

**Kalinga University Atal Nagar (C.G.)**



**SCHEME OF EXAMINATION  
& SYLLABUS**

**of**

**B.Sc. (ZBC)**

**UNDER**

**Faculty of Science**

**w.e.f. Session 2021-22**

<b>B.Sc. ( ZBC )</b>					
<b>First Semester</b>					
<b>Code No.</b>	<b>Subject</b>	<b>Credits</b>	<b>Internal Marks</b>	<b>External Marks</b>	<b>Total</b>
	<b>(Choose Any One) 101A/101B</b>	2	15	35	50
BZBC101A	English				
BZBC101B	NCC				
BZBC102	Plant Diversity	4	30	70	100
BZBC103	Conceptual Organic Chemistry	4	30	70	100
BZBC104	Animal Diversity	4	30	70	100
BZBC105-P	Plant Diversity –Lab	1	20	30	50
BZBC106-P	Conceptual Organic Chemistry-Lab	1	20	30	50
BZBC107-P	Animal Diversity-Lab	1	20	30	50
		<b>17</b>	<b>165</b>	<b>335</b>	<b>500</b>

<b>B.Sc. ( ZBC )</b>					
<b>Second Semester</b>					
<b>Code No.</b>	<b>Subject</b>	<b>Credits</b>	<b>Internal Marks</b>	<b>External Marks</b>	<b>Total</b>
	<b>(Choose Any One) 201A/201B</b>	2	15	35	50
BZBC201A	Environmental Science				
BZBC201B	NCC				
BZBC202	<b>Cell Biology &amp; Genetics</b>	4	30	70	100
BZBC203	Physical Chemistry for the Sciences	4	30	70	100
BZBC204	Comparative Anatomy and Developmental Biology of Vertebrates	4	30	70	100
BZBC205-P	<b>Cell Biology &amp; Genetics-Lab</b>	1	20	30	50
BZBC206-P	Physical Chemistry for the Sciences-Lab	1	20	30	50
BZBC207-P	Comparative Anatomy and Developmental Biology of Vertebrates-Lab	1	20	30	50
		<b>17</b>	<b>165</b>	<b>335</b>	<b>500</b>

<b>B.Sc. (ZBC)</b>					
<b>Third Semester</b>					
<b>Code No.</b>	<b>Subject</b>	<b>Credits</b>	<b>Internal Marks</b>	<b>External Marks</b>	<b>Total</b>
BZBC301	Fundamental of IT	3	30	70	100
BZBC302	Diversity of Angiosperms: Systematics, Development & Reproduction	4	30	70	100
BZBC303	Chemical Bonding, Transition Metal & Coordination Chemistry	4	30	70	100
BZBC304	Physiology and Biochemistry	4	30	70	100
BZBC305-P	Fundamental of IT-Lab	1	20	30	50
BZBC306-P	Diversity of Angiosperms: Systematics, Development & Reproduction-Lab	1	20	30	50
BZBC307-P	Chemical Bonding, Transition Metal & Coordination Chemistry-Lab	1	20	30	50
BZBC308-P	Physiology and Biochemistry-Lab	1	20	30	50
		<b>19</b>	<b>200</b>	<b>400</b>	<b>600</b>

<b>B.Sc. (ZBC)</b>					
<b>Fourth Semester</b>					
<b>Code No.</b>	<b>Subject</b>	<b>Credits</b>	<b>Internal Marks</b>	<b>External Marks</b>	<b>Total</b>
	<b>SEC-II (Choose Any One)</b>	4	30	70	100
BZBC401A	Herbal Technology				
BZBC401B	Basic Analytical Chemistry				
BZBC401C	Apiculture				
BZBC402	Plant Physiology and Metabolism	4	30	70	100
BZBC403	Molecules of Life	4	30	70	100
BZBC404	Genetics and Evolutionary Biology	4	30	70	100
BZBC405-P	Plant Physiology and Metabolism - Lab	1	20	30	50
BZBC406-P	Molecules of Life-Lab	1	20	30	50
BZBC407-P	Genetics and Evolutionary Biology-Lab	1	20	30	50
		<b>19</b>	<b>180</b>	<b>370</b>	<b>550</b>

<b>B.Sc. (ZBC)</b>					
<b>Fifth Semester</b>					
<b>Code No.</b>	<b>Subject</b>	<b>Credits</b>	<b>Internal Marks</b>	<b>External Marks</b>	<b>Total</b>
	<b>SEC-III (Choose Any One)</b>	4	30	70	100
BZBC501A	Ethanobotany				
BZBC501B	Intellectual Property Rights (IPR)				
BZBC501C	Aquarium Fish Keeping				
	<b>Elective-I Botany (Any One)</b>	4	30	70	100
BZBC502A	Plant Pathology				
BZBC502B	Plant Ecology and Taxonomy				
	<b>Elective-I Chemistry (Any One)</b>	4	30	70	100
BZBC503A	Polymer Chemistry				
BZBC503B	Analytical Methods in Chemistry				
BZBC503C	Inorganic Materials of Industrial Importance				
	<b>Elective-I Zoology (Any One)</b>	4	30	70	100
BZBC504A	Applied Zoology				
BZBC504B	Animal Biotechnology				
BZBC504C	Aquatic Biology				
	<b>Practical-I Elective Botany (Any One)</b>	2	20	30	50
BZBC505P(A)	Plant Pathology-Lab				
BZBC505P(B)	Plant Ecology and Taxonomy-Lab				
	<b>Practical-I Elective Chemistry (Any One)</b>	2	20	30	50
BZBC506P(A)	Polymer Chemistry-Lab				
BZBC506P(B)	Analytical Methods in Chemistry-Lab				
BZBC506P(C)	Inorganic Materials of Industrial Importance-Lab				
	<b>Practical-I Zoology (Any One)</b>	2	20	30	50
BZBC507P(A)	Applied Zoology-Lab				
BZBC507P(B)	Animal Biotechnology-Lab				
BZBC507P(C)	Aquatic Biology-Lab				
		<b>22</b>	<b>180</b>	<b>370</b>	<b>550</b>

<b>B.Sc. (ZBC )</b>					
<b>Sixth Semester</b>					
<b>Code No.</b>	<b>Subject</b>	<b>Credits</b>	<b>Internal Marks</b>	<b>External Marks</b>	<b>Total</b>
	<b>SEC-IV (Choose Any One)</b>	4	30	70	100
BZBC601A	Biofertilizer				
BZBC601B	Fuel and Pesticide Chemistry				
BZBC601C	Sericulture				
	<b>Elective-II Botany (Any One)</b>	4	30	70	100
BZBC602A	Plant Tissue Culture				
BZBC602B	Economic Botany and Biotechnology				
	<b>Elective-II Chemistry (Any One)</b>	4	30	70	100
BZBC603A	Instrumental Methods of Analysis				
BZBC603B	Novel Inorganic Solids				
BZBC603C	Organometallics, Bioinorganic chemistry, Polynuclear hydrocarbons and UV, IR Spectroscopy				
	<b>Elective-II Zoology (Any One)</b>	4	30	70	100
BZBC604A	Immunology				
BZBC604B	Reproductive Biology				
BZBC604C	Insect, Vector and Diseases				
	<b>Practical-II Elective Botany (Any One)</b>	2	20	30	50
BZBC605P(A)	Plant Tissue Culture-Lab				
BZBC605P(B)	Economic Botany and Biotechnology-Lab				
	<b>Practical-II Elective Chemistry (Any One)</b>	2	20	30	50
BZBC606P(A)	Instrumental Methods of Analysis -Lab				
BZBC606P(B)	Novel Inorganic Solids -Lab				
BZBC606P(C)	Organometallics, Bioinorganic chemistry, Polynuclear hydrocarbons and UV, IR Spectroscopy-Lab				
	<b>Elective-II Zoology (Any One)</b>	2	20	30	50
BZBC607P(A)	Immunology-Lab				
BZBC607P(B)	Reproductive Biology-Lab				
BZBC607P(C)	Insect, Vector and Diseases-Lab				
BZBC608P	Project/Dissertation	4	30	70	100
		<b>26</b>	<b>210</b>	<b>440</b>	<b>650</b>

English  
(BZBC101A)

### Course Objective

The purpose of this course is to introduce students to the theory, fundamentals and tools of communication and to develop in them vital communication skills which should be integral to personal, social and professional interactions. One of the critical links among human beings and an important thread that binds society together is the ability to share thoughts, emotions and ideas through various means of communication: both verbal and non-verbal. In the context of rapid globalization and increasing recognition of social and cultural pluralities, the significance of clear and effective communication has substantially enhanced.

### CONTENTS

<b>Unit I: Introduction:</b>	<b>06</b>
Theory of Communication, Types and modes of Communication, <i>Mediums and channels of communication, barriers to communication, English as a Global language, the Lingua Franca, Social influences on English</i>	
<b>Unit II: Language of Communication:</b>	<b>06</b>
Verbal and Non-verbal (Spoken and Written) Personal, Social and Business Barriers and Strategies Intra-personal, Inter-personal and Group communication, <i>Varieties of English, Language, Accent, Dialect, Colloquialism, Historical influences on English</i>	
<b>Unit III: Speaking Skills:</b>	<b>06</b>
Monologue Dialogue Group Discussion Effective Communication/ Mis- Communication Interview Public Speech, <i>Regional influences on English, Convergence and divergence, Linguistic Imperialism,</i>	
<b>Unit IV: Reading and Understanding-</b>	<b>06</b>
Close Reading, Reading analysis of a text - Audience and purpose, Content and theme, Tone and Mood, stylistic devices, structure Comprehension- Analysis and Interpretation Translation(from Indian language to English and vice-versa) Literary/Knowledge Texts	
<b>Unit V: Writing Skills</b>	<b>06</b>
Documenting Report Writing Making notes Letter writing, Writing tabloids, diary entry, open letters, essays, newsletter and magazine articles, skits, short stories, impersonating characters	

### Course outcome:

It will enhance Language of communication, various speaking skills such as personal communication, social interactions and communication in professional situations such as interviews, group discussions and office environments, important reading skills as well as writing skills such as report writing, notetaking etc. While, to an extent, the art of communication is natural to all living

beings, in today's world of complexities, it has also acquired some elements of science. It is hoped that after studying this course, students will find a difference in their personal and professional interactions.

**Recommended Readings:**

1. Fluency in English - Part II, Oxford University Press, 2006.
2. Business English, Pearson, 2008.
3. Language, Literature and Creativity, Orient Blackswan, 2013.
4. Language through Literature (forthcoming) ed. Dr. Gauri Mishra, DrRanjanaKaul, DrBrati Biswas



RAIPUR

## Plant Diversity

(BZBC102)

### • Course Objective

- The course aims at making the students understand the diversity among algae, fungi, bryophytes, pteridophytes and Gymnosperms.
- To impart an insight into the modern classifications in lower forms of plants.
- To impart basic knowledge of plant diversity.
- To train the students to pursue further education.

### UNIT I

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

### UNIT II

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

### UNIT III

Bryophyta: General characteristics, Classification (up to family), morphology, anatomy and reproduction of *Marchantia* and *Funaria*. (Developmental details not to be included). Ecology and economic importance of bryophytes. Outlines of classification and importance of bryophytes. Structure, reproduction and classification of Hepaticopsida (*Marchantia*); Anthocerotopsida (*Anthoceros*), Bryopsida (*Funaria*).

### UNIT IV

Pteridophyta: Important characteristics of Psilopsida, Lycopsida, Sphenopsida and Pteropsida; Structure, reproduction in *Rhynia*, *Lycopodium*, *Selaginella*, *Equisetum* and *Marsilea*. (details not required)

### UNIT V

General features of gymnosperms and their classification.  
*Structure and reproduction in Cycas and Pinus and Ephedra*

### Course Outcomes:

On completion of the course, students are able to:

- Understand the diversity among Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms.
- Understand the life cycle pattern of plant diversity.
- Know the Economic Importance of plant diversity

### Suggested Readings:

- Introduction to botany – Bendre & Kumar
- Botany for degree students – Algae: Vashishtha et al.
- Botany for degree students – Bryophyta: Vashishtha et al.



- An introduction to Pteridophyta – A Rashid
- Angiosperms: G. L Chopra
- Plant Taxonomy: O. P Sharma

### **Plant Diversity -Lab**

(BZBC105P)

**Lab Objectives:** Microscopic observation and identification of algae, fungi, bryophyte, Pteridophyta and Gymnosperms. Know the technique of section cutting and staining of plant materials.

1. Study of the genera include under algae with the help of Permanent slide.
2. Study of the genera includes under fungi the help of Permanent slide.
3. Morphological study of the plant body: Genera as mentioned in theoretical syllabus and *Riccia*, *Marchantia* (With the help of specimen).
4. Study from permanent slides: *Riccia* (V.S. of thallus with sporophyte), *Marchantia* (L.S. through gemma cup, antheridiophore, archegoniophore) , *Anthoceros* (L.S. of sporophyte).
5. Morphological study of the sporophytic plant body: Genera as mentioned in the theoretical syllabus and *Selaginella*, *Equisetum*, *Lycopodium*.
6. Study of different Pteridophyta, with the help of permanent slides and also by cutting sections
7. Morphological study: *Cycas* (microsporophyll and megasporophyll), *Pinus* (female and male cone), *Gnetum* (female and male cone).
8. Study from permanent slides: *Cycas* (L.S. of ovule), *Pinus* (L.S. of male and female cone), *Ginkgo* (L.S. of female strobilus), *Gnetum* (L.S. of male cone and ovule).

#### **Lab Outcome-**

- Students are able to recognize types of algae and able to draw their thallus structure.
- Students get to know about primitive plants and know about their different life cycle.
- Students are able to recognize different types of fungi and diseases caused by it.

R A I P U R

## Conceptual Organic Chemistry

(BZBC103)

### Unit 1: Stereochemistry (18 Lectures)

Writing of Fischer projection, Newmann and Sawhorse projection and Wedge formulae. Interconversion of one type of structural representation into another type.

**Conformations:** Restricted rotation about single bonds, Various conformations of ethane, butane, ethane-1,2-diol and cyclohexane. Relative stability of different conformations in terms of energy difference is to be discussed for all these compounds.

**Geometrical Isomerism:** Requirements for a molecule to show geometrical isomerism, Cis-Trans and E/ Z notation along with CIP rules for geometrical isomers.

**Optical Isomerism:** Optical activity, specific and molar rotation, chirality, enantiomerism, diastereoisomerism, racemic mixtures and their resolution by salt formation method.

**Relative and absolute configuration:** D / L nomenclature system for configuration of carbohydrates (difference between d/l and D/L notations). Threo and Erythro designation. R and S-configuration (upto two chiral centres).

### Unit 2: Addition Reactions (10 Lectures)

**Alkenes and Alkynes:** Hydrogenation, addition of halogens, Hydrohalogenation (Markovnikov's and anti-Markovnikov's addition), hydration, hydroxylation (cis and trans), oxymercuration-demercuration, hydroboration-oxidation, ozonolysis. Reactivity of alkenes vs alkynes.

**Aldehydes and ketones:** (formaldehyde, acetaldehyde, benzaldehyde, acetone) Addition of sodium bisulphite, hydrogen cyanide and alcohols. Addition- elimination reactions with ammonia and its derivatives

**Name reactions:** Aldol, cross Aldol, Claisen, Knoevenagel, Cannizzaro, cross Cannizzaro

### Unit 3: Substitution Reactions (15 Lectures)

**Free radical substitution reactions:** Halogenation of alkanes, allylic compounds and alkyl benzenes.

**Nucleophilic substitution reactions:** Alkyl, allyl and benzyl halides – substitution of halogen by some common nucleophiles. Mechanism of SN1 and SN2 reactions (stereochemistry, nature of substrate, nucleophile and leaving group)

**Benzene diazonium chloride:** Replacement of diazo group

**Alcohols, amines and phenols:** Substitution of active hydrogen, replacement of hydroxyl group in alcohols (using PCl5, SOCl2 and HI)

**Carboxylic acid derivatives:** Hydrolysis **Ethers:** Cleavage by HI

**Electrophilic Substitution Reactions** (aromatic compounds): General mechanism of electrophilic substitution reactions (nitration, halogenation, sulphonation, Friedel Crafts alkylation and acylation), directive influence of substituents.

### Unit 4: Elimination Reactions (6 Lectures)

Alkyl halides (dehydrohalogenation, Saytzeff's rule), vicinal dihalides (dehalogenation), alcohols (dehydration), Quaternary ammonium salts (Hofmann's elimination). Mechanism of E1

and E2 reactions (nature of substrate and base), elimination vs substitution

### Unit 5: Oxidation (6 Lectures)

**Aromatic side chain:** Oxidation with potassium permanganate, potassium dichromate

**Alcohols:** Oxidation with potassium permanganate, potassium dichromate, catalytic dehydrogenation and Oppenauer oxidation. Oxidation of 1,2-diols with periodic acid and lead tetraacetate.

**Aldehydes:** Oxidation with potassium permanganate, chromic acid and Tollen's reagent

**Ketones:** Oxidation with potassium permanganate, sodium hypoiodite (iodoform reaction) and Baeyer–Villiger oxidation

### Reductions (5 Lectures)

**Aldehydes and Ketones:** Catalytic hydrogenation, reduction with sodium borohydride, lithium aluminium hydride, Clemmensen, Wolff-Kishner

**Carboxylic acids and their derivatives:** Lithium aluminium hydride, sodium-ethanol and Rosenmund reduction.

**Nitro compounds:** Acidic, alkaline and neutral reducing agents, lithium aluminium hydride and electrolytic reduction.

### Recommended Texts:

1. I. L. Finar: *Organic Chemistry* (Vol. I & II), E. L. B. S.
2. R. T. Morrison & R. N. Boyd: *Organic Chemistry*, Pearson Education.
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. Eliel, E. L. & Wilen, S. H. *Stereochemistry of Organic Compounds*; Wiley: London, 1994.
6. T. W. Graham Solomon's *Organic Chemistry*, John Wiley and Sons.
7. P.S. Kalsi, *Stereochemistry, Conformation and Mechanism*, John Wiley and Sons.
8. D. Nasipuri, *Stereochemistry of Organic Compounds*, New Age International Publishers.

R A I P U R

## Conceptual Organic Chemistry-Lab

(BZBC106P)

1. Purification of organic compounds by crystallization using the following solvents:
  - a. Water
  - b. Alcohol
2. Determination of the melting points of organic compounds (by Kjeldahl method and electrically heated melting point apparatus).
3. Determination of optical activity by using polarimeter

**Organic preparations:** Carry out the following preparations using 0.5 - 1 g of starting compound. Recrystallize the product and determine the melting point of the recrystallized sample.

4. To prepare acetanilide by the acetylation of aniline.
5. To prepare p-bromoacetanilide.
6. Benzoylation of aniline or  $\beta$ -naphthol by Schotten-Baumann reaction
7. Hydrolysis of benzamide or ethyl benzoate.
8. Semicarbazone derivative of one the following compounds: acetone, ethyl methyl ketone, diethylketone, cyclohexanone, benzaldehyde.
9. Nitration of nitrobenzene.
10. Oxidation of benzaldehyde by using alkaline potassium permanganate.

**Recommended Texts:**

1. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. *Practical Organic Chemistry, 5th Ed.*, Pearson (2012).
2. Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry*, Longman, London & New York.
3. Ahluwalia, V.K.; Dhingra, S. & Gulati, A. *College Practical Chemistry*, Universities Press.

R A I P U R

## ANIMAL DIVERSITY

(BZBC104)

### Unit-1:

<b>Kingdom Protista</b>	<b>4</b>
General characters and classification up to classes; Locomotory Organelles and locomotion in Protozoa	
<b>Phylum Porifera</b>	<b>3</b>
General characters and classification up to classes; Canal System in <i>Sycon</i>	
<b>Phylum Cnidaria</b>	<b>3</b>
General characters and classification up to classes; Polymorphism in Hydrozoa	
<b>Unit-II: Phylum Platyhelminthes</b>	<b>3</b>
General characters and classification up to classes; Life history of <i>Taenia solium</i>	
<b>Phylum Nematelminthes</b>	<b>5</b>
General characters and classification up to classes; Life history of <i>Ascaris lumbricoides</i> and its parasitic adaptations	
<b>Phylum Annelida</b>	<b>3</b>
General characters and classification up to classes; Metamerism in Annelida	
<b>Unit-III: Phylum Arthropoda</b>	<b>5</b>
General characters and classification up to classes; Vision in Arthropoda, Metamorphosis in Insects	
<b>Phylum Mollusca</b>	
General characters and classification up to classes; Torsion in gastropods	
<b>Phylum Echinodermata</b>	
General characters and classification up to classes; Water-vascular system in Asteroidea	
<b>Unit-IV: Protochordates</b>	
General features and Phylogeny of Protochordata	
<b>Agnatha</b>	
General features of Agnatha and classification of cyclostomes up to classes	
<b>Pisces</b>	
General features and Classification up to orders; Osmoregulation in Fishes	
<b>Amphibia</b>	<b>4</b>
General features and Classification up to orders; Parental care	

**Unit1-V: Reptiles****4**

General features and Classification up to orders; Poisonous and non-poisonous snakes, Biting mechanism in snakes

**Aves****5**

General features and Classification up to orders; Flight adaptations in birds

**Mammals****5**

Classification up to orders; Origin of mammals



## ANIMAL DIVERSITY-Lab

(BZBC107P)

**1. Study of the following specimens:**

Amoeba, Euglena, Plasmodium, Paramecium, Sycon, Hyalonema, and Euplectella, Obelia, Physalia, Aurelia, Tubipora, Metridium, Taenia solium, Male and female Ascaris lumbricoides, Aphrodite, Nereis, Pheretima, Hirudinaria, Palaemon, Cancer, Limulus, Palamnaeus, Scolopendra, Julus, Periplaneta, Apis, Chiton, Dentalium, Pila, Unio, Loligo, Sepia, Octopus, Pentaceros, Ophiura, Echinus, Cucumaria and Antedon, Balanoglossus, Herdmania, Branchiostoma, Petromyzon, Sphyrna, Pristis, Torpedo, Labeo, Exocoetus, Anguilla, Ichthyophis/Ureotyphlus, Salamandra, Bufo, Hyla, Chelone, Hemidactylus, Chamaeleon, Draco, Vipera, Naja, Crocodylus, Gavialis, Any six common birds from different orders, Sorex, Bat, Funambulus, Loris

**2. Study of the following permanent slides:**

T.S. and L.S. of Sycon, Study of life history stages of Taenia, T.S. of Male and female Ascaris

**3. Key for Identification of poisonous and non-poisonous snakes**

An “animal album” containing photographs, cut outs, with appropriate write up about the above mentioned taxa. Different taxa/topics may be given to different sets of students for this purpose.

### SUGGESTED READINGS

- Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.
- Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science
- Young, J.Z. (2004). The Life of Vertebrates. III Edition. Oxford University Press.
- Pough H. Vertebrate life, VIII Edition, Pearson International.
- Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc.

Environmental Science  
(BZBC201A)

**Unit 1 : Introduction to Environmental Studies**

**(6 Lecture)**

- Multidisciplinary nature of environmental studies;
- Scope and importance; Concept of sustainability and sustainable development.

**Ecosystems**

- What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies of the following ecosystems :
  - a) Forest ecosystem
  - b) Grassland ecosystem
  - c) Desert ecosystem
  - d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

**Unit 2 : Natural Resources : Renewable and Non-renewable Resources**

**(6 Lecture)**

- Land resources and land use change; Land degradation, soil erosion and desertification.
- Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.
- Water : Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state).
- Energy resources : Renewable and non renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

**Unit 3 : Biodiversity and Conservation**

**(5 Lecture)**

- Levels of biological diversity : genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots
- India as a mega-biodiversity nation; Endangered and endemic species of India
- Threats to biodiversity : Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity.
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

**Unit 4 : Environmental Pollution**

**(9 Lecture)**

- Environmental pollution : types, causes, effects and controls; Air, water, soil and noise pollution
- Nuclear hazards and human health risks
- Solid waste management : Control measures of urban and industrial waste.
- Pollution case studies.

**Environmental Policies & Practices**



- Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture
- Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD).
- Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

## Unit 5 : Human Communities and the Environment

(4 Lecture)

- Human population growth: Impacts on environment, human health and welfare.
- Resettlement and rehabilitation of project affected persons; case studies.
- Disaster management : floods, earthquake, cyclones and landslides.
- Environmental movements : Chipko, Silent valley, Bishnois of Rajasthan.
- Environmental ethics: Role of Indian and other religions and cultures in environmental conservation.
- Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

### Suggested Readings:

1. Carson, R. 2002. *Silent Spring*. Houghton Mifflin Harcourt.
2. Gadgil, M., & Guha, R. 1993. *This Fissured Land: An Ecological History of India*. Univ. of California Press.
3. Gleeson, B. and Low, N. (eds.) 1999. *Global Ethics and Environment*, London, Routledge.
4. Gleick, P. H. 1993. *Water in Crisis*. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
5. Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. *Principles of Conservation Biology*. Sunderland: Sinauer Associates, 2006.
6. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. *Science*, 339: 36--37.
7. McCully, P. 1996. *Rivers no more: the environmental effects of dams*(pp. 29--64). Zed Books.
8. McNeill, John R. 2000. *Something New Under the Sun: An Environmental History of the Twentieth Century*.
9. Odum, E.P., Odum, H.T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.
10. Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. *Environmental and Pollution Science*. Academic Press.
11. Rao, M.N. & Datta, A.K. 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
12. Raven, P.H., Hassenzahl, D.M. & Berg, L.R. 2012. *Environment*. 8th edition. John Wiley & Sons.
13. Rosencranz, A., Divan, S., & Noble, M. L. 2001. *Environmental law and policy in India*. Tripathi 1992.
14. Sengupta, R. 2003. *Ecology and economics: An approach to sustainable development*. OUP.
15. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. *Ecology, Environmental Science and Conservation*. S. Chand Publishing, New Delhi.

16. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). 2013. *Conservation Biology: Voices from the Tropics*. John Wiley & Sons.
17. Thapar, V. 1998. *Land of the Tiger: A Natural History of the Indian Subcontinent*.
18. Warren, C. E. 1971. *Biology and Water Pollution Control*. WB Saunders.
19. Wilson, E. O. 2006. *The Creation: An appeal to save life on earth*. New York: Norton.
20. World Commission on Environment and Development. 1987. *Our Common Future*. Oxford University Press.



## **Cell Biology & Genetics**

(BZBC202)

- **Course Objectives –**
- **To** explains the different organelles present in the plant along with their function.
- This course helps the students to develop a firm foundation in the fundamentals of cell biology and genetics.
- To learn the principles and theories of inheritance

### **Unit I**

Concept of Cell, Cell organization, Structure and function of Cell wall and Plasma Membrane, Structure and function of cell organelles: Golgi body, Endoplasmic reticulum, Lysosomes, Peroxisomes, Vacuoles, Chloroplast, Mitochondria.

### **Unit II**

Structure and function of nucleus; Ultra structure of nuclear membrane; Nucleolus; Extra nuclear genome, Mitochondrial and plastid DNA; Chromosome Structure: Morphology, chemical nature. Organization: Nucleosome model; special types of chromosomes-Polytene and Lampbrush chromosome, Cell cycle: Mitosis and Meiosis.

### **Unit III**

Variation in chromosomes structure: Deletions, duplications, translocations, inversions; Variations in chromosome number: Aneuploidy and polyploidy. DNA as a genetic material, its structure and replication; Structure and types of RNA; Satellite and repetitive DNA.

### **Unit IV**

Structure of Gene; Genetic code; Transfer of genetic information-transcription and translation; Protein synthesis; RNA and ribosomes, Regulation of Gene-Expression in prokaryotes and eukaryotes; Protein: structure and function.

### **Unit V**

Genetic inheritance: Mendelism-laws of segregation and independent assortment;

Linkage and crossing over; Allelic and non-allelic interactions of genes, Genetic variations: Mutation-spontaneous and induced; Transposable genetic elements; DNA damage and repair.

### **Course outcome:**

On completion of the course, students are able to understand

- knowledge about cell and its function.
- Understand ultra structure of cell wall, plasma membrane and cell organelles.
- The eukaryotic cell cycle and mitotic and meiotic cell division
- Structure and organization of cell membrane
- To study the phenomenon of dominance, laws of segregation, independent assortment of genes.

**Cell Biology & Genetics-Lab**  
(BZBC205P)

**Lab Objective: -**

- To understand cell division (Mitosis and Meiosis by preparing micropreparation and showing the stages of mitosis Onion root tips and showing permanent slides/photographs of mitosis and meiosis.
  - To know about Mendel's Law.
1. To study cell structure from Onion leaf peels; demonstration of staining and mounting methods.
  2. Comparative study of cell structure in Onion cells, *Hydrilla* and *Spirogyra*.
  3. Study of cyclosis in *Tradescantia* staminal cells.
  4. Study of plastids to examine pigment distribution in plants (e.g. species of *Cassia*, *Lycopersicon* and *Capsicum*).
  5. Examination of transmission electron micrographs (TEM) of eukaryotic cells with special reference to organelles.
  6. Study of transmission electron micrographs (TEM) of viruses, bacteria, cyanobacteria and eukaryotic cells for comparative cellular organization.
  7. Studying pea plant as tool for investigating Laws of Inheritance.
  8. Demonstration of Mendel's Law of segregation.
  9. Demonstration of Mendel's Law of Independent Assortment.

**Lab outcome-**

- They got to know about different stages of division.
- Students are able to isolated different organelles, get the knowledge about various structure of microbes.
- Studied about Mendel's law .

R A I P U R

## Physical Chemistry for the Sciences

(BZBC203)

### Unit 1: Chemical Energetics (10 Lectures)

Review of the Laws of Thermodynamics.

Important principles and definitions of thermochemistry. Concept of standard state and standard enthalpies of formation, integral and differential enthalpies of solution and dilution. Calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data.

Variation of enthalpy of a reaction with temperature – Kirchhoff's equation.

Statement of Third Law of thermodynamics and calculation of absolute entropies of substances.

### Unit 2: Chemical Equilibrium (20 Lectures)

Free energy change in a chemical reaction. Thermodynamic derivation of the law of chemical equilibrium. Distinction between  $\Delta G$  and  $\Delta G^\circ$ , Le Chatelier's principle. Relationships between  $K_p$ ,  $K_c$  and  $K_x$  for reactions involving ideal gases.

#### 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 3: Chemical Kinetics (8 Lectures)

The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction. Derivation of integrated rate equations for zero and first order reactions. Half-life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation. Enzyme kinetics.

### Unit 4: Spectroscopy (16 Lectures)

Introduction to spectroscopy: Electromagnetic radiation, fundamental definitions, electromagnetic spectrum, introduction to concepts of absorption and emission spectroscopy, Beer-Lambert law.

IR Spectroscopy: Fundamental and non-fundamental molecular vibrations, IR spectrum, fingerprint and group frequency regions and their significance, Hooke's law and vibrational frequency. Factors affecting vibrational frequency.

Characterization of functional groups: alkanes, alkenes, alkynes (only alicyclic systems), aldehydes, ketones, carboxylic acids and their derivatives, hydroxy compounds and amines. Study of hydrogen bonding.

Electronic Spectroscopy: Electronic transitions, singlet and triplet states, dissociation and predissociation.

UV spectroscopy: Types of electronic transitions, UV spectrum,  $\lambda_{\max}$ ,  $\epsilon_{\max}$ , chromophores, auxochromes, bathochromic shift, hypsochromic shift (definitions and elementary examples) and solvent effect. Characteristic UV transitions in common functional groups.

General applications of UV spectroscopy including distinction between cis-trans isomers.

Woodward rules for calculating  $\lambda_{\max}$  in the following systems:

- Conjugated dienes: alicyclic, homoannular, heteroannular.
- $\alpha, \beta$  Unsaturated aldehydes and ketones.
- Extended conjugated systems: dienes aldehydes and ketones.

PMR spectroscopy: Basic principles of NMR spectroscopy, PMR scale, chemical shifts (concept of shielding and deshielding), factors influencing chemical shifts, simple spin-spin couplings, coupling constant, chemical shift equivalence, anisotropic effects in alkenes, alkynes, aldehydes and aromatics. Interpretation of PMR spectra of simple compounds. Application of UV, IR and PMR in solving structures of simple molecules.

**Unit 5: Photochemistry (6 Lectures)**

Laws of photochemistry. Fluorescence and phosphorescence. Quantum efficiency and reasons for high and low quantum yields. Primary and secondary processes in photochemical reactions. Photochemical and thermal reactions.

**Recommended Texts:**

1. Atkins, P. W. & Paula, J. de *Atkin's Physical Chemistry* 9th Ed., Oxford University Press (2011).
2. Ball, D. W. *Physical Chemistry* Thomson Press, India (2007).
3. Castellan, G. W. *Physical Chemistry* 4th Ed. Narosa (2004).
4. Mortimer, R. G. *Physical Chemistry* 3rd Ed. Elsevier: NOIDA, UP (2009).
5. Chang, R. *Physical Chemistry for the Biosciences*. University Science Books (2005).



## Physical Chemistry for the Sciences-Lab

(BZBC206P)

### **(I) Thermo chemistry**

1. Determination of heat capacity of a calorimeter for different volumes.
2. Determination of the enthalpy of neutralization of hydrochloric acid with sodium hydroxide.

3. Determination of integral enthalpy of solution of salts (endothermic and exothermic).

### **(III) pH-metric and potentiometric measurements**

4. Preparation of sodium acetate-acetic acid buffer solutions and measurement of their pH.
5. Potentiometric titrations of (i) strong acid vs strong base (ii) weak acid vs strong base
6. Determination of dissociation constant of a weak acid.

### **(IV) Study the kinetics of the following reactions:**

7. Initial rate method: Iodide-persulphate reaction
8. Integrated rate method:
  - a. Acid hydrolysis of methyl acetate with hydrochloric acid.
  - b. Saponification of ethyl acetate

### **(V) Colourimetry**

9. Verification of Lambert-Beer's Law for potassium dichromate/ potassium permanganate solution.
10. Determination of pK (indicator) for phenolphthalein.
11. Study the kinetics of interaction of crystal violet with sodium hydroxide colourimetrically.

### **Recommended Texts:**

1. Khosla, B.D.; Garg, V.C.; Gulati, A. & Chand, R. *Senior Practical Physical Chemistry*, New Delhi.

R A I P U R

**Comparative Anatomy and developmental biology of vertebrates  
(BZBC204)**

**Unit 1:**

**Integumentary System 4**

Derivatives of integument w.r.t. glands and digital tips

**Skeletal System 3**

Evolution of visceral arches

**Digestive System 4**

Brief account of alimentary canal and digestive glands

**Respiratory System 5**

Brief account of Gills, lungs, air sacs and swim bladder

**Unit-II:**

**Circulatory System 4**

Evolution of heart and aortic arches

**Urinogenital System 4**

Succession of kidney, Evolution of urinogenital ducts

**Nervous System 3**

Comparative account of brain

**Sense Organs 3**

Types of receptors

**Unit-III: Early Embryonic Development 12**

Gametogenesis: Spermatogenesis and oogenesis w.r.t. mammals, vitellogenesis in birds;

Fertilization: external (amphibians), internal (mammals), blocks to polyspermy; Early development of frog and humans (structure of mature egg and its membranes, patterns of cleavage, fate map, up to formation of gastrula); types of morphogenetic movements; Fate of germ layers; Neurulation in frog embryo.

**Unit-IV: Late Embryonic Development**

Implantation of embryo in humans, Formation of human placenta and functions, other types of placenta on the basis of histology; Metamorphic events in frog life cycle and its hormonal regulation.

**Unit-V: Control of Development**

Fundamental processes in development (brief idea) – Gene activation, determination, induction, Differentiation, morphogenesis, intercellular communication, cell movements and cell death

R A I P U R



## Comparative Anatomy and developmental biology of vertebrates

(BZBC207P)

### 1. Osteology:

- a) Disarticulated skeleton of fowl and rabbit
- b) Carapace and plastron of turtle /tortoise
- c) Mammalian skulls: One herbivorous and one carnivorous animal.

2. Frog - Study of developmental stages - whole mounts and sections through permanent slides – cleavage stages, blastula, gastrula, neurula, tail bud stage, tadpole external and internal gill stages.

3. Study of the different types of placenta- histological sections through permanent slides or photomicrographs.

4. Study of placental development in humans by ultrasound scans.

5. Examination of gametes - frog/rat - sperm and ova through permanent slides or photomicrographs.

### SUGGESTED READINGS

- Kardong, K.V. (2005) *Vertebrates' Comparative Anatomy, Function and Evolution*. IV Edition. McGraw-Hill Higher Education.
- Kent, G.C. and Carr R.K. (2000). *Comparative Anatomy of the Vertebrates*. IX Edition. The McGraw-Hill Companies.
- Hilderbrand, M and Gaslow G.E. *Analysis of Vertebrate Structure*, John Wiley and Sons.
- Walter, H.E. and Sayles, L.P; *Biology of Vertebrates*, Khosla Publishing House.
- Gilbert, S. F. (2006). *Developmental Biology*, VIII Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA.
- Balinsky, B.I. (2008). *An introduction to Embryology*, International Thomson Computer Press.
- Carlson, Bruce M (1996). *Patten's Foundations of Embryology*, McGraw Hill, Inc.

R A I P U R

<b>BSCZBC</b>		Total Marks: 100
<b>Semester-I</b>		Internal Marks: 30
<b>Paper Code. BZBC301</b>		External Marks: 70
<b>Fundamentals of IT</b>		No. of Hours: 40
<b>Objectives:</b> This is a basic course for commerce students to familiarize with computer and it's applications in the relevant fields and exposes them to other related courses of IT.		Total Credits: 03
Unit No.	Details	Nos. of Hours
<b>1</b>	<p><b>1.1 Introduction to Computers:</b></p> <p>1.1.1 The evolution of computers – Computer Generation</p> <p>1.1.2 Classifications of Computers –</p> <p>1.1.3 Micro</p> <p>1.1.4 Mini,</p> <p>1.1.5 Mainframe</p> <p>1.1.6 Super Computers</p> <p>1.1.7 Distributed Computer System</p> <p>1.1.8 Parallel Computers</p> <p>1.1.9 Computer Hardware – Major Components of a Digital Computer</p> <p>1.1.10 Block Diagram of Computer</p> <p>1.1.11 Input devices</p> <p>1.1.12 Output devices</p> <p>1.1.13 Description of Computer IPO Cycle</p> <p>1.1.14 CPU</p> <p><b>1.2 Computer Memory:</b></p> <p>1.2.1 Memory Types,</p> <p>1.2.2 Units of memory</p> <p>1.2.3 Read Only Memory,</p> <p>1.2.4 Random Access Memory,</p> <p>1.2.5 Serial Access Memory,</p> <p>1.2.6 Physical Devices Used to construct Memories,</p> <p>1.2.7 Hard disk,</p> <p>1.2.8 Floppy Disk Drives,</p> <p>1.2.9 CD, DVD, Flash Drives,</p> <p>1.2.10 Magnetic Tape Drives.</p>	<b>08</b>
<b>2</b>	<p><b>2.1 Number System:</b></p> <p>2.1.1 Decimal,</p> <p>2.1.2 Binary,</p> <p>2.1.3 Octal,</p> <p>2.1.4 Hexa-decimal.</p> <p>2.1.5 Conversion - Decimal to all other number systems,</p> <p>2.1.6 Binary to octal and Hexa Decimal,</p> <p><b>3.1 Computer Software:</b></p> <p>3.1.1 System software,</p> <p>3.1.2 Operating System concepts,</p> <p>3.1.3 Different types of operating systems,</p> <p>3.1.4 Assemblers,</p> <p>3.1.5 Compilers,</p> <p>3.1.6 Interpreters,</p> <p>3.1.7 linkers,</p>	<b>08</b>

	3.1.8 Application Software, 3.1.9 Firmware Software,	
<b>3</b>	<b>3.1 Introduction of Internet and Objectives</b> <b>3.2 Basic of Computer Networks</b> 3.2.1 Local Area Network (LAN) 3.2.2 Wide Area Network (WAN) <b>3.3 Internet</b> 3.3.1 Concept of Internet 3.3.2 Applications of Internet 3.3.3 Connecting to the Internet 3.3.4 Troubleshooting <b>3.4 World Wide Web (WWW)</b> <b>3.5 Web Browsing Software</b> 3.5.1 Popular Web Browsing Software <b>3.6 Search Engines</b> 3.6.1 Popular Search Engines / Search for content 3.6.2 Accessing Web Browser 3.6.3 Using Favorites Folder 3.6.4 Downloading Web Pages 3.6.5 Printing Web Pages <b>3.7 Understanding URL</b> <b>3.8 Surfing the web</b> 3.8.1 Using e-governance website	<b>08</b>
<b>4</b>	<b>4.1 Word Processor:</b> 4.1.1 Word Processor and its features, 4.1.2 Editing of Text, 4.1.3 Find and Replace, 4.1.4 Bullets and Numbering, 4.1.5 Spell Checker, 4.1.6 Grammar Checker, 4.1.7 Auto Correct, 4.1.8 Auto Complete, 4.1.9 Auto Text, 4.1.10 Header and footer, 4.1.11 tables, 4.1.12 mail merge, 4.1.13 border and shading, 4.1.14 page setup, 4.1.15 Printing. <b>4.2 Spread sheet:</b> 4.2.1 Spread sheet and its features, 4.2.2 Entering Information in Worksheet, 4.2.3 Editing Cell Entry, 4.2.4 Moving and Copying Data, 4.2.5 deleting or Inserting Cells, 4.2.6 Rows and Columns, 4.2.7 Custom 4.2.8 Numeric Formats, 4.2.9 Using Formulas and functions, 4.2.10 Creating charts.	<b>08</b>
<b>5</b>	<b>5.1 Presentation Software</b> 5.1.1. Presentation Software and its uses,	<b>08</b>

	5.1.2. steps for creating Power Point Presentation, 5.1.3. PowerPoint Views, 5.1.4. Assigning Slide Transitions, 5.1.5. Using Preset Animations, 5.1.6. Hiding Slides, 5.1.7. Slide Show, 5.1.8. Controlling the Slide Show with a Keyboard, 5.1.9. Setting Slide Show Timings.	
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**Text Books:**

1. Alex Leon & Mathews Leon, “Fundamentals of Information Technology”, LeonTechworld, 1999.
2. Vikas Gupta, “Comdex Computer Kit”, Wiley Dreamtech, Delhi, 2004
3. P. K. Sinha & Priti Sinha , “Computer Fundamentals”, BPB Publications, 1992.

**Reference Books:**

1. V. Raja Raman, “Introduction to Computers”, PHI, 1998.
2. Alex Leon & Mathews Leon, “Introduction to Computers”, Vikas Publishing House, 1999.
3. Norton Peter, “Introduction to computers”, 4<sup>th</sup> Ed., TMH, 2001.



RAIPUR

<b>BSCZBC</b>		Total Marks: 50
<b>Semester – I</b>		Internal Marks: 20
<b>Paper Code. BZBC305P</b>		External Marks: 30
<b>Fundamentals of IT LAB</b>		No. of Hours: 30
<b>Objectives:</b> This is a basic course for Commerce students to familiarize with computer and it's applications in the relevant fields and exposes them to other related courses of IT.		Total Credits: 01
nit No.	Details	No s. of Hours
	<p><b>MS-WORD</b></p> <ol style="list-style-type: none"> <li>1. Text Manipulations</li> <li>2. Usage of Numbering, Bullets, Tools and Headers</li> <li>3. Usage of Spell Check and Find and Replace</li> <li>4. Text Formatting</li> <li>5. Picture Insertion and Alignment</li> <li>6. Creation of Documents Using Templates`</li> <li>7. Creation of Templates</li> <li>8. Mail Merge Concept</li> <li>9. Copying Text and Picture From Excel</li> <li>10. Creation of Tables, Formatting Tables</li> <li>11. Splitting the Screen</li> <li>12. Opening Multiple Document, Inserting Symbols in Documents</li> </ol> <p><b>MS-EXCEL</b></p> <ol style="list-style-type: none"> <li>1. Creation of Worksheet and Entering Information</li> <li>2. Aligning, Editing Data in Cell</li> <li>3. Excel Function (Date, Time, Statistical, Mathematical, Financial Functions)</li> <li>4. Changing of Column Width and Row Height (Column and Range of Column)</li> <li>5. Moving, copying, Inserting and Deleting Rows and Columns</li> <li>6. Formatting Numbers and Other Numeric Formats</li> <li>7. Drawing Borders Around Cells</li> <li>8. Creation of Charts Raising Moving</li> <li>9. Changing Chart Type</li> <li>10. Controlling the Appearance of a Chart</li> </ol> <p><b>MS -POWER POINT</b> Working With Slides</p> <ol style="list-style-type: none"> <li>1. Creating, saving, closing presentation</li> <li>2. Adding Headers and footers</li> <li>3. Changing slide layout</li> <li>4. Working fonts and bullets</li> <li>5. Inserting Clip art: working with clipart,</li> <li>6. Applying Transition and animation effects</li> <li>7. Run and Slide Show</li> </ol>	<b>30</b>



## Diversity of Angiosperms: Structure, Development & Reproduction

(BZBC302)

- **Course Objectives-**
- Imparting an insight into the internal structure and reproduction of the most evolved group of plants, the Angiosperm.
- To know the embryo development and fertilization in higher plants.
- Understand the morphology and development of reproductive parts.
- Get an insight in to the fruit and seed development.

### UNIT I

The basic body plan of a flowering plant: modular type of growth. Diversity in plant form in annuals, biennials and perennials; **The root system**: the root apical meristem ; differentiation of primary and secondary tissues and their roles ; structural modification for storage, respiration, reproduction and for interaction with microbes.

### UNIT-II

**The shoot system** : The shoot apical meristem and its histological organization ; Anatomy of primary shoot in monocotyledons (*Zea mays*) and dicotyledons (*Helianthus anus*); ; cambium and its functions ; formation of secondary xylem, a general account of wood structure in relation to conduction of water and minerals ; characteristics of growth rings, sapwood and heart wood ; role of woody skeleton ; secondary phloem - structure-function relationships, periderm.

### UNIT-III

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

### UNIT-IV

**Flower** : a modified shoot ; structure, development and varieties of flower, functions, structure of anther and pistil, the male and female gametophytes ; types of pollination ; attractions and rewards for pollinators ; pollen-pistil interaction, self incompatibility, double fertilization, formation of seed-endosperm and embryo ;

### UNIT-V

Fruit development and maturation. Significance of seed : suspended animation ; formation of seed, Seed dormancy, dispersal strategies. Vegetative reproduction: vegetative propagation, grafting, economic aspects

**Course Outcome-** On completion of the course, students are able to:

- Understand various rules, principles and recommendations of plant nomenclature produces in plant identification.
- Understand major evolutionary trends in various parts of angiospermic plants
- Know the methods of pollination and fertilization.

### Suggested Readings:

1. The Embryology of Angiosperms: Bhojwani and Bhatnagar.
2. Anatomy of Seed Plants: Esau, K. John Wiley and Son, USA.
3. Embryology of Angiosperms: Johri, B.M. Springer-Verleg, Berlin.
4. Pollination biology: Kapil, R.P. Inter India Publishers, New Delhi.
5. An Introduction to Embryology of Angiosperms: Maheswari.P
6. Botany for Degree Students: Pandey, B.P. -Diversity of Seed Plants and their Systematics, Structure, Development and Reproduction in Flowering Plants. S. Chand & Company Ltd., New Delhi.

**Diversity of Angiosperms: Systematics, Development & Reproduction –Lab  
(BZBC306P)**

- **Lab Objectives:**
  - Review the basics of identification.
1. Study of different types of leaves.
  2. Study Arrangement of leaves.
  3. Internal structure of monocot and dicot stem.
  4. Internal structure of monocot and dicot leaves.
  5. Study of Pollen-grains of different species.
  6. Study dehiscence mechanism in anthers of various seasonal flowers.
  7. Study of different types of fruits.
  8. Vegetative propagation, grafting, layering etc.
- **Lab Outcome-**
  - Develop an understanding of concepts and fundamentals of plant anatomy.
  - Examine the internal anatomy of plant systems and organs.
  - The students are made to identify the role of anatomy in solving the taxonomic and phylogenetic problems.

RAIPUR



## Chemical Bonding, Transition Metal & Coordination Chemistry

(BZBC303)

### Unit 1: The covalent bond and the structure of molecules (10 Lectures)

Valence bond approach, Concept of resonance in various organic and inorganic compounds, Hybridization and structure, equivalent and non-equivalent hybrid orbitals, Bent's rule and its applications, VSEPR model for predicting shapes of molecules and ions containing lone pairs, sigma and pi bonds.

### Unit 2: Molecular Orbital Approach (10 Lectures)

LCAO method, symmetry and overlap for s-s, s-p and p-p combinations, MO treatment of homonuclear diatomic molecules of 2nd period (B<sub>2</sub>, C<sub>2</sub>, N<sub>2</sub>, O<sub>2</sub>, F<sub>2</sub>) and heteronuclear di-atomic molecules (CO, NO) and their ions.

### Intermolecular forces: (8 Lectures)

van der Waals forces, Hydrogen bonding and its applications, effects of these forces on melting point, boiling point and solubility.

### Unit 3: Transition Elements (3d series) (12 Lectures)

General group trends with special reference to electronic configuration, variable valency, colour, magnetic and catalytic properties, ability to form complexes and stability of various oxidation states (Latimer diagrams) for Mn, Fe and Cu. Lanthanoids and actinoids: Electronic configurations, oxidation states, colour, magnetic properties, lanthanide contraction, separation of lanthanides (ion exchange method only).

### Unit 4: Coordination Chemistry (10 Lectures)

Valence Bond Theory (VBT): Inner and outer orbital complexes of Cr, Fe, Co, Ni and Cu (coordination numbers 4 and 6). Structural and stereoisomerism in complexes with coordination numbers 4 and 6. Drawbacks of VBT. IUPAC system of nomenclature. Coordination compounds in biological systems: Fe, Cu, Co, Mn, Ni, Zn and heavy metal ions.

### Unit 5: Crystal Field Theory

Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Tetrahedral symmetry. Factors affecting the magnitude of D. Spectrochemical series. Comparison of CFSE for *Oh* and *Td* complexes, Tetragonal distortion of octahedral geometry.

Jahn-Teller distortion, Square planar coordination.

#### Suggested Texts:

1. James E. Huheey, "Inorganic Chemistry: Principles of structure and reactivity", Prentice Hall, IV Edition.
2. D. S. Shriver and P.A. Atkins, "Inorganic Chemistry", Oxford University Press, IV Edition.
3. Alan G. Sharpe, "Inorganic Chemistry", University of Cambridge, III Edition.
4. J. D. Lee, "A New Concise Inorganic Chemistry", ELBS IV Edition
5. Grey L. Miessler and Donald A. Tarr, "Inorganic Chemistry", Prentice Hall, III Edition.
6. B. Douglas, D. H. McDaniel and J. J. Alexander, "Concepts and Models of Inorganic Chemistry", John Wiley and Sons, III Edition.
7. Rodgers, G.E. *Inorganic & Solid State Chemistry*, Cengage Learning India Ltd., 2008.

## Chemical Bonding, Transition Metal & Coordination

### Chemistry-Lab

(BZBC307P)

#### Titrimetric Analysis:

Preparations of standard solutions (concept of primary and secondary standards), Different units of concentration (molarity, molality, normality and formality)

#### (A) Titrations involving Acids-Bases:

Principles of acid-base titrations, Principle behind selection of an appropriate indicator.

1. Standardization of NaOH solution (standard solution of oxalic acid to be prepared)
2. Determination of concentration of carbonate and hydroxide present in a mixture.
3. Determination of concentration of carbonate and bicarbonate present in a mixture.
4. Determination of concentration of free alkali present in soaps/detergents/shampoos.

#### (B) Titrations involving redox reactions:

Concept of electrode potential, principle behind selection of an appropriate indicator.

5. Standardization of  $\text{KMnO}_4$  solution (standard solution of Mohr's salt to be prepared).
6. Determination of concentration of Fe(II) in Mohr's salt and/or  $\text{K}_2\text{Cr}_2\text{O}_7$  using diphenylamine/ N-phenylanthranilic acid as internal indicator (standard solution of  $\text{K}_2\text{Cr}_2\text{O}_7$  and /or Mohr's salt to be prepared).
  1. Determination of iron content in ores / alloys using appropriate redox titration.

#### (C) Complexometric Titrations

Principles of complexometric titrations

8. Determination of concentration of Mg (II) & Zn (II) by titrimetric method using EDTA.
9. Determination of concentration of Ca/Mg in drugs or in food samples.
10. Determination of concentration of total hardness of a given sample of water by complexometric titration.

(At least 2 experiments from each set.)

#### Recommended Texts:

1. Vogel, A.I. *A Textbook of Quantitative Inorganic Analysis*, ELBS.
2. Harris, D.C. & Freeman, W.H. & Co. *Quantitative Chemical Analysis 7th Ed.*, New York.

R A I P U R

## **PHYSIOLOGY AND BIOCHEMISTRY**

(BZBC304)

### **Unit-I:**

#### **Nerve and muscle 8**

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

#### **Digestion 5**

Physiology of digestion in the alimentary canal; Absorption of carbohydrates, proteins, lipids

### **Unit-II: Respiration 5**

Pulmonary ventilation, Respiratory volumes and capacities, Transport of Oxygen and carbon dioxide in blood

#### **Excretion 5**

Structure of nephron, Mechanism of Urine formation, Counter-current Mechanism

### **Unit-III: Cardiovascular system 6**

Composition of blood, Hemostasis, Structure of Heart, Origin and conduction of the cardiac impulse, Cardiac cycle

#### **Reproduction and Endocrine Glands 7**

Physiology of male reproduction: hormonal control of spermatogenesis; Physiology of female reproduction: hormonal control of menstrual cycle

Structure and function of pituitary, thyroid, Parathyroid, pancreas and adrenal

### **Unit-IV: Carbohydrate Metabolism 8**

Glycolysis, Krebs Cycle, Pentose phosphate pathway, Gluconeogenesis, Glycogen metabolism, Review of electron transport chain

#### **Lipid Metabolism 5**

Biosynthesis and  $\beta$  oxidation of palmitic acid

### **Unit-V**

#### **Protein metabolism 5**

Transamination, Deamination and Urea Cycle

#### **Enzymes 6**

Introduction, Mechanism of action, Enzyme Kinetics, Inhibition and Regulation

R A I P U R

## **PHYSIOLOGY AND BIOCHEMISTRY-Lab**

(BZBC308P)

1. Preparation of hemin and hemochromogen crystals
2. Study of permanent histological sections of mammalian pituitary, thyroid, pancreas, adrenal gland
3. Study of permanent slides of spinal cord, duodenum, liver, lung, kidney, bone, cartilage
4. Qualitative tests to identify functional groups of carbohydrates in given solutions (Glucose, Fructose, Sucrose, Lactose)
2. Estimation of total protein in given solutions by Lowry's method.
3. Study of activity of salivary amylase under optimum conditions

### **SUGGESTED READINGS**

- Tortora, G.J. and Derrickson, B.H. (2009). *Principles of Anatomy and Physiology*, XII Edition, John Wiley & Sons, Inc.
- Widmaier, E.P., Raff, H. and Strang, K.T. (2008) *Vander's Human Physiology*, XI Edition., McGraw Hill
- Guyton, A.C. and Hall, J.E. (2011). *Textbook of Medical Physiology*, XII Edition, Harcourt Asia Pvt. Ltd/ W.B. Saunders Company
- Berg, J. M., Tymoczko, J. L. and Stryer, L. (2006). *Biochemistry*. VI Edition. W.H Freeman and Co.
- Nelson, D. L., Cox, M. M. and Lehninger, A.L. (2009). *Principles of Biochemistry*. IV Edition. W.H. Freeman and Co.
- Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2009). *Harper's Illustrated Biochemistry*. XXVIII Edition. Lange Medical Books/Mc Graw3Hill.

**R A I P U R**

## **Herbal Technology**

(BZBC401A)

### **Course Objectives:**

- **To know about herbal medicines and their phytochemistry.**

### **UNIT I**

Herbal medicines: history and scope - definition of medical terms - role of medicinal plants in Siddha systems of medicine; cultivation - harvesting - processing - storage - marketing and utilization of medicinal plants.

### **UNIT II**

Pharmacognosy - systematic position and medicinal uses of the following herbs in curing various ailments; Tulsi, Ginger, Fenugreek, Indian Goose berry and Ashoka.

### **UNIT III**

Phytochemistry - active principles and methods of their testing - identification and utilization of the medicinal herbs; Catharanthus roseus (cardiotonic), Withania somnifera (drugs acting on nervous system), Clerodendron phlomoides (anti-rheumatic) and Centella asiatica (memory booster).

### **UNIT IV**

Analytical pharmacognosy: Drug adulteration - types, methods of drug evaluation - Biological testing of herbal drugs - Phytochemical screening tests for secondary metabolites (alkaloids, flavonoids, steroids, triterpenoids, phenolic compounds)

### **UNIT V**

Medicinal plant banks micro propagation of important species (Withania somnifera, neem and tulsi- Herbal foods-future of pharmacognosy).

### **Course outcome:**

On completion of the course, students are able to understand

- Knowledge about herbal medicine.
- Understand phytochemistry and pharmacognosy of herbal plants.

### **Suggested Readings**

1. Glossary of Indian medicinal plants, R.N.Chopra, S.L.Nayar and I.C.Chopra, 1956. C.S.I.R, New Delhi.
2. The indigenous drugs of India, Kanny, Lall, Dey and Raj Bahadur, 1984. International Book - Distributors.
3. Herbal plants and Drugs Agnes Arber, 1999. Mangal Deep Publications.
4. Ayurvedic drugs and their plant source. V.V. Sivarajan and Balachandran Indra 1994. Oxford

IBH publishing Co.

5. Ayurveda and Aromatherapy. Miller, Light and Miller, Bryan, 1998. Banarsidass, Delhi.
6. Principles of Ayurveda, Anne Green, 2000. Thomsons, London.
7. Pharmacognosy, Dr.C.K.Kokate et al. 1999. Nirali Prakashan.



## Basic Analytical Chemistry

(BZBC401B)

### Module –I

**6 Hrs.**

**Introduction:** Introduction to Analytical Chemistry and its interdisciplinary nature. Concept of sampling. Importance of accuracy, precision and sources of error in analytical measurements.

Presentation of experimental data and results, from the point of view of significant figures.

### Module -II

**6 Hrs.**

**Analysis of soil:** Composition of soil, Concept of pH and pH measurement, Complexometric titrations, Chelation, Chelating agents, use of indicators

a. Determination of pH of soil samples.

b. Estimation of Calcium and Magnesium ions as Calcium carbonate by complexometric titration.

**Analysis of water:** Definition of pure water, sources responsible for contaminating water, water sampling methods, water purification methods.

a. Determination of pH, acidity and alkalinity of a water sample.

b. Determination of dissolved oxygen (DO) of a water sample.

### Module -III

**6 Hrs.**

**Analysis of food products:** Nutritional value of foods, idea about food processing and food preservations and adulteration.

a. Identification of adulterants in some common food items like coffee powder, asafoetida, chilli powder, turmeric powder, coriander powder and pulses, etc.

b. Analysis of preservatives and colouring matter.

### Module -IV

**6 Hrs.**

**Chromatography:** Definition, general introduction on principles of chromatography, paper chromatography, TLC etc.

a. Paper chromatographic separation of mixture of metal ion ( $\text{Fe}^{3+}$  and  $\text{Al}^{3+}$ ).

b. To compare paint samples by TLC method.

**Ion-exchange:** Column, ion-exchange chromatography etc.

Determination of ion exchange capacity of anion / cation exchange resin (using batch procedure if use of column is not feasible).

#### **Module -V**

**6 Hrs.**

**Analysis of cosmetics:** Major and minor constituents and their function

a. Analysis of deodorants and antiperspirants, Al, Zn, boric acid, chloride, sulphate.

b. Determination of constituents of talcum powder: Magnesium oxide, Calcium oxide, Zinc oxide and Calcium carbonate by complexometric titration.

#### **Practical:**

**Suggested Applications (Any one):**

a. To study the use of phenolphthalein in trap cases.

b. To analyze arson accelerants.

c. To carry out analysis of gasoline.

**Suggested Instrumental demonstrations:**

a. Estimation of macro nutrients: Potassium, Calcium, Magnesium in soil samples by flame photometry.

b. Spectrophotometric determination of Iron in Vitamin / Dietary Tablets.

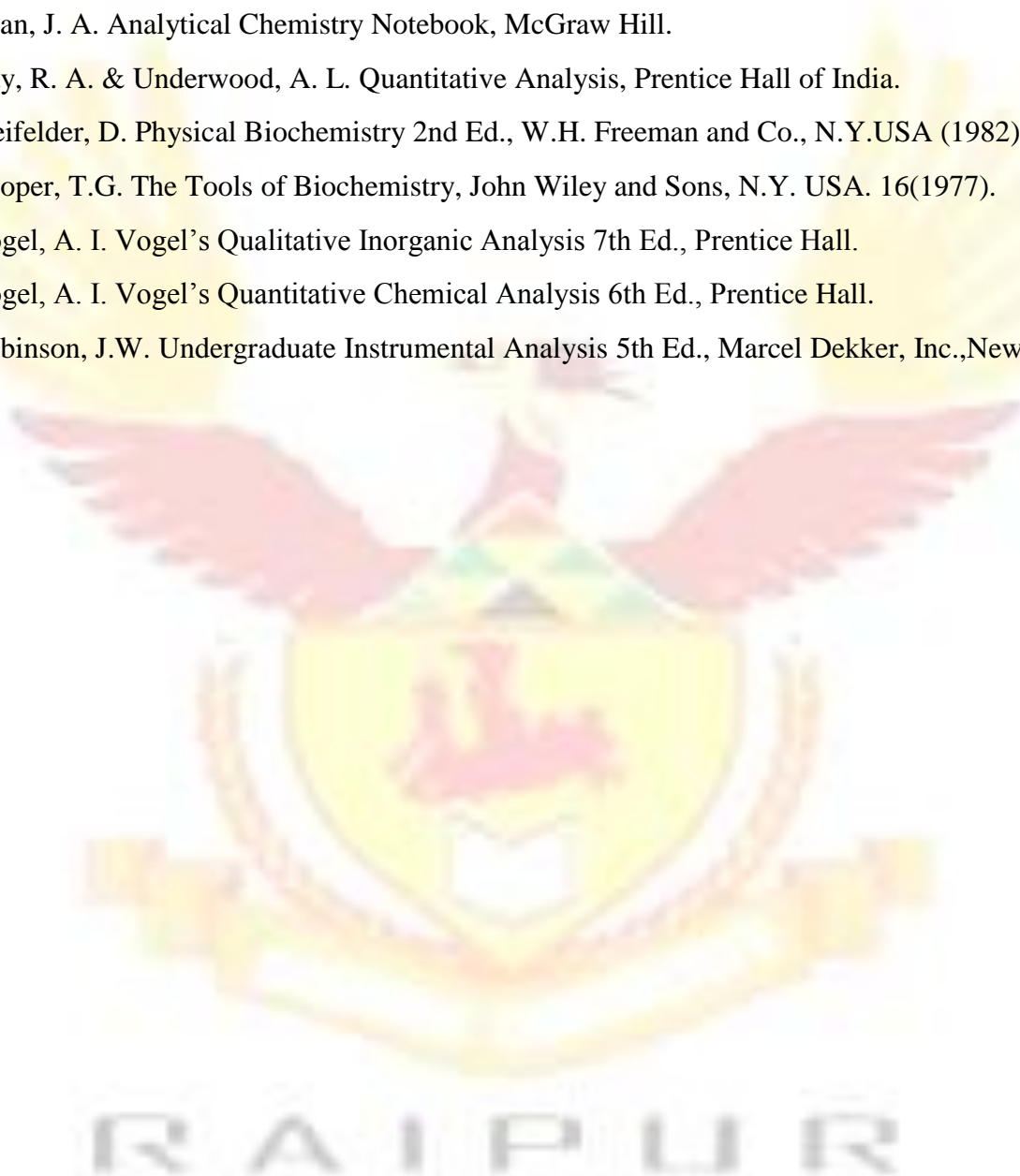
c. Spectrophotometric Identification and Determination of Caffeine and Benzoic Acid in Soft Drink.

#### **Reference Books:**

- Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A. Instrumental Methods of Analysis. 7th Ed. Wadsworth Publishing Co. Ltd., Belmont, California, USA, 1988.



- Skoog, D.A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Ed.
- Skoog, D.A.; West, D.M. & Holler, F.J. Fundamentals of Analytical Chemistry 6th Ed., SaundeCollege Publishing, Fort Worth (1992).
- Harris, D. C. Quantitative Chemical Analysis, W. H. Freeman.
- Dean, J. A. Analytical Chemistry Notebook, McGraw Hill.
- Day, R. A. & Underwood, A. L. Quantitative Analysis, Prentice Hall of India.
- Freifelder, D. Physical Biochemistry 2nd Ed., W.H. Freeman and Co., N.Y.USA (1982).
- Cooper, T.G. The Tools of Biochemistry, John Wiley and Sons, N.Y. USA. 16(1977).
- Vogel, A. I. Vogel's Qualitative Inorganic Analysis 7th Ed., Prentice Hall.
- Vogel, A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Prentice Hall.
- Robinson, J.W. Undergraduate Instrumental Analysis 5th Ed., Marcel Dekker, Inc.,New York (1995).



## **Apiculture**

**(BZBC401C)**

### **Unit 1: Biology of Bees (4)**

History, Classification and Biology of Honey Bees  
Social Organization of Bee Colony

### **Unit 2: Rearing of Bees (10)**

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)

### **Unit 3: Diseases and Enemies (5)**

Bee Diseases and Enemies  
Control and Preventive measures

### **Unit 4: Bee Economy (2)**

Products of Apiculture Industry and its Uses (Honey, Bees Wax, Propolis),  
Pollen etc

### **Unit 5: Entrepreneurship in Apiculture (4)**

Bee Keeping Industry – Recent Efforts, Modern Methods in employing artificial  
Beehives for cross pollination in horticultural gardens

### **SUGGESTED READINGS**

- 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, NewDelhi.

**R A I P U R**

## Plant Physiology and Metabolism

(BZBC402)

- **Course Objectives –**
- This course deals with various processes of plants like photosynthesis (particular emphasis on light and dark reactions), respiration, translocation, absorption and nitrogen metabolism.
- The students also get an insight into the various types of plant growth regulators.

### UNIT I

**Plant-water relations:** Importance of water to plant life; physical properties of water; diffusion and osmosis; absorption, transport of water and transpiration; physiology of stomata.

**Mineral nutrition:** Essential macro-and micro-elements and their role; mineral uptake; deficiency and toxicity symptoms.

**Transport of organic substance:** Mechanism of phloem transport; source-sink relationship; factors affecting translocation.

### Unit II

**Photosynthesis:** Photosynthetic Pigments (Chl a, b, xanthophylls, carotene); Photosystem I and II, reaction center, antenna molecules; Electron transport and mechanism of ATP synthesis; C3, C4 and CAM pathways of carbon fixation; Photorespiration.

### UNIT III

**Respiration:** Aerobic and anaerobic, Glycolysis, anaerobic respiration, TCA cycle; Oxidative phosphorylation, Glyoxylate, Oxidative Pentose Phosphate Pathway Factors affecting respiration.

### UNIT IV

**Basics of Enzymology:** Discover, classification and nomenclature; characteristics of enzymes; concept of holoenzyme, apoenzyme, coenzyme and cofactors; mechanism of action. **Nitrogen metabolism:** Biological nitrogen fixation; Nitrate and ammonia assimilation.

### UNIT V

**Plant growth regulators:** Discovery and physiological roles of auxins, gibberellins, cytokinins, ABA, ethylene. **Plant response to light and :** Photoperiodism (SDP, LDP, Day neutral plants); Phytochrome (discovery and structure), red and far red light responses on photomorphogenesis; Vernalization.

**Course Outcomes:** On completion of the course , students are able to:

- Learn and understand about mineral nutrition in plants.
- Understand the growth and developmental processes in plants.
- Know about Photosynthesis and Respiration in plants.
- Understand the process of translocation of solutes in plants 5) Know the nitrogen metabolism and its importance.

### Suggested Readings

1. Plant Physiology: Salisbury and Ross
2. Plant Physiology: Pandey and Sinha Plant Physiology, Ting I.P Addison
3. Plant Physiology: Devlin and Withem
4. Text of Plant Physiology and Biochemistry: S. K. Verma
5. Taiz, L., Zeiger, E., (2010). Plant Physiology. Sinauer Associates Inc., U.S.A. 5<sup>th</sup> Edition.

6. Hopkins, W.G., Huner, N.P., (2009). Introduction to Plant Physiology. John Wiley & Sons, U.S.A. 4<sup>th</sup> Edition.
7. Bajracharya, D., (1999). Experiments in Plant Physiology- A Laboratory Manual.

### **Plant Physiology and Metabolism – Lab**

(BZBC405P)

- **Lab Objective: The course aims to develop skills of performing basic biochemical tests.**

1. Determination of osmotic potential of plant cell sap by plasmolytic method.
2. To study the effect of two environmental factors (light and wind) on transpiration by excised twig.
3. To study the rate of transpiration using Farmer photometer.
1. To study the process of osmosis in potato tubers.
4. Calculation of stomatal index and stomatal frequency of a mesophyte and a xerophyte.
5. Demonstration of Hill reaction.
6. Demonstrate the activity of catalase and study the effect of pH and enzyme concentration.
7. To study the effect of light intensity and bicarbonate concentration on O<sub>2</sub> evolution in photosynthesis.
8. Comparison of the rate of respiration in any two parts of a plant.
9. Separation of amino acids by paper chromatography.

#### **Lab Outcome:-**

- Students able to perform biochemical tests.

R A I P U R

## Molecules of Life

(BZBC403)

### Module-I

#### Carbohydrates

Classification of carbohydrates, reducing and non-reducing sugars, General properties of glucose and fructose, their open chain structure. Epimers, mutarotation and anomers. Determination of configuration of Glucose (Fischer proof). Cyclic structure of glucose. Haworth projections. Cyclic structure of fructose. Linkage between monosachharides, structure of disacharrides (sucrose, maltose, lactose) and polysacharrides (starch and cellulose) excluding their structure elucidation. **(10 Lectures)**

### Module-II

#### Amino Acids, Peptides and Proteins

Classification of *Amino Acids*, Zwitterion structure and Isoelectric point. Overview of Primary, Secondary, Tertiary and Quaternary structure of proteins. Determination of primary structure of peptides, determination of N-terminal amino acid (by DNFB and Edman method) and C-terminal amino acid (by thiohydantoin and with carboxypeptidase enzyme). Synthesis of simple peptides (upto dipeptides) by N-protection (t-butyloxycarbonyl and phthaloyl) & C-activating groups and Merrifield solid phase synthesis. **(12 Lectures)**

### Module-III

#### Enzymes and correlation with drug action

Mechanism of enzyme action, factors affecting enzyme action, Coenzymes and cofactors and their role in biological reactions, Specificity of enzyme action (including stereospecificity), Enzyme inhibitors and their importance, phenomenon of inhibition (Competitive and Non-competitive inhibition including allosteric inhibition). Drug action-receptor theory. Structure-activity relationships of drug molecules, binding role of -OH group, -NH<sub>2</sub> group, double bond and aromatic ring. **(12 Lectures)**

### Module-IV

#### Nucleic Acids

Components of nucleic acids: Adenine, guanine, thymine and Cytosine (Structure only), other components of nucleic acids, Nucleosides and nucleotides (**nomenclature**), Structure of polynucleotides; Structure of DNA (Watson-Crick model) and RNA (**types of RNA**), Genetic Code, Biological roles of DNA and RNA: Replication, Transcription and Translation. **(10 Lectures)**

#### Lipids

Introduction to lipids, classification.

Oils and fats: Common fatty acids present in oils and fats, Omega fatty acids, Trans fats, Hydrogenation, Saponification value, Iodine number. Biological importance of triglycerides, phospholipids, glycolipids, and steroids (cholesterol).

**(8 Lectures)**

## Module-V

### Concept of Energy in Biosystems

Calorific value of food. Standard caloric content of carbohydrates, proteins and fats. Oxidation of foodstuff (organic molecules) as a source of energy for cells. Introduction to Metabolism (catabolism, anabolism), ATP: the universal currency of cellular energy, ATP hydrolysis and free energy change. Conversion of food into energy. Outline of catabolic pathways of Carbohydrate- Glycolysis, Fermentation, Krebs Cycle. Overview of catabolic pathways of Fats and Proteins. Interrelationships in the metabolic pathways of Proteins, Fats and Carbohydrates.

**(8 Lectures)**

### Recommended Texts:

- □ Morrison, R. T. & Boyd R. N. *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- □ Finar, I. L. *Organic Chemistry (Volume 1)*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- □ Finar, I. L. *Organic Chemistry (Volume 2)*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
- □ Nelson, D. L. & Cox, M. *Lehninger's Principles of Biochemistry 7th Ed.*, W. H. Freeman.
- □ Berg, J.M., Tymoczko, J.L. & Stryer, L. *Biochemistry*, W.H. Freeman, 2002.



RAIPUR

## Molecules of Life-Lab

(BZBC406P)

1. Separation of amino acids by paper chromatography
2. To determine the concentration of glycine solution by formylation method.
3. Study of titration curve of glycine
4. Action of salivary amylase on starch
5. Effect of temperature on the action of salivary amylase on starch.
6. To determine the saponification value of an oil/fat.
7. To determine the iodine value of an oil/fat
8. Differentiate between a reducing/nonreducing sugar.
9. Extraction of DNA from onion/ cauliflower
10. To synthesize aspirin by acetylation of salicylic acid and compare it with the ingredient of an aspirin tablet by TLC.

### Recommended Texts:

1. Furniss, B.S.; Hannaford, A.J.; Rogers, V.; Smith, P.W.G.; Tatchell, A.R. *Vogel's Textbook of Practical Organic Chemistry*, ELBS.
2. Ahluwalia, V.K. & Aggarwal, R. *Comprehensive Practical Organic Chemistry*, Universities Press.



RAIPUR

## **GENETICS AND EVOLUTIONARY BIOLOGY**

(BZBC404)

### **Unit-II: Introduction to Genetics 3**

Mendel's work on transmission of traits, Genetic Variation, Molecular basis of Genetic Information

### **Mendelian Genetics and its Extension 8**

Principles of Inheritance, Chromosome theory of inheritance, Incomplete dominance and codominance,

Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, sex linked inheritance, extra-chromosomal inheritance

### **Unit-II:**

### **Linkage, Crossing Over and Chromosomal Mapping 9**

Linkage and crossing over, Recombination frequency as a measure of linkage intensity, two factor and three factor crosses, Interference and coincidence, Somatic cell genetics - an alternative approach to gene mapping

### **Mutations 7**

Chromosomal Mutations: Deletion, Duplication, Inversion, Translocation, Aneuploidy and Polyploidy; Gene mutations: Induced versus Spontaneous mutations, Back versus Suppressor mutations,

### **Unit-III:**

### **Sex Determination 4**

Chromosomal mechanisms, dosage compensation

### **History of Life 2**

Major Events in History of Life

### **Introduction to Evolutionary Theories 5**

Lamarckism, Darwinism, Neo-Darwinism

### **Unit-IV:**

### **Direct Evidences of Evolution 5**

Types of fossils, Incompleteness of fossil record, Dating of fossils, Phylogeny of horse

### **Processes of Evolutionary Change 9**

Organic variations; Isolating Mechanisms; Natural selection (Example: Industrial melanism); Types of natural selection (Directional, Stabilizing, Disruptive), Artificial selection

### **Unit-V:**

### **Species Concept 6**

Biological species concept (Advantages and Limitations); Modes of speciation (Allopatric, Sympatric)

### **Macro-evolution 5**

Macro-evolutionary Principles (example: Darwin's Finches)

### **Extinction 6**

Mass extinction (Causes, Names of five major extinctions, K-T extinction in detail), Role of extinction in evolution



## Genetics and Evolutionary Biology-Lab

(BZBC407P)

1. Study of Mendelian Inheritance and gene interactions (Non Mendelian Inheritance) using suitable examples. Verify the results using Chi-square test.
2. Study of Linkage, recombination, gene mapping using the data.
3. Study of Human Karyotypes (normal and abnormal).
4. Study of fossil evidences from plaster cast models and pictures
5. Study of homology and analogy from suitable specimens/ pictures
6. Charts:
  - a) Phylogeny of horse with diagrams/ cut outs of limbs and teeth of horse ancestors
  - b) Darwin's Finches with diagrams/ cut outs of beaks of different species
7. Visit to Natural History Museum and submission of report

### SUGGESTED READINGS

- Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). *Principles of Genetics*. VIII Edition. Wiley India.
- Snustad, D.P., Simmons, M.J. (2009). *Principles of Genetics*. V Edition. John Wiley and Sons Inc.
- Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). *Concepts of Genetics*. X Edition. Benjamin Cummings.
- Russell, P. J. (2009). *Genetics- A Molecular Approach*. III Edition. Benjamin Cummings.
- Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. *Introduction to Genetic Analysis*. IX Edition. W. H. Freeman and Co.
- Ridley, M. (2004). *Evolution*. III Edition. Blackwell Publishing
- Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007). *Evolution*. Cold Spring, Harbour Laboratory Press.
- Hall, B. K. and Hallgrimsson, B. (2008). *Evolution*. IV Edition. Jones and Bartlett Publishers
- Campbell, N. A. and Reece J. B. (2011). *Biology*. IX Edition, Pearson, Benjamin, Cummings.
- Douglas, J. Futuyma (1997). *Evolutionary Biology*. Sinauer Associates.

R A I P U R

## **Ethanobotany (BZBC501A)**

### **Course Objectives:**

- To advance and diffuse indigenous knowledge of plants for conservation of our national heritage.
- To enhance awareness of the role played by ethno botany in the economic, cultural, social, recreational and health of the majority of the people.

### **UNIT I**

Ethnobotany Introduction, concept, scope and objectives; Ethnobotany as an interdisciplinary science. The relevance of ethnobotany in the present context; Major and minor ethnic groups or Tribals of India, and their life styles. Plants used by the tribals: a) Food plants b) intoxicants and beverages c) Resins and oils and miscellaneous uses.

### **UNIT II**

Methodology of Ethnobotanical studies a) Field work b) Herbarium c) Ancient Literature d) Archaeological findings e) temples and sacred places.

### **UNIT III**

Role of ethnobotany in modern Medicine Medico-ethnobotanical sources in India; Significance of the following plants in ethno botanical practices (along with their habitat and morphology) a) *Azadirachta indica* b) *Ocimum sanctum* c) *Vitex negundo*. d) *Gloriosa superba* e) *Tribulus terrestris* f) *Pongamia pinnata* g) *Cassia auriculata* h) *Indigofera tinctoria*. Role of ethnobotany in modern medicine with special example *Rauvolfia serpentina*, *Trichopus zeylanicus*, *Artemisia*, *Withania*.

### **UNIT IV**

Role of ethnic groups in conservation of plant genetic resources. Endangered taxa and forest management (participatory forest management).

### **UNIT V**

Ethnobotany and legal aspects Ethnobotany as a tool to protect interests of ethnic groups. Sharing of wealth concept with few examples from India. Biopiracy, Intellectual Property Rights and Traditional Knowledge.

### **Course Outcomes:**

- Bring out the relevance of ethnobotany in the present context Know about the major and minor ethnic groups or Tribals of India, and their life styles.
- Learn about the Methodology of Ethnobotanical studies.
- Gain knowledge on the role of Role of ethnobotany in modern Medicine.

### **Suggested Readings**

- 1) S.K. Jain, Manual of Ethnobotany, Scientific Publishers, Jodhpur, 1995.
- 2) S.K. Jain (ed.) Glimpses of Indian. Ethnobotny, Oxford and I B H, New Delhi – 1981
- 3) Lone et al., Palaeoethnobotany
- 4) S.K. Jain (ed.) 1989. Methods and approaches in ethnobotany. Society of ethnobotanists, Lucknow, India.

- 5) S.K. Jain, 1990. Contributions of Indian ethnobotany. Scientific publishers, Jodhpur.
- 6) Colton C.M. 1997. Ethnobotany – Principles and applications. John Wiley and sons – Chichester
- 7) Rama Ro, N and A.N. Henry (1996). The Ethnobotany of Eastern Ghats in Andhra Pradesh, India. Botanical Survey of India. Howrah.
- 8) Rajiv K. Sinha – Ethnobotany The Renaissance of Traditional Herbal Medicine – INA –SHREE Publishers, Jaipur-1996

## **Intellectual Property Rights (IPR)**

**(BZBC501B)**

### **Course Objectives**

- To introduce fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries.
- To disseminate knowledge on patents, Copyrights, Trademarks and registration aspects in India and abroad
- To disseminate knowledge on Design, Geographical Indication (GI), Plant Variety and Layout Design Protection and their registration aspects
- To create awareness of protecting the scientific discoveries, with commercial potential and enforcement of intellectual property rights.
- The purpose of this course is to apprise the students about the multifaceted dimensions of this issue and current trends in IPR and Govt. steps in fostering IPR

### **Module I**

#### **Introduction to Intellectual Property:**

Historical Perspective, Different Types of IP, Importance of protecting IP.

#### **Copyrights**

Introduction, How to obtain, Differences from Patents.

#### **Trade Marks**

Introduction, How to obtain, Different types of marks – Collective marks, certification marks, service marks, Trade names, etc. Differences from Designs.

### **Module II**

#### **Patents**

Historical Perspective, Basic and associated right, WIPO, PCT system, Traditional Knowledge, Patents and Healthcare – balancing promoting innovation with public health, Software patents and their importance for India.

#### **Geographical Indications**

Definition, rules for registration, prevention of illegal exploitation, importance to India.

### **Module III**

#### **Industrial Designs**

Definition, How to obtain, features, International design registration.

#### **Layout design of integrated circuits** Circuit Boards

Introduction and Historical Perspectives, Scope of Protection, Risks involved and legal aspects of Trade, Integrated Chips for industries **Trade Secrets**

Secret Protection.

## **Module IV**

### **Different International agreements**

#### **(a) World Trade Organization (WTO):**

- (i) General Agreement on Tariffs & Trade (GATT), Trade Related Intellectual Property Rights (TRIPS) agreement
- (ii) General Agreement on Trade related Services (GATS)
- (iii) Madrid Protocol
- (iv) Berne Convention
- (v) Budapest Treaty

#### **(b) Paris Convention**

**WIPO and TRIPS, IPR and Plant Breeders Rights, IPR and Biodiversity**

## **Module V**

**IP Infringement issue and enforcement** – Role of Judiciary, Role of law enforcement agencies – Police, Customs etc. Economic Value of Intellectual Property – Intangible assets and their valuation, Intellectual Property in the Indian Context – Various laws in India Licensing and technology transfer.

### **Reference Books:**

- N.K. Acharya: *Textbook on intellectual property rights*, Asia Law House (2001).
- Manjula Guru & M.B. Rao, *Understanding Trips: Managing Knowledge in Developing Countries*, Sage Publications (2003).
- P. Ganguli, *Intellectual Property Rights: Unleashing the Knowledge Economy*, Tata McGraw-Hill (2001).
- Arthur Raphael Miller, MichealH.Davis; *Intellectual Property: Patents, Trademarks and Copyright in a Nutshell*, West Group Publishers (2000).
- JayashreeWatal, *Intellectual property rights in the WTO and developing countries*, Oxford University Press, Oxford.

### **Course Outcomes:**

- The students once they complete their academic projects, shall get an adequate knowledge on patent and copyright for their innovative research works
- During their research career, information in patent documents provide useful insight on novelty of their idea from state-of-the art search. This provide further way for developing their idea or innovations
- Pave the way for the students to understand the role of Intellectual Property(IP) in a. R&D b. Government Jobs – Patent Examiner c. Private Jobs d. Patent agent and Trademark agent e. Entrepreneur

## **AQUARIUM FISH KEEPING**

**(BZBC501C)**

### **Unit1: Introduction to Aquarium Fish Keeping**

The potential scope of Aquarium Fish Industry as a Cottage Industry, Exotic and Endemic species of Aquarium Fishes

### **Unit 2: Biology of Aquarium Fishes**

Common characters and sexual dimorphism of Fresh water and Marine Aquariumfishes such as Guppy, Molly, Sword tail, Gold fish, Angel fish, Blue morph, Anemone fish and Butterfly fish

### **Unit 3: Food and feeding of Aquarium fishes**

Use of live fish feed organisms. Preparation and composition of formulated fish feeds

### **Unit 4: Fish Transportation**

Live fish transport - Fish handling, packing and forwarding techniques.

### **Unit 5: Maintenance of Aquarium**

General Aquarium maintenance – budget for setting up an Aquarium Fish Farm as a Cottage Industry



**R A I P U R**

## Elective -I Botany- **Plant Pathology**

**(BZBC502A)**

### **Course Objectives**

- To know plant diseases and its control
- To know the microbial biodiversity

### **Unit - I**

Definition and importance of plant pathology. Causes of plant diseases.

Classification of plant diseases according to cause and occurrence.

### **Unit - II**

Plant Pathogens: **Fungi**-Economic importance and general characteristics. Morphology of different vegetative structures (thallus, mycelium, haustoria etc.), Reproduction, Different types of spores, Levels of parasitism, Nomenclature.

### **Unit -III**

Classification of fungi with special reference to genera listed under following items Life histories of Pythium, Albugo, Erysiphe, Ustilago, Claviceps and Puccinia. Diagnostic characters of the following genera: Phytophthora, Peronospora, Sclerospora, Ustilago, Sphacelotheca, Tolyposporium, Melampsora, Alternaria, Cerospora, Fusarium, Helminthosporium Pyricularia, Rhizoctonia, Colletotrichum.

### **UNIT-IV**

**Bacteria:** Brief history of bacteria as plant pathogens. Morphology and Cell structure. Vegetative reproduction. Brief outline of classification of plant pathogenic bacteria. A brief account of mycoplasma.

### **UNIT\_ V**

**Viruse:** Nature and properties. Transmission of plant virus, Phanerogamic parasites: Cuscuta, Loranthus, Orobanche and Striga.

### **Course Outcomes:**

- Learn about classification, characteristics, ultra structure of Prokaryotic and Eukaryotic microbes.
- Know about organisms and causal factor responsible for plant diseases & methods of studying plant diseases .

- Familiarize with some common plant diseases.
- Gain knowledge on Host parasite interaction process.
- Know the prevention and control measures of plant diseases and its effect on economy of crops.

### **Suggested Readings**

1. Plant Pathology: B P Pandey
2. Plant Pathology: G N Agrios
3. Plant Pathogens and Principles of Plant Pathology : Sanjeev Singh
4. Microbial Plant Pathogens – Detection and Disease Diagnosis: P Narayanaswamy
5. Plant Pathology Concepts and Laboratory Exercises: Robert N Trigiano



**KALINGA UNIVERSITY**  
**RAIPUR**

## Elective-I Botany- **Plant Ecology and Taxonomy**

### (BZBC502B)

#### • **Course Objectives-**

- Structural adaptations in plants growing in different environments are also taught.
- The students are made aware about the ecosystem so as to bring awareness on different aspects of Biodiversity and conservation of Biodiversity.
- To introduce modern trends in taxonomy

#### **UNIT I**

**Introduction:** Inter-relation between the living world and environment. **Ecological factors** Soil: Origin, formation, composition, soil profile. Water: States of water in the environment, precipitation types. Light and temperature: Variation Optimal and limiting factors; Shelford law of tolerance.

#### **UNIT II**

**Plant communities:** Characters; Ecotone and edge effect; Succession; Processes and types (autogenic, allogenic, autotrophic, heterotrophic, primary and secondary) **Ecosystem** :Structure; energy flow trophic organisation; Food chains and food webs, Ecological pyramids production and productivity; Biogeochemical cycling; Cycling of carbon, nitrogen and Phosphorous. **Phytogeography:** Principle biogeographical zones; Endemism (definition and types).

#### **UNIT III**

Introduction to plant taxonomy :Taxonomic concepts, Processes and principles, Botanical Nomenclature Taxonomic ranks. Modern trends in Taxonomy – Cytology, Phytochemistry Embryology Taximetrics etc. Systematic Institutions - Taxonomic literature, Herbarium, Botanical garden

#### **UNIT IV**

**Botanical nomenclature** Principles and rules (ICN); ranks and names; binominal system, typification, author citation, valid publication, rejection of names, principle of priority and its limitations. **Classification: Types** of classification-artificial, natural and phylogenetic. Bentham and Hooker (up to series), Engler and Prantl (up to series).

#### **UNIT V**

Taxonomic study of following families and their economic importance: Ranunculaceae Brassicaceae, Rutaceae, Apiaceae, Asclepiadaceae, Solanaceae, Lamiaceae, Euphoricaceae, Liliaceae and Poaceae.

#### • **Course Outcomes-**

- Know the biotic and abiotic components of ecosystem.
- Understand plant community & ecological adaptation in plants.
- Scope , importance and management of biodiversity

#### **Suggested Readings**



1. Kormondy, E.J. (1996). Concepts of Ecology. Prentice Hall, U.S.A. 4th edition.
2. Sharma, P.D. (2010) Ecology and Environment. Rastogi Publications, Meerut, India. 8th edition.
3. Simpson, M.G. (2006). Plant Systematics. Elsevier Academic Press, San Diego, CA, U.S.A. 4.
4. Singh, G. (2012). Plant Systematics: Theory and Practice. Oxford & IBH Pvt. Ltd., New Delhi. 3rd edition.



**Elective-I Chemistry-Polymer Chemistry**

(BZBC503A)

**Module –I****12 Hrs.****Introduction and history of polymeric materials:**

Different schemes of classification of polymers, Polymer nomenclature, Molecular forces and chemical bonding in polymers, Texture of polymers.

**Functionality and its importance:**

Criteria for synthetic polymer formation, classification of polymerization processes, Relationships between functionality, extent of reaction and degree of polymerization. Bi-functional systems, Poly-functional systems.

**Module –II****12 Hrs.****Kinetics of Polymerization:**

Mechanism and kinetics of step growth, radical chain growth, ionic chain (both cationic and anionic) and coordination polymerizations, Mechanism and kinetics of copolymerization, polymerization techniques.

**Crystallization and crystallinity:**

Determination of crystalline melting point and degree of crystallinity, Morphology of crystalline polymers, Factors affecting crystalline melting point.

**Nature and structure of polymers**-Structure Property relationships.

**Determination of molecular weight of polymers** ( $M_n$ ,  $M_w$ , etc) by end group analysis, viscometry, light scattering and osmotic pressure methods. Molecular weight distribution and its significance. Polydispersity index.

**Module –III****12 Hrs.****Kinetics of Polymerization:**

Mechanism and kinetics of step growth, radical chain growth, ionic chain (both cationic and anionic) and coordination polymerizations, Mechanism and kinetics of copolymerization, polymerization techniques.

**Crystallization and crystallinity:**

Determination of crystalline melting point and degree of crystallinity, Morphology of crystalline polymers, Factors affecting crystalline melting point.

**Module- IV****12 Hrs.**

**Nature and structure of polymers**-Structure Property relationships.

**Determination of molecular weight of polymers** ( $M_n$ ,  $M_w$ , etc) by end group analysis, viscometry, light scattering and osmotic pressure methods. Molecular weight distribution and its significance. Polydispersity index.

**Glass transition temperature ( $T_g$ ) and determination of  $T_g$** , Free volume theory, WLF equation, Factors affecting glass transition temperature ( $T_g$ ).

**Module –V**

**12 Hrs.**

**Polymer Solution** – Criteria for polymer solubility, Solubility parameter, Thermodynamics of polymer solutions, entropy, enthalpy, and free energy change of mixing of polymers solutions, Flory-Huggins theory, Lower and Upper critical solution temperatures.

**Properties of Polymers** (Physical, thermal, flow & mechanical properties). Brief introduction to preparation, structure, properties and application of the following polymers: polyolefins, polystyrene and styrene copolymers, poly(vinyl chloride) and related polymers, poly(vinyl acetate) and related polymers, acrylic polymers, fluoro polymers, polyamides and related polymers. Phenol formaldehydes resins (Bakelite, Novalac), polyurethanes, silicone polymers, polydienes, Polycarbonates, Conducting Polymers, [polyacetylene, polyaniline, poly(p-phenylene sulphide), polypyrrole, polythiophene].

#### **TEXT AND REFERENCE BOOKS**

1. Seymour, R.B. & Carraher, C.E. Polymer Chemistry: An Introduction, Marcel Dekker, Inc. New York, 1981.
2. Odian, G. Principles of Polymerization, 4th Ed. Wiley, 2004.
3. Billmeyer, F.W. Textbook of Polymer Science, 2nd Ed. Wiley Interscience, 1971.
4. Ghosh, P. Polymer Science & Technology, Tata McGraw-Hill Education, 1991.
5. Lenz, R.W. Organic Chemistry of Synthetic High Polymers. Interscience Publishers, New York, 1967.

R A I P U R

## Elective-I Chemistry

## Analytical Methods in Chemistry

(BZBC503B)

**Qualitative and quantitative aspects of analysis:**

Sampling, evaluation of analytical data, errors, accuracy and precision, methods of their expression, normal law of distribution if indeterminate errors, statistical test of data; F, Q and t test, rejection of data, and confidence intervals. (5 Lectures)

**Optical methods of analysis:**

Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law. *UV-Visible Spectrometry*: Basic principles of instrumentation (choice of source, monochromator and detector) for single and double beam instrument; *Basic principles of quantitative analysis*: estimation of metal ions from aqueous solution, geometrical isomers, keto-enol tautomers. Determination of composition of metal complexes using Job's method of continuous variation and mole ratio method. *Infrared Spectrometry*: Basic principles of instrumentation (choice of source, monochromator & detector) for single and double beam instrument; sampling techniques. Structural illustration through interpretation of data, Effect and importance of isotope substitution.

*Flame Atomic Absorption and Emission Spectrometry*: Basic principles of instrumentation (choice of source, monochromator, detector, choice of flame and Burner designs. Techniques of atomization and sample introduction; Method of background correction, sources of chemical interferences and their method of removal. Techniques for the quantitative estimation of trace level of metal ions from water samples. **Thermal methods of analysis:** Theory of thermogravimetry (TG), basic principle of instrumentation. Techniques for quantitative estimation of Ca and Mg from their mixture.

(5 Lectures)

**Electroanalytical methods:**

Classification of electroanalytical methods, basic principle of pH metric, potentiometric and conductometric titrations. Techniques used for the determination of equivalence points. Techniques used for the determination of pK<sub>a</sub> values.

(10 Lectures)

**Separation techniques:**

Solvent extraction: Classification, principle and efficiency of the technique.

Mechanism of extraction: extraction by solvation and chelation.

Technique of extraction: batch, continuous and counter current extractions.

Qualitative and quantitative aspects of solvent extraction: extraction of metal ions from aqueous solution, extraction of organic species from the aqueous and nonaqueous media.

Chromatography: Classification, principle and efficiency of the technique.

Mechanism of separation: adsorption, partition & ion exchange.

Development of chromatograms: frontal, elution and displacement methods.

Qualitative and quantitative aspects of chromatographic methods of analysis: IC, GLC, GPC, TLC and HPLC.

Stereoisomeric separation and analysis: Measurement of optical rotation, calculation of Enantiomeric excess (ee)/ diastereomeric excess (de) ratios and determination of enantiomeric composition using NMR, Chiral solvents and chiral shift reagents. Chiral chromatographic techniques using chiral columns (GC and HPLC).

Role of computers in instrumental methods of analysis.

(15 Lectures)

**Reference Books:**

□ □ Jeffery, G.H., Bassett, J., Mendham, J. & Denney, R.C. *Vogel's Textbook of*

*Quantitative Chemical Analysis*, John Wiley & Sons, 1989.

□ □ Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A *Instrumental Methods of Analysis*, 7th Ed. Wadsworth Publishing Company Ltd., Belmont, California, USA, 1988. Christian, G.D; *Analytical Chemistry*, 6th Ed. John Wiley & Sons, New York, 2004.

□ □ Harris, D. C *Exploring Chemical Analysis*, Ed. New York, W.H. Freeman, 2001.

□ □ Khopkar, S.M *Basic Concepts of Analytical Chemistry*. New Age, International Publisher, 2009.

□ □ Skoog, D.A. Holler F.J. & Nieman, T.A. *Principles of Instrumental Analysis*, Cengage Learning India Ed.

□ □ Mikes, O *Laboratory Hand Book of Chromatographic & Allied Methods*, Elles Harwood Series on Analytical Chemistry, John Wiley & Sons, 1979.

□ □ Ditts, R.V *Analytical Chemistry; Methods of Separation*, van Nostrand, 1974.



**Elective-I Chemistry-Inorganic Materials of Industrial Importance****(BZBC503C)****Module-I****12 Hrs.****Silicate Industries**

*Glass:* Glassy state and its properties, classification (silicate and non-silicate glasses). Manufacture and processing of glass. Composition and properties of the following types of glasses: Soda lime glass, lead glass, armoured glass, safety glass, borosilicate glass, fluorosilicate, coloured glass, photosensitive glass.

*Ceramics:* Important clays and feldspar, ceramic, their types and manufacture. High technology ceramics and their applications, superconducting and semiconducting oxides, fullerenes carbon nanotubes and carbon fibre. *Cements:* Classification of cement, ingredients and their role, Manufacture of cement and the setting process, quick setting cements.

**Module-II****12 Hrs.****Fertilizers:**

Different types of fertilizers. Manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates; polyphosphate, superphosphate, compound and mixed fertilizers, potassium chloride, potassium sulphate.

**Surface Coatings:**

Objectives of coatings surfaces, preliminary treatment of surface, classification of surface coatings. Paints and pigments-formulation, composition and related properties. Oil paint, Vehicle, modified oils, Pigments, toners and lakes pigments, Fillers, Thinners, Enamels, emulsifying agents. Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint), Dyes, Wax polishing, Water and Oilpaints, additives, Metallic coatings (electrolytic and electroless), metal spraying and anodizing.

**Module-III****12 Hrs.****Batteries:**

Primary and secondary batteries, battery components and their role, Characteristics of Battery. Working of following batteries: Pb acid, Li-Battery, Solid state electrolyte battery. Fuel cells, Solar cell and polymer cell.

**Module-IV****12 Hrs.****Alloys:**

Classification of alloys, ferrous and non-ferrous alloys, Specific properties of elements in alloys. Manufacture of Steel (removal of silicon decarbonization, demanganization, desulphurization dephosphorisation) and surface treatment (argon treatment, heat treatment, nitriding, carburizing). Composition and properties of different types of steels.

#### **Module-V**

**12 Hrs.**

##### **Catalysis:**

General principles and properties of catalysts, homogenous catalysis (catalytic steps and examples) and heterogenous catalysis (catalytic steps and examples) and their industrial applications, Deactivation or regeneration of catalysts. Phase transfer catalysts, application of zeolites as catalysts.

##### **Chemical explosives:**

Origin of explosive properties in organic compounds, preparation and explosive properties of lead azide, PETN, cyclonite (RDX). Introduction to rocket propellants.

##### **Reference Books:**

1. E. Stocchi: *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK.
2. R. M. Felder, R. W. Rousseau: *Elementary Principles of Chemical Processes*, Wiley Publishers, New Delhi.
3. W. D. Kingery, H. K. Bowen, D. R. Uhlmann: *Introduction to Ceramics*, Wiley Publishers, New Delhi.
4. J. A. Kent: *Riegel's Handbook of Industrial Chemistry*, CBS Publishers, New Delhi.
5. P. C. Jain & M. Jain: *Engineering Chemistry*, Dhanpat Rai & Sons, Delhi.
6. R. Gopalan, D. Venkappayya, S. Nagarajan: *Engineering Chemistry*, Vikas Publications, New Delhi.
7. B. K. Sharma: *Engineering Chemistry*, Goel Publishing House, Meerut

## Elective-I Zoology- Applied Zoology

(BZBC504A)

### Unit-I: Introduction to Host-parasite Relationship 3

Host, Definitive host, Intermediate host, Parasitism, Symbiosis, Commensalism, Reservoir, Zoonosis

### Epidemiology of Diseases 7

Transmission, Prevention and control of diseases: Tuberculosis, typhoid

### Unit-II: Rickettsiae and Spirochaetes 6

Brief account of *Rickettsia prowazekii*, *Borrelia recurrentis* and *Treponema pallidum*

### Parasitic Protozoa 8

Life history and pathogenicity of *Entamoeba histolytica*, *Plasmodium vivax* and *Trypanosoma gambiense*

### Unit-III: Parasitic Helminthes 5

Life history and pathogenicity of *Ancylostoma duodenale* and *Wuchereria bancrofti*

### Insects of Economic Importance 8

Biology, Control and damage caused by *Helicoverpa armigera*, *Pyrilla perpusilla* and *Papilio demoleus*, *Callosobruchus chinensis*, *Sitophilus oryzae* and *Tribolium castaneum*

### Unit-IV: Insects of Medical Importance 8

Medical importance and control of *Pediculus humanus corporis*, *Anopheles*, *Culex*, *Aedes*, *Xenopsylla cheopis*

### Animal Husbandry 5

Preservation and artificial insemination in cattle; Induction of early puberty and synchronization of estrus in cattle

### Unit-V: Poultry Farming 5

Principles of poultry breeding, Management of breeding stock and broilers, Processing and preservation of eggs

### Fish Technology 5

Genetic improvements in aquaculture industry; Induced breeding and transportation of fish seed

R A I P U R



## Elective-I Zoology- Applied Zoology-Lab

(BZBC507P(A))

1. Study of *Plasmodium vivax*, *Entamoeba histolytica*, *Trypanosoma gambiense*, *Ancylostoma duodenale* and *Wuchereria bancrofti* and their life stages through permanent slides/photomicrographs or specimens.
2. Study of arthropod vectors associated with human diseases: *Pediculus*, *Culex*, *Anopheles*, *Aedes* and *Xenopsylla*.
3. Study of insect damage to different plant parts/stored grains through damaged products/photographs.
4. Identifying feature and economic importance of *Helicoverpa (Heliothis) armigera*, *Papilio demoleus*, *Pyrilla perpusilla*, *Callosobruchus chinensis*, *Sitophilus oryzae* and *Tribolium castaneum*
5. Visit to poultry farm or animal breeding centre. Submission of visit report
6. Maintenance of freshwater aquarium

### SUGGESTED READINGS

- Park, K. (2007). *Preventive and Social Medicine*. XVI Edition. B.B Publishers.
- Arora, D. R and Arora, B. (2001). *Medical Parasitology*. II Edition. CBS Publications and Distributors.
- Kumar and Corton. *Pathological Basis of Diseases*.
- Atwal, A.S. (1986). *Agricultural Pests of India and South East Asia*, Kalyani Publishers.
- Dennis, H. (2009). *Agricultural Entomology*. Timber Press (OR).
- Hafez, E. S. E. (1962). *Reproduction in Farm Animals*. Lea & Fabiger Publisher
- Dunham R.A. (2004). *Aquaculture and Fisheries Biotechnology Genetic Approaches*. CABI publications, U.K.
- Pedigo, L.P. (2002). *Entomology and Pest Management*, Prentice Hall.

R A I P U R

**Elective-I Zoology- ANIMAL BIOTECHNOLOGY****(BZBC504B)****Unit 1: Introduction 8**

Concept and scope of biotechnology

**Unit 2: Molecular Techniques in Gene manipulation 12**

Cloning vectors: Plasmids, Cosmids, Phagemids, Lambda Bacteriophage, M13, BAC, YAC, MAC and Expression vectors (characteristics)

Restriction enzymes: Nomenclature, detailed study of Type II.

**Unit 3: 12**

Transformation techniques: Calcium chloride method and electroporation.

Construction of genomic and cDNA libraries and screening by colony and plaque hybridization

Southern, Northern and Western blotting; DNA sequencing: Sanger method

Polymerase Chain Reaction, DNA Finger Printing and DNA micro array

**Unit 4: Genetically Modified Organisms 18**

Production of cloned and transgenic animals: Nuclear Transplantation, Retroviral Method, DNA microinjection

Applications of transgenic animals: Production of pharmaceuticals, production of donor organs, knockout mice.

Production of transgenic plants: *Agrobacterium* mediated transformation.

Applications of transgenic plants: insect and herbicide resistant plants.

**Unit 5: Culture Techniques and Applications 10**

Animal cell culture, Expressing cloned genes in mammalian cells, Molecular diagnosis of genetic diseases (Cystic fibrosis, Sickle cell anemia)

Recombinant DNA in medicines: Recombinant insulin and human growth hormone, Gene therapy

**R A I P U R**

Elective-I Zoology- **ANIMAL BIOTECHNOLOGY-Lab**

**(BZBC507P(B))**

1. Genomic DNA isolation from *E. coli*
2. Plasmid DNA isolation (pUC 18/19) from *E. coli*
3. Restriction digestion of plasmid DNA.
4. Construction of circular and linear restriction map from the data provided.
5. Calculation of transformation efficiency from the data provided.
6. To study following techniques through photographs
  - a) Southern Blotting
  - b) Northern Blotting
  - c) Western Blotting
  - d) DNA Sequencing (Sanger's Method)
  - e) PCR
  - f) DNA fingerprinting
7. Project report on animal cell culture

**SUGGESTED READINGS**

- Brown, T.A. (1998). *Molecular Biology Labfax II: Gene Cloning and DNA Analysis*. II Edition, Academic Press, California, USA.
- Glick, B.R. and Pasternak, J.J. (2009). *Molecular Biotechnology - Principles and Applications of Recombinant DNA*. IV Edition, ASM press, Washington, USA.
- 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.
- Snustad, D.P. and Simmons, M.J. (2009). *Principles of Genetics*. V Edition, John Wiley and Sons Inc.
- 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.
- Beauchamp, T.I. and Childress, J.F. (2008). *Principles of Biomedical Ethics*. VI Edition, Oxford University Press.

R A I P U R

## Elective-I Zoology- **AQUATIC BIOLOGY**

**(BZBC504C)**

### **UNIT 1: Aquatic Biomes**

Brief introduction of the aquatic biomes: Freshwater ecosystem (lakes, wetlands, streams and rivers), estuaries, intertidal zones, oceanic pelagic zone, marine benthic zone and coral reefs.

### **UNIT 2: Freshwater Biology**

**Lakes:** Origin and classification, Lake as an Ecosystem, Lake morphometry, Physico-chemical Characteristics: Light, Temperature, Thermal stratification, Dissolved Solids, Carbonate, Bicarbonates, Phosphates and Nitrates, Turbidity; dissolved gases (Oxygen, Carbon dioxide). Nutrient Cycles in Lakes-Nitrogen, Sulphur and Phosphorous.

**Streams:** Different stages of stream development, Physico-chemical environment, Adaptation of hill-stream fishes.

### **UNIT 3: Marine Biology**

Salinity and density of Sea water, Continental shelf, Adaptations of deep sea organisms, Coral reefs, Sea weeds.

### **UNIT 4: Management of Aquatic Resources**

Causes of pollution: Agricultural, Industrial, Sewage, Thermal and Oil spills, Eutrophication, Management and conservation (legislations), Sewage treatment Water quality assessment- BOD and COD.

**R A I P U R**

Elective-I Zoology- **AQUATIC BIOLOGY-Lab**

**(BZBC507P(C))**

1. Determine the area of a lake using graphimetric and gravimetric method.
2. Identify the important macrophytes, phytoplanktons and zooplanktons present in a lake ecosystem.
3. Determine the amount of Turbidity/transparency, Dissolved Oxygen, Free Carbon dioxide, Alkalinity (carbonates & bicarbonates) in water collected from a nearby lake/ water body.
4. Instruments used in limnology (Secchi disc, Van Dorn Bottle, Conductivity meter, Turbidity meter, PONAR grab sampler) and their significance.
5. A Project Report on a visit to a Sewage treatment plant/Marine bioreserve/ Fisheries Institutes.

**SUGGESTED READINGS**

- Anathakrishnan** : Bioresources Ecology 3rd Edition
- Goldman** : Limnology, 2nd Edition
- Odum and Barrett** : Fundamentals of Ecology, 5th Edition
- Pawlowski** : Physicochemical Methods for Water and Wastewater Treatment, 1st Edition
- Wetzel** : Limnology, 3rd edition
- Trivedi and Goyal** : Chemical and biological methods for water pollution studies
- Welch** : Limnology Vols. I-II

**R A I P U R**

Elective-I Botany

**Plant Pathology Lab**

(BZBC505P(A))

**Lab Objective: -**

- Learn culture media preparation.
- Isolate disease causing microbes from diseased plants.

1. Identification of disease symptoms-

Specimens:

- a. Blast disease in rice
- b. Anthracnose in chilli
- c. Powdery mildew in grapes
- d. Downy mildew in grapes
- e. Canker in citrus
- f. Rust in groundnut
- g. Leaf spot in cowpea
- h. Club root in cabbage
- i. Damping off in chilli
- j. Vascular wilt in brinjal
- k. Die back in chilli
- l. Leaf curl in chilli
- m. Mosaic disease in cucumber

2. Preparation of PDA media.
3. Artificial inoculation of pathogens from diseased plant parts to nutrient media.
4. Isolation and identification of pathogen from disease affected plant parts using celotape impression method.
5. Temporary slide preparation of representative genera of disease causing fungi for morphological studies

**Lab Outcomes-**

- Students are able to recognize different plant diseases present in plants and their casual organism, studied about different life cycle of different fungi.
- Students will get the knowledge of diseases in plants in their local area.

## Elective-I Botany

### Plant Ecology and Taxonomy Lab

(BZBC505P(B))

#### Lab Objective: -

- Learn the method of calculate frequency, density of plant population in a ecosystem.
- Practice identifying plant taxa using available dichotomous keys .



1. Study of representative plants of family Ranunculaceae, Brassicaceae, Malvaceae.
2. Study of representative plants of family Rutaceae, Apiaceae, Asclepidaceae,
3. Study of representative plants of family Solanaceae, Limiaceae, Euphorbiaceae and Liliaceae.
4. Study of morphological adaptations of hydrophytes and xerophytes (four each).
5. Study of biotic interactions of the following: Stem parasite (Cuscuta), Root parasite (Orobanche), Epiphytes, Predation (Insectivorous plants)
6. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus by species area curve method. (Species to be listed)
7. Quantitative analysis of herbaceous vegetation in the college campus for frequency and comparison with Raunkiaer's frequency distribution law
8. Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the record book).

#### Lab outcome-

- Students are able to calculate the size, density, frequency of plant with various parameters; also they are able to recognize different grass species.

R A I P U R

Elective-I Chemistry  
Polymer Chemistry Lab  
(BZBC506P(A))

### 1. Polymer synthesis

1. Free radical solution polymerization of styrene (St) / Methyl Methacrylate(MMA) / Methyl Acrylate (MA) / Acrylic acid (AA).

a. Purification of monomer

b. Polymerization using benzoyl peroxide (BPO) / 2,2'-azo-bisisobutyronitrile(AIBN)

2. Preparation of nylon 66/6

1. Interfacial polymerization, preparation of polyester from isophthaloyl chloride (IPC) and phenolphthalein

a. Preparation of IPC

b. Purification of IPC

c. Interfacial polymerization

3. Redox polymerization of acrylamide

4. Precipitation polymerization of acrylonitrile

5. Preparation of urea-formaldehyde resin

6. Preparations of novalac resin/resold resin.

7. Microscale Emulsion Polymerization of Poly(methylacrylate).

### Polymer characterization

1. Determination of molecular weight by viscometry:

(a) Polyacrylamide-aq.NaNO<sub>2</sub> solution

(b) (Poly vinyl propylidene (PVP) in water

2. Determination of the viscosity-average molecular weight of poly(vinyl alcohol) (PVOH) and the fraction of "head-to-head" monomer linkages in the polymer.

3. Determination of molecular weight by end group analysis: Polyethylene glycol (PEG) (OH group).

4. Testing of mechanical properties of polymers.

5. Determination of hydroxyl number of a polymer using colorimetric method.

### Polymer analysis

1. Estimation of the amount of HCHO in the given solution by sodium sulphite method

2. Instrumental Techniques

3. IR studies of polymers

4. DSC analysis of polymers

5. Preparation of polyacrylamide and its electrophoresis

\*at least 7 experiments to be carried out.

### Reference Books:

□ M.P. Stevens, *Polymer Chemistry: An Introduction*, 3rd Ed., Oxford University Press, 1999.

□ H.R. Allcock, F.W. Lampe & J.E. Mark, *Contemporary Polymer Chemistry*, 3rd ed. Prentice-Hall (2003)

□ F.W. Billmeyer, *Textbook of Polymer Science*, 3rd ed. Wiley-Interscience (1984)

□ J.R. Fried, *Polymer Science and Technology*, 2nd ed. Prentice-Hall (2003)

□ P. Munk & T.M. Aminabhavi, *Introduction to Macromolecular Science*, 2<sup>nd</sup>ed. John Wiley & Sons (2002)

□ L. H. Sperling, *Introduction to Physical Polymer Science*, 4th ed. John Wiley & Sons (2005)

□ M.P. Stevens, *Polymer Chemistry: An Introduction* 3rd ed. Oxford University Press (2005).

□ Seymour/ Carraher's *Polymer Chemistry*, 9th ed. by Charles E. Carraher,

□ Svehla, G. *Vogel's Qualitative Inorganic Analysis*, Pearson Education, 2012.

□ Merdham, J. *Vogel's Quantitative Chemical Analysis*, Pearson, 2009.



## Elective-I Chemistry

### ANALYTICAL METHODS IN CHEMISTRY-Lab

#### (BZBC506P(B))

#### I. Separation Techniques

##### 1. Chromatography:

###### (a) Separation of mixtures

(i) Paper chromatographic separation of  $\text{Fe}^{3+}$ ,  $\text{Al}^{3+}$ , and  $\text{Cr}^{3+}$ .

(ii) Separation and identification of the monosaccharides present in the given mixture (glucose & fructose) by paper chromatography. Reporting the  $R_f$  values.

(b) Separate a mixture of Sudan yellow and Sudan Red by TLC technique and identify them on the basis of their  $R_f$  values.

(c) Chromatographic separation of the active ingredients of plants, flowers and juices by TLC

#### II. Solvent Extractions:

(i) To separate a mixture of  $\text{Ni}^{2+}$  &  $\text{Fe}^{2+}$

by complexation with DMG and extracting the  $\text{Ni}^{2+}$ -

DMG complex in chloroform, and determine its concentration by spectrophotometry.

(ii) Solvent extraction of zirconium with amberliti LA-1, separation from a mixture of irons and gallium.

3. Determine the pH of the given aerated drinks fruit juices, shampoos and soaps.

4. Determination of Na, Ca, Li in cola drinks and fruit juices using flame photometric techniques.

5. Analysis of soil:

(i) Determination of pH of soil.

(ii) Total soluble salt (iii) Estimation of calcium, magnesium, phosphate, nitrate

6. Ion exchange:

(i) Determination of exchange capacity of cation exchange resins and anion exchange resins.

(ii) Separation of metal ions from their binary mixture.

(iii) Separation of amino acids from organic acids by ion exchange chromatography.

#### III Spectrophotometry

1. Determination of  $pK_a$  values of indicator using spectrophotometry.

2 Structural characterization of compounds by infrared spectroscopy.

3 Determination of dissolved oxygen in water.

4 Determination of chemical oxygen demand (COD).

5 Determination of Biological oxygen demand (BOD).

6 Determine the composition of the Ferric-salicylate/ ferric-thiocyanate complex by Job's method.

#### Reference Books:

□ □ Jeffery, G.H., Bassett, J., Mendham, J. & Denney, R.C. *Vogel's Textbook of Quantitative Chemical Analysis*, John Wiley & Sons, 1989.

□ □ Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F. *Instrumental Methods of Analysis*, 7th Ed. Wadsworth Publishing Company Ltd., Belmont, California, USA, 1988.

□ □ Christian, Gary D; *Analytical Chemistry*, 6th Ed. John Wiley & Sons, New York, 2004.

□ □ Harris, Daniel C: *Exploring Chemical Analysis*, Ed. New York, W.H. Freeman, 2001.

□ □ Khopkar, S.M. *Basic Concepts of Analytical Chemistry*. New Age, International Publisher, 2009.

- □ Skoog, D.A. Holler F.J. & Nieman, T.A *Principles of Instrumental Analysis*, Cengage Learning India Ed.
- □ Mikes, O *Laboratory Hand Book of Chromatographic & Allied Methods*, Elsevier Harwood Series on Analytical Chemistry, John Wiley & Sons, 1979.
- □ Ditts, R.V *Analytical Chemistry; Methods of Separation*, van Nostrand, 1974.



## Elective-I Chemistry

### Inorganic Materials of Industrial Importance Lab

#### (BZBC506P(C))

1. Determination of free acidity in ammonium sulphate fertilizer.
2. Estimation of calcium in calcium ammonium nitrate fertilizer.
3. Estimation of phosphoric acid in superphosphate fertilizer.
4. Electroless metallic coatings on ceramic and plastic material.
5. Determination of composition of dolomite (by complexometric titration).
6. Analysis of (Cu, Ni); (Cu, Zn) in alloy or synthetic samples.
7. Analysis of Cement.
8. Preparation of pigment (zinc oxide).

#### Reference Books:

- □ E. Stocchi *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK.
- □ R. M. Felder, R. W. Rousseau: *Elementary Principles of Chemical Processes*, Wiley Publishers, New Delhi.
- □ W. D. Kingery, H. K. Bowen, D. R. Uhlmann: *Introduction to Ceramics*, Wiley Publishers, New Delhi.
- □ J. A. Kent: Riegel's *Handbook of Industrial Chemistry*, CBS Publishers, New Delhi.
- □ P. C. Jain, M. Jain: *Engineering Chemistry*, Dhanpat Rai & Sons, Delhi.
- □ R. Gopalan, D. Venkappayya, S. Nagarajan: *Engineering Chemistry*, Vikas Publications, New Delhi.
- □ Sharma, B.K. & Gaur, H: *Industrial Chemistry*, Goel Publishing House, Meerut (1996).

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## **Biofertilizers**

**(BZBC601A)**

### **Course Objectives:**

- To facilitate the students to understand basics of biofertilizers.
- To impart training to develop skills about handling, cultivation, and propagation of quality microbial inoculants
- To provide exposure to biofertilizer production technology
- To make students ready for industry as entrepreneurs.

### **UNIT I**

General account about the microbes used as biofertilizer – Rhizobium – isolation, identification, mass multiplication, carrier based inoculants, Actinorrhizal symbiosis.

### **UNIT II**

Azospirillum: isolation and mass multiplication – carrier based inoculant, associative effect of different microorganisms. Azotobacter: classification, characteristics – crop response to Azotobacter inoculum, maintenance and mass multiplication.

### **UNIT III**

Cyanobacteria (blue green algae), Azolla and Anabaena azollae association, nitrogen fixation, factors affecting growth, blue green algae and Azolla in rice cultivation.

### **UNIT IV**

Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution, phosphorus nutrition, growth and yield – colonization of VAM – isolation and inoculum production of VAM, and its influence on growth and yield of crop plants.

### **UNIT V**

Organic farming – Green manuring and organic fertilizers, Recycling of biodegradable municipal, agricultural and Industrial wastes – biocompost making methods, types and method of vermicomposting – field Application.

**Course Outcomes:** At the end of the course, Students will be able to understand:

- To acquaint with the importance of bio-fertilizers in present scenario.
- To educate about concept and classification of bio-fertilizers.
- Role of bio-fertilizers in quality parameters of various agricultural products and key role of bio-fertilizer in maintain soil health.

### **Suggested Readings**

1. Dubey, R.C., 2005 A Text book of Biotechnology S.Chand & Co, New Delhi.

2. Kumaresan, V. 2005, Biotechnology, Saras Publications, New Delhi.
3. John Jothi Prakash, E. 2004. Outlines of Plant Biotechnology. Emkay Publication, New Delhi.
4. Sathe, T.V. 2004 Vermiculture and Organic Farming. Daya publishers.
5. Subha Rao, N.S. 2000, Soil Microbiology, Oxford & IBH Publishers, New Delhi.
6. Vayas,S.C, Vayas, S. and Modi, H.A. 1998 Bio-fertilizers and organic Farming Akta Prakashan, Nadiad



## Fuel and Pesticide Chemistry

(BZBC601B)

### Unit-I

#### Fuel Chemistry

Review of energy sources (renewable and non-renewable). Classification of fuels and their calorific value.

**Coal:** Uses of coal (fuel and nonfuel) in various industries, its composition, carbonization of coal. Coal gas, producer gas and water gas—composition and uses. Fractionation of coal tar, uses of coal tar bases chemicals, requisites of a good metallurgical coke, Coal gasification (Hydro gasification and Catalytic gasification), Coal liquefaction and Solvent Refining.

### Unit-II

**Petroleum and Petrochemical Industry:** Composition of crude petroleum, Refining and different types of petroleum products and their applications. Fractional Distillation (Principle and process), Cracking (Thermal and catalytic cracking), Reforming Petroleum and non-petroleum fuels (LPG, CNG, LNG, bio-gas, fuels derived from biomass), fuel from waste, synthetic fuels (gaseous and liquids), clean fuels. Petrochemicals: Vinyl acetate, Propylene oxide, Isoprene, Butadiene, Toluene and its derivatives Xylene.

### Unit-III

**Lubricants:** Classification of lubricants, lubricating oils (conducting and non-conducting) Solid and semisolid lubricants, synthetic lubricants. Properties of lubricants (viscosity index, cloud point, pore point) and their determination.

### Modern Fuel

### Unit-IV

#### Pesticide Chemistry

General introduction to pesticides (natural and synthetic), benefits and adverse effects, changing concepts of pesticides, structure activity relationship, synthesis and technical manufacture and uses of representative pesticides in the following classes: Organochlorines (DDT, Gammexene,); Organophosphates (Malathion, Parathion); Carbamates (Carbofuran and carbaryl); Quinones (Chloranil), Anilides (Alachlor and Butachlor).

#### Reference

- Stocchi, E. Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK (1990).
- Jain, P.C. & Jain, M. Engineering Chemistry Dhanpat Rai & Sons, Delhi.
- Sharma, B.K. & Gaur, H. Industrial Chemistry, Goel Publishing House, Meerut (1996).
- Cremlyn, R. Pesticides. Preparation and Modes of Action, John Wiley & Sons, New York, 1978.

#### Book:



## SERICULTURE

(BZBC601C)

### Unit 1: Introduction

(3)

Sericulture: Definition, history and present status; Silk route  
Types of silkworms, Distribution and Races  
Exotic and indigenous races  
Mulberry and non-mulberry Sericulture

### Unit 2: Biology of Silkworm

(3)

Life cycle of *Bombyx mori*  
Structure of silk gland and secretion of silk

### Unit 3: Rearing of Silkworms

(13)

Selection of mulberry variety and establishment of mulberry garden  
Rearing house and rearing appliances  
Disinfectants: Formalin, bleaching powder, RKO  
Silkworm rearing technology: Early age and Late age rearing  
Types of mountages  
Spinning, harvesting and storage of cocoons

### Unit 4: Pests and Diseases

(4)

Pests of silkworm: Uzi fly, dermestid beetles and vertebrates  
Pathogenesis of silkworm diseases: Protozoan, viral, fungal and bacterial  
Control and prevention of pests and diseases

### Unit 5: Entrepreneurship in Sericulture

(2)

Prospectus of Sericulture in India: Sericulture industry in different states, employment, potential in mulberry and non-mulberry sericulture. Visit to various sericulture centres.

### SUGGESTED READINGS

- Handbook of Practical Sericulture: S.R. Ullal and M.N. Narasimhanna CSB, Bangalore
  - Appropriate Sericultural Techniques; Ed. M. S. Jolly, Director, CSR & TI, Mysore.
  - Handbook of Silkworm Rearing: Agriculture and Technical Manual-1, Fuzi Pub. Co. Ltd., Tokyo, Japan 1972.
  - Manual of Silkworm Egg Production; M. N. Narasimhanna, CSB, Bangalore 1988.
  - Silkworm Rearing; Wupang—Chun and Chen Da-Chung, Pub. By FAO, Rome 1988.
- A Guide for Bivoltine Sericulture; K. Sengupta, Director, CSR & TI, Mysore 1989.
- Improved Method of Rearing Young age silkworm; S. Krishnaswamy, reprinted CSB, Bangalore, 1986.



## Elective-II Botany

### Plant Tissue Culture

(BZBC602A)

#### Course Objectives:

- To provide knowledge of the techniques of the culturing totipotent single cells and developing the *plants*.
- Students will also get to know about how plants are genetically modified and their importance and disadvantages.

#### UNIT I

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

#### UNIT II

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

#### UNIT III

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

#### UNIT IV

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

#### UNIT V

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

#### Course Outcomes:

- Understand tissue culture techniques.
- Know the application of plant tissue culture.

#### Suggested Readings:

- Plant Cell Culture , A practical approach; R. A. Dixon and Gonzalez
- Plant Molecular Biology; Donald, Grieson
- Elements of Biotechnology; P. K. Gupta and Rastogi
- Plant Biotechnology; J. Hammond, P. McGarvey and V. Yusibov
- Introduction to Plant Tissue Culture; Kalyan Kumar De

- Plant Tissue Culture; S. S. Bhojwani
- Plant Cell Culture: D. E. Evans

## **Elective-II Botany**

### **Plant Tissue Culture-Lab**

**(BZBC605P(A))**

#### **Lab Objective: -**

- To learn tissue culture techniques.
- Propagation of large quantity of good quality planting material from elite mother **plants**.

1. Introduction and awareness of lab safety measures.
2. Study of sterilization of explants and working place.
3. Preparation of MS media
4. *In vitro* culture imitation from germinated seeds, juvenile and mature shoots, buds.
5. Sub culturing of in vitro grown tissues.
6. In vitro Rooting of micro shoot.
7. Hardening and acclimatization of in vitro regenerated micro plants
8. Induction of callus from different tissues.
9. Organogenesis / somatic embryogenesis from callus.

#### **Lab outcome –**

- Students are able to understand instrumentation, basic requirements and applied aspects of plant tissue culture.
- get to know about how to culture various plant parts and develop new plant from it,

**R A I P U R**

## Elective-II Botany

### Economic Botany and Biotechnology

(BZBC602B)

#### Course Objectives:

- This course helps the students to explore the intimate relationship between plants and our lives.
- Topics covered under this course include our use of plants as medicines, food, beverages and textiles.
- The students are made to understand the basic concepts and techniques in genetic engineering.

#### UNIT I

**Origin of Cultivated Plants:** Concept of centres of origin, their importance with reference to Vavilov's work. **Cereals: Wheat** -Origin, morphology, uses, **Legumes:** General account with special reference to Gram and soybean

#### UNIT II

**Spices:** General account with special reference to clove and black pepper (Botanical name, family, part Used morphology and uses) **Beverages:** Tea (morphology, processing, uses)

#### UNIT III

**Oils and Fats:** General description with special reference to groundnut, **Fibre Yielding Plants** General description with special reference to Cotton (Botanical name, family, part used, morphology and uses),

#### UNIT IV

**Medicinal Plants:** Brief account of Ocimum, Tinospora, Aloe, Rauwolfia, Emblica and Cathranthus

#### UNIT V

**Biotechnological Techniques** : Introduction to r-DNA, Cloning vehicles, Gene transfer techniques in plants, Transgenic plants, Agarose electrophoresis, Blotting techniques: Northern, Southern and Western Blotting, DNA Fingerprinting; Molecular DNA markers i.e. RAPD, RFLP, SNPs; DNA sequencing, PCR and Reverse Transcriptase-PCR. ELISA, Hybridoma and monoclonal antibodies, ELISA and Immunodetection.

#### Course Outcomes:

- Brief studied the economic products with special reference to the Botanical name, family, morphology of useful part and the uses.
- Know about the biotechnological Techniques

#### Suggested Readings

1. Kochhar, S.L. (2017). Economic Botany, Cambridge University Press.
2. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.

3. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.



## **Elective-II Botany**

### **Economic Botany and Biotechnology-Lab**

**(BZBC605P(B))**

#### **Lab Objectives:**

- Acquire knowledge on economically important plants
  - Learn about equipments.
1. Study of economically important plants : Wheat, Rice, Gram, Soybean, Potato, Black pepper, Clove, Cinnamon, Ginger, Turmeric, Tea, Coffee, Cotton, Groundnut, Sugarcane and Medicinal plants through specimens, sections and microchemical tests
  2. Familiarization with basic equipment used in tissue culture through videos, images or visit to nearby research Institute.
  3. Study through photographs: Anther culture, somatic embryogenesis, endosperm and embryo culture; micropropagation.
  4. Study of equipments used in PCR, Blotting techniques and PAGE with the help of photographs or videos

#### **Lab Outcomes:**

- Gain knowledge about various plants of economic use.
- Know importance of plants & plant products.
- Know about the Genetic Engineering

**R A I P U R**

## Elective-II Chemistry

### INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS

(BZBC603A)

#### Unit-I

##### Introduction to spectroscopic methods of analysis:

Recap of the spectroscopic methods covered in detail in the core chemistry syllabus: Treatment of analytical data, including error analysis. Classification of analytical methods and the types of instrumental methods. Consideration of electromagnetic radiation.

#### Unit-II

##### Molecular spectroscopy:

###### *Infrared spectroscopy:*

Interactions with molecules: absorption and scattering. Means of excitation (light sources), separation of spectrum (wavelength dispersion, time resolution), detection of the signal (heat, differential detection), interpretation of spectrum (qualitative, mixtures, resolution), advantages of Fourier Transform (FTIR). Samples and results expected. Applications: Issues of quality assurance and quality control, Special problems for portable instrumentation and rapid detection.

*UV-Visible/ Near IR* – emission, absorption, fluorescence and photoacoustic. Excitation sources (lasers, time resolution), wavelength dispersion (gratings, prisms, interference filters, laser, placement of sample relative to dispersion, resolution), Detection of signal (photocells, photomultipliers, diode arrays, sensitivity and S/N), Single and Double Beam instruments, Interpretation (quantification, mixtures, absorption vs. fluorescence and the use of time, photoacoustic, fluorescent tags).

#### Unit-III

##### Separation techniques

*Chromatography:* Gas chromatography, liquid chromatography, supercritical fluids, Importance of column technology (packing, capillaries), Separation based on increasing number of factors (volatility, solubility, interactions with stationary phase, size, electrical field), Detection: simple vs. specific (gas and liquid), Detection as a means of further analysis

(use of tags and coupling to IR and MS), Electrophoresis (plates and capillary) and use with DNA analysis. *immunoassays and DNA techniques*

*Mass spectroscopy:* Making the gaseous molecule into an ion (electron impact, chemical ionization), Making liquids and solids into ions (electrospray, electrical discharge, laser desorption, fast atom bombardment), Separation of ions on basis of mass to charge ratio, Magnetic, Time of flight, Electric quadrupole. Resolution, time and multiple separations, Detection and interpretation (how this is linked to excitation).

#### Unit-IV

##### Elemental analysis:

Mass spectrometry (electrical discharges).

Atomic spectroscopy: Atomic absorption, Atomic emission, and Atomic fluorescence. Excitation and getting sample into gas phase (flames, electrical discharges, plasmas), Wavelength separation and

resolution (dependence on technique), Detection of radiation (simultaneous/scanning, signal noise), Interpretation (errors due to molecular and ionic species, matrix effects, other interferences).

### **Unit-V**

**NMR spectroscopy:** Principle, Instrumentation, Factors affecting chemical shift, Spincoupling, Applications.

**Electroanalytical Methods:** Potentiometry & Voltammetry

**Radiochemical Methods**

**X-ray analysis and electron spectroscopy (surface analysis)**

#### **Reference books:**

- Skoog, D.A. Holler F.J. & Nieman, T.A. *Principles of Instrumental Analysis*, Cengage Learning India Ed.
- Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A. *Instrumental Methods of Analysis*, 7th Ed. Wadsworth Publishing Company Ltd., Belmont, California, USA, 1988.
- P.W. Atkins: Physical Chemistry.
- G.W. Castellan: Physical Chemistry.
- C.N. Banwell: Fundamentals of Molecular Spectroscopy.
- Brian Smith: Infrared Spectra Interpretations: A Systematic Approach.
- W.J. Moore: Physical Chemistry.

**R A I P U R**

## Elective-II Chemistry

### INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS-Lab

#### (BZBC606P(A))

1. Safety Practices in the Chemistry Laboratory
2. Determination of the isoelectric pH of a protein.
3. Titration curve of an amino acid.
4. Determination of the void volume of a gel filtration column.
5. Determination of a Mixture of Cobalt and Nickel (UV/Vis spec.)
6. Study of Electronic Transitions in Organic Molecules (i.e., acetone in water)
7. IR Absorption Spectra (Study of Aldehydes and Ketones)
8. Determination of Calcium, Iron, and Copper in Food by Atomic Absorption
9. Quantitative Analysis of Mixtures by Gas Chromatography (i.e., chloroform and carbon tetrachloride)
10. Separation of Carbohydrates by HPLC
11. Determination of Caffeine in Beverages by HPLC
12. Potentiometric Titration of a Chloride-Iodide Mixture
13. Cyclic Voltammetry of the Ferrocyanide/Ferricyanide Couple
14. Nuclear Magnetic Resonance
15. Use of fluorescence to do “presumptive tests” to identify blood or other body fluids.
16. Use of “presumptive tests” for anthrax or cocaine
17. Collection, preservation, and control of blood evidence being used for DNA testing
18. Use of capillary electrophoresis with laser fluorescence detection for nuclear DNA (Y chromosome only or multiple chromosome)
19. Use of sequencing for the analysis of mitochondrial DNA
20. Laboratory analysis to confirm anthrax or cocaine
21. Detection in the field and confirmation in the laboratory of flammable accelerants or explosives
22. Detection of illegal drugs or steroids in athletes
23. Detection of pollutants or illegal dumping
24. Fibre analysis

*At least 10 experiments to be performed.*

#### Reference Books:

- □ Skoog, D.A. Holler F.J. & Nieman, T.A *Principles of Instrumental Analysis*, Cengage Learning India Ed.
- □ Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A *Instrumental Methods of Analysis*, 7th Ed. Wadsworth Publishing Company Ltd., Belmont, California, USA, 1988.



## Elective-II Chemistry

### Noval Inorganic Solids

(BZBC603B)

#### Unit-I

**Synthesis and modification of inorganic solids:** Conventional heat and beat methods, Co-precipitation method, Sol-gel methods, Hydrothermal method, Ion-exchange and Intercalation methods.

**Inorganic solids of technological importance:** Solid electrolytes – Cationic, anionic, mixed Inorganic pigments – coloured solids, white and black pigments. Molecular material and fullerides, molecular materials & chemistry – one-dimensional metals, molecular magnets, inorganic liquid crystals.

#### Unit-II

##### Nanomaterials:

Overview of nanostructures and nanomaterials: classification. Preparation of gold and silver metallic nanoparticles, self-assembled nanostructures-control of nanoarchitecture-one dimensional control. Carbon nanotubes and inorganic nanowires. Bio-inorganic nanomaterials, DNA and nanomaterials, natural and antisical nanomaterials, bionano composites.

#### Unit-III

##### Introduction to engineering materials for mechanical construction:

Composition, mechanical and fabricating characteristics and applications of various types of cast irons, plain carbon and alloy steels, copper, aluminium and their alloys like duralumin, brasses and bronzes cutting tool materials, super alloys thermoplastics, thermosets and composite materials.

**Composite materials:** Introduction, limitations of conventional engineering materials, role of matrix in composites, classification, matrix materials, reinforcements, metal-matrix composites, polymer-matrix composites, fibre-reinforced composites, environmental effects on composites, applications of composites.

#### Unit-IV

**Speciality polymers:** Conducting polymers - Introduction, conduction mechanism, polyacetylene, polyparaphenylene and polypyrrole, applications of conducting polymers, Ion-exchange resins and their applications. Ceramic & Refractory: Introduction, classification, properties, raw materials, manufacturing and applications.

#### Unit-V

##### Industrial Gases and Inorganic Chemicals

**Industrial Gases:** Large scale production, uses, storage and hazards in handling of the following gases: oxygen, nitrogen, argon, neon, helium, hydrogen, acetylene, carbon monoxide, chlorine, fluorine, sulphur dioxide and phosgene.

**Inorganic Chemicals:** Manufacture, application, analysis and hazards in handling the following chemicals: hydrochloric acid, nitric acid, sulphuric acid, caustic soda, common salt, borax, bleaching powder, sodium thiosulphate, hydrogen peroxide, potash alum, chrome alum, potassium dichromate and potassium permanganate.

### Reference Books:

- Shriver & Atkins. Inorganic Chemistry, Peter Atkins, Tina Overton, Jonathan Rourke, 32 Mark Weller and Fraser Armstrong, 5th Edition, Oxford University Press (2011-2012)
- Adam, D.M. Inorganic Solids: An introduction to concepts in solid-state structural chemistry. John Wiley & Sons, 1974.
- Poole, C.P. & Owens, F.J. Introduction to Nanotechnology John Wiley & Sons, 2003.
- Rodger, G.E. Inorganic and Solid State Chemistry, Cengage Learning India Edition, 2002.
- E. Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK.
- R.M. Felder, R.W. Rousseau: Elementary Principles of Chemical Processes, Wiley Publishers, New Delhi.
- J. A. Kent: Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi.
- S. S. Dara: A Textbook of Engineering Chemistry, S. Chand & Company Ltd. New Delhi.
- K. De, Environmental Chemistry: New Age International Pvt., Ltd, New Delhi.
- S. M. Khopkar, Environmental Pollution Analysis: Wiley Eastern Ltd, New Delhi.
- 42
- S.E. Manahan, Environmental Chemistry, CRC Press (2005).
- G.T. Miller, Environmental Science 11th edition. Brooks/ Cole (2006).
- A. Mishra, Environmental Studies. Selective and Scientific Books, New Delhi (2005).

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**Elective-II Chemistry****Noval Inorganic Solids-Lab****(BZBC606P(B))**

1. Determination of cation exchange method
2. Determination of total difference of solids.
3. Synthesis of hydrogel by co-precipitation method.
4. Synthesis of silver and gold metal nanoparticles.
5. Determination of dissolved oxygen in water.
6. Determination of Chemical Oxygen Demand (COD).
7. Determination of Biological Oxygen Demand (BOD)
8. Percentage of available chlorine in bleaching powder.
9. Measurement of chloride, sulphate and salinity of water samples by simple titration method (AgNO<sub>3</sub> and potassium chromate).
10. Estimation of total alkalinity of water samples (CO<sub>3</sub><sup>2-</sup>, HCO<sub>3</sub><sup>-</sup>) using double titration method.
11. Measurement of dissolved CO<sub>2</sub>.

Preparation of borax/ boric acid.

**Reference Books:**

- E. Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK.
- R.M. Felder, R.W. Rousseau: Elementary Principles of Chemical Processes, Wiley Publishers, New Delhi.
- J. A. Kent: Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi.
- S. S. Dara: A Textbook of Engineering Chemistry, S. Chand & Company Ltd. New

R A I P U R

## Elective-II Chemistry

### Organometallics, Bioinorganic chemistry, Polynuclear hydrocarbons and UV, IR Spectroscopy (BZBC603C)

#### Module-I

##### Chemistry of 3d metals

Oxidation states displayed by Cr, Fe, Co, Ni and Co. A study of the following compounds (including preparation and important properties); Peroxo compounds of Cr,  $K_2Cr_2O_7$ ,  $KMnO_4$ ,  $K_4[Fe(CN)_6]$ , sodium nitroprusside,  $[Co(NH_3)_6]Cl_3$ ,  $Na_3[Co(NO_2)_6]$ .

(6 Lectures)

#### Module-II

##### Organometallic Compounds

Definition and Classification with appropriate examples based on nature of metalcarbon bond (ionic, s, p and multicentre bonds). Structures of methyl lithium, Zeiss salt and ferrocene. EAN rule as applied to carbonyls. Preparation, structure, bonding and properties of mononuclear and polynuclear carbonyls of 3d metals. p-acceptor behaviour of carbon monoxide. Synergic effects (VB approach)- (MO diagram of CO can be referred to for synergic effect to IR frequencies).

(12 Lectures)

#### Module-III

##### Bio-Inorganic Chemistry

A brief introduction to bio-inorganic chemistry. Role of metal ions present in biological systems with special reference to  $Na^+$ ,  $K^+$  and  $Mg^{2+}$  ions:  $Na/K$  pump; Role of  $Mg^{2+}$  ions in energy production and chlorophyll. Role of  $Ca^{2+}$  in blood clotting, stabilization of protein structures and structural role (bones).

(12 Lectures)

#### Section B: Organic Chemistry-4 (30 Lectures)

#### Module-IV

##### Polynuclear and heteronuclear aromatic compounds:

Properties of the following compounds with reference to electrophilic and nucleophilic substitution: Naphthalene, Anthracene, Furan, Pyrrole, Thiophene, and Pyridine.

(6 Lectures)

##### Active methylene compounds:

*Preparation:* Claisen ester condensation. Keto-enol tautomerism. *Reactions:* Synthetic uses of ethylacetoacetate (preparation of non-heteromolecules having upto 6 carbon).

(6 Lectures)

#### Module-V

##### Application of Spectroscopy to Simple Organic Molecules

Application of visible, ultraviolet and Infrared spectroscopy in organic molecules. Electromagnetic radiations, electronic transitions,  $\lambda_{max}$  &  $\epsilon_{max}$ , chromophore, auxochrome, bathochromic and hypsochromic shifts. Application of electronic spectroscopy and Woodward rules for calculating  $\lambda_{max}$  of conjugated dienes and  $\alpha, \beta$ -unsaturated compounds.

Infrared radiation and types of molecular vibrations, functional group and fingerprint region. IR spectra of alkanes, alkenes and simple alcohols (inter and intramolecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on  $>C=O$  stretching absorptions).

**(18 Lectures)**

**Reference Books:**

- James E. Huheey, Ellen Keiter & Richard Keiter: *Inorganic Chemistry: Principles of Structure and Reactivity*, Pearson Publication.
- G.L. Miessler & Donald A. Tarr: *Inorganic Chemistry*, Pearson Publication.
- J.D. Lee: *A New Concise Inorganic Chemistry*, E.L.B.S.
- F.A. Cotton & G. Wilkinson: *Basic Inorganic Chemistry*, John Wiley & Sons.
- I.L. Finar: *Organic Chemistry* (Vol. I & II), E.L.B.S.
- John R. Dyer: *Applications of Absorption Spectroscopy of Organic Compounds*, Prentice Hall.
- R.M. Silverstein, G.C. Bassler & T.C. Morrill: *Spectroscopic Identification of Organic Compounds*, John Wiley & Sons.
- R.T. Morrison & R.N. Boyd: *Organic Chemistry*, Prentice Hall.
- Peter Sykes: *A Guide Book to Mechanism in Organic Chemistry*, Orient Longman.
- Arun Bahland B. S. Bahl: *Advanced Organic Chemistry*, S. Chand.



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## Elective-II Chemistry

Organometallics, Bioinorganic chemistry, Polynuclear hydrocarbons and UV, IR Spectroscopy-Lab  
(BZBC606P(C))

**Section A: Inorganic Chemistry**

1. Separation of mixtures by chromatography: Measure the  $R_f$  value in each case. (Combination of two ions to be given) Paper chromatographic separation of  $Fe^{3+}$ ,  $Al^{3+}$  and  $Cr^{3+}$  or Paper chromatographic separation of  $Ni^{2+}$ ,  $Co^{2+}$ ,  $Mn^{2+}$  and  $Zn^{2+}$

2. Preparation of any two of the following complexes and measurement of their conductivity:

(i) tetraamminecarbonatocobalt (III) nitrate

(ii) tetra ammine copper (II) sulphate

(iii) potassium tri oxalatoferrate (III) trihydrate

Compare the conductance of the complexes with that of M/1000 solution of NaCl,  $MgCl_2$  and  $LiCl_3$ .

**Section B: Organic Chemistry**

Systematic Qualitative Organic Analysis of Organic Compounds possessing

Mono functional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines) and preparation of one derivative.

**Reference Books:**

□ □ A.I. Vogel: Qualitative Inorganic Analysis, Prentice Hall, 7th Edn.

□ □ A.I. Vogel: Quantitative Chemical Analysis, Prentice Hall, 6th Edn.

□ □ Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G. *Textbook of Practical Organic Chemistry*, Prentice-Hall, 5th edition, 1996.

□ □ Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry* Orient-Longman, 1960.

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**Elective-II Zoology  
IMMUNOLOGY  
(BZBC604A)**

**Unit 1: Overview of the Immune System 10**

Introduction to basic concepts in immunology, components of immune system, principles of innate and adaptive immune system

**Unit 2: Cells and Organs of the Immune System 8**

Haematopoiesis, Cells of immune system and organs (primary and secondary lymphoid organs) of the immune system

**Unit 3: Antigens 8**

Basic properties of antigens, B and T cell epitopes, haptens and adjuvants

**Antibodies 8**

Structure, classes and function of antibodies, monoclonal antibodies, antigen antibody interactions as tools for research and diagnosis

**Unit 4: Working of the immune system 12**

Structure and functions of MHC, exogenous and endogenous pathways of antigen presentation and processing, Basic properties and functions of cytokines, Complement system: Components and pathways.

**Unit 5: Immune system in health and disease 10**

Gell and Coombs' classification and brief description of various types of hypersensitivities, Introduction to concepts of autoimmunity and immunodeficiency,

**Vaccines 4**

General introduction to vaccines, Various types of vaccines

**R A I P U R**

**Elective-II Zoology  
IMMUNOLOGY-Lab  
(BZBC607P(A))**

- 1\*. Demonstration of lymphoid organs
2. Histological study of spleen, thymus and lymph nodes through slides/ photographs
3. Preparation of stained blood film to study various types of blood cells.
4. Ouchterlony's double immuno-diffusion method.
5. ABO blood group determination.
- 6\*. Cell counting and viability test from splenocytes of farm bred animals/cell lines.
7. Demonstration of
  - a) ELISA
  - b) Immunoelectrophoresis

**SUGGESTED READINGS**

- Kindt, T. J., Goldsby, R.A., Osborne, B. A. and Kuby, J (2006). *Immunology*, VI Edition. W.H. Freeman and Company.
- David, M., Jonathan, B., David, R. B. and Ivan R. (2006). *Immunology*, VII Edition, Mosby, Elsevier Publication.
- Abbas, K. Abul and Lechtman H. Andrew (2003.) *Cellular and Molecular Immunology*. V Edition. Saunders Publication.

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**Elective-II Zoology**  
**REPRODUCTIVE BIOLOGY**  
**(BZBC604B)**

**Unit 1: Reproductive Endocrinology**

Gonadal hormones and mechanism of hormone action, steroids, glycoprotein hormones, and prostaglandins, hypothalamo – hypophyseal – gonadal axis, regulation of gonadotrophin secretion in male and female; Reproductive System: Development and differentiation of gonads, genital ducts, external genitalia, mechanism of sex differentiation.

**Unit 2: Functional anatomy of male reproduction**

Outline and histological of male reproductive system in rat and human; Testis: Cellular functions, germ cell, stem cell renewal; Spermatogenesis: kinetics and hormonal regulation; Androgen synthesis and metabolism; Epididymal function and sperm maturation; Accessory glands functions; Sperm transportation in male tract

**Unit 3: Functional anatomy of female reproduction**

Outline and histological of female reproductive system in rat and human; Ovary: folliculogenesis, ovulation, corpus luteum formation and regression; Steroidogenesis and secretion of ovarian hormones; Reproductive cycles (rat and human) and their regulation, changes in the female tract; Ovum transport in the fallopian tubes; Sperm transport in the female tract, fertilization; Hormonal control of implantation; Hormonal regulation of gestation, pregnancy diagnosis, foeto – maternal relationship; Mechanism of parturition and its hormonal regulation; Lactation and its regulation

**Unit 4: Reproductive Health**

Infertility in male and female: causes, diagnosis and management; Assisted Reproductive Technology: sex selection, sperm banks, frozen embryos, in vitro fertilization, ET, EFT, IUT, ZIFT, GIFT, ICSI, PROST; Modern contraceptive technologies; Demographic terminology used in family planning

R A I P U R

**Elective-II Zoology**  
**REPRODUCTIVE BIOLOGY-Lab**  
**(BZBC607P(B))**

1. Study of animal house: set up and maintenance of animal house, breeding techniques, care of normal and experimental animals.
2. Examination of vaginal smear rats from live animals.
3. Surgical techniques: principles of surgery in endocrinology. Ovaryectomy, hysterectomy, castration and vasectomy in rats.
4. Examination of histological sections from photomicrographs/ permanent slides of rat/human: testis, epididymis and accessory glands of male reproductive systems; Sections of ovary, fallopian tube, uterus (proliferative and secretory stages), cervix and vagina.
5. Human vaginal exfoliate cytology.
6. Sperm count and sperm motility in rat
7. Study of modern contraceptive devices

**SUGGESTED READINGS**

- Austin, C.R. and Short, R.V. reproduction in Mammals. Cambridge University Press.
- Degroot, L.J. and Jameson, J.L. (eds). Endocrinology. W.B. Saunders and Company.
- Knobil, E. et al. (eds). The Physiology of Reproduction. Raven Press Ltd.
- Hatcher, R.A. et al. The Essentials of Contraceptive Technology. Population Information Programme.

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## **Elective-II Zoology**

### **INSECT, VECTORS AND DISEASES**

**(BZBC604C)**

#### **Unit I: Introduction to Insects 6**

General Features of Insects, Morphological features, Head – Eyes, Types of antennae, Mouth parts w.r.t. feeding habits

#### **Concept of Vectors 6**

Brief introduction of Carrier and Vectors (mechanical and biological vector), Reservoirs, Host-vector relationship, Vectorial capacity, Adaptations as vectors, Host Specificity

#### **Unit II: Insects as Vectors 8**

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

#### **Unit III: Dipteran as Disease Vectors 24**

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

#### **Unit IV: Siphonaptera as Disease Vectors 6**

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

#### **Siphunculata as Disease Vectors 4**

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

#### **Unit V: Hemiptera as Disease Vectors 6**

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

R A I P U R

Elective-II Zoology

**INSECT, VECTORS AND DISEASES-Lab**

(BZBC607P(C))

1. Study of different kinds of mouth parts of insects
2. Study of following insect vectors through permanent slides/ photographs: *Aedes*, *Culex*, *Anopheles*, *Pediculus humanus capitis*, *Pediculus humanus corporis*, *Phthirus pubis*, *Xenopsylla cheopis*, *Cimex lectularius*, *Phlebotomus argentipes*, *Musca domestica*, through permanent slides/ Photographs
3. Study of different diseases transmitted by above insect vectors

**SUGGESTED READINGS**

- Imms, A.D. (1977). A General Text Book of Entomology. Chapman & Hall, UK
- Chapman, R.F. (1998). The Insects: Structure and Function. IV Edition, Cambridge University Press, UK
- Pedigo L.P. (2002). Entomology and Pest Management. Prentice Hall Publication
- Mathews, G. (2011). Integrated Vector Management: Controlling Vectors of Malaria and Other Insect Vector Borne Diseases. Wiley-Blackwell



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**Project/Dissertation**

**(BZBC608P)**

