

DAV UNIVERSITY JALANDHAR

DAV UNIVERSITY, JALANDHAR



**Scheme of Courses for
Bachelor of Science (Biochemistry Hons.)**

(Program ID – 2)

**1st to 6th Semester
Examinations 2013-2014 Session Onwards**

Syllabi Applicable for Admissions in 2013

DAV UNIVERSITY JALANDHAR

**Course Scheme
Bachelor of Science (Biochemistry Hons.)**

Semester 1

S.No.	Paper Code	Course Title	L	T	P	Cr	A	B	C	D	E
1.	BCH 101	Biomolecules	4	1	0	4	25	25	25	25	100
2.	CHE 153	Organic Chemistry	4	0	0	4	25	25	25	25	100
3.	BOT 101	Plant Diversity I	4	1	0	4	25	25	25	25	100
4.	ZOO 101	Animal Diversity I	4	1	0	4	25	25	25	25	100
5.	SGS 101	Human Values and Ethics	2	0	0	2	25	25	25	25	50
6.	EVS 102	Environmental Education	3	0	0	2	25	25	25	25	50
7.	BCH 102	Biomolecules Lab.	0	0	3	2	-	-	-	-	50
8.	CHE 154	Organic Chemistry Lab.	0	0	3	2	-	-	-	-	50
9.	BOT 102	Plant Diversity I Lab.	0	0	3	2	-	-	-	-	50
10.	ZOO 102	Animal Diversity I Lab.	0	0	3	2	-	-	-	-	50
		Total	21	3	12	28					700

A: Continuous Assessment: Based on Objective Type Tests

B: Mid-Term Test-1: Based on Objective Type & Subjective Type Test

C: Mid-Term Test-2: Based on Objective Type & Subjective Type Test

D: End-Term Exam (Final): Based on Objective Type Tests

E: Total Marks

L: Lectures T: Tutorial P: Practical Cr: Credits

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Semester 2

S.No.	Paper Code	Course Title	L	T	P	Cr	A	B	C	D	E
1.	BCH 103	Metabolism	4	1	0	4	25	25	25	25	100
2.	EVS 103	Road Safety and Legal Awareness	2	0	0	2	25	25	25	25	50
3.	ENG 151	Basic Communication Skills	4	0	0	3	25	25	25	25	75
4.	ZOO 103	Animal Diversity II	4	1	0	4	25	25	25	25	100
5.	BOT 103	Plant Diversity II	4	1	0	4	25	25	25	25	100
6.	SGS 102	General Knowledge and Current Affairs	2	0	0	2	25	25	25	25	50
7.	MTH 170	Basic Mathematics	2	0	0	2	25	25	25	25	50
8.	SGS 104	Stenography	2	0	1	0	-	-	-	-	0
9.	SGS 105	Stenography Lab.	0	0	1	0	-	-	-	-	0
10.	BCH 104	Metabolism Lab.	0	0	3	2	-	-	-	-	50
11.	ENG 152	Basic Communication Skills Lab.	0	0	2	1	-	-	-	-	25
12.	ZOO 104	Animal Diversity II Lab.	0	0	3	2	-	-	-	-	50
13.	BOT 104	Plant Diversity II Lab.	0	0	3	2	-	-	-	-	50
		Total	23	4	13	28					700

A: Continuous Assessment: Based on Objective Type Tests

B: Mid-Term Test-1: Based on Objective Type & Subjective Type Test

C: Mid-Term Test-2: Based on Objective Type & Subjective Type Test

D: End-Term Exam (Final): Based on Objective Type Tests

E: Total Marks

L: Lectures T: Tutorial P: Practical Cr: Credits

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Semester 3

S.No.	Paper Code	Course Title	L	T	P	Cr	A	B	C	D	E
1.	ENG180	English	4	0	0	4	25	25	25	25	100
2.	MIC101	Microbiology	4	1	0	4	25	25	25	25	100
3.	BCH201	Enzymology	4	1	0	4	25	25	25	25	100
4.	BTY101	Introductory Biotechnology and Bioanalytical Techniques	4	1	0	4	25	25	25	25	100
5.	BCH 205	Biophysical Chemistry	2	1	0	2	25	25	25	25	50
6.	MIC102	Microbiology Lab.	0	0	3	2	-	-	-	-	50
7.	BCH202	Enzymology Lab.	0	0	3	2	-	-	-	-	50
8.	BTY102	Introductory Biotechnology and Bioanalytical Techniques Lab.	0	0	3	2	-	-	-	-	50
9.	BCH206	Biophysical Chemistry Lab.	0	0	2	1	-	-	-	-	25
		Total	18	4	11	25					625

A: Continuous Assessment: Based on Objective Type Tests

B: Mid-Term Test-1: Based on Objective Type & Subjective Type Test

C: Mid-Term Test-2: Based on Objective Type & Subjective Type Test

D: End-Term Exam (Final): Based on Objective Type Tests

E: Total Marks

L: Lectures T: Tutorial P: Practical Cr: Credits

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Semester 4

S.No.	Paper Code	Course Title	L	T	P	Cr	A	B	C	D	E
1.	BTY 205	Molecular Biology	4	1	0	4	25	25	25	25	100
2.	CHE 155	Spectroscopy	4	0	0	4	25	25	25	25	100
3.	BCH 203	Endocrinology	4	1	0	4	25	25	25	25	100
4.	BTY 103	Principles of Genetics	4	0	0	3	25	25	25	25	75
5.	CSA 253	Basic Computer Applications	3	0	0	3	25	25	25	25	75
6.	CHE 156	Chemistry Lab.	0	0	3	2	-	-	-	-	50
7.	BTY 208	Molecular Biology Lab.	0	0	3	2	-	-	-	-	50
8.	CSA 254	Basic Computer Applications Lab.	0	0	2	1	-	-	-	-	25
9.	BCH 204	Endocrinology Lab.	0	0	3	2	-	-	-	-	50
10.	BTY 104	Principles of Genetics Lab.	0	0	2	1	-	-	-	-	25
		Total	19	2	13	26					650

A: Continuous Assessment: Based on Objective Type Tests

B: Mid-Term Test-1: Based on Objective Type & Subjective Type Test

C: Mid-Term Test-2: Based on Objective Type & Subjective Type Test

D: End-Term Exam (Final): Based on Objective Type Tests

E: Total Marks

L: Lectures T: Tutorial P: Practical Cr: Credits

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Semester 5

S.No.	Paper Code	Course Title	L	T	P	Cr	A	B	C	D	E
1.	MIC 301	Basic Immunology	4	1	0	4	25	25	25	25	100
2.	CHE 353	Physical Chemistry	4	0	0	4	25	25	25	25	100
3.	BTY 201	Cell Biology	4	1	0	4	25	25	25	25	100
4.	BCH 301	Nutritional, Clinical and Environmental Biochemistry	4	1	0	4	25	25	25	25	100
5.	CHE 354	Physical Chemistry Lab.	0	0	2	2	-	-	-	-	50
6.	MIC 302	Basic Immunology Lab.	0	0	3	2	-	-	-	-	50
7.	BTY 202	Cell Biology Lab.	0	0	3	2	-	-	-	-	50
8.	BCH 302	Nutritional, Clinical and Environmental Biochemistry Lab.	0	0	3	2	-	-	-	-	50
		Total	16	3	11	24					600

A: Continuous Assessment: Based on Objective Type Tests

B: Mid-Term Test-1: Based on Objective Type & Subjective Type Test

C: Mid-Term Test-2: Based on Objective Type & Subjective Type Test

D: End-Term Exam (Final): Based on Objective Type Tests

E: Total Marks

L: Lectures T: Tutorial P: Practical Cr: Credits

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Semester 6

S.No	Paper Code	Course Title	L	T	P	Cr	A	B	C	D	E
1.	BCH304	Molecular Physiology	4	1	0	4	25	25	25	25	100
2.	BTY 308	Genomics and Proteomics	2	1	0	2	25	25	25	25	50
3.	BTY 204	Genetic Engineering	2	0	0	2	25	25	25	25	50
4.	BTY 309	Biostatistics and Bioinformatics	4	1	0	4	25	25	25	25	100
5.	BCH306	Membrane Biology	4	1	0	4	25	25	25	25	100
6.	BCH 303	Seminar and Field Trip	0	0	0	1	-	-	-	-	25
7.	BCH305	Molecular Physiology Lab.	0	0	3	2	-	-	-	-	50
8.	BTY 311	Genomics and Proteomics Lab.	0	0	2	1	-	-	-	-	25
9.	BTY 207	Genetic Engineering Lab.	0	0	2	1	-	-	-	-	25
10.	BTY 312	Biostatistics and Bioinformatics Lab.	0	0	3	2	-	-	-	-	25
11.	BCH307	Membrane Biology Lab.	0	0	3	2	-	-	-	-	50
		Total	16	5	12	25					625

A: Continuous Assessment: Based on Objective Type Tests

B: Mid-Term Test-1: Based on Objective Type & Subjective Type Test

C: Mid-Term Test-2: Based on Objective Type & Subjective Type Test

D: End-Term Exam (Final): Based on Objective Type Tests

E: Total Marks

L: Lectures T: Tutorial P: Practical Cr: Credits

Course Title: Biomolecules
Course Code: BCH 101

L	T	P	Credits	Marks
4	1	0	4	100

Course Objectives: This course introduces students to the importance of biochemistry and covers various biomolecules, with a brief overview of their chemistry, their functions and their relevance to physiology and disease.

Unit A **(15 hours)**

Introduction to Biochemistry

Water as a biological solvent. Weak acids and bases. PH and buffers. Henderson-Hasselbalch equation. Physiological buffers. Fitness of the aqueous environment for living organisms.

Carbohydrates

Structure of monosaccharides. Stereoisomerism and optical isomerism of sugars. Reactions of aldehyde and ketone groups. Ring structure and anomeric forms, mutarotation. Reactions of sugars due to hydroxyl groups. Important derivatives of monosaccharides, disaccharides and trisaccharides (structure, function and occurrence of important ones). Structure, occurrence and biological importance of monosaccharides, oligosaccharides and polysaccharides - cellulose, chitin, agar, algenic acids, pectins, proteoglycans, sialic acids, blood group polysaccharides, glycogen and starch. Bacterial cell wall polysaccharides. Glycoproteins.

Unit B **(15 hours)**

Proteins

Introduction to proteins. Classification based on solubility, shape, composition and functions. Amino acids: common structural features, stereoisomerism and RS system of designating optical isomers. Classification and structures of standard amino acids as zwitterion in aqueous solutions. Physical and chemical properties of amino acids. Titration of amino acids. Separation of amino acids. Essential amino acids.

Structure of peptide bond. Solid-phase synthesis of peptides. Peptide sequencing. Chemical and enzymatic cleavage of polypeptide chains and separation of peptides. Levels of structure in protein architecture. denaturation and renaturation of proteins. Behaviour of proteins in solutions. Salting in and salting out of proteins. Structure and biological functions of fibrous proteins (keratins, collagen and elastin), globular proteins (haemoglobin, myoglobin), lipoproteins, metalloproteins, glycoproteins and nucleoproteins.

Unit C **(15 hours)**

Nucleic Acids

Nature of genetic material. Evidence that DNA is the genetic material. Composition of DNA and RNA. Generalized structural plan and Nomenclature of nucleic acids. DNA double helix. Structure and roles of different types of RNA. Size of DNA in prokaryotes and eukaryotes. Central dogma of molecular biology. Concepts of gene, genome and chromosome.

Porphyrins

Porphyrin nucleus and classification of porphyrins. Important metalloporphyrins occurring in nature. Detection of porphyrins. Bile pigments – chemical nature and physiological significance.

Unit D

(15 hours)

Lipids

Definition and classification of lipids. Fatty acids: introduction, classification, nomenclature, structure and properties of saturated and unsaturated fatty acids. Essential fatty acids, prostaglandins. Triacylglycerols: nomenclature, physical properties, chemical properties and characterization of fats – hydrolysis, saponification value, rancidity of fats, Reichert-Meissel Number and reaction of glycerol. Biological significance of fats. Glycerophospholipids (lecithins, lysolecithins, cephalins, phosphatidylserine, phosphatidylinositol, plasmalogens), sphingomyelins, glycolipids – cerebrosides, gangliosides. Properties and functions of phospholipids, isoprenoids and sterols.

Reference Books

1. Nelson, David L., and Cox, Michael M., *Lehninger Principles of Biochemistry*, 5th Edition, W.H. Freeman & Company, New York, 2008. Print.
2. Voet, Donald and Voet, Judith G., *Biochemistry*, 3rd Edition, John Wiley & Sons Inc., Singapore, 2004. Print.
3. Murray, R.K., Granner, D.K. and Rodwell, V.W. *Harper's Illustrated Biochemistry*, 27th Edition, McGraw Hill Company Inc. Singapore, 2006. Print.

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Course Title: Biomolecules Laboratory
Course Code: BCH 102

L	T	P	Credits	Marks
0	0	3	2	50

Experiments:

1. Preparation of normal, molar and percent solutions.
2. Titration curve of Glycine.
3. Buffer preparation.
4. Qualitative tests for Carbohydrates, Lipids, Amino acids, Proteins, Nucleic acids
5. Preparation of casein from milk and determination of its isoelectric point.
6. Titrimetric analysis of Vitamin C.

Course Title: Metabolism
Course Code: BCH 103

L	T	P	Credits	Marks
4	1	0	4	100

Course Objectives: The course is designed to survey the major metabolic pathways involved in energy generation and synthesis of biomolecules.

Unit A (15 hours)

Introduction to Metabolism

General features of metabolism, experimental approaches to study metabolism – intact organisms, bacterial mutants, tissue slices, and radioisotopes.

Carbohydrate Metabolism

Reactions and energetics of glycolysis. Alcoholic and lactic acid fermentations. Reactions and energetics of TCA cycle. Gluconeogenesis, glycogenesis and glycogenolysis. Reactions and physiological significance of pentose phosphate pathway. Regulation of glycolysis and TCA cycle. Photosynthesis – a brief review.

Unit B (10 hours)

Electron Transport Chain and Oxidative Phosphorylation

Structure of mitochondria. Sequence of electron carriers. Sites of ATP production. Inhibitors of electron transport chain. Chemiosmotic hypothesis. Inhibitors and uncouplers of oxidative phosphorylation. Transport of reducing potentials into mitochondria.

Unit C (20 hours)

Lipid Metabolism

Introduction. Hydrolysis of triacylglycerols. Transport of fatty acids into mitochondria. β -oxidation of saturated fatty acids. ATP yield from fatty acid oxidation. Biosynthesis of saturated and unsaturated fatty acids. Metabolism of ketone bodies. Oxidation of unsaturated and odd chain fatty acids. Biosynthesis of triglycerides and important phospholipids, glycolipids, sphingolipids and cholesterol. Regulation of cholesterol metabolism.

Amino Acid Metabolism General reactions of amino acid metabolism – transamination, oxidative deamination and decarboxylation. Urea cycle. Degradation and biosynthesis of amino acids. Glycogenic and ketogenic amino acids.

Unit D (15 hours)

Nucleotide Metabolism

Sources of atoms in the purine and pyrimidine nucleotides. Biosynthesis and degradation of purines and pyrimidines. Regulation of purine and pyrimidine biosynthesis.

Porphyrin Metabolism

Biosynthesis and degradation of porphyrins. Production of bile pigments.

Reference Books

1. Nelson, David L., and Cox, Michael M., *Lehninger Principles of Biochemistry*, 5th Edition, WH Freeman & Company, New York, 2008. Print.
2. Voet, Donald and Voet, Judith G., *Biochemistry*, 3rd Edition, John Wiley & Sons Inc., Singapore, 2004. Print.
3. Murray, R.K., Granner, D.K. and Rodwell, V.W. *Harper's Illustrated Biochemistry*, 27th Edition, McGraw Hill Company Inc. Singapore, 2006. Print.
4. Conn, E.E., Stumpf, P.K., Bruening, G., and Doi, R.H. *Outlines of Biochemistry*. 5th edition, John Wiley & Sons Inc, 1987. Print.

Course Title: Metabolism Laboratory
Course Code: BCH 104

L	T	P	Credits	Marks
0	0	3	2	50

Experiments:

1. Estimation of blood glucose.
2. Estimation of cholesterol
3. Sugar Fermentation in Microorganisms.
4. Estimation of Glucose 6-P.
5. Assay of serum transaminases.
6. Estimation of Urea.
7. Estimation of Uric acid.
8. Estimation of Creatinine.

Course Title: Enzymology
Course Code: BCH 201

L	T	P	Credits	Marks
4	1	0	4	100

Course Objective: This course is an intermediate-level course intended for students majoring in biochemistry. It presents the important concepts of enzyme mechanism and catalysis with particular emphasis on enzyme kinetics and effects on enzyme inhibition. It also covers various applications of enzymes.

Unit A (10 hours)

Introduction

History, general characteristics, nomenclature, IUB enzyme classification (rationale, overview and specific examples), significance of numbering system. Definitions with examples of holoenzyme, apoenzyme, coenzymes, cofactors, activators, inhibitors, active site, metalloenzymes, units of enzyme activity, specific enzymes, isoenzymes, monomeric enzymes, oligomeric enzymes and multi-enzyme complexes. Enzyme specificity. Measurement and expression of enzyme activity – enzyme assays. Definition of IU, katal, enzyme turnover number and specific activity. Role of non-protein organic molecules and inorganic ions – coenzyme, prosthetic groups. Role of vitamins as coenzyme precursors (general treatment).

Unit B (20 hours)

Enzyme catalysis

Role of cofactors in enzyme catalysis: NAD/NADP⁺, FMN/FAD, coenzyme A, biocytin, cobalamin, lipoamide, TPP, pyridoxal phosphate, tetrahydrofolate and metal ions with special emphasis on coenzyme functions. Acid-base catalysis, covalent catalysis, proximity and orientation effects, strain and distortion theory. Mechanism of action of chymotrypsin, carboxypeptidase, ribonuclease and lysozyme. Methods for isolation, purification and characterization of enzymes.

Unit C (20 hours)

Enzyme Kinetics

Factors affecting enzyme activity: enzyme concentration, substrate concentration, pH and temperature. Derivation of michaelis-menten equation for uni-substrate reactions. K_m and its significance. Lineweaver-burke plot and its limitations. Importance of k_{cat}/K_m . Bi-substrate reactions – brief introduction to sequential and ping-pong mechanisms with examples. Kinetics of zero and first order reactions. Significance and evaluation of energy of activation and free energy. Reversible and irreversible inhibition, competitive, non-competitive and uncompetitive inhibitions, determination of K_m and V_{max} in presence and absence of inhibitor. Allosteric enzymes.

Unit D (10 hours)

Industrial and clinical applications of enzymes

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Immobilization of enzymes and their industrial applications. Production of glucose from starch, cellulose and dextran. Use of lactase in dairy industry. Production of glucose-fructose syrup from sucrose. Use of proteases in food, detergent and leather industry. Medical applications of enzymes. Use of glucose oxidase in enzyme electrodes.

Reference Books

1. Devasena, T. *Enzymology*. 1st Edition. Oxford University Press, 2012. Print.
2. Berg J.M., Tymoczko J.L., and Stryer, Lubert. *Biochemistry*, 6th Edition, W. H. Freeman and Co., 2007. Print.
3. Whitaker J.R. *Principles of Enzymology for the Food Sciences*, 2nd edition. Marcel Dekker Inc., 1994. Print.
4. Price, N.C., and Stevens, L. *Fundamentals of Enzymology*, 3rd edition, Oxford University Press, 2000. Print.
5. Fersht, Alan. *Enzyme Structure and Mechanism*, 2nd edition, W.H. Freeman and Co., 1985. Print.
6. Palmer, T. *Enzymes*, 1st Edition. Horwood Publishing, 2001. Print.

Course Title: Enzymology Laboratory
Course Code: BCH 202

L	T	P	Credits	Marks
0	0	3	2	50

Experiments:

1. Assay of acid phosphatase activity, specific activity from germinating mung bean seeds.
2. Linearity curve of enzyme.
3. Effect of substrate concentration on acid phosphatase activity and determination of its K_m , V_{max} and K_i (with respect to inorganic phosphate).
4. Effect of pH and temperature on enzyme activity.
5. Purification of enzyme.

Course Title: Endocrinology
Course Code: BCH 203

L	T	P	Credits	Marks
4	1	0	4	100

Course Objective: This courses introduces students to basic principles of endocrinology. It covers all the major classes of hormones released by various endocrine organs and their mechanism of action.

Unit A **(15 hours)**

Introduction

History, endocrine glands, hormones as chemical messengers, stimulus for hormone release: change in homeostasis , sensory stimulus and others.

Cell signalling & Mechanism of Hormone action

Receptor study, Binding affinity, specificity, Scatchard plot and purification. G protein linked receptor family; Signal transduction pathways involving G-proteins, Adenyl cyclases, Ca⁺², Phosphoinositides, PI-3 Kinase, DAG, cAMP, cGMP, NO, Protein kinases (A,B,C,G), Phosphoprotein phosphatases & Phosphodiesterases. Receptor tyrosine kinase family- EGF receptor family, Insulin receptor family, & Cytokine/erythropoietin receptor family associated with non receptor Tyrosine kinase (Signal transduction pathways involving: SH2 proteins, Ras, IRS-1, Raf, MEK, MAP kinase, JAK-STAT pathway).

Unit B **(15 hours)**

Intracellular Receptors

Steroid hormone receptors, Thyroid hormone receptors.Sensitisation & Desensitization of receptors; Short term regulation & Long term regulation. Drugs and Toxins affecting cell signaling : Cholera toxin, pertussis toxin, anthrax toxin, Bubonic Plague virulence, Forskolin, theophyllin, Phorbol esters, Sildenafil (Viagra).

Hormones

Structures, Receptor type, Regulation of biosynthesis and release (including feed back mechanism). Physiological and Biochemical actions, & Pathophysiology (hyper & hypo secretion).

Hypothalamic Hormones: CRH, TRH, GnRH, PRL/PRIH, GHRH/GHRIH.Pituitary Hormones - Anterior Pituitary hormones- Growth hormone, Prolactin,POMC peptide family, LH, FSH, TSH; Posterior Pituitary : Vasopressin, Oxytocin.

Unit C **(15 hours)**

Endocrine disorders

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Gigantism, Acromegaly, dwarfs, pigmies; Pathophysiology: Diabetes insipidus. Thyroid Hormone (include biosynthesis) Goiter, Graves disease, Cretinism, Myxedema, Hashimoto's disease.

Hormones regulating Ca^{2+} Homeostasis

PTH, Vitamin D, Calcitonin. Pathophysiology : Rickets, Osteomalacia, Osteoporosis. Pancreatic Hormones: Insulin, Glucagon, Diabetes type I & II .GI tract Hormones : Gastrin , Secretin, CCK, GIP, Ghrelin.

Unit D

(15 hours)

Hormones of Adrenal Cortex

Aldosterone (renin angiotensin system) & cortisol. Pathophysiology: Addison's disease, Conn's syndrome, Cushing's syndrome. Hormones of Adrenal Medulla, Epinephrine & norepinephrine.

Reproductive Hormones

Male & female Sex hormones. Interplay of hormones during Reproductive cycle, Pregnancy, Parturition, & Lactation. Oral Contraception.

Other organs with endocrine function: Heart (ANP), Kidney (erythropoietin), Liver (Angiotensinogen, IGF-1), Adipose tissue (Leptin, adiponectin). Pathophysiology : Obesity. Growth factors: PDGF, EGF, IGF-I,II , & NGF.

Reference Books:

1. Norris, D.O., and Carr, J.A. *Vertebrate endocrinology*, 5th Edition. Academic Press, 2012. Print.
2. Nelson, David L., and Cox, Michael M., *Lehninger Principles of Biochemistry*, 5th Edition. WH Freeman & Company, New York, 2008. Print.
3. Widmaier, E.P., Raff, H., and Strang, K.T. *Vander's Human Physiology*, 13th Edition. McGraw-Hill Higher Education, 2013. Print.
4. Lodish, H., Berk, A., Kaiser, C.A., Krieger, M., Bretscher, A., Ploegh, H., Amon, A., and Scott, M.P. *Molecular Cell Biology*, 7th Edition. W.H. Freeman, 2012. Print.

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Course Title: Endocrinology Laboratory

Course Code: BCH 204

L	T	P	Credits	Marks
0	0	3	2	50

Experiments:

1. Lipid profile- TAG, Lipoproteins, Cholesterol
2. Glucose tolerance test
3. Vitamin D assay
4. Assay of estrogen
5. T3/T4 assay by ELISA
6. Estimation of Calcium.

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Course Title: Biophysical Chemistry
Course Code: BCH 205

L	T	P	Credits	Marks
2	1	0	2	50

Objectives: Introduce the student to basic concepts of acid and bases and its importance in biological systems, colloidal systems and its applications, measuring concentrations of solutions, understanding the principle of different types of reactions and basics of thermodynamics as applied to biological system

Unit A **(7 hours)**

Dissociation of water, ionic product of water, concepts of pH, pOH, simple numerical problems of pH, determination of pH using indicators, pH meter and theoretical calculations. Dissociation of weak acids and electrolytes, Bronsted theory of acids and bases, shapes of titration curve of strong and weak acids and bases. Meaning of K_a and pK_a values, Buffers: buffer action, buffers in biological system, Henderson-Hasselbach equation with derivation, simple numerical problems involving application of this equation.

Unit B **(8 hours)**

Meaning of true solution, colloidal solution, and coarse suspension, distinction between lyophilic and lyophobic sols, Fundamental study of Donnan equilibrium- application in biological system, Methods of preparation of colloidal solution, membrane permeability, separation of colloidal solutions, elementary study of charge on colloids, Tyndall effect, application of colloidal chemistry, emulsion and emulsifying agents.

Unit C **(8 hours)**

Meaning of normality, molarity, molality, percentage solution, mole fractions, simple numerical problems from the above, Fundamental principles of diffusion and osmosis, definition of osmotic pressure, isotonic, hypotonic and hypertonic solutions, Biological importance of osmosis, Relationship of osmotic pressure to gas laws, General equation for dilute solutions, influence of ionization and molecular size on osmotic pressure.

Unit D **(7 hours)**

Classification of isomerism, oxidation reduction reactions, substitution, addition, elimination, condensation and decarboxylation with examples for each, Intra and Intermolecular interactions in biological system: Hydrogen bond, Covalent bond, hydrophobic interaction, disulphide bond, Peptide bonds, glycosidic bond, Phosphodiester linkage, Watson- Crick base pairings, Van der Waals force.

Introduction to chemical kinetics, equilibrium reactions, law of mass action, equilibrium constant, definition of catalysis, Basic principles of thermodynamics: free energy, enthalpy, entropy, reversible and irreversible reactions- as applied to biological systems.

Reference Books

1. Allen, J.P. *Biophysical chemistry*, 1st edition. Wiley Blackwell, 2008. Print.

2. Panini, S.R. *Medical Biochemistry – An Illustrated Review*, 1st Edition. Thieme, 2013.
3. Gilbert, H. *Basic Concepts in Biochemistry: A Student's Survival Guide*, 2nd Edition. McGraw-Hill Medical, 1999.

Course Title: Biophysical Chemistry Laboratory
Course Code: BCH 206

L	T	P	Credits	Marks
0	0	2	1	25

Experiments:

1. Preparation of solutions: percentage solutions, molar solutions, normal solutions, dilution of stock solutions.
2. Standardization of pH meter.
3. Measurements of pH of solutions using pH meters.
4. Preparation of buffers using the Henderson-Hasselbalch equation.
5. Preparation of Colloidal solutions: Preparation of Colloidal solution of Prussian blue and Arsenious Sulfide by double decomposition, Preparation of Colloidal Ferric Hydroxide by Hydrolysis, Preparation of emulsoid solutions.
6. Experiments with colloidal gels: Dialysis (Diffusion through membranes), Diffusion through gels, Mutual Precipitation of Colloids, Precipitation of Colloids by salts, Adsorption by Charcoal
7. Experiments on Donnan Equilibrium: Demonstration of Donnan equilibrium using a membrane, Demonstration of Donnan equilibrium without using a membrane

Course Title: Nutritional, Clinical and Environmental Biochemistry
Course Code: BCH 301

L	T	P	Credits	Marks
4	1	0	4	100

Course Objectives: The course teaches basic principles of nutrition, along with clinical aspects of nutrition. The course also surveys biochemistry of environment and biochemical bases of various types of pollution.

Unit A (15 hours)

Nutrition and Dietary habits

Introduction and definition of food and nutrition. Factors determining food acceptance, physiological, energy, body building (growth and development). Regulation of body temperature. Physiology and nutrition of carbohydrates, fats, proteins and water. Vitamin A, D, E, K, vitamin B complex and vitamin C and minerals like Ca, Fe and iodine and their biological functions. Basic food groups: energy giving foods, body building food protective foods. Composition of balanced diet, recommended dietary allowances (RDA) for average Indian, Locally available foods, inexpensive quality foods and food stuffs rich in more than one nutrients. Balanced vegetarian and non-vegetarian diets, emphasis on nutritional adequacy.

Unit B (15 hours)

Nutritive and calorific value of foods

a. Basic concepts of energy expenditure, units of energy, measurement of energy expenditure by direct and indirect calorimetry, calculation of non-protein RQ with respect to carbohydrate and lipids. Determination of heat production of the diet. The basal metabolism and methods of measuring basal metabolic rate (BMR); energy requirements during growth, pregnancy, lactation and various physical activities. Calculation of energy expenditure of average man and woman.

b. Specific dynamic action (SDA) of foods, nutritive value of various kinds of foods generally used by Indian population. Planning of dietary regimes for infants, during pregnancy and old age. Malnutrition, its implications and relationship with dietary habits and prevention of malnutrition specially protein-calorie malnutrition (Kwashiorkar and Marasmus) by improvement of diets. Human milk and its virtues, breast vs formulated milk feeding. Food preservation standards. Food adulterations and precautions, Government regulations on preservation and quality of food.

Unit C (15 hours)

Basic concepts of clinical Biochemistry Definition and scope of clinical biochemistry in diagnosis, a brief review of units and abbreviations used in expressing concentrations and standard solutions. Quality control. Manual vs automation in clinical laboratory.

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Collection and preservation of biological fluids (blood serum, plasma, urine and CSF). Chemical analysis of blood, urine and CSF. Normal values for important constituents (in SI units) in blood (plasma/ serum), CSF and urine, clearance test for urea.

Clinical Enzymology

a. Definition of functional and non functional plasma enzymes. Isoenzymes and diagnostic tests. Enzyme pattern in health and diseases with special mention of plasma lipase, amylase, cholinesterase, alkaline and acid phosphatases, SGOT, SGPT, LDH and CPK.

b. Functional tests of kidney, liver and gastric fluids.

iii) Diseases related to metabolism

Hypo- and hyper-glycemia, glycogen storage diseases; lipid malabsorption, and atorrhea, sphingolipidosis; role of lipoproteins. Inborn errors of amino acid metabolism- alkaptonuria, phenylketonuria, albinism, gout and hyper-uricemia.

Unit D

(15 hours)

Environmental Biochemistry

Air Pollution

Particulate matter, compounds of carbon, sulphur, nitrogen and their interactions, methods for their estimation, their effects on atmosphere.

Water Pollution

Types of water bodies and their general characteristics, major pollutants in domestic, agricultural and industrial wastes, methods of their estimation, effects of pollutants on plants and animals, treatment of domestic and industrial wastes, solid-wastes and their treatment.

Reference Books:

1. Ross, A.C., Caballero, B., Cousins, R.J., Tucker, K.L., and Ziegler, T.R. *Modern Nutrition in Health and Disease*. 11th Edition. Lippincott Williams and Wilkins, 2012. Print.
2. Gropper, S.S., and Smith, J.L. *Advanced Nutrition and Human Metabolism*, 5th Edition. Cengage Learning, 2012. Print.
3. Mann, J., and Truswell, S. *Essentials of human nutrition*, 4th Edition. Oxford university Press, 2012.

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**Course Title: Nutritional, Clinical and
Environmental Biochemistry Laboratory**
Course Code: BCH 302

L	T	P	Credits	Marks
0	0	3	2	50

Experiments:

1. Estimation of calcium and phosphorus in serum and urine
2. Estimation of creatinine in serum and urine.
3. Estimation of bilirubin in serum
4. Estimation of haemoglobin
5. Serum enzyme analysis, amylase, GOT, GPT, acid and alkaline phosphatase

L	T	P	Credits	Marks
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Course Title: Molecular Physiology
 Course Code: BCH 304

4	1	0	4	100
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Unit A

(15 hours)

The body fluid compartments: Intracellular, extracellular and interstitial fluid. Plasma as an extracellular fluid; plasma composition; plasma proteins; Blood cellular components; RBC; Hemostasis and molecular mechanism of Blood coagulation; Role of Vitamin K in coagulation; Anti coagulant and fibrinolytic systems. Anemias, Polycythemia, Haemophilia and Thrombosis.

The cardio vascular system: Anatomy of heart; Physiology of the cardiac muscle; automacity of the cardiac muscle; Excitation contraction coupling; relationship between cardiac cycle, heart sound ventricular volumes and the ECG; Control of cardiac function and output. Physics of blood pressure, flow and resistance; the arterial system; the venous system; the microcirculation and mechanics of capillary fluid exchange; Control of blood flow to the tissues; Portal circulations. Arterial pressure and its regulation Hypertension, Congestive heart disease, atherosclerosis and Myocardial infarction.

Unit B

(15 hours)

Renal physiology: Anatomy of the kidney and the nephron; Regulation of renal blood flow; Cell biology of the Bowmans capsule; physiology of glomerular filtration; GFR ; Tubular processing of the glomerular filtrate; Renal clearance; Assessment of kidney function. Regulation of urine volume and pH. Regulation of ECF electrolyte and water content, blood volume and long term blood pressure. Micturition reflex and voluntary control of micturition. Glomerular nephritis, renal failure, definition and use of dialysis and diuretics.

Respiration: Organization of the pulmonary system; Mechanism of respiration; Pulmonary ventilation and related volumes; Pulmonary circulation. Principles of Gas exchange and transport; Regulation of respiration; Pulmonary edema and regulation of pleural fluid. Blood buffer systems, renal and pulmonary control of blood pH; Acidosis and Alkalosis. Hypoxia, hypercapnea, pulmonary distress, emphesema.

Unit C

(15 hours)

Gastrointestinal and hepatic physiology: Histology of the gastrointe stinal tract; Propulsion and motility of food and digested material; Enteric reflexes; Secretory functions of the gastrointestinal tract; Digestion and absorption of macro and micronutrients. Peptic ulcer, Sprue, celiac disease, regurgitation, diarrhoea and constipation. Anatomy of the hepatic lobule; blood flow into the liver; Formation and secretion of bile; enterohepatic cycle; reticuloendothelial system; Metabolic importance of liver; Liver function tests. Jaundice and Liver cirrhosis.

Musculosketetal system: Bone structure and formation. Physiology of muscle contraction in striated and nonstriated muscle.

Unit D

(15 hours)

Reproductive physiology: Sex determination; development of female and male genital tracts; Spermatogenesis; capacitation of sperm; testis blood barrier; Physiology of female reproductive of placenta; the feto placental unit.

Neurophysiology: Organization of the central nervous system; cells of the nervous system and anatomy and physiology of Blood Brain Barrier. Introduction to neural networks: central, autonomic and peripheral; the sensory and motor tracts; mechanism and importance of myelination. Sensory perception of Pain, temperature, touch and vision; Physiology of reflex action; The motor cortex; corticospinal tracts. Basic physiology and biochemistry of Learning and Memory

Reference Books

1. Fox., S. *Human Physiology*, 13th Edition. McGraw Hill Publishers, 2012. Print.
2. Widmaier, E.P., Raff, H., and Strang, K.T. *Vander's Human Physiology*, 13th Edition. McGraw-Hill Higher Education, 2013. Print.

Course Title: Molecular Physiology Laboratory
Course Code: BCH 305

L	T	P	Credits	Marks
0	0	3	2	50

Experiments:

1. Separation of isoenzymes of LDH by electrophoresis
2. Liver function test
3. Creatine kinase for muscular function
4. Kidney function test
5. Estimation of Iron, Hb, Met Hb and Tranferrin Binding Protein
6. Complement fixation test.
7. Clotting time.

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Course Title: Membrane Biology
Course Code: BCH 306

L	T	P	Credits	Marks
4	1	0	4	100

Unit A

(15 hours)

Introduction: A historical perspective of different models of membranes, their characteristics with experimental basis of the model (Langmuir trough experiment, freeze fracture technique, X-ray diffraction).

Composition of Biomembranes: Lipids, proteins (Integral, peripheral & lipid anchored) & Carbohydrates. Hydrophathy plots & membrane Topology. Composition variation between membranes (Prokaryotic / Eukaryotic / neuronal, Membranes / Sub cellular compartments).

Unit B

(15 hours)

Model Membrane Systems: Monolayers, Planar bilayer & Liposomes (synthesis and drug targeting tool). Isolation & purification of membrane and membrane proteins, use of detergents, density gradient centrifugation etc., Criteria of membrane purification & enzyme markers.

Membrane Structures: Polymorphic structures of amphiphilic molecules (soaps, detergents, lipids) in aqueous solutions: Micelles & Bilayers. Thermodynamic forces and other factors affecting the formation of different structures. Critical packing parameter.

Unit C

(15 hours)

Asymmetry in Membranes: Lipid and Protein Lateral and Transverse Asymmetry. Macro and micro domains in membranes, Specialized features of plasma membrane: Lipid rafts, Caveolae, Tight Junctions. Membrane Skeleton: Role in maintaining cell structure, and membrane asymmetry. Gates and fences model. RBC membrane as a model.

Membrane Dynamics: Lateral diffusion, Transverse / Flip Flop diffusion & rotational motion of lipids and proteins. Techniques used to study different motion of molecules in membranes: FRAP, FRET. Translational diffusion coefficient. Phase Transition studies of lipid bilayer. Transition temperature. Membrane fluidity. Factors affecting membrane fluidity: Composition, Temperature, salt / water stress, Anesthetics, Age, pH, Nutrition etc. Homeoviscous adaptation. Membrane fusion.

Unit D

(15 hours)

Membrane transport: Study of different transport systems; their structure, thermodynamics (free energy change involved, electrochemical potential, membrane potential, Nernst equation), kinetics regulators, Inhibitors / blockers biochemical function and significance. Simple diffusion, Facilitated diffusion: Passive transport (Glucose transporter, anion transporter); Active transport (P type ATPases, V type ATPases, F type ATPases, Na⁺ / H⁺ symport systems). ABC family of transporters (MDR ATPase family, CFTR). Transport processes driven by light (Bacteriorhodopsin, Halorhodopsin). Group translocation. Specialized membrane Pores: Porins in Gram -ve bacterial membranes (*E. coli* OmpF, OmpC, LamB), Pore forming toxins (colicins, α hemolysin, anthrax toxin protective

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antigen) and Aquaporins. Ion channels : Voltage gated ion channels (Na^+ / K^+ voltage gated ion channel) , Ligand gated ion channels (Acetyl choline / IP_3 / cGMP gated ion channel) , Leaky channels. Role of ion channels in nerve transmission & action potential propagation. Neurotransmitters: Acetyl choline, glutamate, & glycine (Metabolism, & signaling with type of receptors). Ionophores: Carriers and channel forming (valinomycin, gramicidin).

Reference Books

1. Nelson, David L., and Cox, Michael M., *Lehninger Principles of Biochemistry*, 5th Edition. WH Freeman & Company, 2008. Print.
2. Voet, Donald and Voet, Judith G., *Biochemistry*, 3rd Edition. John Wiley & Sons Inc., Singapore, 2004. Print.
3. Lodish, H., Berk, A., Kaiser, C.A., Krieger, M., Bretscher, A., Ploegh, H., Amon, A., and Scott, M.P. *Molecular Cell Biology*, 7th Edition. W.H. Freeman, 2012. Print.

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Course Title: Membrane Biology Laboratory
Course Code: BCH 307

L	T	P	Credits	Marks
0	0	3	2	50

Experiments:

1. RBC ghost cell preparation and separation of proteins by SDS PAGE
2. CMC of detergent and phospholipids.
3. Intestinal mobility of Histidine
4. Effect of detergents and other membrane active substances on Erythrocytes.

L	T	P	Credits	Marks
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Course Title: Microbiology
Course Code: MIC101

4	0	0	4	100
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Course Objective: This course is to learn basic microbiology, microbial growth and control methods of microbes.

Unit-A

Microbiology: definition, history and development of Microbiology. Biogenesis versus abiogenesis. **5 hours**

Composition of microbial world and its applications. Distinguishing features of major groups of microorganisms: bacteria, fungi, algae, protozoa, viruses. **5 hours**

Microscopy and observation of microbes: Light microscopy: bright field microscope, dark field microscope, phase contrast microscope, fluorescence microscope. Electron microscopy: The transmission electron microscope, Scanning electron microscope. **5 hours**

Unit-B

Characteristics of microorganisms: Prokaryotic cell structure and function, size, shape, capsule and slime layer, spore, cell wall, cell membrane, outer membrane, ribosome, motility organelle, fimbriae and nuclear region. **6 hours**

Cultivation of microorganisms: nutrition, cultivation methods and environmental factors affecting microbial growth. **5 hours**

Bacterial growth curve. Maintenance of cells in exponential phase, synchronous growth, continuous culture, fed batch culture and measurement of growth. **4 hours**

Cell division, genes in cell division **3 hours**

Unit-C

Microbial metabolism: Metabolic pathways of carbohydrate metabolism common (Embden Meyerhof pathway, pentose phosphate pathway, Entner- Doudoroff pathway, pyruvate decarboxylation, TCA cycle) **6 hours**

Unique to heterotrophic and phototrophic microorganisms (Ketoacid pathway), Electron transport chain, Calvin cycle, patterns of energy yielding metabolism in microorganisms (respiration and fermentation) **8 hours**

Unit-D

Control of microorganisms: control of microorganisms by physical and chemical agents, patterns of microbial death, factors affecting effectiveness of antimicrobial agents activity. **8 hours**

Antimicrobial chemotherapy: Development of chemotherapy, general characteristics of antimicrobial drugs, and mechanisms of action of antimicrobial agents. Origin of drug resistance and its transmission in microorganisms. **8 hours**

60 hours

Reference books

1. Pelczar, M. J., Chan, E. C. S. and Krieg, N. R. *Microbiology*. 5th edition. New Delhi. Tata McGraw Hill Publishing Company Limited. 1993. Print.
2. Stainer, Roger Y., Ingraham, John L., Wheelis, Mark L. and Painter, Page R. *General microbiology*. 5th edition. Macmillan Press Ltd. 1987. Print.

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3. Tortora, G.J., Funke, B. R. and Case, C. L. *Microbiology-An Introduction*. 7th edition. Carson, USA. Benjamin Cummings, 2001. Print.
4. Madigan, Michael T., Martinko, John M., Paul V. Dunlap and David P. Clark. *Brock Biology of Microorganisms*. 12th edition. Benjamin Cummings. 2008. Print.
5. Prescott, Lansing M. *Microbiology*. 5th edition. McGraw-Hill Higher Education. 2002. Print.

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Course Title: Microbiology Lab

Course Code: MIC102

L	T	P	Credits	Marks
0	0	3	2	50

1. Preparation of media
2. Preparation of buffer
3. Culture transfer and pure culture by streaking method
4. Storage of pure culture – slant culture, glycerol stock
5. Bright Field microscopy
6. Phase contrast microscopy
7. Bacterial motility
8. Negative staining
9. Smear preparation and simple staining
10. Gram staining

45 hours

Course Title: Basic Immunology

Course Code: MIC301

Course Objective: This course is to learn basic immunology and clinical microbiology. Antibodies and pathogenic bacteria are covered by this course.

Unit A

History of immunology, Innate immunity, Adaptive immunity.

Hematopoiesis, Cells of immune system, Organs of immune system

Immunogenicity versus antigenicity, Epitopes, Pattern recognition receptors **10 hours**

Unit B

Antibodies: Structure, Effector functions, Antibody classes and biologic activities,

Generation of antibody diversity, class switching. **10 hours**

The B cell receptor, Monoclonal antibodies

Antigen antibody reaction, Cross reactivity, Precipitation reaction, Agglutination reaction, Radioimmunoassay, Enzyme linked immunosorbent assay, Western blotting, Immunoprecipitation, Immunofluorescens, Flow cytometry, Immunoelectron microscopy.

10 hours

Unit C

Major Histocompatibility complex. Antigen processing and presentation: Role of antigen presenting cells, two processing and presentation pathways.

Cytokines, Cytokines receptor, Cytokine related disease, Therapeutic uses of cytokines.

10 hours

The function of complement, Complement activation, Biological consequences of complement activation, Complement deficiencies

Vaccines, Active and passive immunization, Designing vaccine for active immunization, Whole organism vaccine, Purified macromolecules as vaccine, Recombinant vaccine.

10 hours

Unit D

Hypersensitivity and types of hypersensitivity.

Autoimmunity and tolerance and their mechanism.

10 hours

60 hours

Reference books

1. Kindt, Thomas J., Goldsby, Richard A. and Osborne, Barbara A. *Kuby Immunology*. 6th edition. W.H. Freeman and Co. Publishers. 2007. Print
2. Murphy, Kenneth. Trevers, Paul and Walpart, Mark. *Janeway's Immunobiology*. Garland Science Publishers. 2012. Print.
3. Roitt, Ivan M. and Delves, Peter J. *Roitt's Essential Immunology*. 10th edition. Blackwell Publishing Limited. 2001. Print.
4. Paul, William E., Williams, Lippincott and Wilkins, *Fundamental Immunology*. 6th edition. Wolters Kluwer business. 2008. Print.

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Course Title: Basic Immunology Lab
Course Code: MIC302

L	T	P	Credits	Marks
0	0	3	2	50

1. Blood grouping
2. Differential leukocyte counting.
3. Agglutination reaction
4. Immunoelectrophoresis
5. Enzyme linked immunosorbent assay

45 hours

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Course Title: Animal Diversity I
Course Code: ZOO101

L	T	P	Credits	Marks
4	1	0	4	100

Course Objective: To acquaint students with the general characters and classification of invertebrate phyla and the affinities between different groups. To impart knowledge regarding the morphological, anatomical and physiological make up of a few representative organisms from each phylum.

UNIT-A

15 hours

- Description of animal diversity. Principles of classification-salient features and classification upto orders in non-chordates. Structural organization in different classes of non-chordates.
- Protozoa: locomotion, osmoregulation, nutrition and reproduction in Protozoa. Detailed Study of *Euglena*, *Amoeba*, *Paramecium*, *Plasmodium*

UNIT-B

18 hours

- Origin of Metazoa-metamerism and symmetry.
- Porifera: skeleton and canal system. Detailed study of *Sycon*
- Coelenterata: corals and coral reefs, polymorphism in Hydrozoa. Detailed study of *Obelia*, Sea anemone.
- Platyhelminthes: reproduction, variation in life cycles, parasitic adaptations and evolution of parasitism in Helminthes. Detailed study of *Planaria*, *Fasciola*, *Taenia*
- Nematoda: pseudocoelom, parasitic adaptations. Detailed study of *Ascaris*

UNIT-C

15 hours

- Annelida: coelom, metamerism, excretion. Detailed study of *Nereis*, *Pheretima*, *Hirudinaria*
- Arthropoda: vision, respiration and larval forms. Social life in insects. Detailed study of *Palaemon*, *Periplaneta*

UNIT-D

12 hours

- Mollusca: torsion and detorsion, shell and respiration. Detailed study of *Pila*, *Unio*, *Sepia*
- Echinodermata: water vascular system and larval forms. Detailed study of *Asterias*.

Reference books

1. Kotpal, R.L., Modern Text Book of Zoology Invertebrates, 10th ed., Rastogi Publishers, Meerut, 2012.
2. Kotpal, R.L., Minor phyla, 5th ed., Rastogi Publishers, Meerut, 2006.
3. Dhama, P.S. and Dhama, J.K., Invertebrate Zoology, 5th ed., R. Chand & Co., New Delhi, 2004.
4. Parker, T.J. and Haswell, W.A., Text book of Zoology, Invertebrates, 7th ed., Vol. I

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- (eds. A.J. Marshall & W.D. Williams), CBS Publishers & Distributors., Delhi, 1992.
5. Hyman L.H. The Invertebrates. Vol. I, II, III, IV and V. McGraw Hill Book Company. Inc., New York. London. Toronto, 1959.

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Course Title: Animal Diversity I Lab

Course Code: ZOO102

L	T	P	Credits	Marks
0	0	3	2	50

General survey of invertebrate phyla through slides/specimens/charts/models/e-resources:

- Protozoa: *Amoeba*, *Euglena*, *Paramecium* and *Vorticella*, *Balantidium*, *Nyctotherus*, *Opalina*, Radiolarians and Foraminiferans.
- Porifera: *Sycon*, *Grantia*, *Spongilla*, *Euplectella*, *Hyalonema*, *Chalina*, *Euspongia*, Temporary mounts of gemmules and spicules of *Sycon*.
- Coelenterata: *Hydra*, *Obelia*, *Porpita*, *Veleva*, *Physalia*, *Aurelia*, *Metridium*, *Alcyonium*, *Tubipora*, *Zooanthus*, *Madrepora*, *Favia*, *Fungia*, *Gorgoni*, *Pennatula*, *Sertularia*, *Plumularia*, *Pennaria*, *Bougainvillea*, statocyst of *Aurelia*.
- Platyhelminthes: *Planaria*, *Fasciola* (W.M. & T.S.), larval stages of *Fasciola*, *Taenia* (scolex, proglottids-mature and gravid), *Ascaris* (male and female).
- Annelida: *Pheretima*, T.S. of typhlosolar region, setae, pharyngeal nephridia, septal nephridium and integumentary nephridium of *Pheretima*, *Eutyphoeus*, *Lumbricus*, *Nereis*, parapodium of *Nereis*, *Heteronereis*, *Polynoe*, *Aphrodite*, *Amphitrite*, *Chaetopterus*, *Anodonta*, *Mytilus*, *Pholas*, *Pecten*, *Haliotis*, *Aplysia*, *Doris*, *Limax*, *Pila*, *Sepia*, *Octopus*, *Nautilus*, *Chiton* and *Anodonta*. *Arenicola*, *Hirudinaria*, *Pontobdella*.
- Arthropoda: *Peripatus*, *Lepisma*, cockroach, trachea and mouth parts of cockroach, grasshopper, praying mantis, earwig, dragonfly, termite (queen and other castes), ant, butterfly, moth, beetle, wasp, honeybee, crab, prawn, *Lepas*, *Balanus*, *Apus*, *Limulus*, scorpion, spider, millipede and centipede, *Cypris*, *Cyclops*, *Daphnia*, Prawn, Gill and statocyst of Prawn.
- Mollusca: *Anodonta*, *Mytilus*, *Pholas*, *Pecten*, *Haliotis*, *Aplysia*, *Doris*, *Limax*, *Pila*, Glochidium larva and radula of *Pila*, *Sepia*, *Octopus*, *Nautilus*, *Chiton* and *Anodonta*.

Demonstration of anatomy of the following animals through charts/e-resources/dissection of animal

- Earthworm: digestive, reproductive and nervous systems
- Cockroach: digestive, nervous and reproductive systems, mouth parts of cockroach
- Prawn: digestive and nervous systems. Appendages and gills of prawn.
- *Anodonta*: digestive and nervous systems,
- *Pila*: digestive and nervous systems, radula of *Pila*
- Asterias: Aristotle's lantern, tube feet.

Note: Practicals related to Animal Diversity I Lab are in accordance with UGC guidelines and have been approved by Dissection Monitoring Committee.

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Course Title: Animal Diversity II
Course Code: ZOO103

L	T	P	Credits	Marks
4	1	0	4	100

Course Objective: To acquaint students with the general characters and classification of chordates and the affinities between different groups. To impart knowledge regarding the morphological, anatomical and physiological make up of a few representative organisms from each phylum.

UNIT-A **15 hours**

- Origin and general characters of chordates with detailed classification of each animal group with special emphasis on salient features and interrelationships
- Hemichordata: Hemichordates as link between non-chordates and chordates with detailed study of *Balanoglossus*
- Urochordata: development, affinities, retrogressive metamorphosis. Detailed study of *Herdmania*.
- Cephalochordata: development, affinities. Detailed study of *Branchiostoma*.

UNIT-B **15 hours**

- Cyclostomata: migration. Detailed study of *Petromyzon*
- Pisces: scales, fins, migration, parental care. Detailed study of *Scoliodon*, and *Labeo*

UNIT-C **12 hours**

- Amphibia: Respiration, Parental care. Detailed study of *Rana*
- Reptilia: Terrestrial adaptations, parental care. Detailed study of *Uromastix*

UNIT-D **18 hours**

- Aves: Respiration, Flight, Endothermy. Detailed study of *Columba*
- Mammals: Integument, Dentition. Detailed study of *Oryctogalus*

Reference books

1. Dhama, P.S., Dhama, J.K., Chordate Zoology, 5th ed., R. Chand & Co., New Delhi, 2006.
2. Kotpal, R.L., Text Book of Zoology- Vertebrates, Rastogi Publications, Meerut, 2012.
3. Parker, T.J., and Haswell, W.A., A Text Book of Zoology Vertebrates, 7th ed. Vol. II (eds. A.J. Marshall & Williams, W.D.), Mac Millan, London, 1972.
4. Dodson, E.O., A Text Book of Zoology, CBS Publishers & Distributors, Delhi, 1976.

Course Title: Animal Diversity II Lab
 Course Code: ZOO104

L	T	P	Credits	Marks
0	0	3	2	50

General survey of chordates through slides/specimens/charts/models/e-resources:

- Hemichordata: *Balanoglossus*
- Protochordata - *Herdmania*, pharynx and spicules of *Herdmania*, *Molgula*, *Ciona*, *Ascidia*, *Botryllus*, *Pyrosoma*, *Salpa*, *Doliolum*, *Oikopleura* and *Branchiostoma*, T.S. *Branchiostoma* through different regions
- Cyclostomata – *Myxine*, *Petromyzon* and *Ammocoetes* larva. Chondrichthyes - *Zygaena*, *Pristi.*, *Narcine*, *Trygon* and *Rhinobatos*.
- Actinopterygii – *Polypterus*, *Acipenser*, *Lepidosiren*, *Mystus*, *Catla*, *Labeo rohita*, *Cirrhinus mrigala*, *Cyprinus carpio*, *Hippocampus*, *Syngnathus*, *Exocoetus*, *Anabas*, *Diodon*, *Ostracion*, *Tetradon*, *Echeneis*, *Lophius*, *Solea* and *Anguilla*, cycloid and ctenoid scales of fishes.
- Dipneusti (Dipnoi) – Any of the lungfishes.
- Amphibia – *Necturus*, *Proteus*, *Amphiuma*, *Salamandra*, *Ambystoma*, *Triton*, *Hyla*, *Rhacophorus* *chthyophis* and *Axolotl* larva.
- Reptilia- Tortoise, Turtle, *Hemidactylus*, *Calotes*, *Draco*, *Varanus*, *Phrynosoma*, *Chamaeleon*, *Typhlops*, *Python*, *Ptyas*, *Bungarus*, *Naja*, *Hydrus*, *Vipera*, *Crocodylus*, *Gavialis* and Alligator.
- Aves : *Anas*, *Ardea*, *Milvus*, *Pavo*, *Tyto*, *Alcedo*, *Eudynamis*, *Casuaris*; and *Struthio*.
- Mammalia – *Echidna*, *Ornithorhynchus*, *Macropus*, *Erinaceus*, *Sorex*, *Loris*, *Macaca*, *Manis*, *Hystrix*, *Funambulus*, *Felis*, *Capra*, *Canis*, *Herpestes*, *Pteropus* and *Leo*.

Demonstration of anatomy of the following animals through charts/e-resources/dissection of animal

- *Herdmania*: General Anatomy, pharynx and spicules
Labeo: Digestive and reproductive systems, skeleton
Rana: Digestive, arterial, venous and reproductive systems. Skeleton
Varanus: Digestive, arterial, venous and reproductive systems. Skeleton
 Hen: Digestive, arterial, venous and reproductive systems. Skeleton
 Rat: Digestive, arterial, venous, urinogenital systems, skeleton

Note: Practicals related to Animal Diversity II Lab are in accordance with UGC guidelines and have been approved by Dissection Monitoring Committee.

DAV UNIVERSITY JALANDHAR

Course Title: Basic Communication Skills

Course Code: ENG151

No. Of Lectures: 60

L	T	P	Credits	Marks
4	0	0	3	75

Course Objective:

- To enhance students' vocabulary and comprehensive skills through prescribed texts.
- To hone students' writing skills.

Learning Outcomes: Students will be able to improve their writing skills as well as will enrich their word power.

NOTE:

- The question paper for end-semester examination will have a weightage of 25%. It will consist of 100 objective questions of equal marks. All questions will be compulsory.
- Two preannounced tests will be conducted having a weightage of 25% each. Each preannounced test will consist of 20 objective type, 5 short questions/problems on the UGC-NET (objective type) pattern as well as one long answer type question. Students are expected to provide reasoning/solution/working for the answer. They will attempt all questions. Choice will be given only in long answer type. The question paper is expected to contain problems to the extent of 40% of total marks.
- Four objective/MCQ type surprise tests will be taken. Two best out of four objective/MCQ type surprise tests will be considered towards final, each of 12.5% weightage to the final. Each surprise test will include 20-25 questions.
- The books indicated as text-book(s) are suggestive However, any other book may be followed.

Unit – A Applied Grammar (Socio-Cultural Context)		
• Parts of Speech: Noun, Pronoun, Adjective, Verb, Adverb, Preposition, Conjunction, Interjection		5 hours
• Tenses (Rules and Usages in Socio-cultural contexts)		6 hour
• Modals: Can, Could, May, Might, Will, Would, Shall, Should, Must, Ought to		5hours
• Passives		5 hours
• Reported/Reporting Speech		5 hour
Unit – B Reading (Communicative Approach to be Followed)		
• J M Synge: Riders to the Sea (One Act Play)		7 hours
• Anton Chekhov : Joy (Short Story)		5 hours
• Swami Vivekanand : The Secret of Work (Prose)		7 hours
Unit – C Writing		

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• Paragraph and Essay Writing	5Hours
• Letter Writing: Formal and Informal	5 hours
• Notice and Email	5hours

References:

a. Books

1. Kumar, Sanjay and PushpLata. *Communication Skills*. India: OUP, 2012. Print.
2. Vandana, R. Singh. *The Written Word* by. New Delhi: Oxford University Press, 2008. Print.

b. Websites

1. www.youtube.com (to download videos for panel discussions). Web.
2. www.letterwritingguide.com. Web.
3. www.teach-nology.com. Web.
4. www.englishforeveryone.org. Web.
5. www.dailywritingtips.com. Web.
6. www.englishsheets.com. Web.
7. www.mindtools.com. Web.

DAV UNIVERSITY JALANDHAR

Course Title: Basic Communication Skills Lab

Course Code: ENG152

No. Of Lectures: 30

L	T	P	Credits	Marks
0	0	2	1	25

Course Objective:

- To improve fluency in speaking English.
- To promote interactive skills through Group Discussions and role plays.

Learning Outcome: Students will get exposure to speaking through the above mentioned interactive exercises. In addition, they will develop a technical understanding of language learning software, which will further improve their communicative skills.

Unit – A Speaking/Listening	
• Movie-Clippings	10 hours
• Role Plays	10 hours
• Group Discussions	10 hours

Instructions:

1. Each student will prepare a scrap file on any of the topics given by class teacher. Student should be able to justify the contents of his/her Scrap file, which carries the weightage of 10 marks. Marks will be given for originality, creativity and presentation of thoughts.
2. In the end of semester, viva exam will be conducted. Viva will be for 10 marks. Spoken English will be the focus of exam. Examiner will ask questions related to scrap file and other general (non-technical) topics.
3. In the End-term exam, lab activity will carry the weightage of 10 marks.
4. Acknowledge all the sources of information in your scrap file.

References:

Books

1. Gangal, J. K. *A Practical Course In Spoken English*. India: Phi Private Limited, 2012. Print.
2. Kumar, Sanjay and Pushp Lata. *Communication Skills*. India: OUP, 2012. Print.

Websites

1. www.youtube.com (to download videos for panel discussions). Web.
2. www.englishforeveryone.org. Web.
3. www.talkenglish.com. Web.
4. www.mindtools.com. Web.

DAV UNIVERSITY JALANDHAR

Course Title: ENGLISH

Course Code: ENG180

Total Lectures: 60

L	T	P	Credits	Marks
4	0	0	4	100

Course Objective: To familiarize students of non-literary programmes with some of the basics of literary studies through a critical study of the prescribed texts

Learning Outcomes:

Unit – A <i>Never Never Nest</i> by Cedric Mount		
• Consumerist Lifestyle		3 hours
• Bank Loans and Modern Times		3 hours
• Character Analysis		5 hours
• Stylistic Analysis		4 hours
Unit – B <i>Guide</i> by R. K. Narayana		
• Interpersonal Relationships		4 hours
• Religious Beliefs/Rituals in Rural India		4 hours
• Character Analysis		4 hours
• Stylistic Analysis		3 hour
Unit – C <i>Twelfth Night</i> by Shakespeare		
• Salient Features of Shakespearean Comedy		5 hours
• Character Analysis		5 hours
• Stylistic and Thematic Analysis		5 hours
Unit – D <i>Animal Farm</i> by George Orwell		
• Marxist Principles		5 hours
• As a Progressive Text		5 hours
• Symbolic Analysis		5 hours

Suggested Reading:

1. Falvey, Peter Peter Kennedy. *Learning Language Through Literature: A Sourcebook for Teachers of English in Hong Kong*. HKU: Hong Kong University Press, 1997. Print.
2. www.britishcouncil.com. Web.
3. Kumar, Sukrita Paul. *Language, Literature And Creativity*. New Delhi: Orient Blackswan Pvt Ltd, 2010. Print.
4. Swann, Joan , Robert Pope and Ronald Carter. *Creativity in Language and Literature: The State of the Art*. USA : Palgrave MacMillan, 2011. Print.

DAV UNIVERSITY JALANDHAR

Course Title: Human Values and Ethics
Course Code: SGS101

L	T	P	Credits	Marks
2	0	0	2	50

Course Objectives

- To sensitize students about the role and importance of human values and ethics in personal, social and professional life.
- To encourage students to read and realize the values of enlightened human beings.
- To enable students to understand and appreciate ethical concerns relevant to modern lives.

Learning Outcomes:

Students becoming responsible citizens and better professionals who practise Values and Ethics in every sphere of life.

Unit - A

Human Values

1. **Concept of Human Values:** Meaning, Types and Importance of Values. **2 hours**
2. **Human Values:** Lessons from the lives and teachings of great thinkers. **3 hours**
3. **Value Education :** The content of value education **2 hour**
4. **Value crisis and its redressal.** **1 hour**
- 5.

Unit - B

Being Good and Responsible

1. Self Exploration and Self Evaluation **2 hour**
2. Acquiring Core Values for Self Development **2 hour**
3. Living in Harmony with Self, Family, Society and Nature **3 hours**
4. Values enshrined in the Constitution: Liberty, Equality Fraternity and Fundamental Duties. **3 hours**

Unit - C

Value – based living

1. Vedic values of life **2 hour**
2. Karma Yoga and Jnana Yoga **2 hours**
3. Ashta Marga and Tri-Ratna **2 hours**
4. Truth, Contentment and Wisdom **2 hours**

Unit - D

Ethical Living

1. Personal Ethics **2 hours**
2. Professional Ethics **3 hours**
3. Ethics in Governance **2 hours**
4. Ethics in Education **2 hours**

Total = 35 hours

Suggested Readings:

1. Sreedharan,E. and Wakhlu,Bharat. Ed. *Restoring Values*. New Delhi: Sage Publications Ltd., 2010.
2. Nagarajan, K. *Indian Ethos and Values*.New Delhi: Tata McGraw Hill, 2011
3. Tripathi, A N. *Human Values*. New Delhi: New Age International Publishers, 2009

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4. Sankar. *Indian Ethos and Values in Management*. New Delhi: Tata McGraw Hill Education Pvt. Ltd.
5. Osula. *Values and Ethics*. New Delhi: Asian Books, 2001.
6. Surbিরামান, R. *Professional Ethics*. New Delhi: Oxford University Press, 2013.
7. Anand, Rishabh. *Human Values and Professional Ethics*, New Delhi: Satya Prakashan, 2012
8. Bhalla, Sanjeev. *Human Values and Professional Ethics*. New Delhi: Satya Prakashan, 2012.
9. Soryan, Ritu. *Human Values and Professional Ethics*. New Delhi: Dhanpat Rai & Co. Pvt. Ltd., 2010.
10. Jayshree, Suresh, and B S, Raghavan. *Human Values and Professional Ethics*. New Delhi: S Chand & Co. Ltd., 2007.
11. Shukla, Dr. R K, Misra, Anuranjan. *Human Values and Professional Ethics*, A B Publication, 2010.
12. Sharma, Vayu. *Human Values and Professional Ethics*. New Delhi: Education of India Language publishers, 2012.
13. Kannan, S, and Srilakshmi, K. *Human Values and Professional Ethics*. New Delhi: Taxmann Publication, Pvt. Ltd., 2009
14. Srivastava, Smriti. *Human Values and Professional Ethics*. New Delhi: S K Kataria & Sons, 2001
15. Singh, Yogendra, and Garg, Ankur. *Human Values and Professional Ethics*. New Delhi: Aitbs publishers, 2011.
16. Kumar, Vrinder. *Human Values and Professional Ethics*. Ludhiana: Kalyani Publishers, 2013.
17. Gaur, R R, Sangal, R. Bagaria, GP. *Human Values and Professional Ethics*. New Delhi: Excel Books, 2010.
18. Osula, Dr. Bramwell and Upadhyay, Dr. Saroj. *Values and Ethics*, New Delhi : Asian Books Pvt. Ltd., 2011.
19. *Complete works of Swami Vivekanand*, Calcutta: Advaita Ashram, 1931.
20. Radhakrishnan, S. *Indian Philosophy*, George Allen & Unwin Ltd., New York: Humanities Press INC, 1929.
21. Dwivedi, A N. *Essentials of Hinduism, Jainism and Buddhism*, New Delhi: Books Today– 1979
22. Saraswati, Maharishi Dayanand. *Light of Truth: Satyarth Parkash*. New Delhi: Arya Swadhyay Kendra, 1975.
23. Bhan, Suraj. *Dayanand : His life and work*. New Delhi : DAVCMC, 2001.
24. Raghavan, V, and Iyer, N. *Moral and Political Thoughts of Mahatma Gandhi*. New Delhi : Oxford University Press India, 2000.
25. Singh, Narain. *Guru Nanak Dev's view of life*. Amritsar: Bhagat Puran Singh All India Pingalwara Society, 2010.
26. Dwivedi, Kapil Dev. *Esence of Vedas*. Hoshiarpur : Katyayan Vedic Sahitya Prakashan, 1990.
27. Chaubey, B B. *Vedic Concepts*. Hoshiarpur : Katyayan Vedic Sahitya Prakashan, 1990.
28. Radhakrishnan, Saravapalli. *Mahatma Gandhi : Essays and Reflections on his life*. Mumbai: Zaico Publication, 1977.
29. Hardayal, Lala. *Hints for Self Culture*, Mumbai: Jaico Publishing House, 1961.
30. Saraswati Dayanand, *The Light of Truth (The Satyarth Prakashan)*. New Delhi:
31. Krishnamurti J. *The First and Last Freedom*
32. Maharishi, Sri Raman. *Who Am I*.
33. Balsekar, Ramesh S. *Peace and Harmony in Daily Living*. New Delhi: Yogi Impressions.

DAV UNIVERSITY JALANDHAR

Course Title: General Knowledge and Current Affairs

Course Code: SGS102

Course Objectives

L	T	P	Credits	Marks
2	0	0	2	50

The study of General Knowledge and Current Affairs has become even more important today. It is not only a major constituent of most competitive examinations but also aids in acquiring general awareness.

The objectives of this course are:

- To introduce students with the course and contents of various competitive examinations
- To prepare a foundation for appearing in various competitive examinations
- To sensitize the students about the current issues and events of national and international importance
- To provide opportunity to the students to study inter disciplinary subjects like Geography, Science, Economy, Polity, History, International Relations etc.

Learning Outcomes:

- Students would get an opportunity to aspire, plan and prepare for various competitive examinations in advance.
- It would polish their personalities and sharpen the skills of debates, group discussions, communication, interview etc.
- Students would acquire general awareness of National and International Events.

Unit — A

General Geography

World Geography:

The Universe, The Solar System, The Earth, Atmosphere, The World

2 hours

we live in, Countries rich in Minerals, Wonders of the World, Biggest and Smallest.

Indian Geography:

Location, Area and Dimensions, Physical Presence,

2 hour

Indian States and Union Territories,

Important sites and Monuments, Largest-Longest and Highest in India.

General History

3 hours

Glimpses of India History, Ancient Indian, Medieval India, Modern India,

Various Phases of Indian National Movement, Prominent Personalities.

Glimpses of World History

Important Events of World History, Revolutions and Wars of Independence,

2hours

Political Philosophies like Nazism, Fascism,

Communism, Capitalism, Liberalism etc.

Unit — B

General Polity

World Politics – Major Actors and their political relations,

3 hours

UNO and other organizations viz: WTO, EU, SAARC,

ASEAN, BRICS, WTO, OIC, OAU, OPEC, GCC etc.

Indian Polity: Constitution of India:

3 hours

Important Provisions, Basic Structure, Union Government, Union Legislature

and Executive, State Government: State Legislature and Executive,

Indian Judiciary, The Election Commission, Panchayati Raj System, RTI etc.

General Economy:

3 hours

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The process of liberalization, privatization, globalization and Major World Issues. Indian Economy, Indian Financial System, Major Economic Issues, Economic Terminology.

Unit — C

General Science: **3 hours**

General appreciation and understandings of science including the matters of everyday observation and experience. Inventions and Discoveries.

Sports and Recreation : **3 hours**

The World of Sports and recreation. Who's Who is sports, Major Events, Awards and Honours. Famous personalities, Festivals. Arts and Artists.

Current Affairs : **3 hours**

National and International Issues and Events in News. Governments Schemes and Policy Decisions.

India and Neighbours: **2 hours**

Current phase relations with China, Pakistan, Bangladesh, Nepal, Sri Lanka and Afghanistan

Unit — D

Miscellaneous Information

Who is who **2 hours**

Books and Authors, Persons in News, Awards and Honours, Abbreviations and Sports

Reference Books:

1. Aggarwal, R. S. *Advance Objective General Knowledge*, S. Chand Publisher (2013)
2. Sen, S. *Concise General Knowledge Manual 2013*, Unique Publishers, 2013
3. Verma, R P. *Encyclopedia of General Knowledge and General Awareness*, Penguin Books Ltd (2010)
4. Thorpe, Edgar. And Thorpe, Showick. *General Knowledge Manual 2013-14*, the Pearson, Delhi.
5. Mohanty, Mukhtikanta. *General Knowledge Manual 2013-14*, Macmillan Publishers India Ltd., Delhi.
6. India 2013, *Government of India (Ministry of Information Broadcasting)*, Publication Division, 2013.
7. Methew, Mammen. *Manorama Year Book 2013-14*, Malayalam Manorama Publishers, Kottayam, 2013.
8. *Spectrum's Handbook of General Studies – 2013-14*, Spectrum Books (P) Ltd., New Delhi
9. *Unique Quintessence of General Studies – 2013-14*, Unique Publishers, New Delhi.

Current Affairs

Magazines

Economic and Political Weekly, Yojna, the Week, India Today, Frontline, Spectrum. Competition Success Review, Competition Master, Civil Services Chronicle, Current Affairs, World Atlas Book

Newspapers the Hindu, Times of India, the Hindustan Times, the Tribune

DAV UNIVERSITY JALANDHAR

Course Title: Stenography

Course Code: SGS104

L	T	P	Credits	Marks
2	0	0	0	0

Course Objective: The course is to inculcate writing and listening skills among the students. This would act as building blocks for the learner to begin the study of stenography. As the learners are from the senior secondary background the course has been created keeping in mind their requirements for the future.

Learning Outcome:

After going through this course the participant would have understood the basic concepts of shorthand language and would be able to apply them in daily life. Completion of the course will improve their speed of writing and typing. They would be able to pronounce the English words correctly and can use effective English communication.

<p>Unit A I. The Consonants II. The Vowels III. Intervening Vowels and Position Grammalogues, Punctuation IV. Alternative Signs for r and h V. Diphthongs Abbreviated w. VI. Phaseography Tick the VII. Circle s and z—Left and Right Motion VIII. Stroke s and z IX. Large Circles sw and ss or sz X. Loops st and str.</p>	12 hours
<p>Unit B XI. Initial Hooks to Straight Strokes and Curves XII. Alternative Forms for fr, vr, etc. Intervening Vowels XIII. Circle or Loop Preceding Initial Hook XIV. n and f Hooks XV. Circles and Loops to Final Hooks. XVI The shun hook. XVII. The Aspirate. XVIII. Upward and Downward r. XIX. Upward and downward l and sh. XX. Compound consonants XXI. Vowel indication.</p>	12 hours
<p>Unit C XXII. The halving principle (section 1). XXIII. The halving principle (section 2). XXIV. The Doubling principle. XXV. Diphonic or two vowel signs. XXVI. Medial semicircle. XXVII. Prefixes negative words. XXVIII. Suffixes and terminations. XXIX. Contractions. XXX. Figures, etc .proper names.</p>	11 hours
<p>Unit D XXXI. Note taking, transcription, etc. XXXII. Essentials vowels. XXXIII. Special contractions. XXXIV. Advanced pharseography. XXXV. Intersections. XXXVI. Business phrases. XXXVIII. Banking and stockbroking phrases. XXXIX. Insurance and shipping phrases. XL. Technical and railway phrases. XLI. Legal phrases. XLIII. Special list of words. XLIV. Shorthand in practice.</p>	10 hours
Total	45 hours

Text Book:

1. Pitman. *Pitman Shorthand Instructor and Key*, New Delhi: Pearson publisher. 2001.

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Course Title: Stenography Lab

Course Code: SGS105

L	T	P	Credits	Marks
0	0	1	0	0

Course Objective: The course is to inculcate writing and listening skills among the students. This would act as building blocks for the learner to begin the study of stenography. As the learners are from the senior secondary background the course has been created keeping in mind their requirements for the future.

Learning Outcome:

After going through this course the participant would have understood the basic concepts of typing and would be able to apply them in daily life. Completion of the course will improve their speed of typing and typing skills.

Unit A Beginner : Basics-fjdk, sla;, ghty,vmbn,ruei,woqp,cx. .	04 hours
Unit B Shift keys, numeric pad, Digits and symbols	03 hours
Unit C Intermediate- Syllables and words.	04 hours
Unit D Expert- Paragraphs and Stories	04 hours
Total	15 hours

Course Title: Environment Education
Course Code: EVS102

L	T	P	Credits	Marks
2	0	0	2	50

Course Objective: This course aims at understanding the students in aspects of environmental problems, its potential impacts on global ecosystem and its inhabitants, solutions for these problems as well as environmental ethics which they should adopt to attain sustainable development.

Unit 1

The multidisciplinary nature of environmental studies (2 Hours)
 Definition, scope and importance, Need for public awareness

Natural Resources: Renewable and non-renewable resources: (8 Hours)
 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.

Ecosystem: (4 Hours)

- 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, ocean estuaries)

Unit II

Biodiversity and its conservation (4 Hours)

- Introduction – Definition: Genetic, Species and Ecosystem Diversity

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- Bio-geographical classification of India
- Value of biodiversity: Consumptive use, Productive use, Social, Ethical, Aesthetic and Option values
- Biodiversity at global, national and local levels
- India as a mega-diversity nation
- Hot-spots of biodiversity
- Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts
- Endangered and endemic species of India
- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity, global and national efforts.
- Genetically modified crops
- Cartagena Protocol
- Biodiversity Act

Environmental Pollution

(8Hours)

- Definition, 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 pollution
- 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

Indoor Pollution:

2 Hours

- Practical tips on how to save the self from self-inflicted pollution.
- Basics of toxicity.
- Problems of lifestyle based diseases.
- Solutions needed for safety.

Unit III

Social Issues and the Environment

7 Hours

- Population growth, variation among nations, Population explosion – Family Welfare Programmes.
- Environment and human health,
- From unsustainable to sustainable development
- Urban problems and 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

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- Consumerism and waste products
- Environmental Laws: The Environment Protection Act, 1986; The Air (Prevention and Control of Pollution) Act, 1981; The Water (Prevention and control of Pollution) Act 1974; The Wildlife Protection Act, 1972; Forest Conservation Act, 1980.
- Issues involved in enforcement of environmental legislation
- Public Awareness

Unit IV

Human Population and Environment 5 Hours

- Population Growth and Variations among Nations
- Population Explosion
- Human Rights
- Value Education
- HIV / AIDS
- Women and Child Welfare
- Role of Information Technology in Environment and Human Health
- Case Studies

Global environmental issues

5 Hours

- Stockholm Conference
- Brundtland Commission
- Montreal Protocol
- Kyoto protocol
- Earth Summit
- World Summit

Field Work

5 Hours

- 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 (Field work equal to 5 lecture hours)

References:

1. Odum, EP. *Basic Ecology*. Japan : Halt Saundurs, 1983.
2. Botkin, DB, and Kodler EA. *Environmental Studies: The Earth as a living planet*. New York: John Wiley and Sons Inc., 2000.
3. Singh, JS, Singh, SP, and Gupta SR. *Ecology, Environment and Resource Conservation*. New Delhi: Anamaya Publishers, 2006.
4. De, AK. *Environmental Chemistry*. New Delhi: Wiley Eastern Ltd., 1990.
5. Sharma, PD. *Ecology and Environment*. Meerut Rastogi Publications, 2004.

DAV UNIVERSITY JALANDHAR

Course Title: Road Safety and Legal Awareness
Course Code: EVS103

L	T	P	Credits	Marks
2	0	0	2	50

Course Objective: This course aims to aware the students about safety measures taken during driving and commuting on roads.

Unit I

Road Safety

15 Hours

- Road safety: Concept and its importance.
- Attitude of people towards road safety
- Role of traffic police in road safety
- Traffic rules
- Traffic signs
- How to obtain driving license
- Traffic offences, penalties and procedures
- Common driving mistakes
- Significance of first-aid in road safety
- Role of civil society in road safety and Traffic police-public relationship
- Motor Vehicle Act 1998 (2010)

Unit II

Legal Awareness

10 Hours

- Legal literacy
- Child labour
- Domestic Violence
- Right to Education

References:

1. Botkin, D.B., and Kodler E.A.. *Environmental Studies: The Earth as a living planet*. New York: John Wiley and Sons Inc., 2000.
2. Singh, J.S., Singh, SP, and Gupta SR. *Ecology, Environment and Resource Conservation*. New Delhi: Anamaya Publishers, 2006.
3. Sharma, PD. *Ecology and Environment*. Meerut Rastogi Publications, 2004.

Course Title: Organic Chemistry

Course Code: CHE153

Time: 04 Hours

L	T	P	Credits	Marks
4	0	0	4	100

Course Objectives:

This course is intended to learn the basic concepts of Organic Chemistry. The present syllabus has been framed as per the latest UGC guidelines and recent research trends in the subject. The various topics of the syllabus are grouped under different units in order to bring forth the importance of academic and laboratory skills for the undergraduate students.

Expected Prospective:

This course will equip students with the necessary chemical knowledge concerning the fundamentals in the basic areas of Organic chemistry. The students will be able to pursue their career objectives in advance education, in scientific research and in teaching careers following graduation in the course.

PART A

Compounds of Carbon

(8 Hrs)

Differences in chemical and physical behavior as consequences of structure. Discussion (with mechanism) of reactions of hydrocarbons' ranging from saturated acyclic and alicyclic, unsaturated dienes and aromatic systems. Huckel rule; as applied to $4n+2$ systems. Industrial sources and utility of such compounds in daily life for medicine clothing and shelter.

PART B

Stereochemistry

(15 Hrs)

Structure, reactivity and stereochemistry. Configuration and conformation. Optical activity due to chirality; d, l, meso and diastereoisomerism, sequence rules. Reactions involving stereoisomerism. Geometrical isomerism – determination of configuration of geometric isomers. E & Z system of nomenclature. Conformational isomerism – conformational analysis of ethane and n-butane; conformations cyclohexane, axial and equatorial bonds, conformations of monosubstituted cyclohexane derivatives. Newman projection and Sawhorse formula, Fischer and flying wedge formulae.

PART C

Alkyl Halides

(8 Hrs)

Structure of alkyl halides and their physical properties. Preparation from alcohols, hydrocarbons, alkenes and by halide exchange method.

Reactions : (i) Nucleophilic substitution (SN_2 and SN_1) kinetics, mechanism, stereochemistry, steric and electronic factors, reactivity of alkyl halides, rearrangement, dependence on nucleophile, role of solvent (ii) Elimination E_2 and E_1 mechanism, stereochemistry, kinetics, rearrangement.

Alcohols

(4 Hrs)

Structure, physical properties (Hydrogen bonding), Methods of preparation: Grignard synthesis (scope and limitations),

Reactions: Reactions with hydrogen halides. Mechanism and rearrangement, Reaction with Phosphorous trihalides, mechanism of Dehydration rearrangement.

PART D

Ethers

(2 Hrs)

Structure, Physical properties, preparation (Williamson synthesis). Reactions: Cleavage, by acids, Electrophilic substitution in ethers.

Aldehydes and Ketones

(8 Hrs)

Structure, Physical Properties; Methods of Preparation: Oxidation of Primary and secondary alcohols, Oxidation of methylbenzenes, Reduction of acid chlorides, Friedel- Crafts Acylation,

Reactions; Nucleophilic addition, Addition of Grignard reagents, Addition of cyanide. Addition of Bisulphite, Addition of derivatives of ammonia. Acetal Formation, Cannizzaro reaction, Aldol Condensation.

Suggested Books:

1. Morrison R.N. and Boyd, R.N. *Organic Chemistry*, Pearson Education, Dorling Kindersley (India) Pvt. Ltd.
2. Finar, I.L. *Organic Chemistry* (Volume 1), Pearson Education, Dorling Kindersley (India) Pvt. Ltd.
3. Eliel, E.L. and Wilen, S.H. *Stereochemistry of Organic Compounds*, London: Wiley, 1994.
4. March, Jerry. *Advanced Organic Chemistry: Reactions, Mechanism and Structure*, John Wiley, 6th edition, 2007.

Course Title: Organic Chemistry Lab
Course Code: CHE154

L	T	P	Credits	Marks
0	0	3	2	50

Time: 04 Hours

Course Objectives:

This course is intended to learn the basic concepts of Organic Chemistry Laboratory. The present syllabus has been framed as per the latest UGC guidelines and recent research trends in the subject. The various experiments have been designed to enhance laboratory skills of the undergraduate students.

Expected Prospective:

The students will be able to understand the basic objective of experiments in organic chemistry, properly carry out the experiments, and appropriately record and analyze the results through effective writing and oral communication skills. They will know and follow the proper procedures and regulations for safe handling and use of chemicals and solvents.

1. Calibration of Thermometer

80-82° (Naphthalene), 113-114° (acetanilide).
 132.5-133° (Urea), 100° (distilled Water)

2. Determination of melting point

Naphthalene 80-82°, Benzoic acid 121.5-122°
 Urea, 132.5-133°, Succinic acid 184-185°
 Cinnamic acid 132.5-133°, Salicylic acid 157-5-158°
 Acetanilide 113-5-114°, m-Dinitrobenzene 90°
 P-Dichlorobenzene 52°. Aspirin 135°.

3. Determination of boiling points

Ethanol 78°, Cyclohexane 81.4°, Toluene 110.6°, Benzene 80°.

4. Mixed melting point determination

Urea-Cinnamic acid mixture of various compositions (1:4, 1:1, 4:1)

5. Distillation

Simple distillation of ethanol-water mixture using water condenser,
 Distillation of nitrobenzene and aniline using air condenser.

6. Crystallization

Concept of induction of crystallization
 Phthalic acid from hot water (using fluted filter paper and stemless funnel), Acetanilide from boiling water, Naphthalene from ethanol, Benzoic acid from water.

7. Decolorisation and crystallization using charcoal

Decolorisation of brown sugar (sucrose) with animal charcoal using gravity filtration.
 Crystallization and Decolorisation of impure naphthalene (100g of naphthalene mixed with 0.3g of Congo Red using 1g decolorising carbon) from ethanol.

8. Sublimation (Simple and Vacuum)

Camphor, Naphthalene, Phthalic acid and Succinic acid.

9. Extraction: the separatory funnel, drying agent:

Isolation of caffeine from tea leaves

10. Steam distillation

Purification of aniline/nitrobenzene by steam distillation.

Suggested Books:

1. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. and Smith, P.W.G. *Vogel's Text Book of Practical Organic Chemistry*, 5th edition, ELBS, 1989.
2. Pavia, D.L., Lampanana, G.M. and Kriz, G.S. Jr. *Introduction to Organic Laboratory Techniques*, Thomson Brooks/Cole, 3rd edition, 2005.
3. Mann, F.G. and Saunders. P.C. *Practical Organic Chemistry*, London: Green & Co. Ltd., 1978.
4. Svehla, G. *Vogel's Qualitative Inorganic Analysis (revised)*, Orient Longman, 7th edition, 1996.
5. Bassett, J., Denney, R.C., Jeffery, G.H. and Mendham, J. *Vogel's Textbook of Quantitative Inorganic Analysis (revised)*, Orient Longman, 4th edition, 1978.

Course Title: PHYSICAL CHEMISTRY
Course Code: CHE353

L	T	P	Credits	Marks
4	0	0	4	100

Time: 04 Hours

Course Objectives:

This course is intended to learn the basic concepts of Physical Chemistry. The present syllabus has been framed as per the latest UGC guidelines and recent research trends in the subject. The various topics of the syllabus are grouped under different units in order to bring forth the importance of academic and laboratory skills for the undergraduate students.

Expected Prospective:

This course will equip students with the necessary chemical knowledge concerning the fundamentals in the basic areas of physical chemistry. The students will be able to pursue their career objectives in advance education, in scientific research and in teaching careers following graduation in the course.

PART A

Chemical Thermodynamics

(15Hrs)

Objectives and limitations of Chemical Thermodynamics, State functions, thermodynamic equilibrium, work, heat, internal energy, enthalpy.

First Law of Thermodynamics: First law of thermodynamics for open, closed and isolated systems. Reversible isothermal and adiabatic expansion/compression of an ideal gas. Irreversible isothermal and adiabatic expansion, Enthalpy change and its measurement, standard heats of formation and absolute enthalpies. Kirchhoff's equation.

Second and Third Law: Various statements of the second law of thermodynamics. Efficiency of a cyclic process (Carnot's cycle), Entropy, Entropy changes of an ideal gas with changes in P, V, and T, Free energy and work functions, Gibbs-Helmholtz Equation., Criteria of spontaneity in terms of changes in free energy, Third law of thermodynamics, Absolute entropies.

PART B

Chemical Equilibrium

(5 Hrs)

General characteristics of chemical equilibrium, thermodynamic derivation of the law of chemical equilibrium, Van't Hoff reaction isotherm. Relation between K_p , K_c and K_x . Temperature dependence of equilibrium constant-Van't Hoff equation, homogeneous & heterogeneous equilibrium, Le Chetalier's principle.

PART C

Chemical Kinetics

(15 Hrs)

Rates of reactions, rate constant, order and molecularity of reactions. Chemical Kinetics: Differential rate law and integrated rate expressions for zero, first, second and third order reactions. Half-lifetime of a reaction, Methods for determining order of reaction, Effect of temperature on reaction rate and the concept of activation energy, Reaction mechanism, Steady state hypothesis

Catalysis

Homogeneous catalysis, Acid-base catalysis and enzyme catalysis (Michaelis-Menten equation). Heterogeneous catalysis, Unimolecular surface reactions.

PART D

Electro-Chemistry

(5 Hrs.)

Specific conductance, molar conductance and their dependence on electrolyte concentration, Ionic Equilibria and conductance, Essential postulates of the Debye-Huckel theory of strong electrolytes, Mean ionic activity coefficient and ionic strength, Transport number and its relation to ionic conductance and ionic mobility, Conductometry titrations, pH scale, Buffer solutions, salt hydrolysis, Acid-base indicators.

Electrochemical cells

(5Hrs.)

Distinction between electrolytic and electrochemical cells, Standard EMF and electrode potential, Types of electrodes, Reference electrode, Calculation of N_G , N_H , N_S and equilibrium constant from EMF data, Potentiometric determination of pH, Potentiometric titrations.

Suggested Books:

1. Atkins, P.W. *Physical Chemistry*, Oxford University Press, 8th edition, 2006 (Indian Print).
2. Engel, T. and Reid, P. *Physical Chemistry*, Pearson Education, 1st edition, 2006.
3. Castellan, G. W. *Physical Chemistry*, Wiley/Narosa, 3rd edition, 1985 (Indian Print).
4. Barrow, G. M. *Physical Chemistry*, New York: McGraw Hill, 6th edition, 1996.
5. Silbey, R. J., Albert, R. A. and Bawendi, Mounji G. *Physical Chemistry*, 4th edition, New York: John Wiley, 2005.

This syllabus has been designed as per national syllabus suggested by UGC and covers 20% extra syllabus as per requisite of honors degree.

Course Title: Physical Chemistry Lab

Course Code: CHE354

Time: 04 Hours

L	T	P	Credits	Marks
0	0	3	2	50

Course Objectives:

To teach the fundamental concepts of Physical Chemistry and their applications. The syllabus pertaining to B.Sc. (Other branches.) in the subject of Chemistry has been upgraded as per provision of the UGC module and demand of the academic environment. The syllabus contents are duly arranged unit wise and contents are included in such a manner so that due importance is given to requisite intellectual and laboratory skills.

Expected Prospective:

The students will be able to understand the basic objective of experiments in organic chemistry, properly carry out the experiments, and appropriately record and analyze the results through effective writing and oral communication skills. They will know and follow the proper procedures and regulations for safe handling and use of chemicals and solvents.

1. Treatment of experimental data

Recording of experimental data. Significant number, accuracy and precision, error analysis.

2. Liquids and Solutions

(i) To determine relative viscosities of aqueous solutions of glycerol at different concentrations. (ii) Calculate partial molar volume of glycerol at infinite dilution from density measurement.

(ii) To determine viscosity-average molecular weight, number-average molecular weight and mean diameter of polyvinyl alcohol molecule from intrinsic viscosity data.

3. Thermochemistry

(i) To determine heat capacity of a calorimeter and heat of solution of a given solid compound.

(ii) To determine heat of solution of Solid calcium chloride and calculate lattice energy of calcium chloride using Born-Haber cycle.

(iii) To determine heat of hydration of copper sulphate.

4. Distribution Law

(i) To determine distribution (i.e. partition) coefficient of a solute between water and a non-aqueous solvent.

5. Surface Phenomena

To study the adsorption of acetic acid/oxalic acid from aqueous solution on charcoal. Verify Freundlich and Langmuir adsorption isotherms.

6. Colorimetry

(i) To verify Lambert-Beer law.

7. pH-metry

(i) To titrate a strong acid against a strong base pH-metrically.

(ii) To titrate a weak acid against a strong base and determine the ionization constant of the weak acid.

Suggested Books

1. Levitt, B.P. *Findlays Practical Physical Chemistry*, London & New York: Longman Group Ltd., 8th edition, 1978.
2. Khosla, B.D., Garg, V.C. and Gulati, A. *Senior Practical Physical Chemistry*, New Delhi: R. Chand & Co., 11th edition, 2002.
3. Das, R.C. and Behra, B. *Experimental Physical Chemistry*, Tata McGraw Hill Publishing Co. Ltd. 1983.
4. *Vogel's Textbook of Quantitative Chemical Analysis* (revised by Jeffery, Bassett, Mendham and Denney), ELBS, 5th edition, 1989.
5. Svehla, G. *Vogel's Qualitative Inorganic Analysis (revised)*, 6th edition, New Delhi: Orient Longman, 1987.
6. Christian, G.D. *Analytical Chemistry*, Wiley, 6th edition.

Course Title: Basic Computer Applications

Course Code: CSA253

Course Duration: 45 Hours

L	T	P	Credits	Marks
3	0	0	3	75

Course Objective: The students will understand the fundamental concepts of Computer. In addition, they will be proficient in using office automation tools, viz. Word, PowerPoint, Excel, etc.

Unit – A

Introduction to Computer Systems

- Block diagram of a computer: basic functions of each component
- Classification of Digital computers based on size
- Uses of Computers, Operating system basics - Role of operating system
- Networks & data communication
- The uses of a network
- How networks are structured: Network topologies
- Media & hardware, Internet & online resources: How Internet works
- Features of the Internet, Accessing the Internet, Working on the Internet

Unit – B

Word Processing

- Editing and Formatting a Document, Text Formatting, Paragraph Formatting, Headers and Footers
- FIND command & REPLACE command, Checking Spelling and Grammar; On-line Spelling and Grammar correction using Auto correct
- Auto Text, Using Thesaurus, Using Clip Gallery. Inserting Graphics From files
- Working with Tables -Creating Table , Entering Text in the Table
- Changing Format of Text of cells, Changing Column width and Row height, Formatting Table Border
- Using Mail Merge - Mail Merge Procedure, Printing a document

Unit – C

Spreadsheets

- Basic Operations - Arithmetic operators, Comparison operators, Text operator & (ampersand) Reference operator
- Modifying the worksheet layout - Changing Width of Column, Changing Height of Row, Deleting Rows/Columns/Cells, Moving and copying contents of cell, Alignment of text in the cell
- Printing the workbook - Setting up Print Area, Setting up Margins, Defining Header and Footer, Controlling Gridlines
- Working with functions - Date and time function, Statistical function, Financial function, Mathematical and Trigonometric functions, Lookup and Reference Functions, Data Base functions, Text function, Logical functions
- Introduction to CHARTS - Formatting Charts

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- Working with MACRO, Importing and exporting files

Unit – D

Presentations

- Creating a presentation slide, Design Templates and Blank presentations
- Power Point standard toolbar buttons
- Working with the text in a slide, Arranging Text in Different Levels
- Changing Font, Font Size and Bold; Moving the frame and inserting clip art; Different slide layouts; Formatting the Slide Design; Work with the Slide Master; Saving the presentation
- The Auto Content Wizard; Using Existing Slides; Using the different views of a slide
- Adding Transitions and Animation, Running Slide Show

Reference Books:

1. Jain Satish, *MS Office 2010 Training Guide*, Delhi. BPB Publications, 2010.
2. Shelly G. B, Cashman Thomas J. and Vermaat Misty E., *Microsoft Office Word 2007: Complete Concepts and Techniques*. New Delhi. Cengage Learning. 2007
3. Subramanian N. *Introduction to Computers*. Noida, UP, India. Tata McGraw-Hill. 2001.
4. Cyganski D. and Orr J A. *Information Technology Inside and Outside*. New Jersey USA. Pearson Education. 2002.

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Course Title: Basic Computer Applications Laboratory
Course Code: CSA254

L	T	P	Credits	Marks
0	0	2	1	25

- The laboratory will comprise of using commands and tools available in MS Word, PowerPoint, and Excel.
- Assignments based on the applications of above mentioned software packages.

Course Title: Basic Mathematics
Course Code: MTH170

L	T	P	Credits	Marks
2	0	0	2	50

Course Objective: This course is designed to introduce the fundamental concepts of continuity, differentiation and integration of functions of one variable. Its objective is to acquaint students with various applications of these topics relating to extreme value problems, problems of finding areas and distance travelled, moreover to describe connection between integral and differential calculus through Fundamental Theorem of Calculus and This course familiarizes the students with the theory of matrices.

UNIT-A **15 HOURS**
 Review of trigonometric functions, sum and product formulae for trigonometric functions, Trigonometric Equations.
 Complex Numbers and Quadratic Equations Permutations and combinations Binomial Theorem.
 Sequences and series

UNIT-B **14 HOURS**
 Matrices, Operations on Matrices, Determinants, singular and non-singular matrices, Adjoint and Inverse of a matrix.
 Co-ordinate Geometry: Rectangular Coordinate system. Straight lines. Circles and family of Circles. Parabola, Ellipse and Hyperbola-their equations in standard form

UNIT-C **14 HOURS**
 Introduction. Limits. Continuity. Differentiability. Exponential and Logarithmic Differentiation. Derivative of a function in parameter Second order Integral as ant derivative. Integration by substitution, by partial fractions and by parts. Definite integral and its properties. Areas of bounded regions. The definition of integral of a real valued function of real variable as limit of sum motivated by the determination of area. Fundamental theorem of integral calculus.

UNIT-D **13 HOURS**
 Vector valued functions. Limit and continuity of vector functions. Differentiation of vector Functions. Arc length. Line, Surface and Volume integrals. The gradient, divergence and curl. The Del operator. Green's, Gauss' and Stokes' theorems (statements only). Applications to Physical problems

References:

1. Mathematics, *A Text book for Class XI and XII (Parts I & II)*. New Delhi. NCERT 2003.
2. Narayan, Shanti and Mittal P. K., *A Text Book of Matrices*. New Delhi. S. Chand & Co. Ltd. 2002.
3. Thomas, George B. and Finney, Ross L. *Calculus and Analytic Geometry*. 9th Edition. New Delhi. Addison Wesley. 1998.

Course Title: Introductory Biotechnology and Bio analytical Techniques

Course Code: BTY101

L	T	P	Credits	Marks
4	1	0	4	100

Course Objective:

The student will have an introduction to history, scope, importance and interdisciplinary nature of biotechnology and its impact on society. Student will also be exposed to principles, instrumentation & application of various instruments & techniques used in biological field.

Course Contents:

Unit I: Introduction to Biotechnology (7 lectures)

History of Biotechnology, Old and New Biotechnology, Interdisciplinary nature of biotechnology, scope and importance of biotechnology, commercial potential of biotechnology, biotechnology in India.

Unit II: Biotechnology and Healthcare (8 lectures)

Role of biotechnology in prevention, diagnosis and treatment of diseases, detection of genetic diseases, drug designing, drug delivery and targeting, gene therapy, fertility control, DNA fingerprinting and forensic medicine.

Unit III: Fuel Biotechnology (7 lectures)

Renewable and non-renewable energy sources, conventional fuels and their impact on environment, solar energy converters, biofuels, energy crops, biogas, bioethanol, biobutanol, biodiesel, biohydrogen, *in vitro* photosynthetic-hydrogenase system.

Unit IV: Biosafety (6 lectures)

Objectives of biosafety guidelines, risk assessment, physical and biological containment, planned introduction of genetically modified organisms, biosafety during industrial production, biosafety guidelines in India, guidelines and regulations.

Unit V: Instruments, basic principles and usage (8 lectures)

pH meter, absorption and emission spectroscopy, Principle and law of absorption, fluorimetry, colorimetry, spectrophotometry (visible, UV, infra-red), polarography, centrifugation, atomic absorption, NMR, X-ray crystallography.

Unit VI: Chromatography techniques (8 lectures)

Paper chromatography, thin layer chromatography, column chromatography, HPLC, gas chromatography, gel filtration and ion exchange chromatography.

Unit VII: Electrophoresis (8 lectures)

Agarose gel electrophoresis, SDS polyacrylamide gel electrophoresis, immunoelectrophoresis, Isoelectric focussing and 2D gel electrophoresis.

Unit VIII: Radioactive Techniques (8 lectures)

Radioisotope tracer techniques and autoradiography.

Text Books:

1. Wilson, K. and Walker, J. *Practical Biochemistry: Principles and Techniques*. 5th Edition. Cambridge University Press. 2005. Print.

2. Singh, B. D. *Biotechnology Expanding Horizons*. 2nd Edition. Kalyani Publishers. 2008. Print.

Reference Books:

1. Smith, J.E. *Biotechnology*. 5th Edition. Cambridge Press. 2009. Print.
 2. Iserentant, D. M. *Advanced Instrumentation, Data Interpretation, and Control of Biotechnological Processes*. 1st Edition. Springer-verlag Gmbh. 1997. Print.
 3. Hollas, J. M. *Modern Spectroscopy*. 4th Edition. Wiley India Pvt Ltd. 2010. Print.
 4. Gunther, H. *NMR Spectroscopy: Basic Principles, Concepts and Applications in Chemistry*. 2nd Edition. Wiley India Pvt Ltd. 2010. Print.
 5. Ho, P. S., Johnson, C. and van Holde, K. E. *Principles of Physical Biochemistry*. 2nd Edition. Pearson. 2005. Print.
 6. Venn, R. F. *Principles and Practice of Bioanalysis*. 1st Edition. Taylor & Francis. 2000. Print.
 7. Hoppert, M. *Microscopic Techniques in Biotechnology*. 1st Edition. John Wiley & Sons. 2001. Print.
- Stanbury, P.F., Whitaker, A. and Hall, S.J. *Principles of Fermentation Technology*. 2nd Edition. Elsevier India. 2009. Print.

Course Title: Introductory Biotechnology and Bio analytical Techniques Lab

Course Code: Bty102

L	T	P	Credits	Marks
0	0	3	2	50

Experiments

- To understand principle, working and handling of
 - a) Laminar Air Flow
 - b) pH meter
 - c) Autoclave
 - d) BOD Incubator
 - e) Centrifuge
 - f) Agarose and Polyacrylamide gel electrophoresis apparatus
 - g) Micropipettes
 - h) Incubator Shaker
 - i) Water double-distillation unit
- Good Lab Practices:
- Glassware washing & sterilization, Packing and sterile handling, Biosafety issues.
- Preparation of standard buffers and determination of pH of a solution.
- Separation of plant pigments using paper chromatography.
- Estimation of DNA and RNA.

CELL BIOLOGY

Course Code: BTY201

L	T	P	Credits	Marks
4	1	0	4	100

Course Objective: To study in detail about the cell which encompasses the cell structure, structure and functions of organelles, locomotion, life cycle and division. To impart knowledge to students about the basics of stem cells and their applications as well as to introduce them to the world of cellular differentiation and cloning.

Course Contents:

Unit I: Cells and organelles

(18 lectures)

Introduction: Cell as a basic unit of living system, Biochemical composition of cell, the cell theory, ultrastructure of cell.

Cytoskeleton: The Nature of the Cytoskeleton and endomembrane system, intermediate filaments, microtubules, cilia and centrioles, actin filaments, actin-binding proteins.

Cell membranes: Architecture and dynamics (models); Membrane composition, the lipid bilayer/membrane; A summary of membrane functions - simple diffusion, Facilitated transports, Active transport, Endocytosis, Pinocytosis, Phagocytosis, Exocytosis. Introduction to important receptors in cell membrane.

Unit II: Molecule and Protein trafficking

(16 lectures)

The compartmentalization of higher cells, transport of molecules into and out of organelle membranes, the endoplasmic reticulum, transport from the ER through the Golgi Apparatus, transport from the trans Golgi network to lysosomes, transport from the plasma membrane via endosome: Endocytosis, molecular mechanisms of vesicular transport; introduction to transit peptide, signal peptide and translocons.

Unit III: Nucleus and Cell Cycle

(10 lectures)

Genome organization, structure and function of nucleus, nuclear envelope, structure of chromatin, nucleosome and chromosome, cell cycle, mitosis and meiosis.

Unit IV: Eukaryotic cell organelles and functions

(16 lectures)

Structure and functions of the following cell organelles: endoplasmic reticulum, Golgi complex, lysosome, ribosome and mitochondria. Principles & applications of differential centrifugation in the fractionation of cellular organelles and Svedberg unit; endosymbiotic theories.

Recommended Books :

1. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K. and Walter, P. *Molecular Biology of the Cell*. 5th Edition. Garland Science. 2007. Print.
2. Lodish, H.F. *Molecular Cell Biology*. 6th Edition. W.H. Freeman & Company. 2007. Print.
3. Becker, W.M., Kleinsmith, L.J., Hardin, J. and Bertoni, G.P. *The World of the Cell*. 7th Edition. Benjamin Cummings. 2008. Print.
4. Powar, C.B. *Cell Biology*. Himalaya Publishing House. 2007. Print.

CELL BIOLOGY LAB
Course Code: BTY202

L	T	P	Credits	Marks
0	0	3	2	50

- Understanding principle, working and handling of light microscope and microtome.
- Understanding microscope adjustments, light sources, microscopic measurements, calibration and types of microscopes available.
- Observation of microorganisms under phase contrast microscope and dark-field microscope.
- Preparation of different types of stains
- Cytological preparations, Fixation, dehydration and staining
- Squash preparation of meiotic and mitotic cells
- Embedding and sectioning.
- Examination of various stages of mitosis and meiosis

MOLECULAR BIOLOGY

Course Code: BTY205

L	T	P	Credits	Marks
4	1	0	4	100

Course Objective: The aim is to extend understanding of the molecular mechanisms via which genetic information is stored, expressed and transmitted among generations.

Course Contents:

Unit I: Life, Nucleic acids and Genome (13 lectures)

Molecular basis of life, models of DNA structure, RNA structure, brief history of development of double helical model of DNA. C-value paradox, cot curve and its significance, repetitive DNA, satellite DNA.

Unit II: Organization of chromosome and gene (14 lectures)

Chromosome structure in Eukaryotes and Prokaryotes, chromatin, nucleosome, histones and non-histones; fine structure of gene, split genes, overlapping genes, gene clusters, transposons and retrotransposons.

Unit III: Central Dogma of Molecular Biology (20 lectures)

DNA replication: DNA-Protein interaction, DNA-binding motifs, models of DNA replication, enzymology of DNA replication; Process of DNA replication: initiation, elongation and termination. Transcription and mRNA processing: Transcription machinery in Prokaryote and Eukaryotes, initiation, elongation and termination of transcription; capping, polyadenylation and splicing of transcripts, mRNA and its stability. Translation: Genetic code and its nature, tRNA & aminoacyl synthetases, rRNA and ribosomes in Prokaryotes and Eukaryotes; Process of translation: initiation, peptide elongation and peptide termination. Regulation of gene expression.

Unit IV: Gene Mutation and Molecular Evolution (13 lectures)

Somatic vs germinal mutation, Mutant types, Selective Systems, Induction of mutation, Chromosomal mutations, Changes in chromosome structure mutation and cancer. Introduction to DNA based phylogenetic trees and DNA bar coding.

Reference Books:

1. Freshney, R. I. *Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications*. 6th Edition. Wiley-Blackwell, 2010. Print.
2. Atala, A. and Lanza, R. *Methods of Tissue Engineering*. 1st Edition. Academic Press. 2001. Print.
3. Harrison, M.A. and Rae, I.F. *General Techniques of Cell Culture*. 1st Edition. Cambridge University Press. 1997. Print.
4. Masters, J.R.W. *Animal Cell Culture: A Practical Approach*. 3rd Edition. Oxford University Press. 2000. Print.
5. Friefelder, D. *Molecular Biology*. 2nd Edition. Narosa Book Distributors Pvt. Ltd. 2008. Print.
6. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K. and Walter, P. *Molecular Biology of the Cell*. 5th Edition. Garland Science. 2007. Print.

Course Title: Molecular Biology Lab
Course Code: BTY208

L	T	P	Credits	Marks
0	0	3	2	50

Experiments

- Isolation of DNA from animal and plant tissue using classical methods
- Isolation of RNA from animal and plant tissue using classical methods
- Isolation of plasmid DNA from *E. coli* using boiling-prep and alkali lysis method
- Restriction fragment length polymorphism
- Agarose gel electrophoresis
- Polyacrylamide gel electrophoresis
- Elution of nucleic acids from agarose gel
- Primer Designing
- Polymerase Chain Reaction