UTD

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Graduate Degree Courses in BSc -Biology

VISION:

The Department of Biological Sciences will be a leader in acquiring fundamental knowledge of the living world that will advance the health of the planet, including humans. We will fully integrate instruction and research so that all students not only learn but also, through their learning, actively contribute to our understanding of life.

MISSION:

1. Advance our research efforts in emerging fields of the biological sciences and develop nationally recognized learning centers for undergraduate and graduate curricula
2. Increase the recruitment of and support for innovative and outstanding faculty who through research and teaching will develop the scientists, health professionals, government professionals, and mentors of the future
3. Foster an exciting environment where teaching, research, and service will stimulate our students to serve as leaders of the people of this state, the nation, and the world
4. Enrich our regional environment with the development of scientific programs to include opportunities for participation of our local communities

Graduate Attributes in Biology:

As mentioned earlier B.Sc. degree in Biology is the first college/university level degree in the country as in several parts of the world. The students graduating in this degree must have through understanding of basic knowledge or understanding of the fundamentals of Zoology as applicable to wide ranging contexts.

Program Specific Outcomes (PSO): Botany

PO1. Knowledge and understanding: 1. Diversity of plants in terms of structure, function, reproduction and ecological roles. 2. The evaluation and assessment of plant diversity. 3. Plant systematics and classification including flora of India and major biomes of the world. 4. The role of plants in the functioning of the global ecosystem. 5. Application of Statistics in biological data. 6. Application of computer and bioinformatics- utilization of biological data in silico.

PO2. Intellectual skills – able to: 1. Logical interpretation of ideas and concepts into a organcised form. 2. Accumulate and organise knowledge and ideas through reading and searching in internet. 3.Transformation of knowledge based concepts from one area to another within the subject. 4. Plan hypothesis and test. 5. Propose and carry out independent servey or research in various areas of the subject.

PO3. Practical skills: Giving opportunities to students to conduct experiments practically both in field and laboratory. Hands on practical helps the students to gain proficiency and skills in different topics of modules offered to them.

Course Outcomes (CO) of B.Sc. - Botany

CO1. Critically evaluation of ideas and arguments by collection relevant information about the plants,so as recognize the position of plant in the broad classification and phylogenetic level.

CO2. Identify problems and independently propose solutions using creative approaches, acquired through interdisciplinary experiences, and a depth and breadth of knowledge/expertise in the field of Plant Identification.

CO3. Accurately interpretation of collected information and use taxonomical information to evaluate and formulate a position of plant in taxonomy.

CO4. Students will be able to apply the scientific method to questions in botany by formulating testable hypotheses, collecting data that address these hypotheses, and analyzing those data to assess the degree to which their scientific work supports their hypotheses.

CO5. Students will be able to present scientific hypotheses and data both orally and in writing in the formats that are used by practicing scientists.

CO6. Students will be able to access the primary literature, identify relevant works for a particular topic, and evaluate the scientific content of these works.

Program Specific Outcomes (PSO): Zoology

PSO1. Understand the nature and basic concepts of cell biology, genetics, taxonomy, physiology, ecology and applied Zoology

PSO2. Analyse the relationships among animals, plants and microbes

PSO3. Perform procedures as per laboratory standards in the areas of Taxonomy, Physiology, Ecology, Cell biology, Genetics, Applied Zoology, Clinical science, tools and techniques of Zoology, Toxicology, Entomology,Nematology Sericulture, Biochemistry, Fish biology, Animal biotechnology, Immunology and research methodology

PSO4. Understand the applications of biological sciences in Apiculture, Aquaculture, Agriculture and Medicine

5. PSO5. Gains knowledge about research methodologies, effective communication and skills of problem solving methods

6. PSO6. Contributes the knowledge for Nation building.

Course Outcomes:

CO1: Describe general taxonomic rules on animal classification

CO2: Distribution of fauna in different realms interaction

CO3: Imparts conceptual knowledge of vertebrates, their adaptations and associations in relation to their environment

CO4: Classify phylum Protochordates to Mammalia

CO5: Structural and functional aspects of basic unit of life i.e. cell concepts

CO6: Mendelian and non mendielian inheritance

CO7: Seeks to understand the mechanisms that work to keep the human body alive and functioning

CO8: Students are taught the detailed concepts of digestion respiration excretion the functioning of nerves and muscles

CO9: Students gain fundamental knowledge of animal physiology

CO10: Students learn the concepts of endocrine systems and homeostasis a brief account of genetics and organic evolution.

CO11: Understands concepts of fisheries, fishing tools and site selection

CO12: Imparts knowledge of beneficial and non-beneficial insects

CO13: Gives knowledge of silk worm rearing

CO14: Understanding of types of immunity

Program Specific Outcomes (PSO): Chemistry

PSO-1: Demonstrate, solve and an understanding of major concepts in all disciplines of chemistry.

PSO-2: Solve the problem and also think methodically, independently and draw a logical conclusion.

PSO-3: Employ critical thinking and the scientific knowledge to design, carry out, record and analyze the results of chemical reactions.

PSO-4: Create an awareness of the impact of chemistry on the environment, society, and development outside the scientific community.

PSO-5: Find out the green route for chemical reaction for sustainable development.

PSO-6: To inculcate the scientific temperament in the students and outside the scientific community.

PSO-7: Use modern techniques, decent equipments and Chemistry software‟s

Course Outcomes:

CO-1. Write an expression for rate constant K for third order reaction

CO-2. Solve the numerical problems based on Rate constant

CO-3.Understand the term specific volume, molar volume and molar refraction

CO-4. Know the meaning of various terms involved in co-ordination chemistry

CO-5. To understand Werner‟s formulation of complexes and identify the types of valences

CO-6. Know the limitations of VBT

CO-7. Define organic acids and bases.

CO-8. Distinguish between geometrical and optical isomerism.

CO-9. Discuss kinetics, mechanism and stereochemistry of SN1 and SN2 reactions.

(06) Programme PO's and PSO's Mapping

			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9		
S. No	Program	Courses Category	Problem Analysis	Design/Development of Solution	Investigation	Modern Tool Usage	Environment and Sustainability	Ethics	Individual and Team Work	Project Management	Life-Long Learning	PSO 1	PSO 2
1	BSc BIO	Humanities and Social Sciences including Management courses	*			*		*			*	*	
2		Basic Science courses	*	*	*	*	*						*
3		Engineering Science courses including											

		workshop, drawing, basics of electrical/mechanical/computer etc.											
4		Professional core courses	*	*	*							*	
5		Professional Elective courses relevant to chosen specialization/branch	*	*	*	*		*	*				*
6		Open subjects – Electives from other technical and /or emerging *subjects	*	*	*	*	*	*	*		*	*	*
7		Project work, seminar and internship in industry or elsewhere	*	*	*		*	*	*	*	*		*
8		Specific core subject	*	*	*								
9		Mandatory Course (Non credit)					*	*	*		*		

(07) Year wise PO's and PSO's Mapping

YEAR	Name of the Courses/POs /Basic, Core Electives, Projects, Internships etc.)	PO1 Problem Analysis	PO2 Design/Development of Solution	PO3 Investigation	PO4 Modern Tool Usage	PO5 Environment and Sustainability	PO6 Ethics	PO7 Individual and Team Work	PO8 Project Management	PO9 Life-Long Learning	PSO 1	PSO 2
YEAR-I	Diversity of Lower plants	*	*	*	*			*	*	*	*	
	Diversity of higher plants	*	*	*						*		
	Zoology-I	*	*	*	*		*			*		*
	Zoology-II	*	*	*	*						*	
	Inorgaic Chemistry											
	Physical Chemistry											
	Organic Chemistry											
YEAR-II	Diversity of Lower plants	*	*	*						*		*
	Diversity of higher plants	*	*	*								
	Zoology-I										*	
	Zoology-II	*	*	*								
	Inorgaic Chemistry											
	Physical Chemistry											
	Organic Chemistry											
YEAR III	Diversity of Lower plants	*	*	*								
	Diversity of higher plants	*	*								*	
	Zoology-I	*	*									
	Zoology-II	*	*									*

	Inorgaic Chemistry					*		*			*	
	Physical Chemistry	*									*	
	Organic Chemistry	*	*									*

(08) <u>Structure of Programme</u>: To fulfill the need of development of all the POs/ GAs, as per above mapping, the following semester wise programme structure are as under.

<u>[L= Lecture, T = Tutorials, P = Practical's & C = Credits]</u>

Total Hrs.*= 160 Hrs.

Structure of MSc program:

S. No.	Course Category	Hours of the MSc ZOO Curriculum
1.	Diversity of Lower plants	11
2.	Diversity of higher plants	12
3.	Zoology-I	19
4.	Zoology-II	20
5.	Inorganic chemistry	18
6.	Physical Chemistry	18
7.	Organic Chemistry	18
8.	Moral value and language	18
9.	Entrepreneurship of Development	20
	TOTAL	Non-credit

***Definition of Credit:**

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
1 Hr. Practical (P) per week	0.5 Credit
2 Hours Practical (Lab)/week	1 Credit

(09) Scheme of Exanimation (MSC Zoology) Academic Year 2019-20

I YEAR

Year	Paper Code	Subject Name	Paper No.	Paper Name	Theory		CCE/Internal		Total		Practical		Total	
					Max	Min	Max	Min	Max	Min	Max	Min		
I st Year	BSCB(Y - 101A)	CHEMISTRY	Paper-I	Inorganic chemistry	29	10	5	2	34	12	50	17	150	50
	BSCB(Y -101B)		Paper-II	Physical Chemistry	28	10	5	2	33	12				
	BSCB(Y -101C)		Paper-III	Organic Chemistry	28	10	5	2	33	12				
	BSCB(Y - 102A)	BOTANY	Paper-I	Diversity of Lower plants	40	13	10	4	50	17	50	17	150	50
	BSCB(Y -102B)		Paper-II	Diversity of higher plants	40	13	10	4	50	17				
	BSCB(Y -103A)	ZOOLOGY	Paper-I	Zoology-I	40	13	10	4	5O	17	50	17	150	50
	BSCB(Y -103B)		Paper-II	Zoology-II	40	13	10	4	50	17				
	FC(Y-104A)	FOUNDATION	Paper-I	Moral value and language	80	26	20	8	100	33	-	-	100	33
	FC(Y-104B)		Paper-II	Entrepreneurship of Development	80	26	20	8	100	33	-	-	100	33
TOTAL					405		95		500		150		**650**	

II YEAR

Year	Paper Code	Subject Name	Paper No.	Paper Name	Theory		CCE/Internal		Total		Practical		Total	
					Max	Min	Max	Min	Max	Min	Max	Min		
IInd Year	BSCB(Y-201A)	CHEMISTRY	Paper-I	PHYSICAL CHEMISTRY	29	10	5	2	34	12	50	17	150	50
	BSCB(Y-201B)		Paper-II	INORGANIC CHEMISTRY	28	10	5	2	33	12				
	BSCB(Y-201C)		Paper-III	ORGANIC CHEMISTRY	28	10	5	2	33	12				
	BSCB(Y-202A)	BOTANY	Paper-I	STRUCTURE DEVELOPMENT AND REPRODUCTION OF FLOWERING PLANTS	40	13	10	4	50	17	50	17	150	50
	BSCB(Y-202B)		Paper-II	PLANT ECOLOGY BIODIVERSITY & PHYTOGEOGRAPHY	40	13	10	4	50	17				
	BSCB(Y-203A)	ZOOLOGY	Paper-I	VERTEBRATES AND EVOLUTION	40	13	10	4	5O	17	50	17	150	50
	BSCB(Y-203B)		Paper-II	ANIMAL PHYSIOLOGY AND BIO-CHEMISTRY	40	13	10	4	50	17				
	FC(Y-204A)	FOUNDATION	Paper-I	MORAL VALUE AND LANGUAGE-II	80	26	20	8	100	33	-	-	100	33
	FC(Y-204B)		Paper-II	ENVIRONMENTAL STUDIES	80	26	20	8	100	33	-	-	100	33
TOTAL					405		95		500		150		**650**	

III YEAR

Sn	Paper Code	Subject Name	Theory		CCE/Internal		Practical		Project/Internship		Total
			Max	Min	Max	Min	Max	Min	Max	Min	
1	BSCB(Y-301)	Chemistry Paper-I (Physical Chemistry)	28	10	5	2					100
		Chemistry Paper-II(Inorganic Chemistry)	29	10	5	2					
		Chemistry Paper-III(Organic Chemistry)	28	10	5	2					
2	BSCB(Y-302)	Botany Paper-I(Plant physiology and Biochemistry)	40	13	10	4					100
		Botany Paper-II (Cell Biology Genetics &Biotechnology)	40	13	10	4					
3	BSCB(Y-303)	Zoology Paper-I (Biotechnology, Immunology, Biological Tools and Techniques)	40	13	10	4					100
		Zoology Paper-II (Ecology, Animal Behavior and Pollution, Microbiology and Toxicology)	40	13	10	4					
4	FC(Y-304A)	Foundation Course Paper-I(Moral Value and Language-III)	80	26	20	8	-	-			100
5	FC(Y-304B)	Foundation Course Paper-II (Basics of Computer App. Information Technology)	80	26	20	8	-	-			100
6	BSCB(Y301D)	Chemistry: Practical					50	17			50
7	BSCB(Y302C)	Botany :Practical					50	17			50
8	BSCB(Y303C)	Zoology: Practical					50	17			50
9	BSCB(Y-305)	Project/Internship							100	33	100

(10) Course Content

YEAR- I

Preamble:-

Biology is the science of life forms and living processes. Over centuries, biological knowledge has led to many technologies benefiting humans, be it in food security, health sector or national security. One can name sericulture, medical Zoology, vaccines against viral, bacterial and parasite diseases, diagnostic methods for infectious diseases, pregnancy, cancer or genetic and nutritional disorders.

Subject-Botany

Title of paper- Diversity of Lower Plants
Paper – I

BSCB-Y102A	**Botany**	**3L:0T:1P**	**40 hrs.**	**4Hrs/Week**

Unit I:

Viruses and Prokaryotes: Characteristics of Viruses, general account of TMV and T4 bacteriophage, bacterial structure, nutrition, reproduction and economic importance. General account of Mycoplasma, Cyanobacteria and Actinomycetes.

Unit II:

Alage: General characters, classification and economic importance. Important features and life history of Chlorophyceae- Volvox, Oedogonium, Charophyceae-Chara, Xannthophyceae, Vaucheria, Phaeophyceae-Ectocarpus, Rhodophyceae-Polysiphonia.

U nit III

Fungi: General characters, Classification and economic Importance, important features and Life history of Oomycetes- Albugo, Zygomygetes: Mucor, Ascomycetes: Yeast, Peziza. Basidiomycetes: Puccinia, Deuteromytes: Alternaia.General account of Lichens

Unit IV

Bryophyta: General characters and classification, study of morphology, anatomy and reproduction of Hepaticopsida: Riccia, Marchantia, Anthocerotopsida: Anthoceros, Bryopsida: Polytrichum.

Unit V:

Pteridophyta: Important Characters and classification.Stelar organization. Morphology and anatomy of Rhynia.Structure anatomy and reproduction in Lycopodium.Selaginella, Equisetum and Marsilea.

Suggested Readings

1. Bhojwani, S.S. &Bhatnagar, S.P. (2011). Embryology of Angiosperms.VikasPublication House Pvt. Ltd. New Delhi. 5th edition.
2. Mauseth, J.D. (1988). Plant Anatomy. The Benjamin/Cummings Publisher, USA

Practical

1. Study of meristems through permanent slides and photographs.
2.Tissues (parenchyma, collenchyma and sclerenchyma); Macerated xylary elements,Phloem (Permanent slides, photographs)
3. Stem: Monocot: *Zea mays;* Dicot: *Helianthus*; Secondary: *Helianthus* (onlyPermanent slides).
4. Root: Monocot: *Zea mays*; Dicot: *Helianthus*; Secondary: *Helianthus* (onlyPermanent slides).
5. Leaf: Dicot and Monocot leaf (only Permanent slides).
6. Adaptive anatomy: Xerophyte (*Nerium*leaf); Hydrophyte (*Hydrilla*stem).
7. Structure of anther (young and mature), tapetum (amoeboid and secretory)(Permanent slides).

Title of paper -Diversity of Higher Plants
Paper-II

BSCB-Y102B	**Botany**	**3L:0T:1P**	**38 Hrs.**	**3Hrs/Week**

Unit-I **6 Hrs**

Gymnosperms: General Characters and Classification of Gymnosperms. Heterosporyand Origin of seed habit. Diversity of gymnosperms.Geological time scale and Fossilization. Fossil Gymnosperms: Lyginopteris and willamsonia.

Unit-II **4 Hrs**

Gymnosperm: Morphology, Anatomy, Reproduction and life cycle of cycus, Pinus and Ephedra.

Unit-III **6 Hrs**

Taxonomy: Origin and Evolution of Angiosperms: Principles and rules of Botanical nomenclature, Museum, Herbarium and Botanical gardens; Classification of Angiosperms: Bentham and Hooker, and Modern trends in Taxonomy including Molecular taxonomy.APG IV System.

Unit-IV **6 Hrs**

Terminology for plant description in semi-technical language; Diagnostic characteristics and Economic Importance of families- anunculaceae,Brassicaceae,Malvaceae,Rutaceae,Fabaceae,and Apaceae.

Unit-V **4 Hrs**

Taxonomy: Diagnostic characteristics & Economic Importance to Families- Rubiaceae, Asteraceae, Apocynaceae, Solanaceae, Lamiaceae, Euphorbiaceae, Lilliaceae, and Poaceae.

Suggested Readings:

1. Agarwal, S.B 2007 Unified Botany, ShivlalAgarwal& Company.

2. Gangulee H.C &Kar A.K 2006 College Botany Vol-III, New Central book agency p (ltd) London.
3. Vashita P.C 2005.Botany for degree students Vol-V

Title of Paper-Zoology-I
Paper-I

BSCB-Y103A	**Zoology**	**3L:0T:1P**	**36 Hrs.**	**3Hrs/Week**

UNIT I: **6 Hrs**

Classification of Non Chordates up to classes according to Parker sand Haswell.(7th Edition).

1. Classification of lower Invertebrates.
2. Classification of higher invertebrates.
3. Protozoa — Type study of Plasmodium.
4. Porifera — Type study of Sycon.

UNIT II **4 Hrs**

1. Coelenterata — Type study of Obelia.
2. Helminthes — Type study of Liver Fluke.
3. Annelida — Type study of Earthworm, Metamerism, Trochophore Larva of nereis.

UNIT III **5 Hrs**

1. Arthropoda — Type study of Prawn.
2. Mollusca — Type study of Pila.
3. Echinodenneta — External Features of Star Fish and Echinoderm Larvae.

UNIT IV **6 Hrs**

1. The cell - History of Cell Biology, Cell theory, Prokaryotic and Eukaryotic cell.
2. Microscopy: Compound and Electron Microscopy.

UNIT V **6 Hrs**

1. Nuclear Organization of cell.
2. Extra nuclear organization of cell.
3. Cell reproduction - Amitosis, mitosis,

SUGGESTED READINGS :

1. An introduction to the Invertebrates – J. Moore (Cambridge Univ. Pr.)
2. Introduction to General Zoology, Volume I – K. K. Chaki, G. Kundu, S. Sarkar (NCBA)
3. Biology of non-chordates – H.C. Nigam (Vishal Pub.)
4. General Zoology – C. A. Villee, W. F. Walker and R. D. Barnes (Saunders College Pub.)
5. Invertebrate Zoology – P. A. Meglisch and F. R. Schram (Oxford Univ Pr.)

Title of Paper-Zoology-II
Paper-II

BSCB-Y103B	**Zoology**	**3L:0T:1P**	**40 Hrs**	**3Hrs/Week**

Unit-I **6 Hrs**

1. Origin of Chordates Classification of phylum Chordata up to orders according to Parker and Haswell (Latest edition).
2. Hemichordata – External features and affinities of Balanoglossus.
3. Urochordata – Type study of Herdmania.
4. Cephalochordata – Type study of Amphioxus. Affinities of Amphioxus.

Unit-II **8 Hrs**

1. Comparison between Petromyzon and Myxine.
2. Comparative account of integuments
3. Comparative account of limb bones and girdles of vertebrates (Amphibia, Reptiles, Birds and Mammals).
4. Comparative account of digestive system.
5. Comparative account of respiratory system.

Unit – III **6 Hrs**

1. Comparative account of aortic arches and heart.
2. Comparative account of brain
3. Placentation in mammals.

Unit - IV **8 Hrs**

1. Origin of life- modern concepts only.
2. Lamarckism, Darwinism.
3. Modern synthetic theories: Variations, Mutation, Isolation & speciation
4. Adaptation and mimicry
5. Micro, macro evolution and mega evolution.

Unit – V **6 Hrs**

1. Fossils, methods of fossilization, determination of age of fossils.
2. Study of extinct forms: Dinosaurs and Archaeopteryx.
3. Zoogeographical distribution.
4. Evolution of man.
5. Geological time scale and insular fauna.

SUGGESTED READINGS :

1. Text book of Zoology, Volume II, Vertebrates – Parker &Haswell (Ed. A. J. Marshall) {ELBS Macmillan}
2. Vertebrate life – F. H. Pough& W. N. McFarland (Prentice Hall)
3. The Life of Vertebrates – J. Z. Yong (ELBS Oxford)
4. Vertebrates: Comparative anatomy, function, Evolution – K. V. Kardong (WCB McGraw Hill)
5. Comparative Anatomy of Vertebrates – G.C. Kent & L. Miller (WCB Pub)

Subject-Chemistry
Title of paper-Inorganic Chemistry
Paper – I

BSCB-Y101A	**Inorganic Chemistry**	**3L:0T:1P**	**40 Hrs**	**3Hrs/Week**

Unit – I Atomic Structure: **6 Hrs**

Dual Nature of matter idea of de Broglic matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrodinger wave equation, significance of Y and Y, Quantum numbers, radial and angular wave functions and probability distribution curves, shapes of s, p, and d orbitals. Aufbau and Pauli exclusion principles, Hund's multiplicity rule Electronic configuration of the elements, effective nuclear charge.

Unit – II Chemical Bonding – Part I **6 Hrs**

Covalent Bond – Valence bond theory and its limitations. Directional characteristics of convalent bond.Various types of hybridization and shapes of simple inorganic molecules ions. Valence shell electron pair repulsion (VSEPR) theory to NH_3, H_3O, SF_4, CIF_3, and H_2O, MO theory, homonuclear and heteronuclear (CO and NO)4 diatomic molecules, multicenter bonding in election deficient molecules, bond strength and bond energy.

Unit III Chemical Bonding Part II: **8 Hrs**

Ionic Solids- lonic structures, radius ratio effect and coordination number, limitation of radius ratio rule, lattice defects, semiconductors, lattice energy and Born- Haber cycle, solvation energy and solubility of ionic solids, polarizing power and Polaris ability of ions. Fajan's rule. Metallic bond- free election, valence bond and band theories. Weak Interactions- Hydrogen bonding, van der Waals forces.

Unit IV: S- Block Elements: **8 Hrs**

Comparative study Li and Mg. diagonal relationships, salient features of hydrides.Solvation and complexation tendencies including their functions in bio systems and introduction to alkyls and aryls.

Unit V: P- Block Elements Part – I: 6 Hrs

Comparative study be and AI (including diagonal relationship) of group 13-17 elements. Compound like hydrides.Oxides.Oxyacids and halides of groups 13-16.

p- Block Elements Part- II: Hydrides of boron-diborane and higher boranes, borazine, boroydrides. , Fullerenes, fluorocarbons, silicates (structural principle), tetrassulphurtertantride, basic properties of halogens, interhalogens and polyhalides.

Reference Books:

1. Inorganic Chemistry , - J D Lee, Pearson Education
2. Inorganic Chemistry- Cotton and Wilkinson, John Wiley
3. Inorganic Chemistry – Huheey, Harper Collins Pub. USA
4. Inorganic Chemistry – GR Chhatwal, Himalaya Publication

Title of paper-Physical Chemistry
Paper – II

BSCB-Y101B	**Physical Chemistry**	**3L:0T:1P**	**40 Hrs**	**3Hrs/Week**

Unit – I Gaseous States and Molecular Velocities: 6 Hrs

Critical Phenomenon: PV isotherms of ideal gases. Andrew's experiment, continuity of state, the isotherms of van der Waals equations, relationship between critical constants and van der Waals constants, Root mean square, average and most probable velocities Qualitative discussion of the Maxwell's distribution of molecular velocities. Collision numbers, mean free path and collision diameter.

Unit – II Liquid State: 6 Hrs

Intermolecular forces, structure of Liquids (a qualitative description) Liquid crystals: Difference between liquid crystal. Solid and liquid.Classification.Structure of nematic and cholestic phases.Thermography and seven segment cell.

UnitIII Chemical Kinetics: 6 Hrs

Chemical kinetics and its scope, rate of a reaction. Factors influencing the rate of a reaction_ concentration, temperature, pressure, solvent, light and catalyst.Dependence of rate on concentration, mathematical.Characteristics of simple chemical reaction-zero order. First order, second and pseudo order, half – life and mean life. Determination of the order of reaction, Differential method, Integration method and half life method.Study of chemical kinetics by polarimetry and spectrophotometry.Effect of temperature on rate of reaction.Arrhenius equation, concept of activation energy.Simple collision theory.Transition state theory (equilibrium hypothesis).

Unit IV:Radioactivity and Nuclear Chemistry:
Natural and artificial radioactivity, radioactive radiations, detection and measurement of radioactive radiation, theory of radioactivity, Group displacement law of soddy, radioactive disintegration, nuclear reactions, nuclear fission and nuclear fusion, half life period, isotopes. Isobars and isomers, application of radiochemistry.

Unit V:

A. **Chemical Equilibrium :**
   Law of mass action, Equilibrium constant, Lechatelier's Principles.
B. Colloidal Solutions: Classification, lyophilic and lyophobic colloids, properties: Kinetic, optical and electrical, coagulation, Hardy- Schulze rule, gold number, emulsions, gels and sols, application of colloidal.

Reference Books:

1- Physical Chemistry – Puri, Sharma and Pathania- Vikas Publications, New Delhi
2- Physical Chemistry – GM Barrow, International Student Edition McGraw Hills
3- The Elements of Physical Chemistry, PW Atkins, Oxford University Press
4- Physical Chemistry – R A Alberty, Willey Eastern Limited
5- Physical Chemistry Through Problems, SK Dograjn

Title of paper-Organic Chemistry
Paper – III

BSCB-Y101C	**Organic Chemistry**	**3L:0T:1P**	**40 Hrs**	**3Hrs/Week**

Unit – I Spectroscopy:
Nuclear Magnetic Resonance Spectroscopy. Proton Magnetic Resonance (1HNMR) Spectroscopy Nuclear shielding and dis-shielding, chemical shift and molecular structure, spin-spin coupling and coupling constant, region of signals, Explanation of PMR spectra of simple organic molecules like ethyl bromide, ethanol, acetaldehyde, 1,1,2 tribromo ethane, ethyl acetate, toluene and acetophenone. Applications of UV, IR and PMR spectroscopy for simple organic compounds.

Unit – II Organo- Metallic compounds:-
Organ magnesium compound- Grignard reagent, preparations, structure and chemical reactions.Organ zinc compounds- Preparations and chemical reactions. Organ lithium compounds- Preparations and chemical reactions.

Unit III Fat, Oil and Detergents:
Natural fat, edible and industrial oil of plant origin.Normal fatty acids, glycerides.Hydrogenation of unsaturated oil, saponification value, iodine value and acid value. Synthetic Detergents:- Alkyl and aryl Sulphonate.

Unit IV - **6 Hrs**

Amino Acid, Peptide, Protein and nucleic acid, Classification of amino acids, structure and stereo chemistry.Acid base behavior, isoelectric point and electrophoresis.Preparations and chemical reactions of alpha amino acids.

Unit V – **8 Hrs**

Introductory idea about five- and six – membered condensed heterocyclic compounds. Indole, Quinaline and isoquinoline- preparations and chemical properties (Fischer- Indole synthesis, Skraup's synthesis, BischlerNapiaralsky synthesis) Electrophilic substitution reactions of Indole, Quinoline and Isoquinoline

Reference Books:

1. Organic Chemistry, Morrison and Boyd, Prentice Hall

Organic Chemistry, LG Wade Jr, Prentice Hall Fundamentals of Organic chemistry, Solomon, johin Wiley

YEAR- II

PAPER-I (STRUCTURE DEVELOPMENT AND REPRODUCTION OF FLOWERING PLANTS) CODE- BSCB(Y- 202A)

BSCB-Y202A	**Botany**	**3L:0T:1P**	**40 Hrs**	**3Hrs/Week**

UNIT I **4 Hrs**

Tissue system- Types of Vascular bundles, Apical meristems, classification of meristems, The root system root apical meristem, anatomy of monocot and dicot root.

UNIT II **4 Hrs**

Shoot system, monocot systems of vascular cambiums and their functions, heart and sap wood, sec. growth in nyctanthus, dracaena , leptadenia, bohravia, salvadora.

UNIT III **6 Hrs**

Leaf system- Origin and development of leaf, Diversity in size, arrangement and shape, internal structure of mono and dicot leaf. adaptation to photosynthesis and water stress, senescence ,abscission.

UNIT IV **6 Hrs**

Embryology: concept of flower as a modified shoot, structure of anther, microsporogenesis, megasporogenesis, gametophyteand its types, pollination –mechanism and agencies, pollen pistil interaction and self incompatibility.

UNIT V **6 Hrs**

Embryology; Double fertilization, development and types of endosperm, development of embryo in monocot and dicot plants, fruit development and maturation ,seed structure and dispersal, Mode of vegetative propagation

SUGGESTED READIING;

1 GANGULEE,H.C, DAS,K.S , COLLLLEGE BOTANY- CENTRAL BOO; AGENCY
2 SINGH, V. , PANDE P.C & JAIN- STRUCTURE AND DEV IN ANGIOSPERMS
2. MAHESWARI,P- PLANT EMBRYOLOGY

PAPER-II (PLANT ECOLOGY BIODIVERSITY & PHYTOGEOGRAPHY)

BSCB-Y202B	Botany	3L:0T:1P	40 Hrs	3Hrs/Week

UNIT I **4 Hrs**

Ecosystems-Structure and types ,biotic and abiotic concept, Trophic levels, food chain, food web, ecological pyramids, biogeo chemical cycles- carbon,nitrogen,sulphur

UNIT II **4 Hrs**

Ecological adaptations- Morphological and anatomical adaptations, physiological responses water, adaptation (hydrophyte and xerophytes) temp. adapotation (thermoperiodism,vernalization0light
adaptation (photoperiodism) sucession, types of sucession- hydroxere, xerosere.

UNIT III **6 Hrs**

Biodiversity and Population ecology – Distribution pattern, Density, natality, moratality, growth curves, ecotypes, ecads, community ecology, biodiversity conservation, ex situ and in situ conservation, national parks and sanctuaries of mp , Red data book

UNIT IV **6 Hrs**

Soil and pollution- physical and chemical properties of soil, soil formation and development, soil profile ,soil classification, composition, pollution types-causes, global warming, acid rain, climate change, ozone hole and ozone layer.

UNIT V **4 Hrs**

Phytogeography- phytogeographical regions of india,vegetation types of M.P., National parks and sanctuaries of M.P,NATURAL RESOURES and types, conservation of natural resourses, Land resourse management, water and wet resourse management.

SUGGESTED READINGS :

1 KUMAR, V.K, BIO DIVERSITY CONSERVATION, AGROBOTANICA, BIKANER
2 P.D. SHARMA, ECOLOGY AND ENVIORNMENT, RASTOGI PUBLICATION

SUBJECT- ZOOLOGY

PAPER-I (VERTEBRATES AND EVOLUTION)

BSCB-Y203A	**Zoology**	**3L:0T:1P**	**30 Hrs**	**3Hrs/Week**

UNIT - I **6 Hrs**

1. Origin of Chordates, Classification o phylum Chordate upto orders according to Parker and Haswell (latest edition)
2. Urochorbata- Type study of Herdmania
3. Cephalochordata –Type study of Amphioxus, Affinities of Amphioxus
4. Comparison between Petromyzon and Myxine.

UNIT - II **6 Hrs**

1. Comparative account of integuments
2. Comparative account of limb bones and girdles of vertebrates (Amphibia, Reptiles, Birds and Mammals).
3. Comparative account of digestive system (Amphibia, Reptiles, Birds and Mammals).
4. Comparative account of respiratory system (Amphibia, Reptiles, Birds and Mammals).

UNIT – III **6 Hrs**

1. Comparative account of aortic arches and heart.
2. Comparative account of brain
3. Comparative account of Urinogenital system
4. Placentation in mammals.

UNIT – IV **6 Hrs**

1. Origin of life- modern concept only.
2. Lamarckism, Darwinism. ‘
3. Modern synthetic theories Variations, Mutation, Isolation & Speciation
4. Adaptation and Mimicry
5. Micro, Macro evolution and mega evolution

UNIT – V **6 Hrs**

1. Fossils, methods of fossilization , determination of age of fossils.
2. Study of extinct forms: Dinosaurs and Archaeopteryx.
3. Zoogeographical distribution.
4. Evolution of man.
5. Geological time scale and Insular fauna.

PAPER-II (ANIMAL PHYSIOLOGY AND BIO-CHEMISTRY)

BSCB-Y2013B	Zoology	3L:0T:0P	40 Hrs	3Hrs/Week

UNIT- I **6 Hrs**

Nutrition and Metabolism

1. Physiology of digestion in mammals
2. Protein Metabolism: Deamination, Decarboxylation. Transamination of amino acids, and Ornithine cycle.
3. Carbohydrate metabolism- Glycogenesis, Glycogenolysis, Glycolysis, the Citric Acid cycle, Gluconeogenesis.
4. Lipid Metabolism-Beta oxidation of fatty acids.

UNIT-II **6 Hrs**

Respiration, Excretion and Immune System

1. Mechanism and Physiology of respiration in mammals (transport of gases, chloride shift)
2. Physiology of Excretion- urea and urine formation in mammals
3. Innate and acquired immunity, immune cells and lymphoid system, immune response: cellular and humoral immunity

UNIT-III **6 Hrs**

Regulatory Mechanisms of Enzymes and role of Vitamins

1. Thermoregulation.
2. Definition and nomenclature of enzymes, classification of enzymes.
3. Mechanism of enzyme action.
4. Co-enzymes
5. Vitamins

UNIT- IV **6 Hrs**

Neuromuscular Co-ordination

1. Types of neurons and glial cells
2. Physiology of nerve impulse conduction.
3. Types and structure of Muscles
4. Theory of muscle contraction and its biochemistry.

UNIT-V **6 Hrs**

Endocrine system

1. Structure and functions of Pituitary gland.
2. Structure and functions of Thyroid gland.
3. Structure and functions of Adrenal gland.
4. Structure and functions of Parathyroid, Thymus and Islets of Langerhan's
5. Physiology of Male and Female Sex Hormones.

SUGGESTED READING:

1. MAMMALIAN PHYSIOLOGY: BY C. S. SHERRINGTON, 2001.
2. ANIMAL PHYSIOLOGY, CC CHATTERJEE, 1980.
3. VERTEBRATE ZOOLOGY, RL KOTPAL, 1989.

PRACTICAL

1. Dissections of commercial available species of locally available Fishes (Efforts may be done to use computer simulation technique).
2. Study of museum specimens (Vertebrates)
3. Study of specimens of evolutionary importance viz living fossils, connecting link,extinct animals,
fossils: Limulus, Latimeria, Dianosaurs, Asciatic chital, Archeopteryx, Peripatus etc.
4. Osteology :Limb bones and girdle bones of Frog,Varanus,Pigeon and Rabbit.
5. Detection of protein,Carbohydrate and lipid/study of human salivary enzyme activity in relation to pH.
6. Hematological Experiment-RBC and WBC counting /Blood grouping in blood samples/Estimation of Hemoglobin and sugar in blood samples.
7. Histological study of various endocrine glands-T.S.of Thyroid,T.S.of Pituitary gland,T.S.of Adrenal gland,T.S.of Testis,T.S.of Ovary.
8. Histological study of Digestive and Visceral organ –T.S of Stomach,T.S of intestine,T.S of Pancreas T.S. of Liver,T.S of Lungs and L.S. of Kidney.

SUBJECT- CHEMISTRY PAPER-I (PHYSICAL CHEMISTRY)

CODE- BSCB(Y- 201A)

BSCB-Y201A	**Chemistry**	**3L:0T:0P**	**35 Hrs**	**3Hrs/Week**

UNIT-I **8Hrs.**

Thermodynamics: Definition of thermodynamics, First Law of Thermodynamics, Seconds Law of Thermodynamics: Need for the law, different statements of the law. Carnot cycle and its efficiency, Carnot theorem. Thermodynamic scale of temperature. Concept of entropy : entropy as a state function, entropy as a function of V & T, entropy as a function of P & T, entropy change in physical change, Clausius inequality, entropy as a criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases. Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions ; Gibbs function (G) and Helmholtz function (Z) as thermodynamic quantities, A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change.Thermochemistry: standard state, standard enthalpy of formation-Hess's Law of heat summation and its applications. Heat of reaction at constant pressure and at constant

UNIT-II **8 Hrs**

Phase Equilibrium : Statement and meaning of the terms - phase, component and degree of freedom, derivation of Gibbs phase rule, phase equilibria ofone component system - water, CO2 and S systems. Phase equilibria of two component system - solid -liquid equilibria, simple eutectic - Bi-Cd, Pb-Ag systems, desilverisation of lead. Solid solutions - compound formation with congruent melting point (Mg-Zn) and incongruent melting point, (NaCl-H2O), Fecl3-H2O) and CuSO4-H2O) system. Freezing mixture, acetone-dry ice. Liquid - liquid mixtures - Ideal liquid mixtures, Raoult's and Henry's law. Non-ideal system-azeotropes - HCl-H2O and ethanol - water systems. Partially miscible liquids - Phenol-water, trimethylamine-water, nicotine-water systems. Lower and upper consolute temperature. Effect of impurity on consolute temperature. Immiscible liquids, steam distillation. Nernst distribution law – thermodynamic derivation, applications.

UNIT-III **08 Hrs.**

Electrochemistry – I : Conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific coductance with dilution. Migration of ions and Kohlrausch law Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law its uses and limitations. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only). Transport number, definition and determination by Hittorf method and moving boundary method.

UNIT-IV **10 Hrs.**

Electrochemistry - II : Types of reversible electrodes - gas - metal ion, metal-metal ion, metal - insoluble

salt - anion and redox electrodes. Electrode reactions, Nernst equation, derivation of cell E.M.F. and single electrode potential, standard hydrogen electrode-reference electrodes- standard electrode potential, sign conventions, electrochemical series and its significance. Electrolytic and Galvanic cells - reversible and irreversible cells, conventional representation of electrochemical cells. EMF of a cell and its measurements. Computation of cell EMF. Calcuation of thermodynamic quantities of cell reactions (DG, DH and K), polarization, over potential and hydrogen overvoltage. Concentration cell with and without transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titrations. Definition of pH and pKa determination of pH usinghydrogen, quinhydrone and glass electrodes, by potentiometric methods. Buffers - mechanism of buffer action, Henderson - Hazel equation. Hydrolysis of salts. Corrosion - types, theories and methods of combating it

UNIT-V **6 Hrs**

Surface Chemistry: Adsorption, adsorption and adsorption, types of Adsorption, Adsorption of gases and Liquids in solid adsorption, Freundlich and Langmuir adsorption isotherms surface area and determination of the surface area. Catalysis: Characteristics of Catalyzed reactions, classification of Catalysis, application of Catalysis.

Suggested Readings:

1. ADVANCED PHYSICAL CHEMISTRY, GURDEEP RAJ, 2014.

PAPER-II (INORGANIC CHEMISTRY)

BSCB-Y201B	**Chemistry**	**3L:0T:0P**	**60 Hrs**	**3Hrs/Week**

UNIT-I **6 Hrs**

Chemistry of Elements of First Transition Series: Characteristic properties of d-block elements. Properties of the elements of the first transition series, their binary compounds and complexes illustrating relative stability of their oxidation states, coordination number and geometry.

UNIT-II **6 Hrs**

Chemistry of Elements of Second and Third Transition Series: General characteristics, comparative treatment with their 3d-analogues in respect of ionic radii, oxidation states, magnetic behaviour, spectral properties and stereochemistry.

UNIT-III **8 Hrs**

Oxidation and Reduction: Use of redox potential data-analysis of redox cycle, redox stability in water - Frost, Latimer and Pourbaix diagrams. Principles involved in the extraction of the elements. Coordination Compounds: Warner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes.

UNIT-IV **6 Hrs**

Chemistry of Lanthanide Elements: Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation, lanthanide com pounds.
Chemistry of Actinides: General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from U, similarities between the later actinides and the later lanthanides.

UNIT-V **4Hrs**

Acids and Bases: Arrhenius, Bronsted-Lowry, the Lux-Flood, solvent system and Lewis concepts of acids and bases. Non-aqueous Solvents : Physical properties of a solvent, types of solvents and their general characteristics, reactions in non-aqueous solvents with reference toliquid NH3 and liquid SO2

Suggested Readings:

1. A Text-Book Inorganic Chemistry, G. S. Newth
2. Physical Inorganic Chemistry: A Coordination Chemistry Approach, 1996, S.F.A. Kettle
2. Industrial Inorganic Chemistry, Werner Buchner

PAPER-III (ORGANIC CHEMISTRY)

BSCB-Y201C	**Chemistry**	**3L:0T:0P**	**120 Hrs**	**3Hrs/Week**

UNIT-I **08 Hrs.**

Electromagnetic Spectrum : Absorption Spectra Ultraviolet (UV) absorption spectroscopy - absorption laws (Beer-Lambert law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transition, effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones. Infrared (IR) absorption spectroscopy--molecular vibrations, Hooke's law, selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region, characteristic absorptions of various functional groups and interpretation of IR spectra of simple organic compounds.

UNIT-II **06 Hrs.**

Alcohols: Classification and nomenclature. Monohydric alcohols -- nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding. Acidic nature. Reactions of alcohols. Dihydric alcohols -- nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [Pb(OAc)4and HlO4] and pinacol-pinacolone rearrangement. Trihydric alcohols -- nomenclature and methods of formation, chemical reactions of glycerol. Phenols: Nomenclature, structure and bonding. Preparation of phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols --electrophilic aromatic substitution, acylation and carboxylation. Mechanisms of

Fries rearrangement, Claisen rearrangement, Gaterman synthesis, Hauben-Hoesch reaction, LedererManasse reaction and Reimer-Tiemann reaction.

UNIT-III **06 Hrs.**

Aldehydes and Ketones: Nomenclature and structure of the carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1, 3-dithianes, synthesis of ketones from nitriles and from carboxylic acids. Physical properties. Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensations. Condensation with ammonia and its derivatives. Witting reaction. Mannich reaction. Use of acetals as protecting group. Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones, Cannizzaro reaction. MPV, Clemmensen, Wolf f-Kishner, LiAlH4and NaBH4reductions. Halogenation of enolizable ketones. An introduction to α, β unsaturated aldehydes and ketones.

UNIT-IV **05 Hrs.**

Carboxylic Acids : Nomenclature, structure and bonding, physical prop erties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids. Reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction. Synthesis of acid chlorides, esters and amides. Reduction of carboxylic acids. Mechanism of decarboxylation. Methods of formation and chemical reactions of unsaturated monocarboxylic acids. Dicarboxylic acids: methods of formation and effect of heat and dehydrating agents.

UNIT-V **08 Hrs.**

Organic Compounds of Nitrogen: Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes. Mechanisms of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media. Picric acid. Halonitroarenes : reactivity. Structure and nomenclature of amines, physical properties. Stereo chemistry of amines. Separation of a mixture of primary, secondary and tertiary amines. Structural features effecting basicity of amines. Amine salt as phase-transfer catalysts. Preparation of alkyl and aryl amines (reduction of nitro compounds nitriles), reductive amination of aldehydic and ketonic compounds. Gabriel-phthalimide reaction. Hofmann bromoamide reaction. Reactions of amines, electrophilic aromatic substitution in aryl amines, reactions of amines with nitrous acid. Synthetic transformations of aryl diazonium salts, azo coupling.

Suggested Readings:

1. ORGANIC CHEMISTRY, VOL. 1 - DR. SULTANAT
2. Advanced Organic Chemistry, VOL IV - S.P. BHUTANI
3. TEXTBOOK OF ORGANIC CHEMISTRY, VOL.III - V. K. AHLUWALIA

YEAR- III

Paper-I (Physical Chemistry)

BSCB-Y301	**Chemistry**	**3L:0T:1P**	**38 Hrs**	**3Hrs/Week**

UNIT –I **6 Hrs**

A. Elementary Quantum Mechanics: Black-body radiation, Planck's radiation law, photoelectric effect, heat capacity of solids, Bohr's model of hydrogen atom (no derivation) and its defects, Compton effect. De-Broglie hypothesis, the Heisenberg's uncertainly principle, Sinusoidal wave equation, Hamiltonian operator, Schrodinger wave equation and its mportance, physical interpretation of the wave function, postulates of quantum mechanics, and particle in a one-dimensional box.

B. **Molecular orbital theory:** Basic ideas-criteria for forming M.O. from A.O., construction of M.O.'s by LCAO-H_2 ion, calculation of energy levels from wave functions, physical picture of bonding and antibonding wave functions, concept of σ, σ*, Л, Л* orbitals and their characters. Hybrid orbitals sp, sp^2 , sp^3 ; calculation of coefficients of A.O.'s used in these hybrid orbitals. Introduction to valence bond model of H_2 ion, comparison of M.O. and V.B. models.

UNIT – II **6 Hrs**

Spectroscopy: Introduction: Electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born-Oppenheimer approximation, degrees of freedom. **Rational Spectrum:** Diatomic molecules, energy levels of a rigid rotor (semi-classical principles), selection rules, spectral intensity, distribution using population distribution Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect. **Vibrational Spectrum:** Infra-red spectrum : Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of an harmonic motion and isotope on the spectrum. Idea of vibrational frequencies of different functional groups.

UNIT- III **6 Hrs**

Raman Spectrum: Concept of polarizability, pure rotational and pure vibrational Raman

spectra of diatomic molecules, selection rules.

Electronic Spectrum: Concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Franck-Condon principle. Qualitative description of σ, Ꮭ and n M.O. their energy levels and the respective transition. **UV Spectroscopy:** Electronic excitation, elementary idea of instrument used, application to organic molecules, Woodward-Fieser rule for determining λ_{max} of enes, polyenes and α,β unsaturated carbonyl compounds.

UNIT – IV **6 Hrs**

Photochemistry Interaction of radiation with matter, difference between thermal and photochemical processes, Laws of photochemistry: Grothus-Draper law, Stark-Einstein law, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radioactive processes (radioactive processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions energy transfer processes (simple examples.)

UNIT – V **6 Hrs**

Physical properties and Molecular Structure: Optical activity, Polarization (Clausis – Mossotti equation), orientation of diploes in an electric field, diploe moment, induced diploe moment measurement of diploe moment, temperature method and refractive method, dipole moment and structure of molecules, magnetic properties paramagnetic, diamagnetism and ferromagnetism.

Suggested Textbook & reference Books:

- Physical Chemistry – Puri, Sharma and Pathania – Vikas publications, New Delhi
- Physical Chemistry – G M Barrow, International student Edition McGraw hills.
- The elements of physical chemistry – PW Atkins, Oxford University press
- Physical Chemistry – R A Albetry, Willey Eastern Limited
- Physical Chemistry Through problems, S K Dogra and S Dogra, Wiley Easter.

Paper-II (Inorganic Chemistry)

BSCB-Y301	Chemistry	3L:0T:1P	40 Hrs	3Hrs/Week

UNIT –I **06 Hrs.**

1. Hard and soft acids and bases (HSAB) Introduction, classification of hard and soft acid-base, Hard and soft acid-base concept of Pearson, application of hard-soft acid base theory, Symbiosis, acid-base strength and hardness and softness; theoretical basis of hardness and softness, electronic theory, Л- bonding theory, and dragowayland theory, electronegativity and hardness and softness, limitations of hard soft acid-base concept.

2. Silicones and Phosphazenes Introduction: Silicones-methods of preparation, classification, properties and application (uses), phosphazenes (Phosphonitrilic chloride)-method of preparation and properties: structure of riphosphazenes, some other phosphazenes and uses of phosphazenes.

UNIT – II **06 Hrs.**

1. Metal Ligand Bonding in Transition Metal Complexes: Introduction, limitations of valence bond theory, crystal field theory, and crystal field splitting of d-orbitals, d-orbital splitting and stabilization energy in octahedral, tetrahedral and square planer complexes; factor affecting the crystal field parameters, Application of crystal field theory and limitations of crystal field theory.

2. Thermodynamic and Kinetic Aspects of Metal Complexes. Introduction: Thermodynamic aspects of metal complexes, factors affecting thermodynamic stability of complexes, kinetic aspects of metal complexes, stabilization reactions of square planer complexes and factors affecting the rate of substitution reactions in square planar complexes.

UNIT- III **08 Hrs.**

Magnetic Properties of Transition Metal Complexes Introduction, types of magnetic behavior, diamagnetisms, Paramagnetism, Ferromagnetism, Antiferromagnetism, Ferrimagnetis, Origin and calculation of magnetism, methods of determining susceptibility- Guoy, Bhatnagar Mathur, Quincke's Curie and Nuclear magnetic Resonance method, Magnetic moment; L-S coupling, Determination of ground state term symbol, correlation of μ_s and μ_{eff} values, Orbital contribution to magnetic moments and application of magnetic moment data for 3d model complexes.

UNIT – IV **06 Hrs.**

A. Electronic Spectra of Transition Metal Complex Introduction: Type of electronic transition, Selection rules for d-d transition; spectroscopic ground states-Notations, Spectroscopic states and spectroscopic ground states in complexes; Spectrochemical series; orgal energy level diagram-Uses in octahedral and tetrahedral complexes having d^1 to d^9 states: Electronic spectrum of $[Ti(H_2O)_6]^{3+}$ = complex ion.

B. Organometallic Chemistry

Introduction: Nomenclature and classification of Organometallic compounds, General methods of preparation: Alky1 and ary1 organometallic compounds of Lithium preparation, Properties, Bond nature and application; organometallic compounds of A1, Hg, Sn and Ti-Preparation, properties, bond nature and applications.

UNIT – V **06 Hrs.**

A. Bio-Inorganic Chemistry Introduction: Essential and trace elements in biological processes, Biological function of the bio-elements, Availability of bio-metals and bio-non-metals: etlloporphyrins, Hemoglobin structure and biological function, Myoglobin-mechanism of oxygen transfer through hemoglobin and myoglobin: Relation between hemoglobin and myoglobin and chemical reaction of hemoglobin and myoglobin; Biological role of alkali and alkaline earth metal ions with special reference to Ca2=; Nitrogen fixation.

B. Metal Nitrosyl Complex Nitrosylating agent, Synthesis, structure, properties and Bonding,

Suggested Textbook & reference Books:

- Inorganic Chemistry, Mac Murray, Pearson Education.
- Inorganic Chemistry – J D Lee, John Wiley
- Inorganic Chemistry – Cotton and Wilkinson, John Wiley
- Inorganic Chemistry – Huheey, Harper Collins pub, USA
- Inorganic Polymer – G R Chhatwal, Himalaya Publication.

Paper-III (Organic Chemistry)

BSCB-Y301	Chemistry	3L:0T:1P	40 Hrs	4Hrs/Week

UNIT –I **06 Hrs.**

Structure and Bonding

Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bond inclusion compounds, clatherates, Charge transfer complexes, resonance, hyper onjugation, inductive, electrometric, mesmeric and steric effect. **Mechanism of Organic Reactions** Hemolytic and heterotypic bond fission, types of reagents- electrophiles and nucleophiles, Types or organic reaction, energy consideration. Reactive intermediates (carbonations, carbanions, free radicals, arynes and nitrnewith examples.) Methods of determination of reaction mechanism (active intermediate products) isotope effects, kinetic and stereo chemical studies.

UNIT – II **05 Hrs.**

Alkanes and cycloalkanes IUPAC nomenclature of branched and unbranched alkanes, classification of alkanes, Isomerism in alkanes, methods of formation (with special reference to Wurtz reaction, Kolbe reaction, Corey- House reaction and decarboxylation of carboxylic acids), physical properties and chemical reactions of alkanes, conformation of alkanes, Mechanism of free radical halogenation of alkanes, Cycloalkanes nomenclature, methods of formation, chemical reaction, Baeyer strain theory and its limitation, Theory of strainless rings, The case of cyclopropane ring: Banana bonds, conformation of cycloalkanes.

UNIT- III **06 Hrs.**

Alkenes, Cycloalkanes, Dienes Nomenclature of alkenes, methods of formation mechanism of dehydration of alcohols and dehydrohalgenation of alkyl halides, regioselectivity in alcohol dehydration, The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes-mechanism involved in hydrogenation, electrophilic and free radical addition, Markownikoff's rule, hydroboration-oxidation, oxymercuration reduction, Epoxidation, ozonolysis, Polymerization of alkenes, Substitution at the allylic and vinylic positions, industrial application of ethylene and propene, Methods of formation, conformation and chemical reactions of cycloalkanes, Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes, structure of allenes and butadiene, methods of formation, polymerisation, chemical reaction – 1,2 and 1,4 addition, Diels- Alder reaction.

UNIT – IV **06 Hrs.**

Alkynes and Alkyl Halides Nomenclature, structure and bonding in alkynes, methods of formation, Chemical reactions, acidity of alkynes, Mechanism of electrophilic and nucleophillic addition reaction, hydroboration oxidation, metal-ammonia reduction, oxidation and polymerization Nomenclature and classification of alkyl halides, methods of formation; hemical reactions, Mechanisms of nucleophillic substitution reaction of reaction of alky1 halides, $S_{N}1$ and $S_{N}2$ reaction with energy profile diagrams, Elimination reaction Polyhalogen compounds: methods of preparation and properties of chloroform and properties of Chloroform and carbon tetrachloride.

UNIT – V **08 Hrs.**

Stereochemistry of Organic Compounds

Concept of isomerism, types of isomerism, Optical isomerism elements of symmetry, molecular chirality, enantiomers, stereo genic centers, diastereomers, threo and erythro diasteromers, meso compounds, resolution of enantiomers, inversion, retention and racemization. Relative and absolute configuration, sequence rule, D & L and R & S systems of nomenclature, Geometrical isomerism- determination of configuration of geometric isomers, E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds.

Suggested Textbook & reference Books:

- Organic Chemistry, F A Carey McGraw hills Inc.
- Introduction to Organic Chemistry streitwiesser, Healthcock and Kosover, MacMillan.
- Vogel's Qualitative and Quantitative analysis, Vol I, II, III, ELBS
- Advanced organic chemistry, I.L. Finar, ELBS
- Basic Concepts of analytical chemistry, S.M. Khoper, New age International Publishers.

PRACTICAL

CODE-BSCB (Y-301D)

Inorganic Chemistry:

I. Gravimetric analysis:
Barium as Barium sulphate, Copper as cuprous-thiocynate.
II. Complex compound preparation
a. Potassium chlorochromate (IV)
b. Tetra mine copper (II) sulphate monohydrate
c. Hexamminenickel (II) chloride
III. Effluent water analysis, Identification of cations and anions in different samples.
IV. Water analysis, to determine dissolved oxygen in water samples in ppm.

Physical Chemistry:

I. To determine the velocity constant (specific reaction rate) of hydrolysis of methyl acetate/ ethyl acetate catalyzed by hydrogen ions at room temperature and water:
II. Determination of partition coefficient of iodine between carbon tetra chloride and water.
III. Job's method
IV. pH-metric titrations, conduct metric titrations

Organic Chemistry:

I. Binary mixture analysis containing two solids:
Separation, identification and preparation of derivatives
II. Preparation
a. Acetylation
b. Benzolylation
c. Meta dinitro benzene
d. Picric acid

Subject- Botany

Paper-I (Plant physiology and Bio chemistry)

BSCB-Y302	**Botany**	**3L:0T:0P**	**30 Hrs**	**3Hrs/Week**

Unit-I **06 Hrs.**

Plant water relation- Properties of water, importance of water in plants life, Diffusion ,osmosis, ascent of sap, structure of stomata and its mechanism ,transpiration –its mechanism ,factors affecting rate of transpiration.

Unit II **03 Hrs.**

Plant Nutrition and Bio molecules- Mineral Nutrition and essential macro & micro nutrients and their role, absorption of mineral nutrients, hydroponics, Tran's location of organic solvents Bio molecules- structure and function of carbohydrate, amino acids, proteins, lipids.

Unit III **04 Hrs.**

Photo synthesis,chloroplast,concept of two photo system, ark reaction, light reaction, red drop ,emerson effect,calvin,hatch and slack cycle,CAM pathway, factors effecting rate of photo synthesis.

UNIT IV **03 Hrs.**

Respiration- Mitochondria, aerobic and anaerobic respiration, Krebs cycle, MP pathway, electron transport system.facors affecting rate of respiration

Unit V **03 Hrs.**

Enzymology and plant hormone- classification and nomenclature of enzymes, concept of holo enzyme,coenzyme,apoenzyme,cofactorsPlant harmones- discovery ,structure, mode of action, role of auxin, gibberllins,cytokinnin,ethylene,absicissic acid.

Suggested readings:

1 Verma Plant physiology, emkey publication

2 Salisburry and ross –Plant physiology

3 Das,dutta & gangully- College botany vol II , Central Book Agency

Paper-II (Cell Biology Genetics &Bio Technology)

BSCB-Y302	Botany	3L:0T:0P	30 Hrs	3Hrs/Week

Unit I **03 Hrs**

Cell envelops & cell organelles- Plasma membrane, lipid bilayer structure, functions of cell wall, Golgi complex, mitochondria, vacuole, and chloroplast.

Unit II **04 Hrs**

Chromosome organization- structure and function of chromosome,cetromere and telomere, nucleosome model, special types of choromosome,variation in choromosome numbers,deletion,duplication,translocation and inversion,euploidy and aneuploidy,DNA structure,dna genetic material ,DNA replication

Unit III **03 Hrs**

Genetic Inheritence-Mendelism; las of segregation, independent assortment, linkage, interaction of genes, cytoplasmic inheritance, Mutation; spontaneous and induced mutation, DNA DAMAGE REPAIR

Unit IV **04 Hrs**

Gene - structure of gene, genetic code, transfer of genetic information, transcription translation, protein synthesis, tRNA & ribosomes, regulation of gene expression in protein synthesis.

Unit V **04 Hrs**

Biotechnology Definition, basic aspects of plant tissue culture, cellular totipotiency, differentiation and morphogenesis, important achievements of biotechnology in agriculture.

Suggested reading:

1 P.k .Gupta Text book of cell and molecular biology Rastogi publication.

2 Sinha & Sinha Cytogenetic and Plant Breeding, vikas publication.

3 P.K.Gupta Genetics Rastogi publication.

Practical-Botany

CODE-BSCB (Y-302C)

1 Exercise based on Physiology- 10

2 Bio chemical test-05

3 Exercise based on cytology-10

4 Ex based on genetic problem- 05

5 Spotting-10

6 VIVA VOICE- 05

7 Sessional- 05

Subject- Zoology

Paper-I (Biotechnology, Immunology, Biological Tools and Techniques)

BSCB-Y303	Zoology	3L:0T:0P	35 Hrs	3Hrs/Week

Unit-I **04 Hrs**

Biotechnology: Genetic Engineering (concept and recombinant DNA technology) and its application in agriculture & medical areas and energy production. Biotechnology of food processing, pharmaceuticals (e.g. use of microbes in insulin production) and fermentation.

Unit-II **04 Hrs**

Immunology. Concepts of immunity, types of immunity, Antigen and Antibodies, vaccines of different diseases and immunological reactions.

Unit-III **04 Hrs**

Biological Tools and Techniques: Principles and uses of instruments: pH Meter, Calorimeter, Microtome, Spectrophotometer & Centrifuge. Microscopy (light, transmission and scanning electron microscopy) Chromatography and Electrophoresis.

Unit-IV **04 Hrs**

Biostatistics: Sampling, Measures of central tendency (mean, median and Mode) and dispersion (variance, standard deviation and standard error); Correlation and Regression

Unit-V **04 Hrs**

Animal breeding and culture: Aquaculture, Pisciculture, Poultry, Sericulture, Apiculture, Lac culture. Wild Life of India: Endangered species. Important sanctuaries; national parks of India; Different projects launched for the preservation of animal species; in-situ and ex-situ conservation of wild life.

Books References:

1. Invertebrates: R.L. Kotpal
2. Vertebrates: R.L. Kotpal
3. Ecology: PD Sharma
4. Zoology- Shivlal agrawal & company.
5. Ayush Aggarwal. Animal Biochemistry, 2013
6. Pelzar Jr, M.J. Chan, E.C.S. and Krieig N.R (Microbiology)

Paper-II

(Ecology, Animal Behavior and Pollution, Microbiology and Toxicology)

BSCB-Y303	**Zoology**	**3L:0T:1P**	**40 Hrs**	**3Hrs/Week**

Unit- I **04 Hrs**

Ecology: Ecosystem: Concept, components, fundamental operations, energy flow, food-chain, food webs and trophic levels, ecological niche, abiotic and biotic factors. Population: haracteristics and regulation. Ecological succession. Adaptation: Aquatic, terrestrial, aerial and arboreal.

Unit-II **04 Hrs**

Animal Behavior: Introduction to Ethology, Patterns of behavior (taxes, reflexes, instinct and motivation); biorhythms; learning and memory, Migration of fishes & birds.

Unit-III **04 Hrs**

Pollution and Toxicology: Concept, sources, types (air, water, soil, noise & radiation), and control of environmental pollution. Exposure of toxicants (routes of exposure, and duration and frequency of exposure); dose -response relationship categories of toxic effects.

Unit-IV **03Hrs**

Microbiology: Morphology, physiology and infection (outline) of bacteria and viruses. Bacterial and viral diseases.

Unit-V **04 Hrs**

Parasitology: (a) Structure, life cycle, pathogenicity, including diseases, causes, symptoms and control of the following parasites of domestic animals and humans: Trypanosome, Giardia and Wuchereria, Vectors and pests: Life cycle and their control of following pests: Gundhi bug, Sugarcane leafhopper, Rodents. Termites and Mosquitoes and their control.

Books References:

1. Invertebrates: R.L. Kotpal
2. Vertebrates: R.L. Kotpal
3. Ecology: PD Sharma

Zoology Practical

BSCB(Y-303C)

• Permanent Preparation of: Euglena, Paramecium and rectal protozoans from frog.

• Stool examination for different intestinal parasites.

• Study of prepared slides/ specimens of Entamoeba, Giardia, Leishmania, Trypanosoma, Plasmodium, Fasciola, Cotugnia, Taenia, Rallietina, Polystoma Paramphistomum, Schistosoma, Echinococcus, Dipylidium, Enterobius, Ascaris and Ancylostoma;