

## **BACHELOR OF SCIENCE BACHELOR OF EDUCATION (ZBC) – SECOND SEMESTER**

<b>Second Semester</b>			
<b>S. No.</b>	<b>Name of Subject</b>	<b>Credits</b>	<b>Total Marks</b>
1	Environmental Science	3	100
2	Chemical Energetics, Equilibria & Functional Group Organic Chemistry-I	4	100
3	Chemical Energetics, Equilibria & Functional Group Organic Chemistry-I Lab	3	100
4	Plant Ecology and Taxonomy	4	100
5	Plant Ecology and Taxonomy Lab	3	100
6	Comparative Anatomy and Developmental Biology of Vertebrates	4	100
7	Comparative Anatomy and Developmental Biology of Vertebrates Lab	3	100
8	Language Across the Curriculum	4	100
<b>Total</b>		<b>28</b>	

**Subject Name:** ENVIRONMENTAL SCIENCE

**Unit 1:** The Multidisciplinary nature of environmental studies Definition; Scope and importance, Need for public awareness.

**Unit 2: Natural Resources:** Renewable and non-renewable resources:

Natural resources and associated problems

- a) Forest resources: Use and Over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
- b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams benefits and problems.
- c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
- d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, Case studies.
- f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

### **Unit 3: Ecosystems:**

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Producers, consumers and decomposers.
- Energy flow in the ecosystem.
- Ecological succession. - Food chains, food webs and ecological pyramids.
- Introduction, types, characteristic features, structure and function of the following ecosystem:
  - a. Forest ecosystem
  - b. Grassland ecosystem
  - c. Desert ecosystem
  - d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

### **Unit 4: Biodiversity and its Conservation**

- a. Introduction-Definition: genetic, species and ecosystem diversity.
- b. Biogeographical classification of India.
- c. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
- d. Biodiversity at global, National and local levels.
- e. India as a mega-diversity nation.
- f. Hot-spots of biodiversity.
- g. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.
- h. Endangered and endemic species of India.
- i. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

### **Unit 5: Environmental Pollution:**

- Causes, effects and control measures of: -
  - a. Air pollution
  - b. Water pollution
  - c. Soil pollution
  - d. Marine pollution
  - e. Noise pollution
  - f. Thermal pollution
  - g. Nuclear hazards
- Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution.
- Pollution case studies.
- Disaster management: floods, earthquake, cyclone and landslides.

### **Unit 6: Social Issues and the Environment**

- From Unsustainable to Sustainable development.
- Urban problems related to energy.
- Water conservation, rain water harvesting, watershed management.
- Resettlement and rehabilitation of people; its problems and concerns. Case studies.
- Environmental ethics: Issues and possible solutions.
- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
- Wasteland reclamation.
- Consumerism and waste products.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and Control of Pollution) Act.
- Wildlife Protection Act. - Forest Conservation Act.
- Issues involved in enforcement of environmental legislation.
- Public awareness.

### **Unit 7: Human Population and the Environment**

- Population growth, variation among nations.
- Population explosion-Family welfare Programme.
- Environment and human health.
- Human Rights.
- Value Education.
- HIV/AIDS.
- Women and Child Welfare.
- Role of information Technology in Environment and human health.
- Case Studies.

### **Unit 8: Field Work (Practical)**

- Visit to a local area to document environmental assets-river/forest/grassland/hill/mountain.
- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural.
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.

**Subject Name:** CHEMICAL ENERGETICS, EQUILIBRIA & FUNCTIONAL GROUP ORGANIC CHEMISTRY-I

#### ***Physical Chemistry***

#### **Chemical Energetics**

Review of thermodynamics and the Laws of Thermodynamics.

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

### **Chemical Equilibrium:**

Free energy change in a chemical reaction. Thermodynamic derivation of the law of chemical equilibrium. Distinction between  $G$  and  $G^\circ$ , 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.

### **Organic Chemistry**

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure.

#### **Aromatic hydrocarbons**

*Preparation* (Case benzene): from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid.

*Reactions*: (Case benzene): Electrophilic substitution: nitration, halogenation and sulphonation. Friedel-Craft's reaction (alkylation and acylation) (upto 4 carbons on benzene). Side chain oxidation of alkyl benzenes (upto 4 carbons on benzene).

#### **Alkyl and Aryl Halides**

**Alkyl Halides** (Upto 5 Carbons) Types of Nucleophilic Substitution ( $SN_1$ ,  $SN_2$  and  $SN_i$ ) reactions.

*Preparation*: from alkenes and alcohols.

*Reactions*: hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation. Williamson's ether synthesis: Elimination vs substitution

**Aryl Halides** *Preparation*: (Chloro, bromo and iodo-benzene case): from phenol, Sandmeyer & Gattermann reactions.

*Reactions* (*Chlorobenzene*): Aromatic nucleophilic substitution (replacement by  $-OH$  group) and effect of nitro substituent. Benzyne Mechanism:  $KNH_2/NH_3$  (or  $NaNH_2/NH_3$ ).

Reactivity and Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides.

#### **Alcohols, Phenols and Ethers** (Upto 5 Carbons)

**Alcohols**: *Preparation*: Preparation of  $1^\circ$ ,  $2^\circ$  and  $3^\circ$  alcohols: using Grignard reagent, Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acid and esters.

*Reactions*: With sodium,  $HX$  (Lucas test), esterification, oxidation (with PCC, alk.  $KMnO_4$ , acidic dichromate, conc.  $HNO_3$ ). Oppeneauer oxidation *Diols*: (Upto 6 Carbons) oxidation of diols. Pinacol-Pinacolone rearrangement.

**Phenols**: (Phenol case) *Preparation*: Cumene hydroperoxide method, from diazonium salts. *Reactions*: Electrophilic substitution: Nitration, halogenation and sulphonation. Reimer-Tiemann Reaction,

Gattermann-Koch Reaction, Houben–Hoesch Condensation, Schotten – Baumann Reaction.

**Ethers (aliphatic and aromatic):** Cleavage of ethers with HI.

**Aldehydes and ketones (aliphatic and aromatic):** (Formaldehyde, acetaldehyde, acetone and benzaldehyde)

*Preparation:* from acid chlorides and from nitriles.

*Reactions* – Reaction with HCN, ROH, NaHSO<sub>3</sub>, NH<sub>2</sub>-G derivatives. Iodoform test. Aldol Condensation, Cannizzaro's reaction, Wittig reaction, Benzoin condensation. Clemensen reduction and Wolff Kishner reduction. Meerwein-Ponndorf Verley reduction.

#### **Reference Books:**

- Graham Solomon, T.W., Fryhle, C.B. & Snyder, S.A. *Organic Chemistry*, John Wiley & Sons (2014).
- McMurry, J.E. *Fundamentals of Organic Chemistry*, 7<sup>th</sup> Ed. Cengage Learning India Edition, 2013.
- Sykes, P. *A Guidebook to Mechanism in Organic Chemistry*, Orient Longman, New Delhi (1988).
- Finar, I.L. *Organic Chemistry* (Vol. I & II), E.L.B.S.
- Morrison, R.T. & Boyd, R.N. *Organic Chemistry*, Pearson, 2010
- Bahl, A. & Bahl, B.S. *Advanced Organic Chemistry*, S. Chand, 2010.
- Barrow, G.M. *Physical Chemistry* Tata McGraw-Hill (2007).
- Castellan, G.W. *Physical Chemistry* 4th Ed. Narosa (2004).
- Kotz, J.C., Treichel, P.M. & Townsend, J.R. *General Chemistry* Cengage Learning India Pvt. Ltd., New Delhi (2009).
- Mahan, B.H. *University Chemistry* 3rd Ed. Narosa (1998).
- Petrucci, R.H. *General Chemistry* 5th Ed. Macmillan Publishing Co.: New York (1985)

**Subject Name:** CHEMICAL ENERGETICS, EQUILIBRIA & FUNCTIONAL GROUP ORGANIC CHEMISTRY-I  
LAB

#### **Physical Chemistry**

##### **Thermochemistry**

1. Determination of heat capacity of calorimeter for different volumes.
2. Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
3. Determination of enthalpy of ionization of acetic acid.
4. Determination of integral enthalpy of solution of salts (KNO<sub>3</sub>, NH<sub>4</sub>Cl).
5. Determination of enthalpy of hydration of copper sulphate.
6. Study of the solubility of benzoic acid in water and determination of  $H$ .

##### **Ionic equilibria** pH measurements

- a) Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH-meter.
- b) Preparation of buffer solutions:
  - (i) Sodium acetate-acetic acid
  - (ii) Ammonium chloride-ammonium hydroxide

Measurement of the pH of buffer solutions and comparison of the values with theoretical values.

### **Organic Chemistry**

1. Purification of organic compounds by crystallization (from water and alcohol) and distillation.
2. Criteria of Purity: Determination of melting and boiling points.
3. Preparations: Mechanism of various reactions involved to be discussed. Recrystallisation, determination of melting point and calculation of quantitative yields to be done.
  - (a) Bromination of Phenol/Aniline
  - (b) Benzoylation of amines/phenols

Oxime and 2,4-dinitrophenylhydrazone of aldehyde/ketone

### **Reference Books**

- 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.
- Khosla, B. D.; Garg, V. C. & Gulati, A. *Senior Practical Physical Chemistry*, R. Chand & Co.: New Delhi (2011)

**Subject Name:** PLANT ECOLOGY AND TAXONOMY

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**Subject Name:** PLANT ECOLOGY AND TAXONOMY LAB

**Unit 1: Introduction**

**Unit 2: 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. Adaptation of hydrophytes and xerophytes

**Unit 3: Plant communities**

Characters; Ecotone and edge effect; Succession; Processes and types

**Unit 4: Ecosystem**

Structure; energy flow trophic organisation; Food chains and food webs, Ecological pyramids production and productivity; Biogeochemical cycling; Cycling of carbon, nitrogen and Phosphorous

**Unit 5: Phytogeography**

Principle biogeographical zones; Endemism

**Unit 6 Introduction to plant taxonomy**

Identification, Classification, Nomenclature.

**Unit 7 Identification**

Functions of Herbarium, important herbaria and botanical gardens of the world and India;  
Documentation: Flora, Keys: single access and multi-access

### **Unit 8 Taxonomic evidences from palynology, cytology, phytochemistry and molecular data.**

### **Unit 9 Taxonomic hierarchy**

Ranks, categories and taxonomic groups

### **Unit 10 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.

### **Unit 11 Classification**

Types of classification-artificial, natural and phylogenetic. Bentham and Hooker (upto series), Engler and Prantl (upto series).

### **Unit 12 Biometrics, numerical taxonomy and cladistics**

Characters; variations; OTUs, character weighting and coding; cluster analysis; phenograms, cladograms (definitions and differences).

### **Practical**

1. Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge and lux meter.
2. Determination of pH, and analysis of two soil samples for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency by rapid field test.
3. Comparison of bulk density, porosity and rate of infiltration of water in soil of three habitats.
4. (a) Study of morphological adaptations of hydrophytes and xerophytes (four each).  
(b) Study of biotic interactions of the following: Stem parasite (*Cuscuta*), Root parasite (*Orobanche*), Epiphytes, Predation (Insectivorous plants)
5. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus by species area curve method. (species to be listed)
6. Quantitative analysis of herbaceous vegetation in the college campus for frequency and comparison with Raunkiaer's frequency distribution law 45
7. Study of vegetative and floral characters of the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification): Brassicaceae - *Brassica*, *Alyssum* / *Iberis*; Asteraceae - *Sonchus*/*Launaea*, *Vernonia*/*Ageratum*, *Eclipta*/*Tridax*; Solanaceae - *Solanum nigrum*, *Withania*; Lamiaceae - *Salvia*, *Ocimum*; Liliaceae - *Asphodelus* / *Lilium* / *Allium*.
8. Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the record book).

### **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. Singh, G. (2012). Plant Systematics: Theory and Practice. Oxford & IBH Pvt. Ltd., New Delhi. 3rd edition

**Subject Name:** COMPARATIVE ANATOMY AND DEVELOPMENTAL BIOLOGY OF VERTEBRATES

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**Subject Name:** COMPARATIVE ANATOMY AND DEVELOPMENTAL BIOLOGY OF VERTEBRATES LAB

**Unit 1: Integumentary System**

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

**Unit 2: Skeletal System**

Evolution of visceral arches

**Unit 3: Digestive System**

Brief account of alimentary canal and digestive glands

**Unit 4: Respiratory System**

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

**Unit 5: Circulatory System**

Evolution of heart and aortic arches

**Unit 6: Urinogenital System**

Succession of kidney, Evolution of urinogenital ducts

**Unit 7: Nervous System**

Comparative account of brain

**Unit 8: Sense Organs**

Types of receptors

**Unit 9: Early Embryonic Development**

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 10: 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 11: Control of Development**

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

**PRACTICAL**

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.
- Weichert C.K and William Presch (1970). Elements of Chordate Anatomy, Tata McGraw Hills
- 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.

### **Subject Name: LANGUAGE ACROSS THE CURRICULUM**

#### **Unit 1: Language Background of Students**

Understanding multilingualism in the classroom; home language and school language; power dynamics of the 'standard' language as the school language vs. home language or 'dialects'; (Deficit theory (Eller, 1989); Discontinuity theory).

(The focus is to create sensitivity to the language diversity that exists in the classrooms. Understanding the language background of students, as first or second language users of the language used in teaching the subject.)

#### **Practicum**

- Discussion on role and importance of home language and school language
- Discussion on role and importance of dialect and standard language.

#### **Project**

- Interview some technical people and find out which language do they prefer to use? And why?
- What are the gaps in learning in a particular language and using local language for work.
- As a student you must have felt that sometimes the language of instruction did not help in understanding of the text. Keeping that in view how will you facilitate your students to understand the content.

#### **Unit 2: Nature of Classroom Discourse**

Classroom Discourse — oral language; discussion as a tool for learning; the nature of questioning in the classroom — types of questions and teacher's role.

(The focus is to help students-teachers understand the nature of classroom discourse and develop strategies for using oral language in the classroom in a manner that promotes learning in the subject area.)

### **Practicum**

- Comprehending and analysing the texts.
- Re-telling the text - in one's own language from different points of view.
- Narrating / describing a related account from one's life experience.
- Discussion of related topics and issues - sharing interpretations and points of view.
- Writing — based on the text, e.g. summary of the text, extrapolation of story, converting a situation into a dialogue, etc.
- Preparing questions that develop critical thinking and problem solving leading to discussion.

### **Project**

- Choose a few words from different text of content areas and give examples how similar word / language used in different context for convey the meaning.

### **Unit 3: Informational Reading and Writing**

Reading in the content areas — social sciences, science, mathematics; nature of expository texts vs. narrative texts; transactional vs. reflexive texts; schema theory; text structures; examining content area textbooks; reading strategies — note-making, summarizing; making reading-writing connections; process writing; analyzing students' writings to understand their conceptions; writing with a sense of purpose — writing to learn and understand.

(The focus is to develop critical reading comprehension in the content areas informational reading and developing writing in specific content areas with familiarity of different registers.)

### **Practicum**

- Using reading strategies, such as scanning, skimming and reading for extracting information - as appropriate for initial reading of articles (guided individual task)
- Analysis of structure of the article, identifying sub-headings, key words, sequencing of ideas, use of concrete details, illustrations and / or statistical representations, etc. (guided working in pairs)
- Critical reading for attending 'framing' of the article, point(s) of view presented, possible biases or slants (small group discussion)
- Researching and writing articles/reports on topics related to content areas and current issues.

### **Project**

- Take different types of texts from content areas. Analyse the language and develop a thematic lesson design.