Category I

BSc. (Honours) Biological Science
(Sri Venkateswara College)

DISCIPLINE SPECIFIC CORE COURSE – 4:

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/ Practice		
Cell Biology (BS-DSC-201)	**4**	**2**	**0**	**2**	Class XII pass with Biology and chemistry, as one of the papers in Class XII	**NIL**

Learning Objectives

The Learning Objectives of this course are as follows:

- To introduce the students to the basic concepts and processes in cyto-biology.
- To understand the structure and function of cell organelles, how they communicate with each other and how division and regulation takes place in cells.
- The practical content of this course is designed to understand the cell measurement methods, cell division, staining procedure and tonicity through different laboratory exercises.

Learning outcomes

On successful completion of course, the student will:

- Understand the cell and its biology which will help them to get an insight into theorigin of cells, cellular structure, various components of cells and functions.
- Understand the chemical composition, physicochemical and functional organization oforganelle.
- Demonstrate the knowledge of common and advanced laboratory practices in cyto-biology.
- Acquire knowledge about how cells divide by means of meiosis and mitosis and willbe able to correlate different factors which control cell cycle progression.

SYLLABUS OF DSC-1

UNIT – I Overview of Cell and Cell membrane (07 Hours)

History of cell biology, cell theory, Structure and functions of membrane, models of membrane structure, transport across membranes (with examples): simple diffusion, facilitated diffusion, active transport (Na+/K+ pumps, Co-transport, proton pumps) and passive transport. Phagocytosis, pinocytosis, exocytosis.

UNIT – II Cell Organelles (13 Hours)

Mitochondria, chloroplast and nucleus: Ultrastructural organization and functions, marker enzymes, transport mechanisms in mitochondria and chloroplasts (Tim/Tom; Tic/Toc); and transport via nuclear pore complex.
Endomembrane system: Ultrastructural organization and functions of Rough and smooth endoplasmic reticulum, Golgi apparatus and lysosomes (GERL complex), tonoplast.
Glyoxysomes and Peroxisomes: Structure and function.

UNIT – III Cytoskeletal System (03 Hours)

Structure and organization of microfilaments, intermediate filaments, microtubules, their functions in plants and animals (in brief).

UNIT – IV Cell wall and extracellular matrix (04 Hours)

Cell wall organization (Primary and secondary cell wall), components of cell wall, Extracellular Matrix and Cell junctions, adhesive junctions, gap junctions and tight junctions, plasmodesmata. Function of cell wall.

UNIT – V Cell Division (03 Hours)

Overview of cell cycle. Regulation: Various checkpoints and the role of cyclins andCdks (Cyclin dependent kinases). Overview of mitosis and meiosis and theirsignificance

Practical component – 60 Hours

1. Estimation of cell size by micrometry/ camera lucida
2. To study plasmolysis and deplasmolysis in a cell/ Isolation of protoplast from tomato and its survival in hypo, hyper and isotonic solution
3. Study the effect of organic solvent/temperature on membrane permeability.
4. Demonstrate the phenomenon of protoplasmic streaming.
5. Study of ultrastructure of a cell (Plasma membrane, Nucleus, Nuclear Pore Complex, Chloroplast, Mitochondrion, Golgi bodies, Endoplasmic reticulum, Lysosomes) through electron micrographs.

6. Study of cytoskeletal structures through photographs.
7. Study of different stages of mitosis by temporary preparation of onion root tips.
8. Study of different stages of meiosis by temporary preparation /permanent slides.
9. Staining and visualisation of mitochondria by Janus green stain

Essential/recommended readings

1. Becker, W. M., Kleinsmith, L. J., Bertni, G. P. (2009). *The World of the Cell* (7thEd.). Pearson Benjamin Cummings Publishing, San Fransisco.
2. Cooper, G.M. and Hausman, R.E., (2009). *The Cell: A Molecular Approach*.(7thed.). ASM Press & Sunderland (Washington DC), Sinauer Associates, MA.
3. Karp, G., (2010). *Cell and Molecular Biology: Concepts and Experiments* (8thed.). John Wiley & SonsA Guidebook to mechanism in organic chemistry (2003) 6 th ed., Sykes, P. NewYork: John Wiley & Sons. Inc

Suggested readings

1. EDP De Robertis, and RE De Robertis (2009). *Cell and Molecular Biology* (8th Ed.).Lippincott Williams and Wilkins, Philadelphia.
2. Nelson, D.L. and Cox, M.M. (2017). *Lehninger: Principles of Biochemistry* (7^{th}ed.).
   W.H. Freeman & Company (New York).

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

DISCIPLINE SPECIFIC CORE COURSE – 5

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/ Practice		
Diversity of Life Forms-II (BS-DSC-202)	**4**	**2**	**0**	**2**	Class XII pass with Biology and chemistry, as one of the papers in Class XII	**NIL**

Learning Objectives

The Learning Objectives of this course are as follows:

- Designed with an aim to provide scope and historical background of evolution and diversity in plants and animals.
- impart knowledge regarding basic concepts of origin of chordates and make the students understand the characteristics and classification of animals with notochord.
- Outline various mechanisms involved in thriving/survival of the animals within their geographic realms.
- Understand important aspects of Gymnosperm classification, structure and economic importance.
- Provide an adequate exposure to fundamentals of plant systematics and most practiced classification systems.
- Emphasis will be on developing interest and invoking a sense of responsibility among students toward sustenance of plant and animal biodiversity.

Learning outcomes

Upon completion of the course, the students will be able to:

- Understand different characteristic features of different plant and animal life forms,classes of chordates, level of organization and evolutionary relationship between differentsubphyla and classes, within and outside the phylum.
- Study about diversity in animals and plants making students understand about theirdistinguishing features.
- Appreciate similarities and differences in life functions among various groups of animals and plants.
- Know about the habit and habitat of animals in marine, freshwater and terrestrial ecosystems.
- Understanding of systematics its importance in biodiversity management, nomenclature and classification systems of the plants.

SYLLABUS OF DSC- 2

UNIT – I Gymnosperms (04 Hours)

Position of Gymnosperms in five kingdom classification. General characteristics, Outline classification and economic importance. Morphology, structure and reproduction of *Pinus* and *Ginkgo*. Evolutionary tendencies in Gymnosperms-a comparative study

UNIT – II Plant taxonomy (07 Hours)

Angiosperm systematics: Fundamental concept of Plant Taxonomy (Identification, nomenclature, classification); Taxonomic resources; Herbarium- functions and important herbaria of India and world, Botanical gardens, Flora, monographs and keys (Single-access and multi-access) herbaria of India and world, Botanical gardens, Flora, monographs and keys (Single access andmultiple access)

UNIT – III Classification **(04 Hours)**

Historical background of plant classification; Artificial (Linnaeus), Natural (Bentham and Hooker), Phylogenetic system of classification; APG system.

UNIT – IV Diversity of Chordates **(11 Hours)**

Introduction to Biodiversity, types of Biodiversity, General characteristics and Classification of chordates (upto order): Protochordata, Aganatha, Pisces: Osteichthyes, Chondrichthyes, Amphibia, Reptilia, Aves and Mammals.

UNIT – V Biogeography **(04 Hours)**

Zoogeographical realms, Distribution of vertebrates in different realms

Practical component: 60 Hours

FLORA

1. *Cycas*: T.S (temporary mount) leaf, specimen: male cone and megasporophyll; T.S.corolloid root (temporary mount), T.S. microsporophyll, L.S. ovule (permanent slides).
2. *Pinus:* Study of morphology, dwarf and long shoots, male and female cone, T.S. needle(temporary mount), L.S. male and female cone (permanent slides).
3. Study the characteristic features of ***any one*** member of the family:
   (a) Malvaceae
   (b) Fabaceae/Lamiaceae
   (c) Euphorbiaceae
   (d) Asteraceae
   (e) Liliaceae
4. Mounting of a properly dried and pressed specimen of any wild plant with herbariumlabel (to be submitted on the herbarium sheet with appropriate label)

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5. Study of following specimens: Balanoglossus, Amphioxus, Petromyzon, Pristis, Hippocampus, Labeo, Icthyophis/Uraeotyphlus, Salamander, Draco, Naja, any two common birds.
6. Slide/ Virtual demonstration of Placoid, Ctenoid and Cycloid scales
7. Identification and classification of one endangered amphibian, reptile, bird and mammalof any one zoogeographical region in Indian.
8. Report on: Biodiversity Park/reserve/ NBPGR.

Essential/recommended readings

1. Young, J. Z., (2004). The Life of Vertebrates. III Edition. Oxford university press.

2. Parker T.J. and Haswell W.A. Textbook of Zoology Vertebrates. VII Edition, Volume II
3. Darlington P.J. The Geographical Distribution of Animals, R.E. Krieger Pub. Co.
4. Kaur I., Uniyal P.L. (2019). *Text Book of Gymnosperms*. New Delhi, Delhi: Daya Publishing House.
5. Vashistha, B.R., Sinha, A.K., Kumar, A. (2010). *Botany For Degree Students, Gymnosperms.* New Delhi, Delhi: S Chand Publication.
6. Bhatnagar, S.P., Moitra, A. (1996). *Gymnosperms*. New Delhi, Delhi: New Age International (P) Ltd Publishers.
7. Singh, G., (2018). *Plant Systematics: Theory and Practice*. Oxford & IBH Publishing Co. Pvt. Ltd.

Suggested readings

1. Ennos, R., & Sheffield, E., (2000). Plant Life. UK: University Press, Cambridge.
2. Ingrowille, M., (1992). Diversity and Evolution of land plants. Chapman and Hall
3. Wilson, E. O., (1998). Biodiversity. National Academic Press.
4. Pough H. Vertebrate life. VIII Edition, Pearson International.
5. Simpson, M.G. (2010). *Plant Systematics*. Elsevier Academic Press, San Diego, CA, U.SA

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

DISCIPLINE SPECIFIC CORE COURSE –6 :

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/ Practice		
Chemical Energetics, Ionic Equilibria and Nanomaterials, (BS-DSC-203))	**4**	**2**	**0**	**2**	Class XII pass with Biology and chemistry, as one of the papers in Class XII	**Nil**

Learning Objectives

The Learning Objectives of this course are as follows:

- To introduce materials at nanoscale, their preparation, characterization techniques and applications in real life.
- Develops basic understanding of the chemical energetics, laws of thermodynamics, chemical and ionic equilibrium.
- It provides basic understanding of the behaviour of electrolytes and their solutions.
- The course will also cover thermodynamic studies with the calculation of energies and interaction of biomolecules withtheir neighbouring environment.

Learning outcomes

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

- Understand the concept of nano-dimensions.
- Know the various methods of preparation of nanomaterials.
- Know the different characterization techniques used for the analysis of nanomaterials andunderstand the basic principle behind these techniques.
- Understand the diverse properties of nanostructures.
- Appreciate the real-world applications of nanomaterials.
- Understand the laws of thermodynamics, basic principles of thermochemistry andequilibria and successfully extend the concepts learnt in this course to biological systems.
- Understand concept of pH and its effect on the various physical and chemical propertiesof the compounds.
- Use the concepts learnt to predict feasibility of chemical reactions and to study thebehaviour of reactions in equilibrium.
- Explain the concept of ionization of electrolytes with emphasis on weak acid and baseand hydrolysis of salt.
- Apply the concepts of pH and electrolytes while studying other chemistry courses andeveryday life.

SYLLABUS OF DSC-3

UNIT – I Nanomaterials of Biological importance (15 Hours)

Overview of nanomaterials, classification, properties, role of size, methods of synthesis (Chemical methods: chemical reduction, coprecipitation, sol-gel, microemulsions or reverse micelles, solvothermal synthesis, Green or biological methods using bacteria, Fungi, etc, Plants based methods using tea leaves, cinnamon bark, etc), characterization techniques (UV-Vis, IR, SEM, TEM, XRD), optical properties of gold and silver metallic nanoparticles, concept of surface plasmon resonance, carbon nanotubes, inorganic nanowires, quantum dots & semiconductor nanoparticles, metal-based nanostructures (Iron Oxide & ZnO nanoparticles), polymer-based nanostructures, protein-based Nanostructures, natural and artificial nanomaterials, bionanomaterials and bio-nanocomposites, bioinorganic nanomaterials, DNA and its nanomaterials, biomimetics, self-assembled nanostructures, control of nanoarchitecture, Applications of nanomaterials in drug delivery, tissue engineering,

medicine, orthopaedics, bioimaging, dental implants and biosensors

UNIT – II Chemical energetics (05 Hours)

Review of laws of thermodynamics, important principles and definitions of thermochemistry, concept of standard state and standard enthalpies of formations, enthalpy of neutralization, integral and differential enthalpies of solution and dilution, calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data, Statement of third law of thermodynamics and calculation of absolute entropies of substances.

UNIT – III Ionic Equilibria (10 Hours)

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, pH scale, common ion effect, salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions and their applicationsin biological systems, Henderson-Hasselbalch equation. Solubility and solubility product ofsparingly soluble salts – applications of solubility product principle.

Practical component: TOTAL HOURS: 60

1. Synthesis of silver nanoparticles (AgNPs) by chemical reduction method and theirspectroscopic characterization using UV-visible spectrophotometer.
2. Green synthesis of silver nanoparticles (AgNPs) using soluble starch or cinnamon barkand their characterization using UV-visible spectroscopy.
3. Phytochemicals mediated synthesis of gold nanoparticles (AuNPs) using tea leaves and tostudy the effect of size on color of gold nanoparticles.
4. Preparation of magnetic nanoparticles (MNPs) of Fe_3O_4 using green tea leaf extract.
5. Synthesis of pure ZnO and Cu-doped ZnO nanoparticles by precipitation method and itscharacterization using UV-visible spectroscopy.
6. XRD pattern of nanomaterials and estimation of particle size. (Students can be providedwith XRD patterns of known materials and asked to interpret the data.)
7. Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
8. Determination of integral enthalpy (endothermic and exothermic) solution of salts.
9. Preparation of buffer solutions: (i) Sodium acetate-acetic acid or (ii) Ammoniumchloride-ammonium acetate.
10. Measurement of the pH of buffer solutions and comparison of the values with theoreticalvalues.

11. pH metric titration of (i) strong acid with strong base, (ii) weak acid with strong base anddetermination of dissociation constant of a weak acid.

Essential/recommended readings

1. Atkins, P., Overton, T., Rourke, J., Weller, M. & Armstrong, F. (2011-12).
2. Shriver and Atkins' Inorganic Chemistry. Oxford, UK: Oxford University Press.
3. Poole Jr.; Charles P.; Owens, Frank J. (2003), Introduction to Nanotechnology, JohnWiley and Sons.
4. Malhotra, P.; Gulati, S., Novel Inorganic Solids and Nanomaterials, (2022) I.K.International Pvt Ltd.
5. Gulati, S., Sharma, J. L., Manocha, S. (2017). Practical Inorganic Chemistry. New Delhi,India: CBS publishers and distributors Pvt. Ltd.
6. Orbaek, W.; McHale, M.M.; Barron, A. R.; Synthesis and Characterization of Silver Nanoparticles for An Undergraduate Laboratory, J. Chem. Educ. 2015, 92, 339−344.
7. Gulati, S.; Shukla, S.; Kumar, S., Practical Green Chemistry, Strategies, Tools &Experiments, SKP Publishers and Distributors, 2019.
8. Shukla, S.; Gulati, S.; Kumar, S., A textbook of Green Chemistry, Benign by Design,SKP Publishers and Distributors, 2019.
9. Ghorbani H.R.; Mehr, F.P; Pazoki, H; Rahmani, B.M.; Synthesis of ZnO Nanoparticlesby Precipitation Method, Orient J Chem 2015, 31(2).
10. Kumar, S., Kapoor, V, Gulati, S, Experiments in Physical Chemistry, (2017), Book AgeSeries.
11. Kapoor, K.L. (2017). A Textbook of Physical Chemistry, Thermodynamics and ChemicalEquilibrium, Vol. 2. India: McGraw-Hill Education.
12. Khosla, B. D., Garg, V. C., Gulati, A. (2011). Senior Practical Physical Chemistry. NewDelhi, India: R. Chand & Co.
13. Rastogi, R. P., Mishra, R. R. (2009). *An Introduction to Chemical Thermodynamics*.India: Vikas Publication.
14. Atkins, P.W.; Paula, J.de. (2014), Atkin's Physical Chemistry Ed., 10th Edition, OxfordUniversity Press.
15. Ball, D. W. (2017), Physical Chemistry, 2nd Edition, Cengage Learning, India.
16. Castellan, G. W. (2004), Physical Chemistry, 4th Edition, Narosa.

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