UGCF- B. Sc. (Programme) Life Science, Botany DSC-for LS-III Semester
Paper: Plant Cell and Developmental Biology
Theory and Practical Guidelines

Theory

Unit 1. Introduction to Plant Cell: structure and function **4 hours**
Structure of plant cell, Structure and functions of cell organelles: cell wall (primary and secondary wall), nucleus, chloroplast, mitochondria, dictyosomes, endoplasmic reticulum

Unit 2. Polarity in plant growth **6 hours**
Growth through primary meristems, and secondary meristems (*discuss briefly*), Organisation of shoot apex (Tunica-Corpus theory, Waiting meristem theory) and root apex (Körper-Kappe theory)

Unit 3. Differentiation of tissues: vegetative organs **7 hours**
Structure and functions of tissues (simple and complex), Structure of stem, root, and leaf (dicot and monocot), Brief mentioning of anomalous secondary growth in stem of *Salvadora/Bignonia* and *Dracaena*, Epidermal system: classification of stomata (Metcalfe and Chalk), trichomes

Unit 4. Differentiation of tissues: reproductive organs **6 hours**
Flower development (ABCDE model), Anther and its wall layers (*ontogeny not to be included*), microsporogenesis and microgametogenesis, pollen wall (intine, exine), male germ unit; Ovule: General structure, megasporogenesis (monosporic, bisporic, tetrasporic) and megagametogenesis (only Polygonum type), ultrastructure and significance of female germ unit

Unit 5. Pollination and Fertilization **3 hours**
Pollination types (Self and Cross; *agencies of pollination not to be included*); Pollen-pistil interactions with brief overview of incompatibility, pollen tube pathway, pollen tube entry into ovule and embryo sac (porogamy, mesogamy and chalazogamy); double fertilization

Unit 6. Development of Embryo and Seed **4 hours**
Endosperm structure (Free nuclear, Cellular and Helobial type, *one example of each*) and functions; development of embryo from zygote in monocot and dicot; establishment of apical, basal and radial organisation; development of seed (general account only)

Practical:

1. To study cytoplasmic streaming in *Hydrilla*.

2. a. Study of cell organelles through electron micrographs – nucleus, mitochondria, chloroplast, mitochondria, dictyosomes, endoplasmic reticulum
   b. Study of cell organelles (through permanent slides/photographs)– nucleus (Feulgen/acetocarmine staining); mitochondria (Janus green B staining); cell wall (PAS staining)

3. Study of plant cells: types of stomata (through peel mounts), trichomes, sclerenchyma, xylem (through maceration).

4. Study of shoot apical meristem and root apical meristem, parenchyma, collenchyma, phloem, laticifers through permanent slides/micrographs.

5. Study organs structure through temporary preparations-
   a. Transverse section of dicot stem- *Helianthus/Cicer,* stem with secondary growth – *Helianthus/Cicer* etc., Transverse section of monocot stem - *Zea mays*
   b. Transverse section of dicot root: primary and with secondary growth- *Cicer/Vigna* etc., monocot root - *Zea mays*
   c. Vertical section of dicot and monocot leaf

6. Study anomalous secondary growth through permanent slides/photomicrographs: *Salvadora/ Bignonia, Dracaena*

7. Study reproductive structures through photographs/ micrographs/permanent slides/specimens:
   a. Transverse section of anther with wall layers, secretory and amoeboid tapetum
   b. Microsporogenesis through micrographs of transverse section anther
   c. Pollen exine patterns (any four types)
   d. Types of ovule, associated structure (obturator, aril, caruncle)
   e. Mature Polygonum type of embryo sac and ultrastructure of egg apparatus

8. Study of pollen viability (TTC/FDA).

9. Calculation of percent pollen germination in any one medium through sitting drop culture/ /Hanging drop culture.

10. Dissection of embryo/endosperm from developing seeds.

B.Sc. (Hons) Botany/ B.Sc. (P) Life Science Semester III
DSE-2-Biostatistics & Bioinformatics for Plant Sciences
(Credits: Theory-2, Practical-2)
Theory and Practical Guidelines

Meeting of teachers of the committee constituted by the Department of Botany, University of Delhi, was held online on August 21, 2023, to discuss and frame the guidelines for the theory and practical examination of "DSE-2 Biostatistics & Bioinformatics for Plant Sciences" The following members were present in the meeting:

Dr Archana Singh, HRC

Dr Somdutta Sinha Roy, MH

Dr Savindra, ZHC

Dr Reema Mishra, GC

Committee unanimously recommends the followings

- Complex numerical based questions of unit 7, 8 and 9 should be covered only in practical.
- In theory, simple and small dataset based questions should be taught.
- Numerical based on regression analysis should not be taught in theory as well as practical.
- Theory paper should be divided in two equal parts:

  Part A: Bioinformatics (30 Marks)

  Part B: Biostatistics (30 Marks)

THEORY

Unit 1: Introduction to Bioinformatics **3 hours**

Historical background; Aims and scope; Bioinformatics in Genomics, Transcriptomics, Proteomics, Metabolomics, Systems biology, Applications of bioinformatics in crop improvement and drug discovery.

Unit 2: Biological databases **4 hours**

Introduction to biological databases - Primary, secondary and composite databases; Study of following databases: NCBI (GenBank, PubChem, PubMed and BLAST); introduction to UniProt, PDB, PlantPepDB.

Unit 3: Basic concepts of Sequence alignment **4 hours**

Similarity, identity and homology. Concepts of alignment (gaps and penalty); Alignment – pairwise and multiple sequence alignments

Unit 4: Molecular Phylogeny **4 hours**

Introduction to Molecular Phylogeny, methods of construction of phylogenetic trees: maximum parsimony (MP), maximum likelihood (ML) and distance (Neighbour-joining) methods (to be discussed briefly).

Unit 5: Biostatistics **2 hours**

Biostatistics – definition, Basics of descriptive and inferential statistics; Limitations and applications.

Unit 6: Data and sampling methods **3 hours**

Primary and secondary data; Sampling methods (in brief); tabulation and presentation of data.

Unit 7: Measures and deviations of central tendencies **4 hours**

Dispersion - range, standard deviation, mean deviation, standard error, skewness and kurtosis, quartile deviation –merits and demerits; Coefficient of variation.

Unit 8: Correlation and Regression **3 hours**

Correlation - types and methods of correlation (I. E. Karl Pearson and Spearman Rank method), Introduction to simple regression equation; similarities and dissimilarities between correlation and regression.

Unit 9: Statistical inference **3 hours**

Hypothesis – (simple hypothesis), student's t test, chi-square test.

Practicals:

1. Biological databases (NCBI, EMBL, UniProt, PDB, PlantPep DB) **4 hours**

2. Literature retrieval from PubMed. **4 hours**

3. Sequence retrieval (protein and gene) from NCBI (formats - FASTA, GenBank and GenPept formats). **8 hours**

4. Protein Structure retrieval from PDB (in pdb format) and visualization by viewing tools (Ras Mol/ J mol/Mol*/Swiss 3D Viewer/Pymol). **4 hours**

5. Multiple sequence alignment (MEGA/ Clustal omega). **4 hours**

6. Construction of phylogenetic tree (PHYLIP/ MEGA/ Clustal omega). **4 hours**

7. Making of Bar diagrams, Pie chart, Histogram, Frequency polygon, Cumulative frequency curve (any four) in the given data set using Microsoft Excel. **4 hours**

8. Calculation of standard deviation, coefficient of variation and standard error (through manual calculation and using Microsoft Excel) (use only ungrouped data). **8 hours**

9. Calculation of correlation coefficient values by Karl Pearson's /Spearman Rank methods (through manual calculation and using Microsoft Excel). **8 hours**

10. Student's t-test (using Microsoft Excel only), chi square test (Manual and using Microsoft Excel).

8 hours

Suggested readings:

1. Ghosh, Z., Mallick, B. (2008). *Bioinformatics – Principles and Applications*, 1st edition. New Delhi, Delhi: Oxford University Press.

2. Baxevanis, A.D., Ouellette, B.F., John (2005). *Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins*, 3rd edition. New Jersey, U.S.: Wiley & Sons, Inc.

3. Roy, D. (2009). *Bioinformatics*, 1st edition. New Delhi, Delhi: Narosa Publishing House.

4. Andreas, D., Baxevanis, B.F., Francis, Ouellette. (2004). *Bioinformatics: A practical guide to the analysis of genes and proteins*, 3rd edition. New Jersey, U.S.: John Wiley and Sons.

5. Khan, I.A., Khanum, A. (2004). Fundamentals of Biostatistics, 5th edition. Hyderabad: Ukaaz publications.

6. Campbell, R.C. (1998). Statistics for Biologists. Cambridge, U.S.A.: Cambridge University Press

Additional Resources:

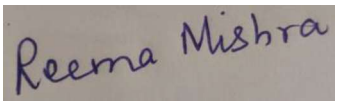
1. Pevsner, J. (2009). Bioinformatics and Functional Genomics, 2nd edition. New Jersey, U.S.: Wiley Blackwell.

2. Xiong, J. (2006). Essential Bioinformatics, 1st edition. Cambridge, U.K.: Cambridge University Press.

3. Mount, D.W. (2004). Bioinformatics: Sequence and Genome analysis 2nd edition, Cold Spring Harbor Laboratory Press, USA.

4. Zar, J.H. (2012). Biostatistical Analysis, 4th edition. London, London: Pearson Publication.

5. Pandey, M. (2015). Biostatistics Basic and Advanced. New Delhi, Delhi: M V Learning.



Assessment Methods:

- Presentations by Individual Student/ Group of Students
- Class Tests at Periodic Intervals.
- Written assignment(s)
- End semester University Theory and Practical Examination

Keywords: Ionic Bonding, Dipole Moment, VSEPR Theory, Covalent Bonding, Multiple Bonding, Molecular Orbitals, Bonding MO, Antibonding MO, Homonuclear, Heteronuclear, Metallic Bonding, Hydrogen bonding, Weak Chemical Forces, Trace metals, toxic metals, Sodium-potassium pump.

SEMESTER –III

Course Code: DSC-8 CHEMISTRY - III
Course Title: Chemical Energetics and Equilibria

Total Credits: 04 (Credits: Theory-02, Practical-02)

(Total Lectures: Theory- 30, Practical-60)

Objectives: The objective of this paper is to develop basic understanding of the chemical energetics, laws of thermodynamics and ionic equilibrium. It provides basic understanding of the behaviour of electrolytes and their solutions. The students will also learn about the properties of ideal and real gases and deviation from ideal behaviour.

Learning Outcomes:

By the end of this course, students will be able to:

- Understand the laws of thermodynamics, thermochemistry and equilibria.
- Understand concept of pH and its effect on the various physical and chemical properties of the compounds.
- Use the concepts learnt to predict feasibility of chemical reactions and to study the behaviour of reactions in equilibrium.

Unit 1: Chemical Energetics — Lectures: 16

Recapitulation of Intensive and extensive variables; state and path functions; isolated, closed and open systems, concept of heat, Q, work, W, internal energy, U, and enthalpy, H.

First law

Concept of heat, Q, work, W, internal energy, U, and statement of first law; enthalpy, H, relation between heat capacities for ideal gas, Joule's experiment, calculations of Q, W, ΔU and ΔH for reversible expansion of ideal gases under isothermal conditions.

Thermochemistry

Enthalpy of reactions: standard states; enthalpy of neutralization, enthalpy of ionization enthalpy of hydration, enthalpy of formation and enthalpy of combustion, Integral enthalpy of solution, bond dissociation energy and bond enthalpy; Hess's law, Born Haber's cycle (NaCl/ KCl).

Second Law

Concept of entropy; statements of the second law of thermodynamics (Kelvin and Clausius). Calculation of entropy change for reversible processes (for ideal gases). Free Energy Functions: Gibbs and Helmholtz energy (Non-PV work and the work function); Free energy change and concept of spontaneity (for ideal gases).

Third Law

Statement of third law, qualitative treatment of absolute entropy of molecules (examples of NO, CO), concept of residual entropy

Unit 2: Chemical Equilibrium — Lectures: 4

Criteria of thermodynamic equilibrium. Free energy change in a chemical reaction and equilibrium constant, exergenic and endergenic reactions with examples such conversion of ATP to ADP or vice verca,, Le Chatelier's principle, relationship between Kp, Kc and Kx for reactions involving ideal gases.

Unit 3: Ionic Equilibria — Lectures: 10

Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, Ostwald's dilution law, ionization constant and ionic product of water, ionization of weak acids and bases, Degree of ionization, pH scale, common ion effect, Buffer solutions, Henderson-Hasselbach equation. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle

Practical: — Credits:02

(Laboratory periods: 60)

Chemical Energetics:

1. Determination of heat capacity of calorimeter.
2. Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
3. Determination of the enthalpy of ionization of acetic acid.
4. Determination of enthalpy of neutralization of acetic acid and ammonium hydroxide using Hess's law.
5. Determination of integral enthalpy of solution of KNO_3.
6. Determination of integral enthalpy of solution of NH_4Cl.
7. Determination of enthalpy of hydration of Copper sulphate.

Ionic equilibria:

8. Preparation of buffer solutions: (i) Sodium acetate-acetic acid or (ii) Ammonium chloride-ammonium acetate. Measurement of the pH of buffer solutions and comparison of the values with theoretical values.
9. Study the effect of addition of HCl/NaOH on pH of the buffer solutions (acetic acid, and sodium acetate).
10. pH metric titration of strong acid with strong base,
11. pH metric titration of weak acid with strong base

References:

Theory:

1. Castellan, G. W. (2004),**Physical Chemistry**, Narosa.
2. Kapoor, K. L. (2015),**A Textbook of Physical Chemistry**,Vol 1, 6th Edition, McGraw Hill Education.
3. Kapoor, K. L. (2015), **A Textbook of Physical Chemistry**, Vol 2, 6thEdition, McGraw Hill Education.
4. Puri, B. R., Sharma, L. R. and Pathania M. S. (2020), **Principles of Physical Chemistry**, Vishal Publishing Co.

Practical:

1. Khosla, B. D.; Garg, V. C.; Gulati, A.(2015), **Senior Practical Physical Chemistry**, R. Chand & Co.
2. Kapoor, K. L. (2019), **A Textbook of Physical Chemistry**, Vol 7, 1st Edition, McGraw Hill Education.
3. Batra, S. K., Kapoor, V and Gulati, S. (2017) 1st Edition, **Experiments in Physical Chemistry,** Book Age series.

Additional Resources:

1. Mahan, B. H.(2013), **University Chemistry**, Narosa.
2. Barrow, G. M. (2006), **Physical Chemistry**, 5th Edition, McGraw Hill.

9. Wolfgang Kaim, Brigite Schwederski, Axel Klein, **Bioinorganic chemistry: Inorganic elements in the chemistry of life**

PRACTICALS:

1. Vogel, A.I. (1972), **Qualitative Inorganic Analysis**, Longman.
2. Svehla, G. (1996), **Vogel's Qualitative Inorganic Analysis**, Prentice Hall.
3. Marsh, D.G.; Jacobs, D.L.; Veening, H., J. Chem. Educ., **Analysis of commercial vitamin C tablets by iodometric and coulometric titrimetry.** 1973, 50 (9), p 626. DOI: 10.1021/ed050p626
4. https://edu.rsc.org/experiments/catalytic-oxidation-of-potassium-sodium-tartrate/1736.article

Teaching Learning Process:

- Conventional chalk and board teaching,
- Class interactions and discussions
- Power point presentation on important topics.
- Encouraging students to correlate the concepts of Biology class with chemistry class topics.
- Group discussions and quiz

Assessment Methods:

- Presentations by Individual Student/ Group of Students
- Class Tests at Periodic Intervals.
- Written assignment(s)
- End semester University Theory Examination

Keywords: Homogeneous and heterogeneous catalysis, Ziegler Natta catalyst, Wilkinson's catalyst, Fischer Tropsch process, zeolite as catalysts, role of metals, chelates in medicine; cisplatin

Course Code DSE – 5: CHEMISTRY

Course Title: Polynuclear Hydrocarbons, Pharmaceutical Compounds, UV- Visible & IR Spectroscopy

Total Credits: 04 (Credits: Theory-02, Practical-02)

Total Lectures: Theory- 30, Practical-60

Objectives: The purpose of this course to introduce the chemistry and applications of polynuclear hydrocarbons and heterocyclic compounds. The learners are introduced to spectroscopy, an important analytical tool which allows identification of organic compounds by correlating their spectra to structure.

Learning Outcomes:

By the end of the course, the students will be able to:

- Understand the fundamentals of polynuclear hydrocarbons and heterocyclic compounds through the study of methods of preparation, properties and chemical reactions with underlying mechanism.
- Gain insight into the basic fundamental principles of IR and UV-Vis spectroscopic techniques.
- Use basic theoretical principles underlying UV-visible and IR spectroscopy as a tool for functional group identification in organic molecules.

Unit 1: Polynuclear Hydrocarbons **Lectures:05**

Introduction, classification, uses, aromaticity of polynuclear compounds, Structure elucidation of naphthalene, preparation and properties of naphthalene and anthracene.

Unit 2: Pharmaceutical Compounds **Lectures: 13**

Introduction, classification, general mode of action of antipyretics and analgesics, aspirin; Synthesis, uses and side effects of the following drugs:

Antipyretics - Paracetamol (with synthesis and mode of action); Analgesics- Ibuprofen (with synthesis and overview of the mode of action); Antimalarials - Chloroquine (synthesis and mode of action).

An elementary treatment of Antibiotics and detailed study of chloramphenicol including mode of action. Medicinal values of curcumin (haldi), azadirachtin (neem), vitamin C and antacid (ranitidine)**.**

Unit 3: UV-Visible and IR Spectroscopy **Lectures:12**

UV-Visible and IR Spectroscopy and their application to simple organic molecules. Electromagnetic radiations and their properties; double bond equivalence and hydrogen deficiency. UV-Visible spectroscopy (electronic spectroscopy): General electronic transitions, λ_{max} & ε_{max}, chromophores &auxochromes, bathochromic & hypsochromic shifts. Application of Woodward rules for the calculation of λ_{max} for the following systems: conjugated dienes - alicyclic, homoannular and heteroannular; α, β-unsaturated aldehydes and ketones, charge transfer complex.

Infrared (IR) Spectroscopy: Infrared radiation and types of molecular vibrations, the significance of functional group & fingerprint region. IR spectra of alkanes, alkenes, aromatic hydrocarbons (effect of conjugation and resonance on IR absorptions), simple alcohols (inter and intramolecular hydrogen bonding and IR absorptions), phenol, carbonyl compounds, carboxylic acids and their derivatives (effect of substitution on >C=O stretching absorptions).

PRACTICALS: **Credits: 02**

(Laboratory periods: 60)

1. Isolation and estimation of the amount of aspirin in a commercial tablet.
2. Preparation of Aspirin.
3. Synthesis of ibuprofen.
4. Systematic qualitative identification and derivative preparation of organic compounds (Aromatic hydrocarbons, Aryl halides)
5. Detection of simple functional groups through examination of IR spectra (spectra to be provided). IR spectra of simple compounds like phenols, aldehydes, ketones, carboxylic acids may be given.
6. Differentiation between of o-/p-hydroxybenzaldehyde by IR spectroscopy (Spectra to be provided).
7. Differentiation between benzoic acid and cinnamic acid by UV spectroscopy.
8. Diel's Alder reaction using Anthracene and Maleic anhydride.
9. Partial Reduction of m-dinitrobenzene to m-nitroaniline and then analysing the IR spectra of reactant and Product.
10. Laboratory preparation of Paraacetamol.

References

Theory:

1. Finar, I. L. **Organic Chemistry** (Volume 1 & 2), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Morrison, R. N.; Boyd, R. N. **Organic Chemistry,** Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Bahl, A; Bahl, B. S. (2012), **Advanced Organic Chemistry**, S. Chand.
4. Pavia, D.L. **Introduction to Spectroscopy**, Cengage learning (India) Pvt. Ltd.
5. Kemp, W. (1991), **Organic Spectroscopy**, Palgrave Macmillan.

Practical:

1. Ahluwalia, V.K.; Dhingra, S.; Gulati, A. (2005), **College Practical Chemistry,** University Press (India) Ltd.
2. Ahluwalia, V.K.; Dhingra, S. (2004), **Comprehensive Practical Organic Chemistry: Qualitative Analysis**, University Press.
3. Vogel, A.I. (1972), **Textbook of Practical Organic Chemistry**, Prentice-Hall.
4. Pasricha, S., Chaudhary, A. (2021), **Practical Organic Chemistry: Volume I**, I K International Publishing House Pvt. Ltd., New Delhi.
5. Pasricha, S., Chaudhary, A. (2021), **Practical Organic Chemistry: Volume I**, I K International Publishing House Pvt. Ltd., New Delhi.

SEMESTER -III
BSc. (Life Science) – Zoology Component

DISCIPLINE SPECIFIC CORE COURSE-9 (Zoo-LS-DSC-9):– Biochemistry: Basic concepts of

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical		
Biochemistry: Basic concepts of metabolism Zoo-LS-DSC-09	**04**	**02**	**00**	**02**	**Passed Class XII**	**NIL**

Learning Objectives

The learning objectives of this course are as follows:

- to learn and develop an understanding of the various metabolic pathways in humans.
- to acquire knowledge of the tissue specific metabolism and its regulation.
- to get acquainted with the concept of enzyme specificity for important metabolic pathways and how the body adjusts to variations in the demand for energy.

Learning Outcomes

By studying this course, students will be able to:

- better understand the properties of carbohydrates, proteins, lipids, and their importance in biological systems.
- explain the biological mechanisms, such as the processes and control of bioenergetics and metabolism, as chemical reactions
- comprehend the concept of enzyme, its mechanism of action and regulation.
- appreciate the importance of high energy compounds, electron transport chain, synthesis of ATP under aerobic and anaerobic conditions.
- acquire knowledge related to the role of TCA cycle in central carbon metabolism, importance of anaplerotic reactions and redox balance.

SYLLABUS OF DSC- 09

UNIT-1: Metabolism of Carbohydrates **8 hrs**

Basic structure and physiological significance of mono-saccharides, disaccharides, homo and hetero-polysaccharides. Glycolysis: Preparatory and Payoff phases, regulation, fates of pyruvate, Pentose phosphate pathway: oxidative and non-oxidative Phases; Gluconeogenesis: Bypass reactions, regulation and reciprocal coordination of glycolysis

and gluconeogenesis; Glycogen Metabolism: Glycogenolysis, Glycogenesis and its coordinated regulation, Kreb's Cycle (formation of Acetyl CoA, reactions of cycle, regulation),

UNIT- 2: Lipid Metabolism **6 hrs**

Basic structure and physiological significance of fatty acids, structure and significance of storage and structural lipids; Biosynthesis: FAS and synthesis reactions, regulation; β oxidation of palmitic acid: activation of fatty acids and oxidation with bioenergetics, regulation.

UNIT- 3: Protein metabolism **6 hrs**

Structure, classification and properties of amino acids, basics of protein structure; Transamination, Deamination, Glutamine formation, Glucose alanine cycle and Urea Cycle

UNIT- 4: Enzyme **6 hrs**

Enzymes and their classification, Introduction (basics of classification, properties and functions), Mechanism of action (understanding of basic concepts, Induced Fit Theory).

UNIT- 5: Oxidative Phosphorylation **4 hrs**

Review of Electron Transport Chain: Basics of electron transfer reactions, Universal Electron Acceptors without detailed structures, electron flow through complexes, Chemiosmotic theory, basics of ATP synthesis.

Practical **60 hrs**

(Laboratory periods: 15 classes of 4 hours each)

1. Qualitative tests to identify functional groups of carbohydrates, amino acids and lipids.
2. Estimation of total protein in given solutions by Lowry's method.
3. Study effect of temperature, pH, and inhibitor on enzymatic activity of salivary amylase.
4. Biological oxidation of goat liver.
5. Identification of normal and abnormal constituents of urine.
6. To study the enzymatic activity of Lipase.
7. Dry Lab: To trace the labelled 'C' atoms of Acetyl-CoA till they evolve as CO_2 in the TCA cycle through models.

Essential/recommended readings

1. Nelson, D.L., Cox, M.M. (2017). Lehninger: Principles of Biochemistry (7th ed.). New York, WH: Freeman Company.
2. Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well,, P.A. (2009). Harper's Illustrated Biochemistry. XXVIII Edition, International Edition, The McGraw- Hill Companies Inc.

Suggestive readings

1. Stryer, L., Berg, J., Tymoczko, J., Gatto, G. (2019). Biochemistry (9 th ed.). New York, WH: Freeman.
2. Voet, D., Voet. J. G. (2013). Biochemistry (4th ed.). New Jersey, John Wiley & Sons Asia Pvt. Ltd.

DISCIPLINE SPECIFIC ELECTIVES (DSE-3): Medical Zoology
Zoo-DSE-3

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course	Department offering the course
		Lecture	Tutorial	Practical/ Practice			
Medical Zoology Zoo-DSE- 3	**04**	**03**	**Nil**	**01**	**Appeared in Sem II**	**NIL**	**Zoology**

Learning Objectives

The learning objectives of this course are as follows:

- This course offers an insight about the various types of human diseases.
- The students will understand the concepts of pathogenic and pathological basis of diseases including infectious diseases caused by viruses, prokaryotes, protozoans, helminthes, vector borne and zoonotic diseases.
- Learn about nutritional deficiencies and lifestyle diseases, endocrine diseases and cancer.

Learning Outcomes

By studying this course, students will be able to:

- understand various types of human diseases.
- clarify the concepts of pathogenic and pathological basis of diseases.
- recognize deficiencies and lifestyle diseases, endocrine diseases and cancer.
- broaden the understanding of medical importance of studying Zoology.

SYLLABUS OF DSE- 3

UNIT- 1: Introduction to Infectious diseases **(6 hrs)**

Concept of Epidemiology, Incidence, Prevalnce, Virulence, Pathogenicity, Transmission, Definitive host, Intermediate host, Parasitism, Symbiosis, Commensalism, Reservoir, Zoonosis.

UNIT- 2: Transmission, prevention and control of Viral infection **(6 hrs)**

Dengue, Polio, Measles, Mumps, influenza, SARS, HIV.

UNIT- 3: Bacterial infections **(6 hrs)**

Tetanus, Diphtheria, Tuberculosis, Typhoid, Cholera; brief account of *Rickettsia, Borellia, Treponema* and *Leptospira*.

UNIT- 4 Protozoan and Helminthic infection **(6 hrs)**

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

Trypanosoma gambiense; Wuchereria bancrofti, Faciolopsis buski, Ancylostoma duodenale.

UNIT- 5: Nutritional deficiency and lifestyle-based diseases. (6 hrs)

Kwashiorkar, Marasmus, Beri-beri, Scurvy, Pellagra, Anaemia, Night blindness, Rickets, Osteoporosis, Obesity, Cardiovascular diseases (CVD), Atherosclerosis, Diabetes mellitus, Inflammatory Bowel Disease (IBD).

UNIT- 6: Endocrine Diseases (9 hrs)

Hormonal imbalances leading to diseases: Diabetes insipidus, Acromegaly, Gigantism, Dwarfism, Goitre, Cretinism, Cushing and Crohn's syndrome, Addison's disease.

UNIT- 7: Cancer (6 hrs)

Definitions, Nomenclature, characteristics of benign and malignant neoplasms, grading and staging of cancer, biology of tumor growth, invasion and metastasis, carcinogens and cancer.

Practical (30 hrs)

(Laboratory periods: 15 classes of 2 hours each)

1. Study of Disease specific bacteria and viruses through pictures/micrographs/Videos.
2. Performing of gram staining and study of Acid Fast staining through permanent slides.
3. Urine analysis for abnormal constituents: protein, blood, bile salts and glucose.
4. Study of arthropod vectors associated with human diseases: *Anopheles, Aedes, Culex, Phlebotomus, Xenopsylla*.
5. Study of permanent slides and specimens of *Plasmodium sp, Entamoeba histolytica, Trypanosoma gambiense, Schistosoma haematobium* and *Wuchereria bancrofti.*
6. Study of endocrine diseases through case studies (any 2).
7. Identification and study of cancer cells- Slides/Photomicrographs/Videos.
8. Project work/report: field visit to a research institute/laboratory to study some of the pathological and diagnostic techniques.

Essential/recommended readings

1. Park, K. (2017) Textbook of Preventive and social medicine. 23rd Edition. B.B Publisher.
2. Robbins, Basic Pathology, 9th edition (2012), Kumar, Abbas, Fausto and Mitchell; Saunders Publication, ISBN-13: 978-1437717815
3. Ramnik. Sood (2009) Medical Laboratory Technology Methods and Interpretations, 6 th edition; Jaypee Brothers Medical Publishers, ISBN-13: 978-8184484496.

Suggested readings

1. Robbins and Cotran. Pathologic Basis of Disease, 8th edition (2009), Vinay Kumar, Abul. K. Abbas, Jon C. Aster, Nelson Fausto; Saunders Publishers, ISBN-13: 978-1416031215
2. Arora, D.R and Arora, B. (2001) Medical Parasitology. II Edition. CBS Publications