for studying biology are intellectual, ethical and pragmatic: to increase knowledge about all aspects of organisms, to encourage greater benevolence in the relationship between humans and the natural environment and to implement biological factors into various technologies or management techniques.

Understanding Living Systems and Critical Thinking:

The study of biology aims to increase understanding of living systems and to allow you to consider the systems in relationship to the self and other organisms in the natural environment. The goal is to be able to test theories developed about living things by utilizing the scientific method and then to apply the new information in a beneficial way.
Field Biology, Health Care and Education
Biology has many applications, both in the natural environment and the environment of health and education. Studying biology allows health care workers to understand the living systems of the body and to apply the knowledge in direct ways to recover and maintain the physical health of both animal and human patients. Educators rely on biology to teach the study of life to future generations. Field biologists use biology to understand relationship between living organisms and to notice what's beneficial and what is imbalanced and dangerous

SURESH GYAN VIHAR UNIVERSITY
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Teaching and Examination Scheme
To commence from the Academic year: 2018-19
Department: School of Applied Sciences **Program: B.Sc. : Semester: I**

S.No.	Course Code	Course Name	Type of Course Core/Elective	Credit	Contact Hrs/Wk.			Exam Hours	Weightage (in%)	
					L	T	P		CIE	ESE
1.	EN 103	**English Language 1**	University Core	2	2	0	0	3	40	60
2.	PC 101	**Proficiency in co-curricular activities**	University Core	2	0	0	0	0	100	0
3.	CP 101	**Elementary Computer**	University Core	3	3	0	0	3	40	60
4.	FD102	**Foundation Course-I**	University Core	1	1	0	0	3	25	75
5.	ES 101	**Environmental Studies**	University Core	2	2	0	0	3	40	60
6.	BY 111	**Botany-I Biodiversity (Microbes, Algae, Fungi and Archegoniatae)**	Program Core	4	4	0	0	3	40	60
7.	BY 161	**Botany-I Biodiversity (Microbes, Algae, Fungi and Archegoniatae) Lab**	Program Core	1	0	0	2	3	60	40
8.	CY 111	**Fundamental of Chemistry-I**	Program Core	4	3	1	0	3	40	60
9.	CY 161	**Fundamental of Chemistry-I Lab**	Program Core	1	0	0	2	3	60	40
10.	ZY 111	**Zoology-I Systematics and Animal Diversity**	Program Core	4	4	0	0	3	40	60
11.	ZY 161	**Zoology-I Animal Diversity Lab**	Program Core	1	0	0	2	3	60	40

L – Lecture
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ESE – End Semester Examination

Signature of Concerned Teacher

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SURESH GYAN VIHAR UNIVERSITY
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Teaching and Examination Scheme
To commence from the Academic year: 2018-19
Department: School of Applied Sciences **Program: B.Sc. : Semester: II**

S.No.	Course Code	Course Name	Type of Course Core/Elective	Credit	Contact Hrs/Wk.			Exam Hours	Weightage (in%)	
					L	T	P		CIE	ESE
1.	EM 101	Employability Skills	University Core	1	0	0	2	3	60	40
2.	PC 102	Proficiency in co-curricular activities	University Core	2	0	0	0	0	100	00
3.	HUM 102	Human Value s & Ethics	University Core	1	1	0	0	3	40	60
4.	FD104	Foundation Course-I	University Core	1	1	0	0	3	25	75
5.	EN 104	English language II	University Core	3	3	0	0	3	40	60
6.	BY-112	Botany-II Plant Anatomy and Embryology	Program Core	4	4	0	0	3	40	60
7.	BY 162	Botany-II Plant Anatomy and Embryology Lab	Program Core	1	0	0	2	3	60	40
8.	CY-112	Fundamentals of Chemistry II	Program Core	4	3	1	0	3	40	60
9.	CY 162	Fundamentals of Chemistry II Lab	Program Core	1	0	0	2	3	60	40
10.	ZY-112	Zoology-II Animal Physiology and Biochemistry	Program Core	4	4	0	0	3	40	60
11.	ZY 162	Zoology-II Physiology and Biochemistry Lab	Program Core	1	0	0	2	3	60	40

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Teaching and Examination Scheme
To commence from the Academic year: 2018-19

Department: School of Applied Sciences **Program: B.Sc.: Semester: III**

S. No.	Course code	Course Name	Type of Course Core/Elective	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
					L	T/S	P		CE	ESE
1.	PCA	Proficiency in Co-curricular	**University Core**	2	0	0	0	0	100	0
2.	EM 203	Employability Skills	**University Core**	1	0	0	2	3	60	40
3.	BY 213	Botany III- Bryophyta and Pteridophyta	**Programme Core**	4	4	0	0	3	40	60
4.	CY-211	Chemistry –III (Inorganic-I)	**Programme Core**	4	3	1	0	3	40	60
5.	CY-213	Chemistry –IV (Organic-I)	**Programme Core**	4	3	1	0	3	40	60
6.	ZY 213	Zoology III- Genetics and Evolutionary Biology	**Programme Core**	4	4	0	0	3	40	60
7.	ZY 215	ZoologyIV-Endocrinology and Ethology	**Programme Core**	4	4	0	0	3	40	60
8.	BY 263	Botany III-Bryophyta and Pteridophyta Lab	**Programme Core**	2	0	0	3	3	60	40
9.	CY-261	Chemistry- III Lab	**Programme Core**	2	0	0	3	3	60	40
10.	ZY 263	Zoology III- Genetics and Evolutionary Biology Lab	**Programme Core**	2	0	0	3	3	60	40

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Teaching and Examination Scheme
To commence from the Academic year: 2018-19

Department: School of Applied Sciences **Program: B.Sc.: Semester: IV**

S. No.	Course code	Name of Course	Type of Course Core/Elective	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
					L	T/S	P		CE	ESE
1.	PCA	Proficiency in Co-curricular Activities	**University Core**	2	0	0	0	0	100	0
2.	EM 204	Employability Skills	**University Core**	1	0	0	2	3	60	40
3.	BY 214	Botany IV- Gymnosperm and Angiosperms	**Programme Core**	4	4	0	0	3	40	60
4.	BY 216	Botany V (Cell Biology and Genetics)	**Programme Core**	4	4	0	0	3	40	60
5.	CY-212	Chemistry- V (Physical-I)	**Programme Core**	4	3	1	0	3	40	60
6.	ZY 216	Zoology-V Comparative Anatomy and Developmental Biology of Vertebrate	**Programme Core**	4	4	0	0	3	40	60
7.	BY 264	Botany IV-(Gymnosperm and Angiosperms) Lab	**Programme Core**	2	0	0	3	3	60	40
8.	ZY264	Zoology-IV Comparative Anatomy and Developmental Biology of Vertebrate Lab	**Programme Core**	2	0	0	3	3	60	40
9.	CY-262	Chemistry -IV Lab	**Programme Core**	2	0	0	3	3	60	40
10.	ZY 264	Zoology IV-Endocrinology and Ethology Lab	**Programme Core**	2	0	0	3	3	60	40

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Teaching and Examination Scheme
To commence from the Academic year: 2018-19

Department: School of Applied Sciences **Program: B.Sc.: Semester: V**

S. No.	Course code	Course Name	Type of Course Core/Elective	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage(in%)	
					L	T/S	P		CIE	ESE
1.	PC 301	Proficiency in Co-curricular Activities- V	**University Core**	2	0	0	0	0	100	0
2.	EM 301	Employability Skills – IV	**University Core**	1	0	0	2	3	60	40
4.	BY-311	Botany VI (Analytical Techniques in Plant Sciences)	**Programme Core**	4	4	0	0	3	40	60
5.	CY-311	Chemistry –VI (Inorganic Chemistry-II)	**Programme Core**	4	4	0	0	3	40	60
6.	ZY 311	Zoology VI (Environmental Biology)	**Programme Core**	4	4	0	0	3	40	60
	ZY 313	Zoology VII (Microbiology)	**Programme Core**	4	4	0	0	3	40	60
8.	BY 363	Botany VI (Analytical Techniques in Plant Sciences) Lab	**Programme Core**	2	0	0	3	3	60	40
9.	ZY 361	Zoology V (Environmental Biology) Lab	**Programme Core**	2	0	0	3	3	60	40
10	CY 361	Chemistry –V Lab	**Programme Core**	2	0	0	3	3	60	40

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Teaching and Examination Scheme
To commence from the Academic year: 2018-19

Department: School of Applied Sciences **Program: B.Sc.: Semester: VI**

S. No.	Course code	Course Name	Type of Course Core/Elective	Credits	Contact Hrs/Wk.			Exam Hrs.	Weightage (in%)	
					L	T/S	P		CE	ESE
1.	BY 312	Botany VII- (Plant Physiology)	Programme Core	4	4	0	0	3	40	60
	BY 314	Botany VIII- (Biotechnology and Utilization of Plants)	Programme Core	4	4	0	0	3	40	60
2.	CY-312	Chemistry- VII (Physical & Misc Chemistry-II)	Programme Core	4	4	0	0	3	40	60
3.	CY-314	Chemistry- VIII (Organic Chemistry-II)	Programme Core	4	4	0	0	3	40	60
4.	ZY 312	Zoology VIII (Applied Zoology)	Programme Core	4	4	0	0	3	40	60
5.	BY 362	Botany VII- (Plant Physiology and Biochemistry) Lab	Programme Core	2	0	0	3	4	60	40
6.	CY-362	Chemistry- VI Lab	Programme Core	2	0	0	3	3	60	40
7.	ZY -362	Zoology VI-(Applied Zoology) Lab	Programme Core	2	0	0	3	4	60	40

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BY111	BOTANY-I BIODIVERSITY (MICROBES, ALGAE, FUNGI AND ARCHEGONIATAE) C (L, T, P) = 4 (4, 0, 0)
Version	**Ist**
Learning objective	The learning objectives of course are: To create an understanding regarding plant taxonomy, To gain knowledge about plant diversity and morphology of microbs, To have understanding about algae and fungi.
Salient features	The student will be able to conceptualize about identification and classification of microbs, Able to know economic importance of families of algae and fungi.
Utility	A degree in Biology allows health care workers to understand the living systems of the body and to apply the knowledge in direct ways to recover and maintain the physical health of both animal and human patients. Educators rely on biology to teach the study of life to future generations. Field biologists use biology to understand relationship between living organisms and to notice what's beneficial and what is imbalanced and dangerous
Unit-I	**Plant Taxonomy 7hr**
Plant Taxonomy. Principles of classification, nomenclature; comparative study of different classification systems, viz. Linnaeus, Bentham & Hooker, Engler & Prantl, Hutchinson, and Cronquist. Herbarium techniques and important Botanic Gardens.	
Unit- II	**Microbes 7hr**
Viruses- Discovery, general structure, replication (general account), DNA virus (T-phage) Lytic and lysogenic cycle, RNA virus (TMV); Economic iDJ.portance; Bacteria- Discovery, General characteristics and cell structure; Reproduction- vegetative, asexual and recombination (conjugation, transformation and transduction); Economic importance.	
Unit-III	**Algae 7hr**
General characteristics; Ecology and distribution; Range of thallus organization and reproduction; Classification of algae; Morphology and life-cycles of the following: Nostoc, Chlamydomonas, Oedogonium, Vaucheria, Fucus, Polysiphonia. Economic importance of algae	
Unit-IV	**Fungi 7hr**
Introduction- General characteristics , ecology and signiticance, range of thallus organization, cell wall composition , nutrition, reproduction and classification; True Fungi- General characteristics, ecology and significance, life cycle of Rhizopus (Zygomycota) Penicillium, Alternaria (Ascomycota), Puccinia, Agaricus (Basidiomycota); Symbiotic Associations-Lichens: General account, reproduction and significance; Mycorrhiza: ectomycorrhiza and enclomycorrhiza and their signiticance	
Unit-V	**Archegoniate 8hr**
Unifying features of archegonintes, Transition to land habit , Alternation of generations. General characteristics , adaptations to land habit , Classification, Range of thallus organization. general characteristics, classification, Early land plants (Cooksonia and Rhynia).	
Reference books	Eames, A. J. 1981. Morphology of Angiosperms .McGraw Hill, New York. Gifford, E.M. and Foster, A.S. 1989. Morphology and Evolution of Vascular Plants. W.H. Freeman, New York. Sporne, K.R. 1974. Morphology of Angiosperms. Hutchinson University Press, London.
Mode of Examination	Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT
Recommended By BOS on:	
Approved by academic council on:	

ZY111	ZOOLOGY I- SYSTEMATICS AND ANIMAL DIVERSITY C (L, T, P) = 4 (4, 0, 0)
Version	**Ist**
Learning objective	The learning objective of course are: To create an understanding regarding the multicellular animal, To gain knowledge about reproduction in non-chordates, To have understanding about hemichordate.
Salient features	The student will be able to conceptualize about concept of five kingdom, Able to analyze economic importance of chordates.
Utility	A degree in Biology allows health care workers to understand the living systems of the body and to apply the knowledge in direct ways to recover and maintain the physical health of both animal and human patients. Educators rely on biology to teach the study of life to future generations. Field biologists use biology to understand relationship between living organisms and to notice what's beneficial and what is imbalanced and dangerous
Unit-I	**Classification of multicellular animals** **8hr**
Criteria for classification of multicellular animals. Taxonomy and classification: General principles of taxonomy - Binomial nomenclature, -Trinomial nomenclature, Rules of nomenclature, Concept of Five kingdom, concept of protozoa, metazoan and levels of organization. Basis of Classification: symmetry, coelom, segmentation and embryology.	
Unit- II	**Non–Chordates** **8hr**
General characters and Outline Classification upto class, Economic importance:- Protozoans - Entamoebahistolytica. Poriferans - Skeleton and canal system of sponges.Coelenterates - Coral and coral reefs.Platyhelminths - Parasitic adaptations. Aschelminthes - Nematodiasis.	
Unit-III	**Non–Chordates** **7hr**
General characters and Outline Classification up to class, Economic importance:- Annelids –Vermiculture. Arthropods - Larval forms. Molluscs - Pearl culture. Echinoderms - Water vascular system	
Unit-IV	**Hemichordata** **7hr**
Classification (up to class) and Habit, habitat, distribution and General characters:- Protochordates: Urochordates, Cephalochordates**.** Cyclostomes	
Unit-V	**Chordates** **6hr**
General characters and Outline Classification up to order, Economic importance:- Fishes, Amphibian, Reptiles, Birds and Mammals.	
Reference books	1. R .L.Kotpal :Modern text book of biology – Invertebrate –(Rastogi Publication, Meerut). 2. Jordan, E. L. : Invertebrate Zoology (S. Chand Co. New Delhi.). 3. Dhami and Dhami : Invertebrate Zoology (S. Chand & Co. New Delhi). 4. Shrivastava, : Economic Zoology. (CommercialPub.brue,N.Delhi). 5. Vishwapremi K.K., : Economic Zoology (AkashdeepPub.House,New Delhi). 6. V.P.Agrawal and L. D.Chaturvedi: A text book of Invertebrate Zoology –(Jagmander Book Agency, New Delhi). 7. R.L.Kotpal :Modern text book of biology –Vertebrate –(Rastogi Publication, Meerut). 8. Young, J.Z. : Life of Vertebrate.(E L B S) 1983.Oxford. 9. Dalela, R.C. : A text book of Chordate Zoology, (Jai Prakash Nath publications, Meerut.). 10. Newman, H.H. : The phylum Chordate, (Satish Book Enterprise, Agra). 11. Jordon, E.L. :Vertebate Zoology, (S.Chand and Co., New Delhi.).
Mode of Examination	Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT
Recommended By BOS on:	
Approved by academic council on:	

BY112	BOTANY-II PLANT ANATOMY AND EMBRYOLOGY C (L, T, P) = 4 (4, 0, 0)
Version	**Ist**
Learning objective	The learning objectives of course are: To create an understanding regarding plant anatomy, To gain knowledge about plant diversity and anatomy of plants, To have understanding about medicinal plants and economic botany.
Salient features	The student will be able to conceptualize about identification and classification of plant, Able to understand Apomixis and polyembryony.
Utility	A degree in Biology allows health care workers to understand the living systems of the body and to apply the knowledge in direct ways to recover and maintain the physical health of both animal and human patients. Educators rely on biology to teach the study of life to future generations. Field biologists use biology to understand relationship between living organisms and to notice what's beneficial and what is imbalanced and dangerous
Unit-I	**Meristematic, permanent tissues and Organs** **7hr**
Root and shoot apical meristems; Simple and complex tissues**.** Structure of dicot and monocot root stem and leaf.	
Unit- II	**Secondary Growth, Adaptive and protective systems** **7hr**
Vascular cambium- structure and function, seasonal activity. Secondary growth in root and stem , Wood (heartwood and sapwood). Epidermis, cuticle, stomata; General account of adaptations in xerophytes and hydrophytes.	
Unit-III	**Structural organization of flower** **7hr**
Structure of anther and pollen; Structure and types of ovules ; Types of embryo sacs, organization and ultrastructure of mature embryo sac. Pollination mechanisms and adaptations; Double fertilization; Seed-structure appendages and dispersal mechanisms.	
Unit-IV	**Embryo and endosperm** **7hr**
Endosperm types, structure and functions; Dicot and monocot embryo; Embryo endosperm relationship.	
Unit-V	**Apomixis and polyembryony** **8hr**
Definition, types and practical applications, reproductive behaviour of the species, type of endosperm development, effect of pollination on embryo development, the effect of pollination on polyembryony.	
Reference books	1. Bhojwani, S.S. & Bhatnagar, S.P. (2011). Embryology of Angiosperms. Vikas Publication House Pvt. Ltd. New Delhi. 5th edition. 2. Mauseth, J.D. (1988). Plant Anatomy. The Benjamin/Cummings Publisher, USA.
Mode of Examination	Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT
Recommended By BOS on:	
Approved by academic council on:	

ZY 112	ZOOLOGY-II ANIMAL PHYSIOLOGY AND BIOCHEMISTRY C (L, T, P) = 4 (4, 0, 0)
Version	**Ist**
Learning objective	The learning objectives of course are: To create an understanding regarding the animal physiology, To gain knowledge about biomolecules, To have understanding about carbohydrate metabolism.
Salient features	The student will be able to conceptualize about protein and their use in biology, Able to analyse classification of proteins.
Utility	A degree in Biology allows health care workers to understand the living systems of the body and to apply the knowledge in direct ways to recover and maintain the physical health of both animal and human patients. Educators rely on biology to teach the study of life to future generations. Field biologists use biology to understand relationship between living organisms and to notice what's beneficial and what is imbalanced and dangerous.
Unit-I	**Introduction to cell** **7hr**
Introduction to cell: Morphology, size, shape and characteristics of Prokaryotic, Eukaryotic, Plant and animal cells; cell-theory. Cell membrane: Characteristics of cell membrane molecules, fluid mosaic model of Singer and Nicolson, concept of unit membrane. Cell membrane transport: Passive (diffusion and osmosis facilitated (mediated) and active transport.	
Unit- II	**Digestion, Respiration and Excretion** **7hr**
Physiology of digestion, Absorption of carbohydrates, proteins, lipids, Pulmonary ventilation, Respiratory volumes and capacities, Transport of Oxygen and carbon dioxide in blood, Structure of nephron, Mechanism of Urine formation, Counter-current Mechanism	
Unit-III	**Cardiovascular and Reproduction System** **7hr**
Composition of blood, Hemostasis, Structure of Heart, Origin and conduction of the cardiac impulse, Cardiac cycle, Physiology of male reproduction: hormonal control of spermatogenesis; Physiology of female reproduction: hormonal control of menstrual cycle.	
Unit-IV	**Protein, Lipids and Carbohydrates** **7hr**
Protein classification, Amino acids, zwitterion, Structure of Protein, Transamination, Deamination and Urea Cycle Carbohydrates and lipid Classification, Structure and physiochemical Properties of Monosaccharides, Oligosaccharides and polysaccharides, Lipids, Wax, Glycerol and Triacyl Glycerol, Glycolysis, Krebs Cycle, Pentosc phosphate pathway , Gluconeogenesis, Glycogen metabolism, electron transport chain, Biosynthesis and oxidation of lipid	
Unit-V	**Nerve and muscle** **8hr**
Structure of a neuron, Resting membrane potential, Graded potential, Origin of Action potential and its propagation in myelinated and non-myelinated nerve fibres, Ultra-structure of skeletal muscle, Molecular and chemical basis of muscle contraction	
Reference books	1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc. 2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia. 3. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA. 4. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009. The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco. 5. Nelson, D.L., Cox, M.M. (2004) Lehninger Principles of Biochemistry, 4th Edition, WH Freeman and Company, New York, USA
Mode of Examination	Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT
Recommended By BOS on:	
Approved by academic council on:	

CY111	Fundamentals of Chemistry-I
Prerequisite	All students are expected to have a general knowledge of organic and inorganic chemistry principles.
Learning objective	The learning objectives of course are: To create an understanding regarding the atomic structure, To gain knowledge about electron displacement effects, To have understanding about chemical reaction mechanisms.
Salient features	The student will be able to conceptualize about hybridization, Able to analyse physical effect in organic chemistry.
Utility	A degree in Biology and chemistry allows health care workers to understand the living systems of the body and to apply the knowledge in direct ways to recover and maintain the physical health of both animal and human patients.

Unit-I	**Atomic Structure**	**9hr**

Atomic Structure: Recapitulation of: Bohr's theory de-Broglie's relation, Heisenberg Uncertainty principle. Need of a new approach to Atomic structure. Time independent Schrodinger equation ($H\Psi = E\Psi$). Significance of Ψ and Ψ 2, Schrodinger equation for hydrogen atom. Transformation of Cartesian coordinates (x,y,z) into polar coordinates (r,θ,φ). Radial and angular parts of the hydrogen wave functions (atomic orbitals) and their variations for 1s, 2s, 2p, 3s, 3p and 3d orbitals. (Only graphical representation), Radial and angular nodes and their significance. Radial distribution functions (1s and 2s atomic orbitals). Significance of quantum numbers, orbital angular momentum and quantum numbers mr and ms. Shapes of s, p and d atomic orbitals, nodal planes. Discovery of spin, spin quantum number (s) and magnetic spin quantum number (ms). Electronic configurations of the atoms. Concept of exchange energy. Relative energies of atomic orbitals, Anomalous electronic configurations.

Unit- II	**Chemical Bonding and Molecular Structure**	**8hr**

Chemical Bonding and Molecular Structure, Ionic Bonding: Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Born-Lande equation for calculation of lattice energy, Born-Haber cycle and its applications, polarizing power and polarizability. Fajan's rules, bond moment, dipole moment and percentage ionic character. Covalent bonding: VB Approach: Concept of hybridization and VSEPR theory. Resonance and resonance energy: study of some inorganic and organic compounds. Molecular Orbital Approach: LCAO method, bonding and antibonding MOs and their characteristics for s-s, s-p and p-p combination of atomic orbitals, non- bonding combination of orbitals, MO treatment of homo-nuclear diatomic molecules of 1st and 2nd periods (including idea of s-p mixing) and hetero-nuclear diatomic molecules such as CO, NO and HF

Unit-III	**Fundamentals of Organic Chemistry**	**6hr**

Fundamentals of Organic Chemistry: Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis. Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions free radicals. Strength of organic acids and bases: Comparative study with emphasis on factors affecting pK values. Aromaticity: Benzenoids and Huckel's rule

Unit-IV	**Stereochemistry**	**6hr**

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

Unit-V	**Aliphatic Hydrocarbons: Alkane and Alkene**	**7hr**

Aliphatic Hydrocarbons-Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure. Alkanes: (Upto 5 Carbons) Preparation: Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, from Grignard reagent. Reactions: Free radical Substitution: Halogenation. Alkenes: (Upto 5 Carbons) Preparation: Elimination reactions: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction). Hoffmann rule, Reactions: cis-addition (alk. $KMnO_4$) and trans-addition (bromine).

Reference books	1. J. D. Lee: A new Concise Inorganic Chemistry, E L. B. S. 2. James E. Huheey, Ellen Keiter and Richard Keiter : Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Publication. 3. I. L. Finar : Organic Chemistry (Vol. I & II), E. L. B. S. 4. R. T. Morrison & R. N. Boyd : Organic Chemistry, Prentice Hall. 5. ArunBahl and B. S. Bahl : Advanced Organic Chemistry, S. Chand 6. Peter Sykes : A Guide Book to Mechanism in Organic Chemistry, Orient Longman.
Mode of Examination	Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT
Recommended By BOS on:	
Approved by academic council on:	

CY 112	Fundamentals of Chemistry - II
Prerequisite	All students are expected to have a general knowledge of organic, inorganic and physical chemistry.
Learning objective	The learning objective of course are: To create an understanding regarding the thermodyanamics, To gain knowledge about chemical equilibrium, To have understanding about ionic equilibrium, Able to analyse reaction mechanisms.
Salient features	The student will be able to conceptualize about nucleophilic substitution reaction, Able to analyse hydrolysis of salt.
Utility	A degree in Biology allows health care workers to understand the living systems of the body and to apply the knowledge in direct ways to recover and maintain the physical health of both animal and human patients.
Unit-I	**Chemical Thermodynamics** **8hr**
Chemical Thermodynamics: What is thermodynamics? State of a system, state variables, intensive and extensive variables, concept of heat and work, thermodynamic equilibrium, thermodynamic properties, various types of systems and processes. First Law of thermodynamics. Calculation of work (w), heat (q), changes in internal energy (ΔU) and enthalpy (ΔH) for expansion or compression of ideal gases under isothermal and adiabatic conditions for both reversible and irreversible processes. Calculation of w, q, ΔU and ΔH for processes involving changes in physical states. Important principles and definitions of thermo-chemistry. Concept of standard state and standard enthalpies of formations, integral and differential enthalpies of solution and dilution. Calculation of bond energy, bond dissociation energy and resonance energy from thermo-chemical data.	
Unit- II	**Chemical Equilibrium** **6hr**
Chemical Equilibrium: Free energy change in a chemical reaction. Thermodynamic derivation of the law of chemical equilibrium. Distinction between ΔG and ΔG^{o}, Le Chatelier's principle. Relationships between Kp, Kc and Kx for reactions involving ideal gases.	
Unit-III	**Ionic Equilibria** **7hr**
Ionic Equilibria: Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect, Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle.	
Unit-IV	**Aromatic hydrocarbons and, alkyl and aryl halides** **8hr**
Aromatic hydrocarbons: Preparation (Case benzene): from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid. Reactions: (Case benzene): Electrophilic substitution: nitration, halogenation and sulphonation. Friedel Craft's reaction (alkylation and acylation). (Upto 4 carbons on benzene). Side chain oxidation of alkyl benzenes (Upto 4 carbons on benzene). Alkyl and Aryl Halides Alkyl Halides (Upto 5 Carbons) Types of Nucleophilic Substitution (SN^2, SN^1 and SNi) reactions. Preparation: from alkenes and alcohols. Reactions: hydrolysis, nitrite & nitro formation, nitrile & iso-nitrile formation. Williamson's ether synthesis: Elimination vs substitution.	
Unit-V	**Alcohols, Phenols and Ethers** **7hr**
Alcohols, Phenols and Ethers (Upto 5 Carbons) Alcohols: Preparation: Preparation of 1, 2 and 3 alcohols: using Grignard reagent, Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acid and esters. Reactions: With sodium, HX (Lucas test), esterification, oxidation (with PCC, alk. $KMnO_4$, acid. dichromate, con. HNO_3). Oppeneauer oxidation Diols: (Upto 6 Carbons) oxidation of diols. Pinacol-Pinacolone rearrangement. Phenols: (Phenol case) Preparation: Cumene hydroperoxide method, from diazonium salts. Reactions: Electrophilic substitution: Nitration, halogenation and sulphonation. Reimer-Tiemann Reaction, Gattermann-Koch Reaction.	
Reference books	1 Barrow, G. M. Physical Chemistry Tata McGraw-Hill (2007). 2. Castellan, G. W. Physical Chemistry 4th Ed. Narosa (2004). 3. Mahan, B. H. University Chemistry 3rd Ed. Narosa (1998). 4. I. L. Finar : Organic Chemistry (Vol. I & II), E. L. B. S. 5. R. T. Morrison & R. N. Boyd : Organic Chemistry, Prentice Hall. 6. Arun Bahl and B. S. Bahl : Advanced Organic Chemistry, S. Chand 7. Peter Sykes : A Guide Book to Mechanism in Organic Chemistry, Orient Longman.
Mode of Examination	Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT
Recommended By BOS on:	
Approved by academic council on:	

BY 213	BOTANY III BRYOPHYTA AND PTERIDOPHYTA C (L, T, P) = 4 (4, 0, 0)
Version	**Ist**
Learning objective	The learning objectives of course are: To create an understanding regarding the Bryophytes, To gain knowledge about Pteridophyta.
Salient features	The student will be able to understand Bryophytes and Lichens, Able to understand economic importance of these lower plants and role of lichens as indicators of pollution.
Utility	A degree in biology opens doors to job opportunities in science, industry and environmental management, Conservation and Resource Management, and Biotechnology.
Unit-I	**Bryophyta: Introduction**
Bryophytes: General characters and classification Sporophytic generation, Gametophytic generation, alternation of generations, Affinities of Bryophyta with algae and Pteridophyta.	
Unit- II	**Bryophyta: Type Studies**
Structure, Reproduction , life cycle, systematic position and economic importance of Hepaticopsida: *Riccia*, *Marchantia* and *Porella*, Anthoceratopsida-*Anthoceros*, Polytrichum, Bryopsida-*Sphagnum, Funaria*.	
Unit-III	**Pteridophytes- Introduction**
The first vascular land plant, general characters of pteridophytes, types of steles, development of sporangia (eusporangiate and leptosporangiate), life cycle of pteridophytes (homosporus and heterosporus), Important characteristies of Psilopsida, Lycopsida, Sphenopsida, and Pteropsida, classification of Pteridophyta. Economic importance of Pteridophytes.	
Unit-IV	**Pteridophyta: Type Studies**
General characters and classification (Sporne's), Structure, reproduction, life cycle and systematic position of Rhynia, Lycopodium, Equisetum and Marsilea psilotopsida: psilotum, sphenopsida: equisetum, .Stelar evolution, heterospory and seed habit in Pteridophytes. Morphology, anatomy and reproduction of Lycopodium, Selaginella, Equisetum, Adiantum and Marsilea.	
Unit-V	**Lichens**
Lichens- General characters, Types of lichens: Crustose, Foliose and Fructicose, habitat, structure, reproduction, economic and ecological importance of lichens, indicators of environment	
Reference books	M. S. 1985. Cryptpogamic Botany. Vol. I and II second edition. Tata McGra Hill Publishing Co. Ltd., New Delhi. Manjula K. and Tyagi, Annuja (2015), Algae, Lichens and Bryophyta, B.Sc. Pt-I, Paper I, University of Rajasthan, CBH, Jaipur. E.V. 1971. The structure and life of Bryophytes. Hutchinson University Library, London K.R. 1967. The Morphology of Bryophytes. Hutchinson University Library, London. G.M. 1938. Crytogramic Botany Vol. II. Bryophytes and Pteridophytes. Mc Graw Hill Book Company, London. Parihar, N.S. 1965. An Introduction to Bryophyta. Central Book Depot, Allahabad. Vashishta, B. R., Sinha, A. K. and Kumar, A. 2011. Botany for degree students, Bryophyta. S. Chand and Co. New Delhi.
Mode of Examination	Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT
Recommended By BOS on:	
Approved by academic council on:	

ZY 213	ZOOLOGY III- GENETICS AND EVOLUTIONARY BIOLOGY C (L, T, P) = 4 (4, 0, 0)
Version	**Ist**
Learning objective	The learning objectives of course are: To create an understanding regarding Mendelian genetics, To gain knowledge about genetic disorder, To have understanding about molecular genetics, Able to understand environmental biotechnology.
Salient	The student will be able to conceptualize about sex determination, Able to understand evolution.
Utility	A degree in Biology opens doors to job opportunities in science, industry and environmental management, Conservation and Resource Management, Forest Rangers, tree genetics and biotechnology, forestry technicians and forestry workers.
Unit-I	**Mendelian Genetics**
Mendelian Genetics: - Mendel's laws of inheritance. Monohybrid and dihybrid cross. Dominance. Incomplete dominance. Current status of Mendelism. Genetic variation: Variation in chromosome number (Euploidy and Aneuploidy).	
Unit- II	**Genetic disorders in Human beings**
Genetic disorders in Human beings (Down's, Turner's, Klinefelter's and Edward's syndrome) Types of chromosomal mutations. Molecular basis of gene mutation, mutagens, crossing over and linkage.	
Unit-III	**Sex-determination**
Sex-determination XX-XY. XO-XY and WZ mechanisms. Sex-linked inheritance (X-and Y-linked) Color blindness. Haemophilia. Gene interactions. Supplementary, complementary, epistasis and inhibitory. Multiple allele-ABO, Rh and MN blood groups and their inheritance, polymorphic genes.	
Unit-IV	**Molecular genetics**
Molecular genetics: Nucleic acids, structure, function and type of DNA. Structure, function and types of RNA, genetic code. Transcription, protein synthesis. Gene structure (Recon. muton, cistron) and regulation of gene (lac operon: inducible and repressible system). Bacterial genetic transformation, Transduction and conjugation. Lytic and lysogenic cycle. Elementary idea about eugenics. Elementary idea about genetic engineeering. Gene cloning and recombinant DNA technology (Vectors for gene transfers. Plasmids and phages). Restriction enzymes.	
Unit-V	**Evolution**
Natural selection as a guiding force – Its attributes and action Basic characteristics of natural selection. Colouration, camouflage and mimicry, Co-adaptation and co-evolution, Man-made causes of change – Industrial melanism; brief mention of drug, pesticide, antibiotic and herbicide resistance in various organisms. Modes of selection, Polymorphism, Heterosis and Balanced lethal systems. Genetic Drift (Sewall Wright effect) as a stochastic/random force – Its attributes and action. Basic characteristics of drift; selection vs. drift, Bottleneck effect. Founder principle	
Reference books	1.Microbial genetics – Friedfelder 2. Principles of gene manipulation – Old and Primrose 3. Genes VII by Lewine 4. Microbiology –Pelczar 5Text book of Microbiology by Tortora 6. Microbiology by Brock
Mode of Examination	
Recommended By BOS on:	
Approved by academic council on:	

ZY 215	ZOOLOGY IV-ENDOCRINOLOGY AND ETHOLOGY C (L, T, P) = 4 (4, 0, 0)
Version	**Ist**
Learning objective	The learning objectives of course are: To create an understanding regarding the Endocrinology, To gain knowledge about hormone regulation, To have understanding about the ethology, Able to understand MRI and CT scan.
Salient features	The student will be able to conceptualize about structure and function of endocrine gland, Able to understand animal behavior.
Utility	A Graduate degree in Biology opens doors to job opportunities in science, industry and environmental management, Zoologist and biotechnology.
Unit-I	**Endocrinology** **8hr**
Introduction, basics and functions. Glands: Exocrine and endocrine; Secretions: Autocrine and paracrine. Hormones: Chemical nature and properties, role in homeostasis. Structure and functions of major endocrine glands: Pituitary, thyorid, parathyroid, adrenal gland, pancreas; their hormones, role and abnormalities due to hyposecretion and hypersecretion. Structure and functions of minor endocrine glands: Thymus, pineal, GIT, kidney, heart; endocrine glands in insects; their hormones and role.	
Unit- II	**Endocrinology** **7hr**
Control and regulation of secretion and molecular mechanism. Regulation of hormone secretion; positive and negative feedback control mechanism. Extra cellular and intracellular receptors. Second messengers: Cyclic AMP, PIP2, IP3, DG, G-protein, protein kinase and role of Ca++ as messenger; cell signalling; amplification of signal. Molecular mechanism of insulin action.	
Unit-III	**Endocrinology** **6hr**
Role in reproduction. Hormones from testis, ovary and placenta, their structure and functions. Importance of hormones in sexual differentiation in embryo. Hormonal control of menstrual cycle, implantation, pregnancy. Parturition and lactation. Different types of contraceptives, their composition and effects.	
Unit-IV	**Ethology** **7hr**
Introduction and basics. Introduction and history of behaviour, approaches and study of animal behaviour (ecological, physiological, evolutionary and neural methods) MRI and CAT scan. Genetic basic of animal behaviour and evolution of ethology.Biological clock; circadian and circannual rhythms.Learning and imprinting, instinct behaviour.	
Unit-V	**Ethology** **8hr**
Areas of behavior. Searching of food: Honey bee, rhesus monkey and langoor. Social behaviour and organization : Honey bee, termite, mammals (black-buck and monkeys).Communication, fights and alarm call : Vocal, visual, tactile, olfactory and acoustic; honey bee language; pheromonal and hormonal basis of aggression, brain hormone relation in sexual behaviour. Migration in fishes and birds. Orientation: Taxes and kinesis.	
Reference books	1. Barrington EJW -General & comparative 2. Endoctrinology-Oxford, Claredon Press 3. Williams R.H. -Text Book of Endocrinology-W.B. Saunders 4. Martin C. R. - Endocrine Physiology-Oxford University Press. 5. Darnell, J. Lodish H. and Baltimore D. Molecular CellBiology- -Scientific, American Book USA
Mode of Examination	
Recommended By BOS on:	
Approved by academic council on:	

BY 214	BOTANY IV- GYMNOSPERM AND ANGIOSPERMS C (L, T, P) = 4 (4, 0, 0)
Version	**Ist**
Learning objective	The learning objectives of course are: To create an understanding regarding diversity of Gymnosperms and their classification, structure and reproduction, To gain knowledge about economic importance of Gymnosperms and Angiosperms, To have understanding about fossil plants, their formation.
Salient features	The student will be able to conceptualize about characteristics of anatomy of Gymnosperms and Angiosperms.
Utility	A degree in Biology opens doors to job opportunities in science, industry and environmental management, Conservation and Resource Management, Forest Rangers, tree genetics and biotechnology, forestry technicians and forestry workers.
Unit-I	**Gymnosperm: Introduction** **7hr**
Gymnosperms: Important Characteristics, distribution, Classification up to classes, Anatomy, Life cycle patterns: Sporophyte: male and female cones, Gemetophyte, Male and female gametophytes, fertilization, embryo and seeds, Ecological and Economic importance of Gymnosperms, affinities of Gymnosperm with Pteridophytes and Angiosperm.	
Unit- II	**Gymnosperm: Type Studies** **8hr**
General characteristics of Cycadales, Coniferales and Ephadrales, Morphology, anatomy, reproduction and life cycle of *Cycas*, *Pinus* and *Ephedra*	
Unit-III	**Angiosperms Introduction** **7hr**
Classification as per Bentham and Hooker with economic importance, dicotyledons: Polypetalae: Menispermaceae, Meliaceae, Anacardiaceae, Umbelliferae. Gamopetalae: Sapotaceae, Verbenaceae, Asteraceae Apetalae: Urticaceae, Polygonaceae, Monocotyledons: Cannaceae.	
Unit-IV	**Anatomy** **7hr**
Anomalous secondary growth: Abnormal behavior of normal cambium Eg.Achyranthes and Mirabilis stem. Accessory cambium formation and its activity. Eg. Bougainvillea and Boerhaavia stem, Abnormal secondary growth in fleshy roots. Eg. Carrot, Raphanus and Beet root, Nodal Anatomy:- Unilacunar, Trilacunar, Multilacunar. Leaf Trace and Leaf Gaps, Branch trace and Branch gaps	
Unit-V	**Palaeobotany** **7hr**
Fossilization, Types of fossils, Techniques of fossil study, Geological time scale. Fossil Pteridophytes: General characters, structure and spore producing organs of *Rhynia*, reconstructed plants of *Lepidodendron* and *Calamites,* Fossil Gymnosperms: *Glossopteris* and *Williamsonia*	
Reference books	1. Smith G. N. 1955. Cryptogamic Botany Vol. II – Bryophyta and Pteridophyta. Tata Mc Graw Hill Publishing Co. Ltd. New Delhi. 2. Vashishta, P.C.1972 Botany for Degree Students, Vol IV- Vascular Cryptogams (Pteridophyta), S.Chand& Co. Pvt. Ltd. 3. Vashishta, P.C. 1976 Gymnosperms, S.Chand & Co. Pvt. Ltd. 4. Pandey, B.P.1997. A text book of Bryophyta, Pteridophyta and Gymnosperms. K.Nanth and Co., Meerut 5. P.C. Trivedi, Meena, P and Verma, L. Pteridophyta, Gymnosperm and Palaeobotany, RBD Publication House, Jaipur & New Delhi.
Mode of Examination	
Recommended By BOS on:	
Approved by academic council on:	

ZY 216	**ZOOLOGY-V COMPARATIVE ANATOMY AND DEVELOPMENTAL BIOLOGY OF VERTEBRATE** **C (L, T, P) = 4 (4, 0, 0)**
Version	**Ist**
Learning objective	The learning objectives of course are: To create an understanding regarding the comparative anatomy, To gain knowledge about developmental biology, To have understanding about the embryonic adaptation.
Salient features	The student will be able to conceptualize about cloning of animal, Able to understand biology of ageing.
Utility	A Graduate degree opens doors to job opportunities in science, industry and environmental management, Zoologist and biotechnology.
Unit-I	**Comparative Anatomy** **7hr**
Derivatives of integument w.r.t. gland s and digital tips, digestive glands, Sense Organs, Types of receptors. Comparative account of brain, Digestive, Urinogenital, circulatory, Skeletal, respiratory system.	
Unit- II	**Developmental Biology-Scope and Early Events** **6hr**
Developmental Biology-Scope and Early Events: Historical review and types and scope of embryology. Gametogenesis: Formation of egg and spemi. Vitellogenesis Fertilization: Activation of ovum, essence of activation: changes in the organization of the egg cytoplasm. Parthenogensis.	
Unit-III	**Developmental Biology-Pattern and Processes** **8hr**
Developmental Biology-Pattern and Processes: Cleavage: Definition, planes and patterns among non-chordates and chordates_ significance of cleavage. blastulation and morulation. Fate maps, morphogenetic cell movements, significance of gastrulation. Embryonic induction; primary organizer, differentiation and competence. Development of chick up to 96 hours stage.	
Unit-IV	**Embryonic adaptations** **8hr**
Embryonic adaptations: i. Extra-embryonic membranes in cheek_ their development and functions. ii. Placentation in Mammals: Definition. Types. classification on the basis of morphology and histology; ltmctiottsol placenta	
Unit-V	**Dimensions in Developmental Biology** **7hr**
Dimensions in Developmental Biology. Regeneration Various types of stem cells and their applications. Cloning of animals: i. Nuclear transfer technique. ii. l-. Embryo transfer technique. Teratology. Biology of aging.	
Reference books	1. Principles of Development. Lewis Wolpert, Oxford universityPress. Oxford. 2. An Introduction to Embryology. Balinsky, B.l. : W.B. Sauders.Philadelphia. 3. Development Biology. Berrill. NJ. McGraw Hill book Company. New York. 4. Principles of Animal Developmental Biology :Goyal S.C. I, Himalaya Publishing Co., Mumbai. 5. Fundamentals of Comparative Embryology :Huettner, A.F.Millan, New York. _ 6. Elements of Chordate Embryology Jain P.C. Visual Publication.Delhi. 7. Chordate Embryology :Verma. P .S. Agrawal. V.K. and Tyagi,B.S.. S. Cltand and Co. New Delhi. 8. Development Biology. Veer BalaRastogi and M.S. Jayaraj, KedarNathRamnath, Meerut
Mode of Examination	
Recommended By BOS on:	
Approved by academic council on:	

BY216	BOTANY V (CELL BIOLOGY AND GENETICS) C (L, T, P) = 4 (4, 0, 0)
Version	Ist
Prerequisite	All students are expected to have a general knowledge of plant cell.
Learning objective	The learning objectives of course are: To create an understanding regarding the structure and function of cell organelles, To gain knowledge about recombination and tools used in molecular Biology, To have understanding about application of genetics in botany.
Salient features	The student will be able to understand molecular Biology mechanism of mutations, Able to analyze importance of cell and molecular biology for human welfare.
Utility	A degree in botany opens doors to job opportunities in science, industry and environmental management, Conservation and Resource Management, and biotechnology.
Unit-I	**Cell and Cell Organelles** **7Hrs**
The Cell Theory; Prokaryotic and eukaryotic cells; Cell size and shape; Eukaryotic Cell components. Mitochondria:- Structure, marker enzymes, composition; Semiautonomous nature; Symbiont hypothesis; Proteins synthesized within mitochondria; mitochondrial DNA. Chloroplast-Structure, marker enzymes, composition; semiautonomous nature, chloroplast DNA. ER, Golgi body & Lysosomes:-Structures and roles. Peroxisomes and Glyoxisomes:_Structures, composition, functions in animals and plants and biogenesis. Nucleus:- Nuclear Envelope- structure of nuclear pore complex; chromatin; molecular organization, DNA packaging in eukaryotes, euchromatin and hcterochromatin, nucleolus and ribosome structure (brief).	
Unit- II	**Molecular Biology** **7Hrs**
History of molecular biology, DNA, Meselson and Stahl's Replication experiment. chromatin, molecular organisation of chromosome: Nucleosome-solenoid Model, Gene Concepts and expression, Polymerase Chain Reaction, DNA sequencing, DNA finger printing Central Dogma. Reverse transcriptase and its application, Transcription and Translation, RNA processing, capping, splicing, and polyadenylation, Transcription in eukaryotes, Translation, initiation,elongation and termination, Jacob-Monad and lac operon, negative and positive control, structure of promoter.	
Unit-III	**Mendelian Genetics and its Extension** **7Hrs**
Principles of inheritance, Incomplete dominance and co-dominance, Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Sex-linked, sexinfluenced and sex-limited characters inheritance. Linkage and crossing over, Cytological basis of crossing over, Molecular mechanisms of crossing over including models of recombination, Recombination frequency as a measure of linkage intensity, Two factor and three factor crosses, Interference and coincidence, Somatic cell hybridization.	
Unit-IV	**Mutations** **8Hrs**
Types of gene mutations (Classification), Types of chromosomal aberrations (Classification, figures and with one suitable example of each), Molecular basis of mutations in relation to UV light and chemical mutagens; Detection of mutations: CLB method, attached X method. Chromosomal mechanisms of sex determination in Drosophila and Man	
Unit-V	**Recombination in Bacteria and Viruses** **7Hrs**
Conjugation, Transformation, Transduction, Complementation test in Bacteriophage, Transposons in bacteria, Ac-Ds elements in maize and P elements in Drosophila, Transposons in humans	
Reference books	1. Brown, T. A. 2010. Gene cloning and DNA analysis: An Introduction. Blackwell Publication, USA. 2. Buchanan, B., Gruissem, W. and Jones, R. 2000. Biochemistry and Molecular Biology of Plants. American Society of Plant Biologists., USA. 3. An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing 4. Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press 5. Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker 6. Plant Biotechnology, J. Hammond, P. McGarvy and V. Yusibov, Springer Verlag. 7. Plant Cell & Tissue Culture for the production of Food Ingredients, T-J Fu, G. Singh and W.R. Curtis, Kluwer Academic/Plenum Press
Mode of Examination	**Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT**
Recommended By BOS on:	
Approved by acadmic council on:	

CY 211	Chemistry-III Inorganic Chemistry- I
Prerequisite	All students are expected to have a general knowledge of general chemistry principles.
Learning objective	The learning objectives of course are: To create an understanding regarding the transition element, To gain knowledge about oxidation reduction, To have understanding about nature of organomettalic compound, Able to structure of solid.
Salient features	The student will be able to conceptualize Acid or Base, Able to analyse. Crystal structure of solid.
Utility	A degree in forestry opens doors to job opportunities in science, industry and environmental management, Conservation and Resource Management, chemist
Unit-I	**S-Block Element** **5hr**
Comparative study, diagonal relationships, salient features of hydrides, salvation and complexation tendencies including their function in biosystems, an introduction to their alkyls and aryls.	
Unit- II	**p-block elements** **9hr**
Periodicity of p-block elements: Periodicity in properties of p-block elements with special reference to atomic and ionic radii, ionization energy, electron affinity, electro-negativity, diagonal relationship, catenation. **Some important compounds of p-block elements:** Hydrides of boron, diboranes and higher boranes, borazine, fullerene, carbides, fluorocarbons, silicates (structural principles), tetra-sulphur tetra-nitride, basic properties of halogens, interhalogen and polyhalides.	
Unit-III	**Chemistry of Second and Third Transition Series** **8hr**
Chemistry of Second and Third Transition Series: Characteristic properties of d-block elements. Binary compounds (hydrides, carbides and oxides) of the elements of the first transition series and complexes with respect to relative stability of their oxidation states, coordination number and geometry. Chemistry of Elements of Second and Third Transition Series: General characteristics, comparative treatment of Zr/Hf, Nb/Ta, Mo/W in respect of ionic radii, oxidation states, magnetic behavior, spectral properties and stereochemistry.	
Unit-IV	**Acid Base** **7hr**
Acid Base: Acid base concepts, Role of solvent, Relative strengths of acids and bases, Ionization, Law of mass action, Common ion effect, Ionic product of water, pH, Hydrolysis of salts, Henderson Hesselbach equation, Buffer solutions, Neutralization curves, Acid base indicators, Theory of indicators, Choice of indicators, Mixed indicators. Hard soft acid base concept. Pearson's HSAB concept. Symbiosis, theoretical basis of hardness and softness, electro negativity and hardness and softness.	
Unit-V	**Oxidation Reduction** **7hr**
Oxidation Reduction: Concepts of Oxidation and reduction, Redox reactions, Strengths and equivalent weights of oxidizing and reducing agents, Theory of Redox titrations, Redox indicators, Cell representations, types of cells, corrosion, Measurement of electrode potential, Oxidation-reduction curves, Iodimetry and Iodometry, Titrations involving ceric sulphate, potassium iodate, potassium bromate, potassium permanganate; titanous chloride and Sodium 2, 6 dichlorophenol, indophenol. Latimar and Pourbaix diadgrams. Application of redox data in the extraction of elements.	
Reference books	1. Basic Inorganic Chemistry F.A. Cotton. G. Wilkinson and P.L. Gaus. Wiley. 2. Concise Inorganic Chemistry, J.D. Lee ELBS. 3. Concepts of Models Inorganic Chemistry B.Douglas. D.McDaniel and J.Alexander, John Wiley. 4. Inorganic Chemistry. D.E. Shriver P.W. Atkins and C.H. Langfor, Oxford. 5. Inorganic Chemistry, W.W. Porterfield Addison Wesley. 6. Inorganic Chemistry, A.G. Sharpe. ELBS.
Mode of Examination	
Recommended By BOS on:	
Approved by academic council on:	

CY 212	Chemistry IV (Physical Chemistry-I) C (L,T,P) = 3 (3,0,0)
Prerquisites	Physical Chemistry I needs Chemistry I and II and Organic and Inorganic I Papers
Objectives	This course deals with the application of structure and theory to the study of physical aspects including reaction dynamics, isotope effects and molecular orbital theory applied. Electrochemistry for fuel systems of daily life
Salient features	The student will be able to conceptualize emulsion, kinetics of reactions,
Utility	A degree B.Sc. by knowing these topics can develop paint, varnish or coating material manufacturing companies.
Unit- I	**Colloidal States**:
Definition of colloids, classification of colloids; Solids in liquids (sols): properties – kinetic, optical and electrical; stability of colloids, protective action, Hardy-Schulze law, gold number. Liquids in liquids (emulsions): types of emulsions, preparation, Emulsifier, Liquids in solids (gels): classification, preparation and properties, inhibition, general application of colloids, colloidal electrolytes.	
Unit- II	**Chemical Kinetics I**
Chemical kinetics and its scope, rate of a reaction, factors influencing the rate of a reaction, concentration dependence of rates, mathematical characteristics of simple, chemical reactions – zero order, first order, second order, pseudo order, half life and mean life, Determination of the order of reaction – differential method, method of integration, method of half life period and isolation method. Radioactive decay as a first order phenomenon; Enzyme catalysis. Unimolecular reactions.	
Unit- III	**Chemical kinetics-II**:
Theories of chemical kinetics. Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis), Expression for the rate constant based on equilibrium constant and thermodynamic aspects, Catalysis. Experimental methods of chemical kinetics: conductometric, potentiometric, optical methods, polarimetry and spectrophotometer.	
Unit- IV	**Electrochemistry**
Electrolyte Solutions, Electrical Conductivity, Electrified Interfaces, Equilibrium Electrochemistry, Dynamic Electrochemistry, Electrolysis, Biological Electrochemistry, photosynthesis, nerve excitation, blood coagulation, vision, smell, membrane transport.	
Unit- V	**Thermodynamics – II**
Statistical thermodynamics, Thermodynamic equilibrium, Quasi-static transfers between simple systems are nearly in thermodynamic equilibrium and are reversible, Non-equilibrium thermodynamics Account in terms of states of thermodynamic equilibrium, Thermodynamic processes between states of thermodynamic equilibrium, Dependent and independent variables for a process ,Scope of thermodynamics, Applied fields .	
References and Text Books:	1. R.G. Compton and G.H.W. Saunders ,Electrode Potentials Oxford Chemistry Primer 2. A.C. Fisher Electrode Dynamics Oxford Chemistry Primer 3 Barrow, G. M. Physical Chemistry Tata McGraw-Hill (2007). 4. Castellan, G. W. Physical Chemistry 4th Ed. Narosa (2004). 5. Mahan, B. H. University Chemistry 3rd Ed. Narosa (1998).
Mode of Examination	
Recommended By BOS on:	
Approved by academic council on:	

CY 213	Chemistry-V (Organic Chemistry-I)
Prerequisite	All students are expected to have a general knowledge of basic chemistry principles.
Learning objective	The learning objective of course are: To create an understanding regarding principle of spectroscopy, To gain knowledge about heterocyclic compound, To have understanding about biomolecules, Able to understand polymer..
Salient features	The student will be able to conceptualize about NMR spectroscopy, Able to analyse structure of protein.
Utility	A degree in chemistry opens doors to job opportunities in science, industry and environmental management, chemist and biochemist.
Unit-I	**NMR Spectroscopy** **9hr**
Proton magnetic resonance spectroscopy (1H-NMR): Nuclear Shielding and Deshielding, Chemical shift and molecular, spin-spin splitting and coupling constants, Interpretation of NMR spectra, of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, ethyl acetate, toluene, and acetophenone.	
Unit- II	**Heterocyclic Compounds** **7hr**
Introduction, MO Picture, Aromatic Characteristics, Methods for preparation and chemical reactions of Pyrrole, furan, and thiophene, with particular emphasis on the mechanism of electrophilic substitution. Diels-Alder reaction of furan. Pyridine: synthesis and Mechanism of its Nucleophilic substitution reactions.	
Unit-III	**Organic Synthesis via Enolates** **6hr**
Organic Synthesis via Enolates: Acidity of alpha Hydrogen in reactive methylene compounds, Alkylation of diethyl Malonate and ethyl acetate. Synthetic applications of ethyl acetoacetate and malonic ester. Claisen condensation and keto-enol tautomerism.	
Unit-IV	**Biomolecules** **7hr**
Carbohydrates: Classification and Nomenclature and structure and synthesis of Glucose and fructose. Ribose and Deoxyribose, Interconversion of mannose, glucose and fructose. Classification of Amino Acids. Peptides, Proteins and Nucleic Acids: Structure and nomenclature of Peptides and Proteins, Constituents of Nucleic Acids.	
Unit-V	**Synthetic polymer and Synthetic Dyes** **7hr**
Synthetic Polymers: Addition and chain growth polymerization. Free radical and ionic polymerization. Condensation and step growth polymerization. Polyester, polyamides, Phenol-formaldehyde resins, urea formaldehyde resins. Natural and synthetic rubber. Ziegler-Natta Catalyst. Synthetic Dyes: Classification Color and constitution (electronic concept). Classification of dyes. Chemistry and synthesis of Methyl orange, Congo red and Malachite green, phenolphthalein, fluorescein, alizarin and indigo.	
Reference books	1. I. L. Finar : Organic Chemistry (Vol. I & II), E. L. B. S. 2. R. T. Morrison & R. N. Boyd : Organic Chemistry, Prentice Hall. 3. Arun Bahl and B. S. Bahl : Advanced Organic Chemistry, S. Chand 4. Peter Sykes : A Guide Book to Mechanism in Organic Chemistry, Orient Longman. 5. Jonathan Clayden, Nick Geeves, Stuart Warren, organic chemistry, Oxford University Press
Mode of Examination	
Recommended By BOS on:	
Approved by academic council on:	

BY311	BOTANY-VI ANALYTICAL TECHNIQUES IN PLANT SCIENCES C (L, T, P) = 4 (4, 0, 0))
Version	**Ist**
Learning objective	The learning objectives of course are: To create an understanding regarding imaging techniques, To gain knowledge about cell fractionation, To have understanding about spectroscopy and chromatographic techniques.
Salient features	The student will be able to conceptualize about biostatistics, Able to analyze data and characterization method used for protein and nucleic acids.
Utility	A degree in Biology allows health care workers to understand the living systems of the body and to apply the knowledge in direct ways to recover and maintain the physical health of both animal and human patients. Educators rely on biology to teach the study of life to future generations. Field biologists use biology to understand relationship between living organisms and to notice what's beneficial and what is imbalanced and dangerous
Unit-I	**Imaging and Related Techniques** **7hr**
Principles of microscopy; Light microscopy; Fluorescence microscopy; Confocal microscopy; use of fluorochromes: Flow cytometry (FACS), instrumentation and applications of fluorescence microscopy. Chromosome Karyotyping, FISH, chromosome painting; Transmission and Scanning electron microscopy, sample preparation for electron microscopy, cryofixation, negative staining, shadow casting, freeze fracture, freeze etching.	
Unit- II	**Cell fractionation** **7hr**
Centrifugation: Differential and density gradient centrifugation, sucrose density gradient, CsCl gradient, analytical centrifugation, ultracentrifugation. Marker enzymes: Use in biological research, auto-radiography, pulse chase experiment.	
Unit-III	**Spectrophotometry and Chromatography** **7hr**
Principle and its application in biological research. Principle; Paper chromatography; Column chromatography, TLC, GLC, HPLC, Ionexchange chromatography; Molecular sieve chromatography; Affinity chromatography.	
Unit-IV	**Characterization of proteins and nucleic acid** **7hr**
Mass spectrometry; X-ray diffraction; X-ray crystallography; Characterization of proteins and nucleic acids; Electrophoresis: AGE, PAGE, SDS-PAGE	
Unit-V	**Biostatistics** **8hr**
Statistics, data, population, samples, parameters; Representation of Data: Tabular, Graphical; Measures of central tendency: Arithmetic mean, mode, median; Measures of dispersion: Range, mean deviation, variation, standard deviation; Chi-square test for goodness of fit.	
Reference books	1. An Introduction to Practical Biochemistry (1996) 3rd ed., Plummer, D.T. Tata McGraw-Hill Publishing Co. Ltd. (New Delhi). 2. Plant Microtechnique and Microscopy (1999) Ruzin, S.E. Oxford University Press, (New York) U.S.A. 3. Short Protocols in Molecular Biology (1995) 3rd ed., Ausubel, F., Brent, R., Kingston, R. E., Moore, D.D., Seidman, J.G., Smith, J.A., Struhl, K. John Wiley & Sons. 4. Biostatistical Analysis (2012) 4th ed., Zar, J.H. Pearson Publication U.S.A.
Mode of Examination	Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT
Recommended By BOS on:	
Approved by academic council on:	

BY 312	BOTANY VII (PLANT PHYSIOLOGY)	C (L, T, P) = 4 (4, 0, 0)
Version	Ist	
Prerequisite	All students are expected to have a general knowledge of botany and plant science.	
Learning objective	The learning objectives of course are: To create an understanding regarding the plant water relation, To gain knowledge about mineral nutrition, To have understanding about photosynthesis.	
Salient features	The student will be able to conceptualize about plant growth and their development, Able to significance of photorespiration.	
Utility	A degree in Biology opens doors to job opportunities in science, industry and environmental management, Conservation and Resource Management, Forest Rangers, tree genetics and biotechnology, forestry technicians and forestry workers.	
Unit-I	**Plant Water Relations**	**8hrs**
Structure and properties of water Absorption of water (active and passive), Ascent of sap; Pathway of water movement; of symplast and apoplast,Guttationand transpiration, Significance of transpiration Physiological role of stomata		
Unit- II	**Mineral Nutrition**	**7Hrs**
Macro and Micro nutrients; Role of essential nutrients in plant metabolism and their deficiency symptoms, Absorption o elements, Active and passive absorption, Simple and facilitated diffusion,Donnan equilibrium Role of ATP, Carrier syst proton pump and ion flux.		
Unit-III	**Photosynthesis**	**7Hrs**
Definition and Significance**,** Site of photosynthesis, Photochemical phase, Electron transport chain.Photophosphorylation- (cyclic and non cyclic)		
Unit-IV	**Photorespiration**	**7Hrs**
- Biosynthetic phase, Benson and Calvin cycle, Hatch and Slack pathway, Photorespiration Significance		
Unit-V	**Plant Growth And Development**	**7Hrs**
Physiological effect of Auxin. Cytokinins, Gibberellinsand Ethylene and their role in plant development. Physiology of senescence and abscission Brief outlines on, Photoperiodism, Vernalization. Phytochrome.		

Reference books	1) Daubenmier, RF.1970. Plants and Environment: A text book of Plant Autoecology, Wiley Eastern Private Limited 2) Dennis, D.T., Layzell, D.B., Lefebre, D.D. and Turpin, D.H. (1997) Plant Metabolism. Addison Wesley Longman. 3) Hopkins, W.G. and Huner, P.A. (2008) Introduction to Plant Physiology. John Wiley and Sons. 4) Kaul RP (2009) Plant Metabolism. Swastik Publishers and Distributors. 5) Koromondy EJ 1996 Concepts of Ecology 4th Edition Prentice-Hall of India Pvt. Ltd. New Delhi 6) Misra KC 1988 Manuals of Plant Ecology (3rd Edition) Oxford and IBH Publishing Co., New Delhi. 7) Mukherjee S., Ghosh AK., 2006 Plant Physiology New Central Book Agency Calcutta
Mode of Examination	Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT
Recommended By BOS on:	
Approved by academic council on:	

BY314	BOTANY-VIII BIOTECHNOLOGY & UTILIZATION OF PLANTS C (L, T, P) = 4 (4, 0, 0)
Version	**Ist**
Learning objective	The learning objectives of course are: To create an understanding regarding biotechnology, To gain knowledge about genetic engineering, To have understanding about medicinal plants and economic botany.
Salient features	The student will be able to understand about tools and techniques of recombinant DNA technology in biotechnology.
Utility	A degree in Biology allows health care workers to understand the living systems of the body and to apply the knowledge in direct ways to recover and maintain the physical health of both animal and human patients. Educators rely on biology to teach the study of life to future generations. Field biologists use biology to understand relationship between living organisms and to notice what's beneficial and what is imbalanced and dangerous
Unit-I	**Biotechnology** **7hr**
Functional definition; basic aspects of plant tissue culture; cellular totipotency differentiation and morphogenesis; biology of Agrobacterium; vectors for gene delivery and marker genes; salient achievements in crop biotechnology.	
Unit- II	**Genetic engineering** **7hr**
Tools and techniques of recombinant DNA technology; cloning vectors; genomic and cDNA library; transposable elements; techniques of gene mapping and chromosome walking.	
Unit-III	**Utilization of plants** **7hr**
Centres of origin distribution, cultivation, harvesting & economic values of the following. Food plants : Rice, wheat, maize, potato and sugarcane. Fibers : Cotton, coir and jute with reference to their sources, characteristic, classification & uses. Vegetable oils : Groundnut, mustard and cocount with reference to properties, extraction & classification.	
Unit-IV	**General account of sources** **7hr**
General account of sources of firewood, timber and bamboos. Spices : Medicinal plants : General account with special reference to Rauwolfia, Cinchona, Neem & Opium. Beverages : Tea and coffee with reference to cultivation, harvesting & processing & utility. Rubber : Technique for manufacture, properties & uses.	
Unit-V	**Useful microbes in biotechnology** **8hr**
Useful microbes in biotechnology; strain selection and improvement with special reference to the role of genetic engineering in strain development, Importance and application of plant tissue and animal cell culture, development of transgenic plants and animals, Prospects of microbial biotechnology in the context of agriculture, environment, medicine and energy, Regulation of the safety of biotechnology procedures and products, Genetically engineered microbes: fate and effects	
Reference books	1. Brown, T.A. (1998). Molecular Biology Labfax II: Gene Cloning and DNA Analysis. II Edition, Academic Press, California, USA. 2. Glick, B.R. and Pasternak, J.J. (2009). Molecular Biotechnology - Principles and Applications of Recombinant DNA. IV Edition, ASM press, Washington, USA. 3. Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M. (2009). An Introduction to Genetic Analysis. IX Edition. Freeman and Co., N.Y., USA. 4. Snustad, D.P. and Simmons, M.J. (2009). Principles of Genetics. V Edition, John Wiley and Sons Inc. 5. Watson, J.D., Myers, R.M., Caudy, A. and Witkowski, J.K. (2007). Recombinant DNA-Genes and Genomes- A Short Course. III Edition, Freeman and Co., N.Y., USA. 6. Beauchamp, T.I. and Childress, J.F. (2008). Principles of Biomedical Ethics. VI Edition, Oxford University Press.
Mode of Examination	Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT
Recommended By BOS on:	
Approved by academic council on:	

ZY 311	ZOOLOGY VI (ENVIRONMENTAL BIOLOGY) C (L, T, P) = 4 (4, 0, 0)
Version	I[st]
Learning objective	The learning objectives of course are: To create an understanding regarding concepts of ecology, To gain knowledge about habitat ecology, To have understanding about waste water technology, Able to understand environmental biotechnology.
Salient features	The student will be able to conceptualize about wild life conservation, Able to Causes, symptoms and control of Social and economic factors of disease including role of health services.
Utility	A degree in Biology opens doors to job opportunities in science, industry and environmental management, Conservation and Resource Management, Forest Rangers, tree genetics and biotechnology, forestry technicians and forestry workers.
Unit-I	**Concept of Ecology** **8Hrs**
Abiotic and Biotic Factors • Energy flow in ecosystem • Food chain and Food web • Biogeochemical cycle: C02. Nand P • Population Concept- Characteristics of population. Factors affecting population growth. • Community Concept-Succession, Periodicity ,Indicators	
Unit- II	**Habitat Ecology** **7Hrs**
Fresh water habitat - Factors and classification. • Marine habitat- Factors and classification • Terrestrial habitat - Factors and classification. • Ecological divisions of India. • Natural resources and their Conservation with special reference to forests	
Unit-III	**Man and Environment** **7Hrs**
Wild life conservation (Laws, National Parks and Sanctuaries of MP) • Environmental degradation and pollution. • Thermal and Noise pollution • Radiation Ecology ,Global Warming and Green House Effect • Urbanisation and effect of human population on environment.	
Unit-IV	**Waste Management Technologies** **7Hrs**
Sources of waste, types and characteristics, Sewage disposal and its management, Solid waste disposal, Biomedical waste handling and disposal, Nuclear waste handling and disposal, Waste from thermal power plants, Case histories on Bhopal gas tragedy, Chernobyl disaster, Seveso disaster and Three Mile Island accident and their aftermath.	
Unit-V	**Diseases** **7Hrs**
Causes, symptoms and control of Social and economic factors of disease including role of health services and other organizations: Infectious (Bacterial-Tuberculosis, Typhoid; Viral- AIDS, Poliomyelitis, Hepatitis; Protozoan-Leishmaniasis, Malaria, Cholera, Lifestyle and Inherited/genetic diseases, Immunological diseases; Cancer; Diseases impacting on Western versus developing societies.	
References	1. OdumE.P.,Fundamental of Ecology- WB Saunders 2. Call man, Ecology- Johnwilley& Sons 3. K. Clark, Elements of Ecology - Wiley • Harper & Row, Elements of Ecology Smith R.S. - New York 4. K.C. Agarwal, Wild Life in India Conservation and Management- Nidhi Pub. 5. M ..ShamimJairajPuri, Biological Diversity and Environment 6. Kumar &Asija , Biodiversity Principles & Conservation- Agrobios 7. Saharia, Wild life of India- Natraj Publisher • K.C. Agarwal, Biodiversity- Botanica 8. Jha, Genes & Evolution- John Pub. • Colbert, Evolution- Wiley- Liss 9. B.D. Sharma, Indian Wild life Resource & Development, Daya Pub.
Mode of Examination	Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT
Recommended By BOS on:	
Approved by acadmic council on:	

ZY313	ZOOLOGY-VII MICROBIOLOGY C (L, T, P) = 4 (4, 0, 0)
Version	**Ist**
Learning objective	The learning objectives of course are: To create an understanding regarding microbiology, To gain knowledge about microbial nutrition and growth, To have understanding microbial cell organization.
Salient features	The student will be able to conceptualize about microbial genetics, Able to analyze importance of microbiology in food science.
Utility	A degree in Biology allows health care workers to understand the living systems of the body and to apply the knowledge in direct ways to recover and maintain the physical health of both animal and human patients. Educators rely on biology to teach the study of life to future generations. Field biologists use biology to understand relationship between living organisms and to notice what's beneficial and what is imbalanced and dangerous
Unit-I	**History of Microbiology and classification 7hr**
History of development of microbiology as a discipline, Spontaneous generation versus biogenesis, development of various microbiological techniques, concept of fermentation, establishment of fields of medical microbiology, immunology and environmental microbiology Molecular methods of assessing microbial phylogeny- molecular chronometer, phylogenetic trees, rRNA, DNA and proteins as indicator of phylogeny. Major Divisions of life-Domains, Kingdoms.	
Unit- II	**Microbial Nutrition and Growth 7hr**
Nutritional types of microorganisms, growth factors, culture media- synthetic and complex, types of media; isolation of pure cultures, growth curves, mean growth rate constant, generation time; general concept of effect of environmental factors on growth of microbes; sterilization and disinfection; activity, use of physical methods (heat, low temperature, filtration, radiation)and chemical agents (phenolics, halogens, heavy water, sterilization gases).	
Unit-III	**Microbial Cell organization 7hr**
Cell size, shape and arrangement, glycocalyx, capsule, flagella, fimbriae and pili; Cell-wall: Composition and detailed structure of Gram positive and Gramnegative cell walls, Archaebacterial cell wall, Gram and acid fast staining mechanisms, lipopolysaccharide (LPS) and protoplasts. Effect ofantibiotics and enzymes on the cell wall; Cell Membrane: Structure, function and chemical composition of bacterial and archaeal cell membranes; Cytoplasm: Ribosomes, mesosomes, inclusion bodies, nucleoid, chromosome and plasmids; Endospore: Structure, formation, stages of sporulation.	
Unit-IV	**Microbial Genetics 7hr**
Bacterial recombination: general and site specific and replicative; Bacterial plasmids - fertility factor, col plasmid; Bacterial conjugation- (Hfr, F`, F+ X F-); Transformation; Transduction- generalized and specialized.	
Unit-V	**Food and Microbiology 8hr**
Overview of importance of microbiology in food and industrial microbiology; Microorganism growth in food; extrinsic and intrinsic factors for food spoilage; microorganisms causing food spoilage in fresh food, milk, and canned food; Preservation of foods by aseptic handling, high temperature, low temperature, dehydration, osmotic pressure, chemicals and radiations; preparation of fermented food products, fermented milk such as yoghurt, curd and cheese.	
Reference books	Sharma P.D. Microbilogy - Rastogi Pub. Meerut. Madigan and Martinko: Brock Biology of Microorganisms (2006, Prentice Hall) Prescott, Harley and Klein: Microbiology (1999, McGraw)
Mode of Examination	Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT
Recommended By BOS on:	
Approved by academic council on:	

ZY312	ZOOLOGY-VIII APPLIED ZOOLOGY C (L, T, P) = 4 (4, 0, 0)
Version	**Ist**
Learning objective	The learning objectives of course are: To create an understanding regarding aquaculture, To gain knowledge about sericulture, To have understanding about lac culture and apiculture.
Salient features	The student will be able to conceptualize about poultry keeping, Able to understand economic importance and medicinal importance of insects.
Utility	A degree in Biology allows health care workers to understand the living systems of the body and to apply the knowledge in direct ways to recover and maintain the physical health of both animal and human patients. Educators rely on biology to teach the study of life to future generations. Field biologists use biology to understand relationship between living organisms and to notice what's beneficial and what is imbalanced and dangerous
Unit-I	**Principles of Aquaculture 7hr**
Concept of Commercial Fish Production, Site, Species, System, Business Selection/Evaluation/Permits and Regulations Production Planning/Types of Production Systems, Record Keeping, Water Budgets, Pond Preparation-Liming and Fertilizing, Pond Preparation.	
Unit- II	**Sericulture, Lac culture and Apiculture 7hr**
History, Classification and Biology of Honey Bees Social Organization of Bee Colony, Artificial Bee rearing (Apiary), Beehives – Newton and Langstroth Bee Pasturage Selection of Bee Species for Apiculture Bee Keeping Equipment Methods of Extraction of Honey (Indigenous and Modern). Sericulture, Lac culture.	
Unit-III	**Pisciculture and Aquarium fish keeping 7hr**
Genetic improvements in aquaculture industry; Induced breeding and transportation of fish seed, The potential scope of Aquarium Fish Industry as a Cottage Industry, Exotic and Endemic species of Aquarium Fishes Insect & Unwanted Fish Control, Handling/Grading/Transportation/Harvesting.	
Unit-IV	**Poultry keeping 7hr**
Principles of poultry breeding, Management of breeding stock and broilers, Processing and preservation of eggs.	
Unit-V	**Insects of Economic and Medicinal Importance 8hr**
Biology, Control and damage caused by Helicoverpa armigera, Pyrilla perpusilla and Papilio demoleus, Callosobruchus chinensis, Sitophilus oryzae and Tribolium castaneum, Medical importance and control of Pediculus humanus corporis, Anopheles, Culex, Aedes, Xenopsylla cheopis	
Reference books	Dunham R.A. (2004). Aquaculture and Fisheries Biotechnology Genetic Approaches. CABI publications, U.K. Prost, P. J. (1962). Apiculture. Oxford and IBH, New Delhi. Bisht D.S., Apiculture, ICAR Publication. Singh S., Beekeeping in India, Indian council of Agricultural Research, New Delhi.
Mode of Examination	Assignment/Quiz/Viva-Voce/student seminar/written examination/PPT
Recommended By BOS on:	
Approved by academic council on:	

CY 311	Chemistry-VI (Inorganic Chemistry-II)	C (L, T, P) = 4 (3, 1, 0)
Version	**I**	
Prerequisite	Chemistry study of earlier semester	
Objectives:	1. To train qualified, adaptable, motivated, and responsible Mathematicians who will contribute to the scientific and technological development. 2.To impact knowledge by teaching 3.To advance knowledge by research	
Expected outcome:	Better outcomes in chemistry specialization	
Unit-I	**Coordination Chemistry**	**7 Hrs**
Coordination Compounds: Nomenclature, Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory crystal field theory of transition metal complexes.		
Unit-II	**Inner Transition Elements: Actinides and Lanthanides**	**8 Hrs**
Definition of the F-block elements; position in the periodic table; Properties of the atoms and ions: ionization energies, electrode potentials, metallic and ionic radii; Color and electronic spectroscopy; Magnetism; Solid state compounds: halides and oxides; Coordination chemistry of the lanthanides and actinides; Organometallic compounds; comparison with the d-block; Commercial applications;		
Unit-III	**Organometallic compounds**	**6 Hrs**
Organometallic compounds; Definition Nomenclature ,Preparation properties, application and bonding of alkyl and Aryl compound of Lithium, Aluminium, Iron, Mercury and Titanium. Bonding of ligands, Reactions of organometallic, Electron accountancy, Oxidative addition and reductive elimination, Insertion and α/β-elimination, Industrial organometallic catalysis, Olefin catalysis		
Unit-IV	**Recent Advances In Inorganic**	**7 Hrs**
Inorganic nanotechnology Zeolite, Bio-inorganic chemistry (must emphasize the metal), Ceramics ,Inorganic thin films ,Intercalation compounds, Super acids, High-temperature superconductors nanowire battery, Perovskites nonvolatile memory materials.		
Unit-V	**Metallurgy: ores minerals and purification of metals**	**8 Hrs**
Concentration of Ores, extraction of crude metal from concentrated ore, thermodynamic principles of metallurgy, electrochemical principles of metallurgy, oxidation-reduction, refining, uses of Al, Cu, Zn, Fe.		
Reference Books	1. Basic Inorganic Chemistry F.A. Cotton. G. Wilkinson and P.L. Gaus. Wiley. 2. Concise Inorganic Chemistry, J.D. Lee ELBS. 3. Concepts of Models Inorganic Chemistry B.Douglas. D.McDaniel and J.Alexander, John Wiley. 4. Inorganic Chemistry. D.E. Shriver P.W. Atkins and C.H. Langford, Oxford. 5. Inorganic Chemistry, W.W. Porterfield Addison Wesley. 6. Inorganic Chemistry, A.G. Sharpe. ELBS. 7. Inorganic Chemistry, G.L. Miessler and D.A. Tarr, Prentice Hall. 8. Group Theory and Its Chemical Applications: P. K. Bhattacharya 9. Inorganic Chemistry: J. E. Huyee, Principles of Structure & Reactivity, 3rd Ed. 10. Selected Topics in Inorganic Chemistry: W. U. Malik, G. D. Tuli and R. Madan	
Mode of Evaluation: (Percent Weightage)		
Recommended by BOS on :		
Approved by Academic Council on		

CY 312	Chemistry-VII (Physical &Misc. Chemistry-II) C (L, T, P) = 4 (3, 1, 0)
Version	**I**
Prerequisite	Chemistry of Sem I II, III and IV
Objectives:	This course deals with the application of structure and theory to the study of Solution colligative properties, Nuclear chemistry and heterogeneous system
Expected outcome:	Going green can save money while helping to relates with development of physical chemistry.
Unit-I	**Solution and Colligatives : 7Hrs**
Expression of Concentration of Solids in Liquids, Solid Solutions, Colligative Properties-Relative Lowering of Vapor Pressure, Raoult's Law, Elevation of Boiling Point, Depression of Freezing Point ,Osmotic Pressure, Determination of Molecular Masses using Colligative Properties 'Van't Hoff Factor and Calculations involving it.	
Unit-II	**Nuclear Chemistry 8 Hrs**
Atomic Nucleus, Nucleus reactions, Binding energy disintegration, isotope's isobars artificial radioactivity application, radioactive, waste management, radioactivity.	
Unit-III	**Phase equilibrium 6Hrs**
Heterogeneous system , Phase diagram of one and two component system **Surface chemistry:** Interface (chemistry) Surface modification of biomaterials with proteins, Surface finishing ,Surface modification, Surface phenomenon, Tribology	
Unit-IV	**Solid State 7Hrs**
Solid States: Definition of space lattice, unit cell, types of unit cell, close packing in crystal; Laws of crystallography – (i) Law of constancy of interfacial angles, (ii) Law of rationality of indices (iii) Law of symmetry, Symmetry elements in crystals. X-ray diffraction by crystals, Derivation of Bragg equation, Determination of crystal structure of NaCl, KCl and CsCl (Laue's method and powder method). Electrical and magnetic properties of solids. Defects or imperfection in crystalline solid.	
Unit-V	**Environmental and Green Chemistry 8 Hrs**
Environmental Issues: Go Green, Consumer Health & Food Safety Concerns, Environmental Disasters, **Basics of Green Chemistry** Definition of green chemistry, How green chemistry differs from cleaning up pollution, Green chemistry's 12 principles Green chemistry's roots in the Pollution Prevention Act of 1990	
Reference Books	1 Barrow, G. M. Physical Chemistry Tata McGraw-Hill (2007). 2. Castellan, G. W. Physical Chemistry 4th Ed. Narosa (2004). 3. Mahan, B. H. University Chemistry 3rd Ed. Narosa (1998).
Mode of Evaluation: (Percent Weightage)	
Recommended by BOS on :	
Approved by Academic Council on :	

CY 314	Chemistry-VIII (Organic Chemistry-II)	C (L, T, P) = 4 (3, 1, 0)
Version	**I**	
Prerequisite	Organic chemistry is a growing subset of chemistry. To put it simply, it is the study of all carbon-based compounds; their structure, properties, and reactions and their use in synthesis.	
Objectives:	It focuses on the methods used to identify the structure of organic molecules, advanced principles of organic stereochemistry, organic reaction mechanisms, and methods used for the synthesis of organic compounds. Additional special topics include illustrating the role of organic chemistry in biology, medicine, and industry.	
Expected outcome:	Organic chemistry has expanded our world of knowledge and it is an essential part of the fields of biochemistry, biology, industry, nanotechnology, rocket science, and many more!	
Unit-I	**Aldehyde and Ketone**	**7Hrs**
Structure of the carbonyl groups, Synthesis of aldehyde and ketone using 1,3-dithianes, Aldehyde synthesis by hydrolysis, Aldehyde synthesis by oxidation of alcohols and rearrangements-Diketone synthesis by oxidation, Nucleophilic addition reactions of carbonyl groups: benzoin, perkin, aldol and knoevenagel condensation. Wittig and mannich reaction, oxidation of aldehyde and ketone. Cannizzaro reaction, meervein-pondrof-verley, Clemmensen, Wolf-Kishner, Halogenation of enolizable ketones.		
Unit-II	**Carboxylic Acids**	**8 Hrs**
Structure, physical properties, Acidity and factor affecting the acidic strength, Synthesis, reactions of carboxylic acids, hell-Volhard-Zelinsky reaction. Reduction of carboxylic acid and decarboxylation. Structure, nomenclature and synthesis of acid derivatives (acid chlorides, esters, amides, acid anhydrides), Relative stability and inter-conversion of acyl derivatives by nucleophilic substitution, Mechanism of esterification and hydrolysis (in basic and acidic medium).		
Unit-III	**Conjugated Systems**	**6Hrs**
Conjugated Systems and Molecular Orbital Theory: Pericyclic Reactions – Introduction Electrocyclic Processes – Cycloadditions, Diels-Alder cycloaddition, Sigmatropic Rearrangements, Claisen rearrangement, 1,3-dipolar reaction.		
Unit-IV	**Nitrogen containing organic compounds**	**7Hrs**
Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes. Mechanism of nucleophilic substitution of nitroarenes. And their reduction in acidic, neutral and alkaline media. Amines: Structure, nomenclature and preparation of alkyl and aryl amines (reduction of nitro and nitrile compounds), Stereochemistry, and separation of primary, secondary and tertiary amines, Amine salts as phase transfer catalysts. Gabril-phthalimide reaction and Hoffmann bromamide reaction with mechanism. Basic nature of amines. Electrophilic aromatic substitution in arenes.		
Unit-V	**Advanced Organics**	**8Hrs**
Molecular design and synthesis, organic materials and nonmaterials, Synthesis of biologically active compounds and medicinal chemistry: bimolecular Advanced trends in organic synthesis. Elucidating reaction mechanisms, Free radical reactions , Photochemistry, Carbenes, Total synthesis		
Reference Books	1. Carey, F. A., and R. J. Sundberg. Advanced Organic Chemistry, Part A: Structure and Mechanisms. 4th Ed. New York, NY: Springer, 2000. 2. Joule, J. A., and K. Mills. Heterocyclic Chemistry. 4th ed. Malden, MA: Blackwell Science, 2000. 3. Peter Sykes: A Guide Book to Mechanism in Organic Chemistry, Orient Longman. 4. S.M.Mukherjee and S.P.Singh, Reaction Mechanism in Organic Chemistry,Mc Millan (2004). 5. Bhupinder Mehta and Manju Mehta, Organic Chemistry, PHI Learning (2009).	
Mode of Evaluation:		
Recommended by BOS on :		
Approved by Academic Council on :		