INVERTIS
UNIVERSITY BAREILLY

CBCS Scheme of Instruction & Syllabi

of

Bachelor of Science
(Zoology, Botany & Chemistry)
Second Year

(Effective from the academic session 2020- 2021)

Department of Applied Science & Humanities

INVERTIS UNIVERSITY

Invertis Village,
Bareilly-Lucknow NH-24,
Bareilly, U.P. (243123)

Dean
Faculty of Science
Invertis University, Bareilly (U.P.)

VICE CHANCELLOR
INVERTIS UNIVERSITY
BAREILLY

Head
Department of Applied Sci

INVERTIS UNIVERSITY BAREILLY

B.Sc. (Zoology, Botany and Chemistry)

This program provides an ability to identify and solve significant problems across a broad range of application areas, to develop the aptitude to apply the principles of Zoology, Botany and Chemistry to articulate an in depth understanding of core knowledge on various subjects of Biological Sciences. It is designed to help students understand the importance of biodiversity, sustainable development and the role of these in improving the quality of human life. It also helps students recognize and appreciate the contribution of great scientists in the field of Zoology, Botany and Chemistry.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

The program acts as a foundation degree and helps to develop critical, analytical and problem solving skills at first level. The foundation degree makes the graduates employable in scientific organizations and also to assume administrative positions in various types of organizations. Further acquisitions of higher level degrees help the graduates to pursue a career in academics or scientific organizations as a researcher.

The Program Educational Objectives are to prepare the students to:

PEO-1. Work alongside engineering, medical, ICT professionals and scientists to assist them in scientific problem solving.

PEO-2. Act as administrators in public, private and government organizations or business administrator with further training and education.

PEO-3. Pursue masters and doctoral research degrees to work in colleges, universities as professors or as scientists in research establishments.

15/10/20 15/10/20 15/10/20 15/10/20

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PROGRAM OUTCOMES (POs)

After undergoing this programme, a student will be able to execute the following successfully:

PO-1. **Scientific knowledge**: Apply the knowledge of living world, science, scientific fundamentals, and scientific specialization to the solution of complex scientific problems.

PO-2. **Problem analysis**: Identify research literature, and analyze scientific problems to arrive at substantiated conclusions using basic principles of natural sciences.

PO-3. **Design/development of solutions**: Design solutions for scientific problems and design system components, processes to meet the specifications with consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO-4. **Conduct investigations of complex problems**: Application research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO-5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern scientific tools including prediction and modeling to complex activities with an understanding of the limitations.

PO-6. **Scientific temper and society**: Apply reasoning informed by the contextual knowledge to assess societal, health,

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safety, legal, and cultural issues and the consequent responsibilities relevant to the practice.

PO-7. **Environment and sustainability**: Appreciate the impact of the professional scientific solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO-8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the work practice.

PO-9. **Individual and team work**: Act as an individual, and as a member or leader in teams, and in multidisciplinary settings.

PO-10. **Communication**: Connect with their community and with society at large. Be able to comprehend and write effective reports documentation. Make effective presentations, and give and receive clear instructions.

PO-11. **Project management and finance**: Establish knowledge and understanding of scientific and management principles and apply these to one's own work, as a member and leader in a team. Manage projects in multidisciplinary environments.

PO-12. **Life-long learning**: Identify the need for, and have the preparation and ability to engage in independent and life-long learning and research in the broadest context of scientific & technological change.

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Scheme of Instruction
B.Sc. IInd Year (Botany, Zoology and Chemistry)

Second Year									
III Semester			Teaching Scheme			Marks Distribution			
Category	Code	Subject	L	T	P	CA	EE	Total	Credits
DSC-1C	CZT301	Physiology and Biochemistry	3	1	0	30	70	100	4
DSC-2C	CBT301	Plant Anatomy and Embryology	3	1	0	30	70	100	4
DSC-3C	CSR301	Physical Chemistry	3	1	0	30	70	100	4
SEC	CSE301	SEC-1	2	0	0	15	35	50	2
DSC-1C(P)	CZT351	Zoology lab-III	0	0	4	15	35	50	2
DSC-2C(P)	CBT351	Botany lab-III	0	0	4	15	35	50	2
DSC-3C(P)	CSR351	Chemistry lab-III	0	0	4	15	35	50	2
Total			11	3	12	150	350	500	20
IV Semester									
CATEGORY	CODE	SUBJECT	L	T	P	CA	EE	Total	Credits
DSC-1D	CZT401	Genetics and Evolutionary Biology	3	1	0	30	70	100	4
DSC-2D	CBT401	Ecology and Plant Physiology	3	1	0	30	70	100	4
DSC-3D	CSR401	Inorganic Chemistry	3	1	0	30	70	100	4
SEC	CSE401	SEC-2	2	0	0	15	35	50	2
DSC-1D(P)	CZT451	Zoology lab-IV	0	0	4	15	35	50	2
DSC-2D(P)	CBT451	Botany lab-IV	0	0	4	15	35	50	2
DSC-3D(P)	CSR451	Chemistry lab-IV	0	0	4	15	35	50	2
Total			11	3	12	150	350	500	20

*There will be a 2-credit course on human ethics and entrepreneurship which students can choose at any semester during the program.

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CZT301: Physiology and Biochemistry

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks Attendance – 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Basic knowledge of animal processes and their mechanisms.

Course Objectives:

1. To learn about basic principles of physiology of animal with special reference to mammals.
2. To get aware about mechanism of body functions like nerve conduction, muscle contraction and circulation of nutrients etc.
3. To introduce and classify different types of biomolecules.
4. To explore about structure and function of proteins in living system.
5. To learn about structural and physiological role of carbohydrates in living beings.
6. To study metabolism of lipids and their physiological role in organisms.
7. To learn about the enzymes, their mode of action and mechanisms of regulation.
8. To study the details of basic metabolic processes of energy production.

Detailed Syllabus:

Unit 1 Physiology of digestion, respiration and circulation: Digestive System - Mechanical and chemical digestion of food; Role of gastrointestinal hormones; Control and action of GI Tract secretions; Absorptions of carbohydrates, lipids, proteins, water, minerals and vitamins, Respiration: Blood pigments: Role in oxygen transport, Oxygen dissociation curves and their physiological significances, Transport of CO2, Bohr and Haldane effect, Chloride shift, Circulation: Origin and conduction of cardiac impulse, Cardiac cycle, Blood volume, cardiac out-put, Blood pressure and its regulation; Electrocardiogram, Autonomic control and chemical regulation of heart rate.
Unit 2 Physiology of excretion and nerve conduction: Excretion: Structure of nephron, Physiology of Urine formation, Composition of normal urine, Muscle: Types, Ultra structure of striated muscle, mechanism of muscle Contraction , Neuron and glia - Structure and function ,Ionic distribution, Transmembrane potential, Ionic channels, Action potential, Origin and conduction of nerve impulse, Synapse and synaptic transmission.
Unit 3 Biomolecules: Classification, Structure and properties of amino acids. Classification and biological function of proteins. Protein configuration: Primary structure, secondary structure (α-helix & β-pleated structure), Tertiary (Native) structure and structure of multimeric protein (quaternary structure). Classification & properties of carbohydrate, isomers of monosaccharides. Classification & properties of fatty acids. Structure and functions of triglycerols, membrane phospholipid, cholesterols, steroid hormones.
Unit 4 Enzyme and metabolism: Concept of enzyme and mechanism of enzyme action. Respiration: Types - Aerobic respiration, Anaerobic respiration, respiratory substrates, mechanism of respiration: Glycolysis, TCA cycle, terminal oxidation (Oxidative phosphorylation, Electron transport chain). Energy calculation (output) in prokaryotes / eukaryotes. Pentose phosphate pathway, Oxidation of saturated fatty

acids, β-oxidation, oxidation of unsaturated fatty acids, α-oxidation.

Text and Reference Books

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

Course Outcomes:

After completing the course, students will be able to:

CO1	Describe physiology of nerve conduction, muscle contraction, circulation of nutrients and other functions of body.
CO2	Interpret the result of biochemical test and other diagnostics like ECG, EEG.
CO3	Describe the structure and function of biomolecules.
CO4	To determine the physiological role of carbohydrates, lipids and proteins in living beings.
CO5	Discuss the concept of enzyme, its mechanism of action and regulation.
CO6	Understand and apply the basic knowledge of biochemistry in daily life and industry.
CO7	Describe physiology of nerve conduction, muscle contraction, circulation of nutrients and other functions of body.
CO8	Interpret the result of biochemical test and other diagnostics like ECG, EEG.

CBT301: Plant Anatomy and Embryology

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment - 6Marks Attendance – 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Basic knowledge of plant physiology and metabolism.

Course objectives:

1. To learn about the division of labor among different cells and tissues in the plant.
2. To learn about the type of woods and their importance.
3. To learn about the anatomical structures of monocot and dicot plants.
4. To learn about the structure and function of vascular cambium.
5. To learn about the concept of secondary growth in plants.
6. To learn about the reproductive biology and different stages after fertilization and its complexity.

Detailed Syllabus:

Unit 1 Introduction: scope of plant anatomy, applications in systematics. Tissues:classification of tissues, simple and complex tissues, secretory system: hydathodes, cavities, lithocysts and laticifers.**Wood anatomy:** axially and radially oriented elements; sapwood and heartwood, ring and diffuse porous wood; dendrochronology.

Unit 2 Root and Stem: organization of root apex (Apical cell theory, Histogen theory, Korper-Kappe theory); Quiescent centre; root cap; structure of dicot and monocot root and origin of lateral root. Stem organization of shoot apex (Apical cell theory, Histogen theory, Tunica Corpus theory).Structure of dicot and monocot stem.

Unit 3 Leaf: structure of dicot and monocot leaf, Kranz anatomy,vascular cambium structure, function, seasonal activity of cambium; secondary growth in root and stem.

Unit 4 Embryology: Structure and development of male and female gametophytes – microsporogenesis, megasporogenesis, embryo sac types. Double fertilization, development of embryo, endosperm development and its morphological nature, apomixis and polyembryony.

Text and Reference Books

1. Plant Anatomy: S.N. Pandey and A. Chadha. Ist Edition. Vikas Publishing House, New Delhi, India.
2. Principles of Angiosperms Taxonomy. New Age International Limited, New Delhi. Davis, P.H. and Heywood, V.H. 1963. , Oliver and Boyd. London.
3. Morphology and Evolution of Vascular Plants, Gifford, E.M. and Foster, A.S. 1988. W.H. Freeman & Company, New York.
4. Current concepts in Plant Taxonomy. Heywood, V.H. and Moore, D.M. (eds) 1984. Academic Press, London.
5. An introduction to Plant Taxonomy. Jeffrey, C. 1982. . Cambridge University Press, Cambridge,

London. Jones, S.B. Jr. Luchsinger, A.E. 1986.
6. The Embryology of Angiosperms.VI Edition. Vikas Publishing House, New Delhi, India.
7. A Text Book of Botany Volume-III. S.N. Pandey and A. Chadha.. Ist Edition. Vikas Publishing House, New Delhi, India.
8. An Introduction to Archegoniate Plants. A Rashid. Vikas Publishing House, New Delhi, India.

Course Outcomes:

After completing this course, students will be able to:

CO1	Understand the scope and importance of anatomy and embryology.
CO2	Know the function and importance of various tissue systems.
CO	Understand the normal and anomalous secondary growth in plants and their causes.
CO4	Understand structure and development in microsporangium and megasporangium.
CO5	Understand microsporogenesis and megasporogenesis.
CO6	Understand male and female gametophytes.
CO7	Know fertilization, endosperm and embryogeny.

CSR301: Physical Chemistry

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment - 6Marks Attendance – 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Concept of Kinetic theory of gases, Carnot cycle and efficiency of reversible engine, electromotive force and chemical equilibrium.

Course Objectives:

1. To know about laws of thermodynamics and Carnot cycle.
2. To understand the concept of entropy and Gibbs free energy
3. To learn the phase rules and draw the phase diagrams of one component systems two component systems.
4. To know the Third Law of thermodynamics and Nernst hear theorem.
5. To understand the Heat capacities.

Detailed Syllabus:

Unit1 Theory of Gases: Equation of state for ideal and non-ideal (van der Waals) gases; Kinetic theory of gases; Maxwell-Boltzmann distribution law; equipartition of energy.

Unit 2 Thermodynamics: 1st Law: Introduction to thermodynamics, definition of heat, energy and work, 1st Law of thermodynamics and its implications, Enthalpy, Heat capacities, Joule Thompson effect.
2nd Law: Second Law of thermodynamics, Carnot cycle and efficiency of reversible engine, Clausius inequality, conditions of spontaneity, Helmholtz and Gibbs free energy, Third Law of thermodynamics and Nernst hear theorem.

Unit 3 Chemical Equilibrium: The Gibbs energy minimum, the description of equilibrium, how equilibria respond to pressure and temperature.

Unit4 Electrochemical Equilibrium: Half-reactions and electrode, varieties of cells, the electromotive force, standard potentials.

Unit 5 Phase Equilibria: Phase, component, degree of freedom, Phase rule, thermodynamic derivation of phase rule, phase diagrams of one component systems (water), two component systems (phenol-water, lead-silver, tin-magnesium). The distribution law, applications to cases of dissociation and association of solutes in one of the phases.

Unit 6 Quantum Mechanics: Postulates of Quantum mechanics, model systems such as Particle in 1D box, Simple Harmonic Oscillators, Hydrogen atom (Hamiltonian and solutions).

Text and Reference Books

1. *"Physical Chemistry",* P. C. Rakshit, 5th Edition (1985), 4th Reprint (1997), SaratBookHouse, Calcutta.
2. *"Principles of Physical Chemistry",* B. R. Puri, L. R. Sharma, and M. S. Pathania, 37thEdition (1998), Shoban Lal Nagin Chand & Co., Jalandhar.

Course Outcomes:

After completing this course, students will be able to:

CO1	Describe the Maxwell-Boltzmann distribution law
CO2	Understand the Nernst hear theorem.
CO3	Explain the equilibria responds to pressure and temperature.
CO4	Develop the half-reactions and electrode.
CO5	Calculate the phase diagrams of one component systems (water), two component systems.
CO6	Illustrate the quantum mechanics, model systems.

CZT351: Zoology Lab-III

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Attendance – 5 Marks
Credits: 2	Teachers Assessment - 10Marks
	End Semester Exam – 35 marks

Prerequisite: Basic idea of animal organization, knowledge of fundamental processes of animals, awareness of lab equipments and instruments.

Course Objectives:

1. To learn about the physiological processes occur in animals.
2. To demonstrate the activity of salivary amylase.
3. To evaluate the diversity and distribution of blood group among human beings in particular area.
4. To analyze the principles of hemin crystal preparation and determination of osmorality of blood.
5. To learn about methods of checking biochemical activity of different biomolecules
6. To learn the principles of detection of amino acids in blood of an animal by paper chromatography**.**

Detailed Syllabus:

Practicals:

1. Preparation of blood film
2. Identification of blood corpuscles
3. Counting of Red Blood Corpuscles using haemocytometer
4. Counting of White Blood Corpuscles using haemocytometer
5. Estimation of blood haemoglobin using haemoglobionometer
6. Preparation of Haemin crystals from blood
7. Qualitative tests for Carbohydrate, Protein and fat (Tests to be performed – Biuret test, Millon's test, Iodine test, Benedict's test, Barfoed test).
8. Estimation of total protein in given solutions by Lowry's method.
9. Study of activity of salivary amylase under optimum conditions.

Course Outcomes:

After completing the course, students will be able to:

CO1	Discuss and describe the physiological processes of animals through experiments.
CO2	Understand the principle and procedure of amylase test.
CO3	Determine different types of amino acids in given sample through paper chromatography.
CO4	Perform procedures of hemin crystal preparation and blood osmorality determination.
CO5	Determine the appropriateness of different methods to check the biochemical activity of different biomolecules.
CO6	Use and describe functionality of biochemical techniques like chromatography, electorphoresis and centrifuge

CBT 351: Botany Lab – III

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Attendance – 5 Marks
Credits: 2	Teachers Assessment - 10Marks
	End Semester Exam – 35 marks

Prerequisite: Basic knowledge of dicot and monocot stems, embryogenesis and cell cycle.

Course Objectives:

1. To study the anatomical characters of anomalous secondary growth in dicots and monocots
2. To learn the process of embryology in angiosperms
3. To study different types of ovulation in angiosperms
4. To study the anatomical features of ovule
5. To learn about the different stages of cell division

Detailed Syllabus:

Practicals:

1. Stem of *Boerhaavia*, *Bignonia*, *Bougainvellia*, *Dracena*, *Leptadenia*, *Nyctanthes*, *Salvadora*.
2. Embryology of the anatropous ovule
3. Embryology of the Orthotropous ovule
4. Embryology of the Campylotropous ovule
5. T.S. of ovule
6. Embryology of the micro-spores
7. Stages of the cell division-meiosis and mitosis in onion.

Course Outcomes:

After completing the course, students will be able to:

CO1	Determine the arrangement of vascular bundles in dicots and monocots
CO2	Able to differentiate dicot and monocot stems
CO3	Able to find the effect of environment conditions on plant anatomy
CO4	Analyze the process of formation of ovules in angiosperms
CO5	Determine the different stages in cell division cycle

CSR351: Chemistry Lab-III

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Attendance – 5 Marks
Credits: 2	Teachers Assessment - 10Marks
	End Semester Exam – 35 marks

Prerequisite: Skills to perform physical chemistry experiments.

Course Objectives:

1. To study the equilibrium of a reaction using distribution method.
2. To carry out potentiometric titrations between acids and bases.
3. Potentiometric titration of Mohr's salt with potassium dichromate.
4. Determination of critical solution temperature.

Detailed Syllabus:

Practicals:

1. Study the equilibrium of at least one of the following reactions by the distribution method:
   a. $I_2(aq) + I^- \rightarrow I_3^-(aq)$
   b. $Cu^{2+}(aq) + nNH_3 \rightarrow Cu(NH_3)_n^{2+}$
2. Perform the following potentiometric titrations (at least two):
   a. Strong acid with strong base
   b. weak acid with strong base and
   c. dibasic acid with strong base
3. Potentiometric titration of Mohr's salt with potassium dichromate.
4. Determination of critical solution temperature and composition of the phenol-water system and to study the effect of impurities on it.

Note: Experiments may be added/deleted subject to availability of time and facilities

Text and Reference Books

1. "Vogel's Quantitative Analysis" by J. Mendham, Pearson Education; 6 edition (2009).

Course Outcomes:

After completing this course, students will be able to:

CO1	Perform common laboratory techniques.
CO2	Handle laboratory glassware, equipment, and chemical reagents.
CO3	Measure equilibrium concentrations and equilibrium constants.
CO4	Employ the potentiometer to perform titration experiments.
CO5	Collect, record, and analyze data.
CO6	Develop of skill to design experiments for a specific goal.

CZT401: Genetics & Evolutionary Biology

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks Attendance – 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: General knowledge of heredity and variations, basic idea of evolutionary factors.

Course Objectives:

1. To study the basic principles of classical and modern genetics.
2. To understand variation among the population on basis of principles of genetics.
3. To explore the applications of genetics principles in crop improvement and treatment of congenital diseases of human beings.
4. To learn the basic concept of evolution and evidence in support of it.
5. To learn about the various natural evolutionary forces and mechanisms.
6. To learn about the various processes involved in development of individuals.

Detailed Syllabus:

Unit 1 Mendelian genetics and its extension: Mendel's experiments and Principles of Inheritance, Chromosome theory of inheritance, Incomplete dominance and co-dominance, Multiple alleles, Lethal alleles, Epistasis, Pleiotropy.

Unit 2 Linkage, crossing Over and Chromosomal Mapping: Linkage and crossing over, Recombination frequency as a measure of linkage intensity, two factor and three factor crosses, Interference and coincidence, chromosome mapping, Somatic cell genetics - an alternative approach to gene mapping.

Unit 3 Population Genetics: Allele frequencies, Genotype frequencies, Hardy-Weinberg Law, role of natural selection, mutation, genetic drift.

Unit 4 Sex Determination and extranuclear inheritance: Sex determination in *Drosophila*: Chromosomal theory, origin of Gynanders and Intersexes, Genic balance. Sex determination in human: Gene Dosage Compensation and Molecular basis of X-chromosome inactivation, sex linked Inheritance. Cytoplasmic inheritance: Sigma factor in *Drosophila*, Kappa particle inheritance. Chromosomal aneuploidy in human beings.

Unit 5 Concept and theories of evolution: Basic concept of Evolution, Origin of life, evidences of evolution, Theories of evolution: Lamarckism/ Neo- Lamarckism, Darwinism/ Neo-Darwinism, Mutation theory and Modern synthetic theory.

Unit 6 Mechanism of evolution: Organic variations, Isolating Mechanisms, Natural selection (Example: Industrial melanism), Types of natural selection (Directional, Stabilizing, Disruptive), Artificial selection, Speciation: concept and modes.

Text and Reference Books

1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). *Principles of Genetics.* VIII Edition. Wiley India.
2. Snustad, D.P., Simmons, M.J. (2009). *Principles of Genetics.* V Edition. John Wiley and Sons

Inc.
3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). *Concepts of Genetics.* Edition. Benjamin Cummings.
4. Russell, P. J. (2009). *Genetics- A Molecular Approach.* III Edition. Benjamin Cummings.
5. 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.
6. Ridley, M. (2004). *Evolution.* III Edition. Blackwell Publishing.
7. Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007). *Evolution.* Cold Spring, Harbour Laboratory Press.
8. Hall, B. K. and Hallgrimsson, B. (2008). *Evolution.* IV edition. Jones and Bartlett Publishers
9. Campbell, N. A. and Reece J. 13. (2011). *Biology.* IX Edition, Pearson Benjamin, Cummings.
10. Douglas, J. Futuyma (1997). *Evolutionary Biology.* Sinauer Associates.

Course Outcomes:

After completing the course, students will be able to:

CO1	Introduce the basic terms related to genetics like gene, alleles and heredity etc.
CO2	Describe about the sex and environment specific pattern of characters in different populations.
CO3	Evaluate the application of genetics principles in applied branches of biology like biotechnology, food science, medical sciences and agricultural sciences etc.
CO4	Describe the evolutionary theories and arrival of organism of modern era.
CO5	Understand the basic information about the origin of life and its evolution on earth.
CO6	Analyze the impact of environmental changes in development of new adaptive features.

CBT401: Ecology and Plant Physiology

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment - 6Marks Attendance – 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Basic information of inter-relationship between living and non-living components and its importance.

Course Objectives:

1. To study the inter-relationships among organism and its environment.
2. To study the properties of water and soil of different areas.
3. To study the aquatic and terrestrial micro-flora.
4. To maintain a biodiversity record of a given area.
5. To learn the physiology of plants and its relation with external environmental conditions.
6. To learn about the role of hormones in plant growth
7. To study growth, development and senescence in plants and factors responsible for them.

Detailed Syllabus:

Unit 1 Introduction to Ecology: definition, community and ecosystem, Inter-relationships between living world and environment, biosphere, biomes, ecosystem components (abiotic and biotic). Environment related concepts and laws (theory of tolerance, laws of limiting factors). Community characteristics: organization and concept of habitats and niche. Bioenergetics. Biogeochemical and Hydrological cycles.

Unit 2 Plant-water relations: importance of water to plant life, physical properties of water; imbibition, diffusion and osmosis; absorption and transport of water; transpiration; physiology of stomata. **Mineral nutrition:** essential macro and micro elements and their role; mineral uptake; deficiency symptoms.

Unit 3 Transport of organic substances: mechanism of phloem transport, source-sink relationship, factors affecting translocation. **Photosynthesis:** significance, historical aspects, photosynthetic pigments, action spectra and enhancement effects, concept of two photosystems, Z-scheme, photo-phosphorylation; Calvin cycle, C4 pathway, CAM plants. **Respiration:** Glycolysis, Kreb Cycle and ETS System; photorespiration.

Unit 4 Growth and development: definitions, phases of growth and development; seed dormancy; plant movements; the concept of photoperiodism; physiology of flowering, florigen concept; physiology of senescence; fruit ripening.

Unit 5 Plant hormones: auxins, gibberellins, cytokinins, abscissic acid and ethylene, history of discovery, mechanism of action; photo-morphogenesis; phytochromes, physiological role and mechanism of action.

Text and Reference Books

1. Plant Metabolism (2nd Edition). Dennis, D.T., Turpin, D.H., Lefebvre, D.D. and Layzell (eds.). 1997: Longman, Essex, England.
2. Life Processes in Plants. Galston, A.W. 1989: Scientific American Library, Springer-Verlag, New York, USA.
3. Introduction to Plant Physiology. Hopkins, W.G., 1995: John Wiley & Sons, Inc., NewYork, USA.
4. Plant Physiology. Mohr, H. and Schopfer, P. 1995: Springer-Verlag, Berlin Germany.

Course Outcomes:

After completing the course, students will be able to:

CO1	Know importance and scope of plant physiology.
CO2	To understand the plants and plant cells in relation to water.
CO3	Understand the process of photosynthesis in higher plants with particular emphasis on light and dark reactions, C3 and C4 pathways.
CO4	Understand the respiration in higher plants with particular emphasis on aerobic and anaerobic respiration.
CO5	Learn about the movement of sap and absorption of water in plant body.

CSR401: Inorganic Chemistry

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment - 6Marks Attendance – 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Concept of molecular orbital theory, relative strength of acids and Crystals and crystal systems.

Course Objectives:

1. To know about Valence Bond theory.
2. To understand the Hard and Soft Acids Bases (HSAB).
3. To learn the reduction potentials.
4. To learn the NaCl and KCl structures.
5. To know the bonding properties of trivalent nitrogen.
6. To understand the heat capacity of solids.

Detailed Syllabus:

Unit1 Molecular Structure and Bonding: Lewis structure, octet rule, VSPER model, Valence Bond theory, hydrogen molecule, homonuclear diatomic molecules, polyatomic molecules, molecular orbital theory, homonuclear diatomic molecules and heteronuclear diatomic molecules.
Unit 2Acids and Bases: Bronsted- Lowry concept of acid-base reaction, solvated proton, relative strength of acids, types of acid-base reactions, leveling solvents, Lewis acid-base concept, Classification of Lewis acids, Hard and Soft Acids Bases (HSAB), Application of HSAB principle.
Unit3 Redox Reactions: Oxidation and reduction reactions, reduction potentials, electrochemical series, Nernst equation, variable valency of metals and disproportionation reactions.
Unit 4 Solid State: Crystals and crystal systems; X-rays; NaCl and KCl structures; close packing; atomic and ionic radii; radius ratio rules; lattice energy; Born-Haber cycle; isomorphism; heat capacity of solids.
Unit 5 Chemistry of s and p-block elements: Inert pair effect, structure and bonding of boron nitrides and comparison with graphite structure, shape and bonding of diborane, bonding properties of trivalent nitrogen and phosphorous, shape and bonding of XeF_2, XeF_4 and XeF_6.
Text and Reference Books 1. *"A New Concise Inorganic Chemistry",* J. D. Lee, 5th Edition (1996), Chapman & Hall,London. 2. *"Modern Inorganic Chemistry",* R. C. Aggarwal, 1st Edition (1987), KitabMahal,Allahabad. 3. *"Basic Inorganic Chemistry",* F. A. Cotton, G. Wilkinson, and Paul L. Gaus,3rdEdition (1995), John Wiley & Sons, New York.

Course Outcomes:

After completing this course, students will be able to:

CO1	Describe the VSPER model.
CO2	Understand the molecular orbital theory, homonuclear diatomic molecules and heteronuclear diatomic molecules.
CO3	Explain the application of HSAB principle.
CO4	Develop the disproportionation reactions.
CO5	Calculate the Born-Haber cycle; isomorphism; heat capacity of solids.
CO6	Illustrate the shape and bonding of XeF_2, XeF_4 and XeF_6.

CZT451: Zoology Lab-IV

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Attendance – 5 Marks
Credits: 2	Teachers Assessment - 10Marks
	End Semester Exam – 35 marks

Prerequisite: Basic idea of animal organization, knowledge of fundamental processes of animals, awareness of lab equipments and instruments.

Course Objectives:

1. To understand the procedure of solving problems based on genetics and pedigree analysis.
2. To evaluate the diversity and distribution of blood group among human beings in particular area
3. To learn the basic concept of evolution and evidence in support of it.
4. To learn about the various natural evolutionary forces and mechanisms.
5. To understand the major principles of evolutionary theory ranges from the origins of life to mode of survival.

Detailed Syllabus:

Practicals:

1. Study of Mendelian Inheritance mid 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

Course Outcomes:

After completing the course, students will be able to:

CO1	Solve the problems based on genetics and pedigree analysis.
CO2	Apply statistical methods for interpretation of the results of blood group experiments
CO3	Explain about the various natural evolutionary forces and mechanisms.
CO4	Describe the evolutionary theories and arrival of organism of modern era.
CO5	Understand the basic information about the origin of life and its evolution on earth.

CBT451: Botany Lab-IV

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Attendance – 5 Marks
Credits: 2	Teachers Assessment - 10Marks
	End Semester Exam – 35 marks

Prerequisite: Theoretical knowledge of various physiological processes and metabolism occur in plants.

Course Objectives:

1. To learn the basics of the process of Respiration practically
2. To know the movement of solute and solvent through membrane
3. To study the process of transpiration in plants
4. To study the movement of sap in plants
5. To learn the ecology of plants and their distribution
6. To learn the soil types.

Detailed Syllabus:

Practicals:

1. Respirometre.
2. Osmosis by using goat bladder/parchment paper.
3. Process of endo-osmosis/exo-osmosis.
4. Imbibition by using gram seeds.
5. Transpiration by using Ganong's photometer.
6. Photosynthesis by inverted funnel method.
7. Ascent of sap water moves through xylem raising the solution.
8. Four leaf method.
9. Bell Jar experiment.
10. Quadrate method (density, abundance, frequency and plant population density).
11. Soil pH, water absorption capacity of soil and bio-mass.

Course Outcomes:

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

CO1	Understand the value of water for the plants
CO2	Analyze the process of absorption, adsorption and diffusion and the pressure acts behind them.
CO3	Determine the process of mineral, nutrients and water movement in plants
CO4	Determine the process of photosynthesis in plants
CO5	Evaluate the health of a landscape
CO6	Evaluate the fertility and water retaining capacity of soil

CSR451: Chemistry Lab-IV

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Attendance – 5 Marks
Credits: 2	Teachers Assessment - 10Marks
	End Semester Exam – 35 marks

Prerequisite: Skills to perform inorganic chemistry practical.

Course Objectives:

1. To introduce conductometry and pH meter titrations.
2. To have a hands-on using colorimeter.
3. To develop the skill of synthesis and crystallization.

Detailed Syllabus:

Practicals:

1. Inorganic Qualitative Analysis (Semi-Micro Analysis) (At least five mixtures)
2. Separation of calcium and Barium and estimation of Ca- volumetrically or Ba- gravimetrically
3. Separation of Cu and Ni from binary mixtrire solution and estimation of Cri—volumetrically and Nr—gravimetrically.
4. Estimation of oxalic acid and H2SO4 in a given mixture Solution using NaOH and KMnO4 solution.
5. Estimation of Fe by potassium dichromate using diphenyl ammine indicator.
6. Estimation of available chlorine in the given sample of bleaching powder.

Note: Experiments may be added/deleted subject to availability of time and facilities

Text and Reference Books

1. "Vogel's Text book on Practical Organic Chemistry" by Furniss, Pearson Education; 5 edition (2003).

Course Outcomes:

After completing this course, students will be able to achieve the followings:

CO1	Design conductivity, pH meter and colorimetry and polarimeter experiments
CO2	Develop the skill to perform small scale synthesis
CO3	Learn the art of crystallization
CO4	Apply of Lambert-Beer to determine the concentration of any unknown analyte
CO5	Develop basic skills to perform derivatization of common organic functionality
CO6	Apply of chemical knowledge to perform quantitative analysis of organic samples

Human Values & Ethics	
Teaching Scheme Lectures: 2 hrs/Week Tutorials: 0 hr/Week Credits: 2	**Examination Scheme** Class Test -6 Marks Teachers Assessment – 3 Marks Attendance – 6 Marks End Semester Exam – 35 marks

Prerequisite: - Basic requirement for fulfillment of human aspiration.

Course Objectives:

1. To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.
2. To help students initiate a process of dialog within themselves to know what they 'really want to be' in their life and profession
3. To help students understand the meaning of happiness and prosperity for a human being.
4. To facilitate the students to understand harmony at all the levels of human living, and live accordingly.
5. To facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life.

Detailed Syllabus

Unit-1 Need for values education, Self Exploration, Happiness and Prosperity, Basic Features of a good human, life management.
Unit-2 Understanding Harmony in Human Being, Social Health and Concept of Dharma.
Unit-3 Understanding harmony in family and relations, Value of trust and relationship management, Role of religion in human life.
Unit-4 Understanding Harmony in environment, Role of individuals in nation building, Conscious Business.
Unit-5 Comparison of Indian and western view of ethics and values.

Course Outcomes:

After completing the course, students will be able to:

1. Understand the significance of value inputs in a classroom and start applying them in their life and profession.
2. Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
3. Understand the value of harmonious relationship based on trust and respect in their life and profession.
4. Understand the role of a human being in ensuring harmony in society and nature.
5. Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.

Entrepreneurship Development	
Teaching Scheme Lectures: 2 hrs/Week Tutorials: 0 hr/Week Credits: 2	**Examination Scheme** Class Test - 6Marks Teachers Assessment - 3Marks Attendance – 6 Marks End Semester Exam – 35 marks

Course Objectives:

1.	Understanding basic concepts in the area of entrepreneurship.
2.	Understanding the role and importance of entrepreneurship for economic development.
3.	Developing personal creativity and entrepreneurial initiative.
4.	Adopting of the key steps in the elaboration of business idea.
5.	Understanding the stages of the entrepreneurial process and the resources needed for the successful development of entrepreneurial ventures.

Detailed Syllabus

Unit-1 Entrepreneurship: Definition of Entrepreneur, Internal and External Factors, Functions of an Entrepreneur, Entrepreneurial motivation and Barriers, Classification of Entrepreneurship, Theory of Entrepreneurship, The entrepreneurial Culture; Stages in entrepreneurial process. Concept of Entrepreneurship-Evolution of Entrepreneurship; Development of Entrepreneurship;
Unit-2 Entrepreneurship and environment-Policies governing entrepreneurs, entrepreneurial development programmes (EDP's) - Institutions for - entrepreneurship development. Problems of EDP's. .
Unit-3 Entrepreneurial Venture; Idea Generation, Screening and Project Identification, Creative Performance, Feasibility Analysis: Economic, Marketing, Financial and Technical; Project Planning: Evaluation, Monitoring and Control segmentation..
Unit-4 International Entrepreneurship Opportunities: The nature of international entrepreneurship, Importance of international business to the firm, International versus domestics' entrepreneurship, Stages of economic development.
Unit-5 Women entrepreneurship: Need – Growth of women entrepreneurship, Problems faced by women entrepreneurs, prospects.

Unit-6 Entrepreneurship in Informal Sector: Rural Entrepreneurship – Entrepreneurship in Sectors like Agriculture, Tourism, Health Case, Transport & Allied Services.
Text and Reference Books- 1. Entrepreneurship: New Venture Creation, Holt; Prentice-Hall, 1998 2. Entrepreneurship, Dollinger M J; Prentice-Hall, 1999 3. Entrepreneurship, Hisrich; McGraw-Hill Higher Education, 7th edition 4. Dynamics of Entrepreneurship Development, Vasant Desai Himalaya Publications, 11th edition.

Course Outcomes:

1. Appreciate the importance of embarking on self-employment and has developed the confidence and personal skills for the same.
2. Identify business opportunities in chosen sector / sub-sector and plan and market and sell products / services.
3. Consider the legal and financial conditions for starting a business venture.
4. Specify the basic performance indicators of entrepreneurial activity.