

DAV UNIVERSITY JALANDHAR

DAVUNIVERSITY JALANDHAR



SCHEME FOR

**Bachelor of Science (Biotechnology Hons.)
(Program ID-3)**

**1st TO 6th SEMESTER
Examinations 2013–2014 Session Onwards**

Syllabi Applicable For Admissions in 2013

DAV UNIVERSITY JALANDHAR

**Scheme of Courses B.Sc.
B.Sc. Biotechnology (Hons.)**

Semester 1

S.No	Paper Code	Course Title	L	T	P	Cr	% Weightage				E
							A	B	C	D	
1	BTY101	Introductory Biotechnology and Bioanalytical Techniques	4	1	0	4	25	25	25	25	100
2	BCH101	Biomolecules	4	1	0	4	25	25	25	25	100
3	BOT101	Plant Diversity-I	4	1	0	4	25	25	25	25	100
4	CHE153	Organic Chemistry	4	0	0	4	25	25	25	25	100
5	SGS101	Human Values and Ethics	2	0	0	2	25	25	25	25	50
6	EVS102	Environment Education	3	0	0	2	25	25	25	25	50
7	BTY102	Introductory Biotechnology and Bioanalytical Techniques- LAB	0	0	3	2	-	-	-	100	50
8	BCH102	Biomolecules - LAB	0	0	3	2	-	-	-	100	50
9	BOT102	Plant Diversity - I LAB	0	0	3	2	-	-	-	100	50
10	CHE154	Organic Chemistry - LAB	0	0	3	2	-	-	-	100	50
			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

DAV UNIVERSITY JALANDHAR

**Scheme of Courses B.Sc.
B.Sc. Biotechnology (Hons.)**

Semester 2

S.No	Paper Code	Course Title	L	T	P	Cr	% Weightage				E
							A	B	C	D	
1	BTY103	Principles of Genetics	4	1	0	4	25	25	25	25	100
2	BOT103	Plant Diversity-II	4	1	0	4	25	25	25	25	100
3	BCH103	Metabolism	4	1	0	4	25	25	25	25	100
4	EVS103	Road Safety and Legal Awareness	2	0	0	2	25	25	25	25	50
5	SGS102	General Knowledge and Current affairs	2	0	0	2	25	25	25	25	50
6	ENG151	Basic Communication skills	4	0	0	3	25	25	25	25	75
7	MTH170	Basic Mathematics	2	0	0	2	25	25	25	25	50
8	SGS104	Stenography*	2	0	0	0	-	-	-	-	-
9	BTY104	Principles of Genetics LAB	0	0	3	2	-	-	-	100	50
10	BOT104	Plant Diversity-II LAB	0	0	3	2	-	-	-	100	50
11	BCH104	Metabolism LAB	0	0	3	2	-	-	-	100	50
12	ENG152	Basic Communication skills LAB	0	0	2	1	-	-	-	100	25
13	SGS105	Stenography Lab*	0	0	1	0	-	-	-	-	-
			24	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

*Non credit courses

DAV UNIVERSITY JALANDHAR

**Scheme of Courses B.Sc.
B.Sc. Biotechnology (Hons.)**

Semester 3

S.No	Paper Code	Course Title	L	T	P	Cr	% Weightage				E
							A	B	C	D	
1	BTY201	Cell Biology	4	1	0	4	25	25	25	25	100
2	MIC101	Microbiology	4	1	0	4	25	25	25	25	100
3	ZOO101	Animal Diversity-I	4	1	0	4	25	25	25	25	100
4	CHE 253	Inorganic Chemistry	4	0	0	4	25	25	25	25	100
5	ENG 180	English	4	0	0	4	25	25	25	25	100
6	MIC102	Microbiology LAB	0	0	3	2	-	-	-	100	50
7	ZOO102	Animal Diversity-I LAB	0	0	3	2	-	-	-	100	50
8	CHE254	Inorganic Chemistry - LAB	0	0	3	2	-	-	-	100	50
9	BTY202	Cell Biology LAB	0	0	3	2	-	-	-	100	50
			20	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

DAV UNIVERSITY JALANDHAR

**Scheme of Courses B.Sc.
B.Sc. Biotechnology (Hons.)**

Semester 4

S.No	Paper Code	Course Title	L	T	P	Cr	% Weightage				E
							A	B	C	D	
1	BTY203	Plant Tissue Culture and Biotechnology	4	0	0	3	25	25	25	25	75
2	ZOO103	Animal Diversity-II	4	1	0	4	25	25	25	25	100
3	BTY204	Genetic Engineering	2	0	0	2	25	25	25	25	50
4	BTY205	Molecular Biology	4	1	0	4	25	25	25	25	100
5	CSA253	Basic Computer Applications	4	0	0	3	25	25	25	25	75
6	BTY206	Plant Tissue Culture and Biotechnology LAB	0	0	3	2	-	-	-	100	50
7	ZOO104	Animal Diversity-II LAB	0	0	3	2	-	-	-	100	50
8	BTY207	Genetic Engineering LAB	0	0	2	1	-	-	-	100	25
9	BTY208	Molecular Biology LAB	0	0	3	2	-	-	-	100	50
10	CSA 254	Basic Computer Applications LAB	0	0	2	1	-	-	-	100	25
			18	2	13	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

DAV UNIVERSITY JALANDHAR

**Course Scheme
B.Sc. Biotechnology (Hons.)**

Semester 5

S.No	Paper Code	Course Title	L	T	P	Cr	% Weightage				E
							A	B	C	D	
1	BTY301	Tools in Biotechnology	3	1	0	3	25	25	25	25	75
2	CHE353	Physical Chemistry	4	0	0	4	25	25	25	25	100
3	BTY302	Basic Virology	2	1	0	2	25	25	25	25	50
4	MIC301	Basic Immunology	4	1	0	4	25	25	25	25	100
5	BOT205	Plant Systematics & Evolution	4	0	0	3	25	25	25	25	75
6	BTY304	Environmental Biotechnology	2	0	0	2	-	-	-	100	50
7	BTY305	Basic Virology LAB	0	0	2	1	-	-	-	100	25
8	BOT206	Plant Systematics & Evolution Lab	0	0	2	1	-	-	-	100	25
9	CHE354	Physical Chemistry LAB	0	0	3	2	-	-	-	100	50
10	MIC302	Basic Immunology LAB	0	0	3	2	-	-	-	100	50
			19	3	10	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

DAV UNIVERSITY JALANDHAR

**Course Scheme
B.Sc. Biotechnology (Hons.)**

Semester 6

S.No	Paper Code	Course Title	L	T	P	Cr	% Weightage				E
							A	B	C	D	
1	BTY307	Microbial and Industrial Biotechnology	4	1	0	4	25	25	25	25	100
2	BTY308	Genomics and Proteomics	2	1	0	2	25	25	25	25	50
3	BTY309	Biostatistics and Bioinformatics	4	1	0	4	25	25	25	25	100
4	BTY303	Animal Biotechnology	4	1	0	4	25	25	25	25	100
5	BTY310	Microbial and Industrial Biotechnology LAB	0	0	3	2	-	-	-	100	50
6	BTY311	Genomics and Proteomics LAB	0	0	2	1	-	-	-	100	25
7	BTY306	Animal Biotechnology LAB	0	0	3	2	-	-	-	100	50
8	BTY312	Biostatistics and Bioinformatics LAB	0	0	3	2	-	-	-	100	50
9	BTY313	Seminar	0	0	0	2	-	-	-	100	50
10	BTY314	Educational Tour	0	0	0	1	-	-	-	100	25
			14	4	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

**INTRODUCTORY BIOTECHNOLOGY AND
BIOANALYTICAL TECHNIQUES**

L	T	P	Credits	Marks
4	1	0	4	100

Course Code: BTY 101

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.

DAV UNIVERSITY JALANDHAR

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.
8. Stanbury, P.F., Whitaker, A. and Hall, S.J. *Principles of Fermentation Technology*. 2nd Edition. Elsevier India. 2009. Print.

INTRODUCTORY BIOTECHNOLOGY AND BIOANALYTICAL TECHNIQUES LAB

L	T	P	Credits	Marks
0	0	3	2	50

Course Code: BTY102

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.

PRINCIPLES OF GENETICS

Course Code: BTY 103

L	T	P	Credits	Marks
4	1	0	4	100

Course Objective:

This course is aimed at understanding the basic concepts of genetics at molecular level to develop analytical and quantitative skills from classical to molecular genetics.

Course Contents:

Unit I: Chromosome Theory of Inheritance (9 lectures)

The chromosome theory of heredity, Sex chromosomes, Sex linkage, the parallel behaviour of autosomal genes and chromosomes.

Unit II: Mendelian Genetics (20 lectures)

Mendelian laws of inheritance, Monohybrid cross and the law of segregation, Dihybrid cross and law of independent assortment, Chromosome theory of inheritance, Multiple allele, lethal allele, Blood group, Rh factor, Gene interactions, Modified dihybrid ratio. Basic eukaryotic chromosome mapping, The discovery of linkage, Recombination linkage symbolism, Linkage of genes on X chromosomes, Linkage maps, Three point testcross, Interference, Calculating recombinant frequencies from selfed dihybrids, examples of linkage maps, The X2 test mitotic segregation in humans.

Unit III: Fine Structure of Genes and Chromosomes (20 lectures)

The concept of promoter, Coding sequence, Terminator, Induction of gene for expression. Structural organisation of chromatids, Centromeres, Telomeres, Chromatin, Nucleosome organisation; Euchromatin and heterochromatin; Special chromosomes (e.g., polytene and lampbrush chromosomes), Banding patterns in human chromosomes. Structural and numerical aberrations involving chromosomes; Hereditary defects - Klinefelter, Turner, Cri-du-Chat and Down syndromes. Mutations - spontaneous and induced, Chemical and physical mutagens.

Unit IV: Extrachromosomal inheritance and Molecular Genetics (11 lectures)

Coiling of shell in snails, Mitochondrial and chloroplast genetic systems, population genetics: Hardy-Weinberg equilibrium, Gene and genotypic frequencies.

Reference Books:

1. Strickberger M.W. *Genetics*. 3rd Edition. Prentice-Hall, India. 2008. Print.
2. Jones, S. *The Language of the Genes*. HarperCollins Publishers. 2012. Print.
3. Ridley, M. *Nature via Nurture: Genes, Experience, & What Makes Us Human*. HarperCollins Publishers. 2004. Print.
4. Aggarwal, V.K. and Verma, V.S. *Genetics*. 9th Edition. S. Chand, India. 2010. Print.
5. Snustad, D.P. and Simmons, M.J. *Principles of Genetics*. 6th Edition. John Wiley & Sons. 2011. Print.
6. Pierce, B.A. *Genetics: A Conceptual Approach*. 4th Edition. W.H. Freeman & Company 2010. Print.

PRINCIPLES OF GENETICS LAB

Course Code: BTY104

L	T	P	Credits	Marks
0	0	3	2	50

Experiments

- To make squash preparations of pre-treated metaphase chromosomes, and PMCs to view diplotene, diakinesis, metaphase I and anaphase I in *Phlox drummondii*, *Allium cepa* and (or) *Rhoeo discolor*
- Preparation of karyograms from the given photographs for karyotypic formula
- To study through photographs normal and deviant cytogenetic mechanisms
- Study of Mendel's laws, and deviations from Mendelian ratios using seed samples in the ratios of 9:7, 9:4:3, 13:3, 15:1, 12:3:1. Use Chi-Square Test for Testing the ratios
- Isolation of chloroplasts by sucrose gradient. Photographs of Restriction site variation of chloroplast DNA
- Exercises wrt determination of correct sequence and distance between the linked genes
- Induction and recovery of mutants in bacteria by UV irradiation
- Segregation demonstration in preserved material (Maize)
- Detection of Blood groups (A B O & Rh factors)
- Inheritance of other human characteristics, ability to test PTC, Thiourea
- Paternity disputes (blood groups)

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.

Reference 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

**PLANT TISSUE CULTURE
AND BIOTECHNOLOGY**

L	T	P	Credits	Marks
4	0	0	3	75

Course Code: BTY203

Course Objective: The aim is to teach set of in vitro techniques, methods and strategies related to plant biotechnology. Students will learn how to create genetic variability for the improvement of crops, to improve the state of health of planted material and to increase the number of desirable germplasms for conservation and breeding experiments.

Course Contents:

Unit-I (6 lectures)

Conventional Plant Breeding. Introduction to cell and tissue culture, tissue culture as a technique to produce novel plants and hybrids. Tissue culture media (composition and preparation) Cellular totipotency and differentiation.

Unit-II (8 lectures)

Initiation and maintenance of callus and suspension culture; single cell clones. Organogenesis; somatic embryogenesis; transfer and establishment of whole plants in soil. Shoot-tip culture; rapid clonal propagation and production of virus-free plants. Embryo culture, embryo rescue and synthetic seeds.

Unit-III (8 lectures)

Protoplast isolation, culture and fusion; selection of hybrid cells and regeneration of hybrid plants; symmetric and asymmetric hybrids, cybrids. Anther, pollen and ovary culture for production of haploid plants and homozygous lines. Somaclonal variations and triploid production.

Unit-IV (8 lectures)

Bioreactors and terminator seed technology. Apprehensions and challenges. Cryopreservation, slow growth and DNA banking for germ plasm conservation. Arid and semi-arid plant biotechnology.

Unit-V (8 lectures)

Transgene plants with beneficial traits (biotic stresses, Virus resistance, Abiotic stresses) and Diagnostics in Agriculture and Molecular breeding (ELISA, DNA probe, Screening of linked markers), Bioethics in plant genetic engineering. Role of plant tissue culture and biotechnology in agriculture, medicine and human welfare, prospects of genetic engineering of plants.

Unit-VI (7 lectures)

Biotechnology in biocontrol (Baculoviruses, Microbial toxins), Nitrogen fixing bacteria (Nitrogen cycle, fixation, leghaemoglobin, nitrogenase system and hydrogenase system), Introduction: RFLP, RAPD and DNA fingerprinting.

Reference Books:

1. Chawla, H.S. *Introduction to Plant Biotechnology*. 3rd Edition. Oxford & IBH Publishing Co. Pvt. Ltd. 2008. Print.
2. Bhojwani, S.S. and Razdan, M.K. *Plant Tissue Culture: Theory and Practice*. 5th Edition. Elsevier Science. 2005. Print.

DAV UNIVERSITY JALANDHAR

3. Gupta, P.K. *An Introduction to Biotechnology*. Rastogi Publications, India. 1990. Print.
4. Applied and Fundamental Aspects of Plant Cell, Tissue and Organ Culture, (1977) Reinert, J. and Bajaj, Y.P.S. Springer Verlag, Berlin.
5. Razdan, M.K. *Introduction to Plant Tissue Culture*. 2nd Edition. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi. 2006. Print.
6. Singh, B.D. *Plant Breeding: Principles and Methods*. Kalyani Publishers, New Delhi. 2013. Print.

**PLANT TISSUE CULTURE
AND BIOTECHNOLOGY LAB**

L	T	P	Credits	Marks
0	0	3	2	50

Course Code: BTY206

- Sources of contamination and decontamination measures.
- How to clean glass/plastic ware
- Operational use of an autoclave.
- Functions and operations of a Laminar Air Flow Hood
- Preparation of simple growth nutrient (knop's medium), full strength, half strength, solid and liquid.
- Preparation of complex nutrient medium (Murashige & Skoog's medium)
- Laboratory design set up for a PTC laboratory.
- Plugging and sealing of culture vessels.
- To selection, Prune, sterilize and prepare an explant for culture.
- Significance of growth hormones in culture medium.
- To culture different explants for raising callus cultures.
- To demonstrate various steps of Micropropagation.

GENETIC ENGINEERING

L	T	P	Credits	Marks
2	0	0	2	50

Course Code: BTY204

Course Objective: Genetic engineering or genetic modification refers to the process of manipulating the characteristics and functions of the original genes of an organism. The objective of this process is to introduce new physiological and physical features or characteristics. The students will learn how the genes can be cut and pastes from one organism to another and what are its implications.

Course Contents:

Unit-I (6 lectures)

Introduction to genetic engineering. Why gene cloning and DNA analysis is important. Vectors System for *E.coli* : plasmids, 1 phage biology and its vectors, M13 phage and its vectors, cosmids, phagemid and expression vectors

Unit-II (9 lectures)

DNA modifying enzymes (RE, polymerase, kinases, ligase, alkaline phosphatase, exonuclease etc.) Isolation and purification of DNA from bacteria, plants, animals and soil. Transformation of *E.coli*, bacillus, yeast, plant and animal cells.

Unit-III (9 lectures)

Nucleic acid blotting and hybridization, reporter assay Rnase protection assay.

Gene cloning: Preparation of genomic library, mRNA enrichment, cDNA library, directional cloning, subtraction library, linkers and adaptors.

Gene identification: Nucleic acid hybridization, immuno screening, functional complementation.

Unit-IV (6 lectures)

Gene expression: Strategies for maximization of gene expression

Processing of recombinant proteins: Purification using affinity tags like His, GST, MBP and IMPACT etc. refolding and stabilization of proteins. Safety measures and regulations for recombinant work.

Reference Books:

1. Caudy, A.A., Watson, J.D., Myers, R.M. and Witkowski, J.A. *Recombinant DNA: Genes and Genomes*. 3rd Edition. W.H. Freeman & Company. 2006. Print.
2. Primrose, S.B. and Twyman, R.M. *Principles of Gene Manipulation & Genomics*. 7th Edition. Oxford University Press. 2006. Print.
3. Lodge, J., Lund, P. and Minchin, S. *Gene Cloning: Principles and Applications*. 1st Edition. Taylor & Francis. 2006. Print.
5. Brown, T.A. *Gene cloning and DNA analysis: An introduction*. 5th Edition. Wiley-Blackwell. 2010. Print.
6. Sambrook, J., Fritsch, E.F. and Maniatis, T. *Molecular cloning: A Laboratory Manual*. Vol. I-III. 2nd Edition. Cold Spring Harbor Laboratory, 1989. Print.

GENETIC ENGINEERING LAB

L	T	P	Credits	Marks
0	0	2	1	25

Course Code: BTY207

Experiments

- Preparation of competent cells of *E. coli*
- Preparation of culture media for *E. coli*
- Preparation of vector for cloning by restriction digestion and dephosphorylation.
- DNA cloning using plasmid vectors and *E. coli* expression vectors.
- *E. coli* transformation and selection of recombinant clones
- Restriction mapping using plasmids
- Southern and Northern blotting
- Sample preparation for DNA sequencing

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.

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

TOOLS IN BIOTECHNOLOGY

Course Code: BTY301

L	T	P	Credits	Marks
3	1	0	3	75

Course Objective:

To understand the principles and instrumentations to investigate the biological properties and functions of the biomolecules/macromolecules. Student will also get acquainted with various tools used in modern day biotechnological processes.

Course Contents:

Unit-I (13 lectures)

Light Microscopy: Definition, magnification, resolution, Numerical Aperture. Principle, working, sample preparation and applications of light, phase contrast, polarization, dark-field microscopes. **Electron Microscopy:** Principle, working, sample preparation and applications of scanning and transmission electron microscopy.

Principle, working, sample preparation and applications of fluorescence & confocal microscopy, cytophotometry and flow cytometry.

Unit-II (8 lectures)

Protein Purification: Development of an Assay, Selection of a Source from which Macromolecule may be isolated, Method of solubilization, Stabilization, Isolation and Concentration, criteria of purity. Theory and applications of lyophilization.

Unit-III (14 lectures)

Molecular techniques: Nucleic acid isolation and quantification, various types of ELISA, Nucleic acid hybridization, various types of Polymerase chain reaction, Quantitative PCR, NMR, X-ray crystallography, MALDI-TOF, Mass spectrometry, DNA sequencing. Principle and applications of Microarray

Unit-IV (10 lectures)

Radioisotopy: Principles and applications of tracer techniques in biology; Radiation dosimetry; Radioactive isotopes and half-life of isotopes; Effect of radiation on biological system; Autoradiography; Cerenkov radiation; Liquid scintillation spectrometry.

Reference Books:

1. Divan, A. and Royds, J. *Tools and Techniques in Biomolecular Science*. Oxford University Press. 2013. Print.
2. Sheehan, D. *Physical Biochemistry: Principles and Applications*. 2nd Edition. John Wiley & Sons Ltd. 2009. Print.
3. BIOTOL Board. *Techniques used in Bioproduct analysis*. BIOTOL Series (I-IV). 1st Edition. Butterworth-Heinemann, U.K. 1992. Print.
4. Wang, W.K. *Membrane Separation in Biotechnology*. 2nd Edition. CRC Press. 2001. Print.
5. Juan, H. and Sengo, A.A. *Separation, Recovery, and Purification in Biotechnology: Recent Advances and Mathematical Modeling*. American Chemical Society, Washington. 1986. Print.

BASIC VIROLOGY

Course Code: BTY302

L	T	P	Credits	Marks
2	1	0	2	50

Course Objective: To give an introduction to the basics in virology. General information on morphology, architecture, transmission of plant and animal viruses and viruses infecting microbes and insects.

Course Contents:

Unit-I (5 lectures)

Introduction & History of Virology, Origin & Evolution of Viruses, Taxonomy.

Unit-II (6 lectures)

Morphology, Architecture and methods for its study, Host range, Transmission, Movement, Symptomatology, Serology, methods for assay, detection and diagnosis, Virus purification.

Unit-III (8 lectures)

Biochemistry of Viruses & Viral Pathogenesis, Organization & Expression of Viral genomes. Replication of RNA and DNA Viruses.

Unit-IV (5 lectures)

Management and control of viruses including development of virus disease resistant transgenics.

Unit-V (6 lectures)

Defective Particles, Multiparticles, Viroids, Virusoids, Prions, Mycoviruses, Bacteriophage, Cynophage, Virophage, Baculoviruses.

Reference Books:

1. Hull, R. *Matthews Plant Virology*. 4th Edition. Academic Press. 2001. Print.
2. Knipe, D.M. and Howley, P.M. *Fields Virology*. 5th Edition. Lippincott Williams & Wilkins. 2006. Print.
3. Cann, A.J. *Principles of Molecular Virology*. 5th Edition. Academic Press. 2011. Print.
4. Carter, J. and Saunders, V. *Virology: Principles and Applications*. 2nd Edition. John Wiley & Sons Ltd. 2013. Print.

BASIC VIROLOGY LAB

Course Code: BTY305

L	T	P	Credits	Marks
0	0	2	1	25

Experiments

- Virus diagnosis using ELISA
- Virus diagnosis using PCR
- Virus diagnosis using slot-blot hybridization
- Study of symptoms of virus diseases through visit to local diseases fields and/or photographs
- Collection and Processing of Viral Samples
- Effect of virus infection on chloroplast number and cell size
- Transmission of plant viruses
- Collection and Identification of local insect vectors
- Determination of disease progress curve

ENVIRONMENTAL BIOTECHNOLOGY

L	T	P	Credits	Marks
2	0	0	2	50

Course Code: BTY304

Course Objective: To understand the importance and types of environmental pollution, detection of mutagens. Biotechnological approaches to tackle environmental pollution

Course Contents: (8 lectures)

Unit-I Introduction: Historical importance. Environment pollution and its types. Impact of pollution on health

Unit-II (8 lectures)

Introduction to toxicology including genetic toxicology, common assays to detect genetic toxicology, mutagenesis, carcinogenesis. Use of genetic engineering techniques in genetic toxicology. Waste water treatment. Volatile toxic gases and biofiltration

Unit-III (6 lectures)

Methanogenesis, Composting, Biodegradation of organic compounds, Bioremediation.

Unit-IV (8 lectures)

Biosorption of heavy metals, Biomining and bioleaching. Plastic menace, biodegradable plastics. Biosafety levels

Reference Books:

1. Bruce, R. and McCarty, P. *Environmental Biotechnology: Principles and Applications*. 1st Edition. McGraw-Hill Science. 2000. Print.
2. Scragg, A. *Environmental Biotechnology*. 2nd Edition. Oxford University Press. 2005. Print.
3. Shaw, I.C. and Chadwick, J. *Principles of Environmental Toxicology*. 1st Edition. CRC Press. 1998. Print.
4. Jördening, H.J. and Winter, J. *Environmental Biotechnology: Concepts and Applications*. 1st Edition. Wiley-Blackwell. 2005. Print.
5. Evans, G. and Furlong, J. *Environmental Biotechnology: Theory and Applications*. 2nd Edition. Wiley Publishers. 2010. Print.
6. Thakur, I.S. *Environmental Biotechnology: Basic Concepts and Applications*. 2nd Edition. I K International Publishing House. 2011. Print.

MICROBIAL AND INDUSTRIAL BIOTECHNOLOGY

L	T	P	Credits	Marks
4	1	0	4	100

Course Code: BTY307

Course Objective: The objective of this course is to use microorganism to produce various compounds of commercial interest. The student will be exposed to various techniques available for large scale cultivation of microorganisms.

Course Contents:

Unit-I (12 lectures)

Microbial evolution, systematics and taxonomy - new approaches to bacterial taxonomy, classification including ribotyping, ribosomal RNA sequencing, and characteristics of primary domains, taxonomy, nomenclature and Bergey's manual.

Unit-II (8 lectures)

Microbes in extreme environments: Archae as the earliest forms, thermophiles, psychrophiles, halophiles, alkalophiles, acidophiles, hyperthermophiles.

Unit-III (10 lectures)

Introduction to industrially important microbes and microbial fermentative products (Production of antibiotics with special reference to penicillin & streptomycin, enzymes, biotransformation of steroids), food products from microbes (Dairy & SCP etc)

Unit-IV (6 lectures)

Introduction to fermentation, the fermentation industry, Production process batch and Continuous system of cultivation, Solid-state fermentation

Unit-V (12 lectures)

Selection of industrial microorganisms, media for fermentation, aeration, pH, temperature and other requirements during fermentation, downstream processing and product recovery, food industry waste as fermentation substrate.

Unit VI (12 lectures)

Production of compounds like antibiotics, enzymes, organic acids, solvents, beverages, SCP. Production of fermented dairy products. Immobilized enzymes systems, production and applications.

Reference Books:

1. Glazer, A. and Nikaido, H. *Microbial Biotechnology: Fundamentals of Applied Microbiology*. 2nd Edition. Cambridge University Press. 2007. Print.
2. Soetaert, W. and Vandamme, E.J. *Industrial Biotechnology: Sustainable Growth and Economic Success*. 1st Edition. Wiley-VCH. 2010. Print.
3. Pelczar, M.J. *Microbiology*. 6th Edition. McGraw-Hill Companies. 1993. Print.
4. Atlas, R.M. *Principles of Microbiology*. 2nd Edition. William C Brown Pub. 1996. Print.
5. Okafor, N. *Modern Industrial Microbiology and Biotechnology*. 1st Edition. CRC Press. 2007. Print.

**MICROBIAL AND INDUSTRIAL
TECHNOLOGY LAB**

L	T	P	Credits	Marks
0	0	3	2	50

Course Code: BTY310

Experiments

- Autoclaving
- Microbial cells counting by serial dilution techniques.
- Microbial cell counting by pore plate techniques.
- Measurement of bacterial size
- Screening of cellulase producing microorganism from wood degrading soil.
- Antibiotic sensitivity of the above microorganism
- Minimum inhibitory concentration of a antibiotics for the above microorganism.
- Additive and synergistic effect of two drugs on the above microorganisms.
- Plating the milk samples for microbial contamination.
- MBRT Test for determination of milk quality.

GENOMICS AND PROTEOMICS

Course Code: BTY308

L	T	P	Credits	Marks
2	1	0	2	50

Course Objective:

The course helps in developing a detailed understanding of eukaryotic genome complexity and organization. The students will be familiarised with the techniques in Genomics and Proteomics.

Course Contents:

Unit - I (5 lectures)

The origin of genomes. Acquisition of new Genes. The origins of introns. Basic principles of protein structure.

Unit - II (5 lectures)

Restriction mapping, DNA & RNA fingerprinting, DNA sequencing-chemical and enzymatic methods, The Human Genome.

Unit - III (6 lectures)

Phylogeny, SAGE, ESTs, AFLP & RFLP analysis. 2D – gel electrophoresis and mass spectroscopy for proteome analysis.

Unit - IV(8 lectures)

Modeling of three-dimensional structure of a protein from amino acid sequence. Modeling mutants. Designing proteins. Analysis of nucleic acid / protein sequence and structure data, genome and proteome data using web-based tools.

Unit - V: (6 lectures)

Protein – protein interactions: Yeast- two hybrid method, GFP Tags, Proteome- wide interaction maps.

Reference Books:

1. Brown, T.A. *Genomes III*. 3rd Edition. Garland Science. 2006. Print.
2. Lengauer, T., Mannhold, R., Kubinyi, H. and Timmerman, H. *Bioinformatics: From Genomes to Drugs*. 1st Edition. John Wiley and Sons Ltd. 2001. Print.
3. Mount, D. *Bioinformatics: Sequence and Genome Analysis*. 2nd Edition. Cold Spring Harbor Laboratory Press. 2013. Print.
4. Schena, M. *DNA Microarrays: A Practical Approach*. 1st Edition. Oxford University Press. 1999. Print.
5. Gibson, G. and Muse, S.V. *A Primer of Genome Science*. 3rd Edition. Sinauer Associates, Inc. 2009. Print.
6. Caudy, A.A., Watson, J.D., Myers, R.M. and Witkowski, J.A. *Recombinant DNA: Genes and Genomes*. 3rd Edition. W.H. Freeman & Company. 2006. Print.
7. Xiong, J. *Essential Bioinformatics*. 1st Edition. Cambridge University Press. 2006. Print.
8. Twyman, R. *Principles of Proteomics*. 2nd Edition. Garland Science. 2013. Print.

GENOMICS AND PROTEOMICS LAB

L	T	P	Credits	Marks
0	0	2	1	25

Course Code: BTY311

Experiments

- Electrophoretic separation of plasmid DNA.
- Restriction, digestion & ligation of DNA.
- Gene finding tools and genome annotation- Gen Scan, Net Gene, Hmm gene.
- Comparison of two given genomes- Mummer.
- Homology modeling of 3-D structure from amino acid sequence: SWISS-MODELLER
- Graphics tools: SWISS- PDB Viewer.

BIOSTATISTICS AND BIOINFORMATICS

L	T	P	Credits	Marks
4	1	0	4	100

Course Code: BTY309

Course Objective: To learn applications of statistics and basic understanding of computer and bioinformatics tools and skills in the field of biology. To learn to design experiments and analysis of results by tests of significance or analysis of variance.

Course Contents:

Unit-I (15 lectures)

Statistical population, sample from population, random sample. Tabular and graphical presentation, mean and standard deviation of grouped and ungrouped data, probability, relative frequency, probability, distribution, binomial, poisson and normal distributions. Tests of deviations, F and Z residuals, precision, measure of precision, probable error of function, rejection of observations. Methods of averages and least squares. Correlations and linear regression, associated test of significance. Analysis of variance for one and two way clarification.

Unit-II (8 lectures)

Design of experiments, randomization, replication, local control, completely randomized and randomized block design. Determinant evaluations of 3x determinants, matrices manipulations, simultaneous and inversion. Interpolation and polynomial filling. Introduction of curve smoothening, derivative curves, numerical integration, fourier transformation.

Unit – III (10 lectures)

Biological Databases: Sequence databases (EMBL, GenBank, DDBJ, -UNIPROT, PIR, TrEMBL), Protein family/domain databases (PROSITE, PRINTS, Pfam, BLOCK, etc), Cluster databases-An Introduction, Specialised databases (KEGG, etc), Database technologies (Flat-file), Structural databases (PDB)

Unit - IV (14 lectures)

Phylogenetic Analysis: Trees-splits and metrics on trees, tree interpretation, Distance – additive, ultrameric and nonadditive distances, tree building methods, phylogenetic analysis, parsimony, tree evaluation, maximum likelihood trees – continuous time markov chains, estimating the rate of change, likelihood and trees; analysis software. Annotation, comparison of different methods; ESTs – databases, clustering, gene discovery and identification, and functional classification.

Unit – V (13 lectures)

Genome analysis: Annotation, comparison of different methods; ESTs – databases, clustering, gene discovery and identification, and functional classification. Reconstruction of metabolic pathways; Genome analysis, genome anatomy, genome rearrangements with inversions, signed inversions, gene identification, gene expression, expression analysis, gene identification and functional classification.

Reference Books:

1. Banerjee, P.K. *Introduction to Biostatistics*. 4th Edition. S. Chand & Co. Ltd. Print.
2. Sokal, R.R. and Rohlf, F.J. *Introduction to Biostatistics*. 2nd Edition. Dover Publications. 2009. Print.

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3. Pevzner, P. and Shamir, R. *Bioinformatics for Biologists*. Cambridge University Press. 2011. Print.
4. Lesk, A. *Introduction to Bioinformatics*. 3rd Edition. Oxford University Press. 2008. Print.
5. Bourne, P.E. and Weissig, H. *Structural Bioinformatics*. 2nd Edition. John Wiley & Sons Ltd. 2009. Print.

BIostatistics and Bioinformatics Lab

Course Code: BTY312

L	T	P	Credits	Marks
0	0	3	2	50

Experiments

- Presentation of data by frequency tables, diagrams and graphs
- Calculation of measures of central tendencies
- Calculation of measures of dispersion
- Probability
- Calculation of measures of skewness and kurtosis
- Basics of sequence analysis Retrieving a sequence-nucleic acid/Protein
- Local and Global alignment- concepts Pair wise sequence alignment
- Multiple sequence alignment
- Dynamic programming – Smith Watermann algorithm Needleman Wunsch algorithm
- Motif and pattern searching
- Phylogentic prediction and analysis
- Structure prediction
- Finding transcription regulatory signals

ANIMAL BIOTECHNOLOGY

Course Code: BTY303

L	T	P	Credits	Marks
4	1	0	4	100

Course Objective: The aim of the course is to provide equal importance to areas like *in vitro* fertilization, animal cell and tissue culture, hormone vaccine and important enzyme production through animal biotechnology.

Course Contents:

Unit-I (10 lectures)

Principles and objectives of animal biotechnology; physical and chemical procedures; aseptic techniques; types of chemical agents and their applications/limitations.

Unit-II (20 lectures)

Mammalian cell culture systems; Solid versus liquid culture; continuous versus batch culture; bioreactors (e.g. stirred tank, airlift, hollow fibre); scaling up; Establishment and maintenance of mammalian cell cultures Tissue culture; cells as factories/products; cell lines (nomenclature, establishment, maintenance, lifespan, fusion, genetic manipulation, storage); Selection and separation of mammalian cells; Cloning techniques (dilution, micromanipulation, media,etc); separation techniques (e.g. size/sedimentation; FACS; immunological methods).

Unit-III (15 lectures)

Microbial cell culture: Isolation and identification; selective media; indicator and index organisms; detection of food-borne pathogenic bacteria; virus culture (coliphages); Quantitative microbiology: Bacteriological counting procedures; numerical standards; standard/viable counts; bioassays; assaying survival (e.g. heat and/or UV); D and/or Z values.

Unit-IV (15 lectures)

Economic importance of insects. Lac culture, Sericulture, Apiculture and Prawn culture (send to animal biotechnology); Sterilization and disinfection Requirements for culture Media (types/applications in mammalian and microbial cell culture); other growth conditions (e.g. pH, atmosphere, temperature, osmolality).

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. Masters, J.R.W. *Animal Cell Culture: A Practical Approach*. 3rd Edition. Oxford University Press. 2000. Print.
3. Verma, A. and Singh, A. *Animal Biotechnology: Models in Discovery and Translation*. 1st Edition. Academic Press. 2013. Print.
4. Twine, R. *Animals as Biotechnology: Ethics, Sustainability and Critical Animal Studies*. 1st Edition. Routledge Publishers. 2010. Print.

ANIMAL BIOTECHNOLOGY LAB

Course Code: BTY306

L	T	P	Credits	Marks
0	0	3	2	50

Experiments

- Sterilization techniques: Theory and Practical: Glass ware sterilization, Media sterilization, Laboratory sterilization
- Sources of contamination and decontamination measures.
- Preparation of Hanks Balanced salt solution
- Preparation of Minimal Essential Growth medium
- Isolation of lymphocytes for culturing
- Isolation of rat macrophages from peritoneum for culturing
- Primary Lymphoid culture
- DNA isolation from animal tissue
- Quantification of isolated DNA
- Resolving DNA on Agarose Gel.

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L	T	P	Credits	Marks
0	0	0	2	50

SEMINAR

Course Code: BTY313

Seminar Objective: In students will come to know about the general understanding of the most common problems, recent advances in biotechnology research. Each student shall be allotted a topic by the instructor. Student will have to understand the topic, collect literature and prepare the presentation. Through this the students will develop habit of reading newer topics, will become inquisitive and develop confidence of presentation and discussion before audience.

The students shall submit a project report on the allotted topic, which shall be evaluated by the concerned internal faculty. He/She then would present a seminar on the concerned topic. The students will be encouraged to explore all available literature as well as the internet to prepare the seminar report and present the same using informative slides made using Power Point or projectors.

Seminar Contents:

Students will present their work on a selected topic with the following headings:

- Title
- Objectives
- Review of Literature
- Materials and Methods
- Results
- Conclusion/recommendations

Examination Scheme (weightage in %)

Literature study/ Fabrication/ Presentation	50
Written Report	25
Question answer session	25

PLANT DIVERSITY I (PHYCOLOGY, MYCOLOGY AND LICHENOLOGY)

Course Code: BOT101

Course Objective:

To acquaint the students about the morphology, biology and importance of prokaryotes, eukaryotes, algal organisms, fungal organisms and lichens.

Learning Outcome

The course will enable students to know the earlier plants, their vegetative and reproductive structures and their importance.

Instruction for candidates:

- 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 test 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. The student is expected to provide reasoning/solution/working for the answer. The candidates will attempt all question. 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 test will be taken. Two best out of four objective/MCQ type surprise test 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.

L	T	P	Credits	Marks
4	1	0	4	100

UNIT I

Plant Kingdom: Different classifications of kingdoms and criteria; Six and eight kingdom classification; Diversity in habitat, forms, life span and nutrition; Evolution and phylogeny of land plants. (5Lectures)

UNIT II

Algae: General characteristics, classification, ecology and distribution of algae; Morphology; thallus organization, cell structure, pigment system, reserve food, reproduction of Cyanophyta (*Nostoc*), Chlorophyta (*Chara*), Rhodophyta (*Batrachospermum*), Bacillariophyta (*Pinnularia*), Xanthophyta (*Vaucheria*) and Phaeophyta (*Sargassum*); Economic importance of algae. (15 Lectures)

UNIT III

Fungi: General characteristics, classification of fungi, Salient features and brief account of myxomycota (*Physarum*), oomycota (*Albugo*), chytridiomycota, (*Synchytrium*), zygomycota (*Rhizopus*), ascomycota (*Aspergillus*), basidiomycota (*Agaricus*), deuteromycetes (*Alternaria*); Life cycle patterns; Economic importance. (15 Lectures)

UNIT IV

Lichens: Occurrence and general characteristics of lichens; Ecology and distribution; Growth forms in lichens; Nature of association of algal and fungal partners; Reproduction in lichens; Economic importance of lichens. (8 Lectures)

Reference Books:

1. Alexopolous, C.J., Mims, C.W. and Blackwell, M. *Introductory Mycology*. John Wiley and Sons: New York, 1996. Print.

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2. Hale, M.E. *The Biology of Lichens*. Arnold, London, 2001. Print.
3. Kumar, H.D. *Introductory Phycology*. East West Press: New Delhi, 1999. Print.
4. Lee, R.E. *Phycology*. Cambridge University Press: Cambridge, 2008. Print.
5. Pelczar, M.J. *Microbiology*, 5th Edition, Tata McGraw-Hill Co. New Delhi, 2001. Print.

**PLANT DIVERSITY-I (PHYCOLOGY, MYCOLOGY
AND LICHENOLOGY) LAB**

L	T	P	Credits	Marks
0	0	3	2	50

Course Code: BOT102

1. To learn the principles and procedures of fixation and staining.
2. To study of morphology and cell structure of the prokaryotic algae (*Nostoc*), eukaryotic algae unicellular (*Chlamydomonas*), colonial (*Volvox*), Filamentous (*Ulothrix*, *Spirogyra*, *Oedogonium*) through temporary or permanent slides.
3. To study of vegetative and reproductive structures of *Chara*, *Vaucheria*, *Batrachospermum*, *Sargassum* through temporary or permanent slides.
4. To study of the following through temporary or permanent slides:
 - (a) *Asperillus*,
 - (b) *Rhizopus*
 - (c) *Agaricus*
 - (d) *Albugo*
5. To study of growth forms of lichens (crustose, foliose, fruticose) on different substrata.
6. To study of thallus and reproductive structures (isidia, soredia, apothecium) of lichens through permanent slides.

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

PLANT DIVERSITY II (BRYOPHYTES, PTERIDOPHYTES AND GYMNOSPERMS)

L	T	P	Credits	Marks
4	1	0	4	100

Course Code: BOT103

Objective: To make the students learn about morphology, biology and importance of the vascular plants.

Learning Outcome: The students will get to learn the origin of vascular systems, and seed habit from non-vascular plants.

Instruction for candidates:

- 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 test 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. The student is expected to provide reasoning/solution/working for the answer. The candidates will attempt all question. 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 test will be taken. Two best out of four objective/MCQ type surprise test 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 I

Bryophytes: Salient features; Adaptations to land habit; Classification; Characteristic and comparative account of Muscophytina, Hepatophytina and Anthocerophytina; Variation in structure of gametophytes (Isophyllous e.g. *Funaria*; Anisophyllous e.g. *Porella* and thalloid e.g. *Marchantia*); Vegetative and asexual reproduction. **(15 Lectures)**

UNIT II

Pteridophytes: Salient features; Classification; Evolution of stelar system: Telome theory; The earliest known records of Pteridophytes with special reference to *Rhynia*; A general account and evolutionary significance of Psilotopsida (*Psilotum*), Lycopsida (*Selaginella*), Sphenopsida (*Equisetum*) and Pteropsida (*Pteris*). **(15 Lectures)**

Unit III

Gymnosperms: Salient features; Distribution in India; Classification; Morphology and life history (gametophyte, sex organs and embryo) of *Cycas* (Cycadales), *Pinus* (Coniferales), *Ephedra* (Ephedrales); Pteridospermic seeds and evolution of seed habit in gymnosperm. (developmental stages not included). **(15 Lectures)**

UNIT IV

Economic importance of Bryophytes, Pteridophytes and Gymnosperms; Ecological importance of bryophytes (pioneer colonizers, role in water conservation, prevention of soil erosion and management of forest floors, Phytoremediation and pollution monitoring). **(7 Lectures)**

Reference Books:

1. Bhatnagar, S.P. and Moitra, A. *Gymnosperms*. New Age International Limited: New Delhi, 1996. Print.
2. Chopra, R.S. and Kumar, S.S. *Mosses of Western Himalaya and Adjacent Plain*. Chronica Botanica: New Delhi, 1981. Print.

DAV UNIVERSITY JALANDHAR

3. Coulter, J.M. and Chamberlain, C.J. *Morphology of Gymnosperms*. Chicago University Press: Chicago, 1921. Print.
4. Gifford, E.M. and Foster, A.S. *Morphology and Evolution of Vascular Plants*. W.H. Freeman and Company: New York, 1989. Print.
5. Parihar, N.S. *The Biology and Morphology of Pteridophytes*. The Central Book Depot: Allahabad, 1972. Print.
6. Rashid, A. *An Introduction to Pteridophytes*. Vikas Publishing House Pvt. Ltd.: New Delhi, 1992. Print.
7. Richardson, D.H.S. *Biology of Mosses*. Blackwell Scientific Publications: Oxford, 1981. Print.
8. Sporne, K.R. *The Morphology of Pteridophytes-The Structure of Ferns and Allied Plants*. B.I. Publications, Bangalore, 1982. Print.
9. Sporne, K.R. *The Morphology of Gymnosperms*. B.I. Publications, Bombay, 1974. Print.
10. Sundara Rajan, S. *Introduction to Pteridophyta*. Wiley Eastern India: New Delhi, 1995. Print.

**PLANT DIVERSITY II (BRYOPHYTES, PTERIDOPHYTES
AND GYMNOSPERMS)**

L	T	P	Credits	Marks
0	0	3	2	50

Course Code: BOT104

Practicals

1. Morphological studies of *Funaria*, *Porella*, *Marchantia*, *Riccia*, *Anthoceros*.
2. Internal organization of thallus in *Anthoceros*, *Riccia*, *Marchantia*.
3. Structure of sporophytes in *Funaria*, *Marchantia*.
4. Study of morphology, anatomy and reproductive organs of *Selaginella* and *Equisetum*, *Pteris*.
5. Study of morphology, anatomy; and reproductive organs in the available Gymnosperms (*Pinus*, *Cycas*, *Ephedra*, *Zamia* and any other).

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

Plant Systematics & Evolution
Course Code: BOT205

L	T	P	Credits	Marks
4	0	0	3	75

Objective: To make the students familiar of systematics and phylogeny of angiosperms.

Learning Outcome: These studies will gain the knowledge of origin, evolution, classification and nomenclature of plants.

Instruction for candidates:

- 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 test 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. The student is expected to provide reasoning/solution/working for the answer. The candidates will attempt all question. 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 test will be taken. Two best out of four objective/MCQ type surprise test 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 I

Introduction: Aims, components and significance of systematics; Introduction to identification, classification, phylogeny and nomenclature of plants. **(2 Lectures)**

Systematics in Practice: Field inventory; Herbarium preparation and management; Important herbaria and botanical gardens of the world and India; Documentation (Floras, Monographs, Journals, Online Journals, indices). **(4 Lectures)**

Unit II

Taxonomic hierarchy: Concept of Hierarchy, taxa, categories and groups; Concept of species (taxonomic, biological, evolutionary), genus and family. **(2 Lectures)**

Terms and concepts: Homology; analogy; parallelism; convergence; monophyly; polyphyly; clades; phylogenetic tree; cladogram. **(3 Lectures)**

Botanical nomenclature: Principles and rules of nomenclature; ranks and names; type method, author citation, valid publication; rejection of names, principle of priority and its limitation; names of hybrids and cultivars; concept of biocode; International Code for Botanical Nomenclature. **(4 Lectures)**

Unit III

Phylogeny of Angiosperms: Origin and evolution of Angiosperms (with special reference to Bennettitalean, Gnetalean, Caytonialean, herbaceous origin theories); Primitive living angiosperms. **(5 Lectures)**

Introduction to Floral terms. **(3 Lectures)**

UNIT-IV

Salient Features and Economic Importance of Dicot Families: Ranunculaceae; Malvaceae; Brassicaceae; Rutaceae; Fabaceae; Cucurbitaceae; Asteraceae; Asclepiadaceae; Solanaceae; Lamiaceae; Euphorbiaceae. **(11 Lectures)**

Salient Features and Economic Importance of Monocot Families: Orchidaceae; Liliaceae; Cyperaceae; Poaceae. **(4 Lectures)**

Plant Systematics & Evolution
Course Code: BOT206

L	T	P	Credits	Marks
0	0	2	1	25

Practicals

1. Study of floral characters of the following families: Brassicaceae (*Brassica*), Malvaceae (*Hibiscus rosa sinensis*), Ranunculaceae (*Ranunculus*, *Delphinium*), Cucurbitaceae (*Luffa*), Fabaceae (Faboideae-*Lathyrus*; Ceasalpinioideae- *Ceasalpinia*, *Cassia*; Mimosoideae-*Mimosa*, *Acacia*), Asteraceae (*Helianthus*, *Ageratum*), Solanaceae (*Solanum*, *Withania*), Lamiaceae (*Ocimum*, *Salvia*), Euphorbiaceae (*Euphorbia*; *Phyllanthus*), Asclepiadaceae (*Calotropis*; *Asclepias*); Rutaceae (*Citrus*, *Muraya*); Poaceae (*Triticum*, *Hordeum*), Liliaceae (*Asphodelus*, *Asparagus*), Cyperaceae (*Cyperus*); Orchidaceae (Any Orchid).
2. Identification of selected taxa using taxonomic keys.
3. Familiarity with local flora and herbarium techniques.

Reference Books

1. Angiosperm Phylogeny Group. *An update of the Angiosperm Phylogeny Group classification for the orders and families of the flowering plants: APG III*. Botanical Journal of the Linnean Society, 2009. Print.
2. Chopra, G.L. *Angiosperms: Systematic and Life Cycle*. S. Nagin & Company: India, 1977. Print.
3. Crawford, D.J. *Plant Molecular Systematics*. Cambridge University Press: Cambridge, UK, 2003. Print.
4. Cronquist, A. *An Integrated System of Classification of Flowering Plants*. Columbia University Press: New York, 1981. Print.
5. Datta, S.C. *Systematic Botany*. New Age International (P) Ltd. Publishers, 2003. Print.
6. Hollingsworth, P.M., Bateman, R.M. and Gornall, R.J. *Molecular Systematics of Plant Evolution*. Taylor and Francis, London, 1999. Print.
7. Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F. and Donoghue, M.J. *Plant Systematics- A Phylogenetic Approach*. Sinauer Associates Inc, Massachusetts, USA, 2008. Print.

DAV UNIVERSITY JALANDHAR

STENOGRAPHY

Course Code: SGS104

L	T	P	Credits	Marks
2	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.

Unit A

12 hours

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.

Unit B

12 hours

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.

Unit C

11 hours

XXII. The halving principle (section 1). XXIII. The halving principle (section 2). XXIV. The Doubling principle. XXV. Dipthonic or two vowel signs. XXVI. Medial semicircle. XXVII. Prefixes negative words. XXVIII. Suffixes and terminations. XXIX. Contractions. XXX. Figures, etc .proper names.

Unit D

10 hours

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.

Total

45 hours

Text Book:

Pitman, I. *Pitman Shorthand Instructor and Key*. 1st Edition. Pearson. 2003. Print.

STENOGRAPHY LAB

Course Code: SGS105

L	T	P	Credits	Marks
0	0	1	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	04 hours
Beginner :	
Basics-fjdk, sla;, ghty,vmbn,ruei,woqp,cx.	
Unit B	03 hours
Shift keys, numeric pad, Digits and symbols	
Unit C	04 hours
Intermediate- Syllables and words.	
Unit D	04 hours
Expert- Paragraphs and Stories	
Total	15 hours

L	T	P	Credits	Marks
4	0	0	4	100

ORGANIC CHEMISTRY

Course Code: CHE153

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.

Instructions for Candidates:

- 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. The student is expected to provide reasoning/solution/working for the answer. The candidates 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.

PART A

Compounds of Carbon

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. **(8 Hrs)**

PART B

Stereochemistry

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. **(15 Hrs)**

PART C

Alkyl Halides

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,

DAV UNIVERSITY JALANDHAR

dependence on nucleophile, role of solvent (ii) Elimination E2 and E1 mechanism, stereochemistry, kinetics, rearrangement. (8 Hrs)

Alcohols

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. (4 Hrs)

PART D

Ethers

Structure, Physical properties, preparation (Williamson synthesis). Reactions: Cleavage, by acids, Electrophilic substitution in ethers. (2 Hrs)

Aldehydes and Ketones

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. (8 Hrs)

Suggested Books:

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

ORGANIC CHEMISTRY LAB

Course Code: CHE154

L	T	P	Credits	Marks
0	0	3	2	50

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. Print.

DAV UNIVERSITY JALANDHAR

2. Pavia, D.L., Lampanana, G.M. and Kriz, G.S. Jr. *Introduction to Organic Laboratory Techniques*, Thomson Brooks/Cole, 3rd edition, 2005. Print.
3. Mann, F.G. and Saunders. P.C. *Practical Organic Chemistry*, London: Green & Co. Ltd., 1978. Print.
4. Svehla, G. *Vogel's Qualitative Inorganic Analysis (revised)*, Orient Longman, 7th edition, 1996. Print.
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. Print.

DAV UNIVERSITY JALANDHAR

L	T	P	Credits	Marks
4	1	0	4	100

ANIMAL DIVERSITY-I

Course Code: ZOO101

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 (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.

DAV UNIVERSITY JALANDHAR

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*, *Verella*, *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.

DAV UNIVERSITY JALANDHAR

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
<ul style="list-style-type: none">• 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 <i>Balanoglossus</i>• Urochordata: development, affinities, retrogressive metamorphosis. Detailed study of <i>Herdmania</i>.• Cephalochordata: development, affinities. Detailed study of <i>Branchiostoma</i>.	
UNIT-B	15 hours
<ul style="list-style-type: none">• Cyclostomata: migration. Detailed study of <i>Petromyzon</i>• Pisces: scales, fins, migration, parental care. Detailed study of <i>Scoliodon</i>, and <i>Labeo</i>	
UNIT-C	12 hours
<ul style="list-style-type: none">• Amphibia: Respiration, Parental care. Detailed study of <i>Rana</i>• Reptilia: Terrestrial adaptations, parental care. Detailed study of <i>Uromastix</i>	
UNIT-D	18 hours
<ul style="list-style-type: none">• Aves: Respiration, Flight, Endothermy. Detailed study of <i>Columba</i>• Mammals: Integument, Dentition. Detailed study of <i>Oryctogalus</i>	

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.

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* *I chthyophis* and *Axolotl* larva.
- Reptilia- Tortoise, Turtle, *Hemidactylus*, *Calotes*, *Draco*, *Varanus*, *Phrynosoma*, *Chamaeleon*, *Typhlops*, *Python*, *Ptyas*, *Bungarus*, *Naja*, *Hydrus*, *Vipera*, *Crocodilus*, *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	

DAV UNIVERSITY JALANDHAR

• 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.
2. Vandana, R. Singh. *The Written Word* by. New Delhi: Oxford University Press, 2008.

b. Websites

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

BASIC COMMUNICATION SKILLS LAB

L	T	P	Credits	Marks
0	0	2	1	25

Course Code: ENG152

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.
2. Kumar, Sanjay and PushpLata. *Communication Skills*. India: OUP, 2012.

Websites

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

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ENGLISH

Course Code: ENG180

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.
2. www.britishcouncil.com
3. Kumar, Sukrita Paul. *Language, Literature And Creativity*. New Delhi: Orient Blackswan Pvt Ltd, 2010.
4. Swann, Joan, Robert Pope and Ronald Carter. *Creativity in Language and Literature: The State of the Art*. USA: Palgrave MacMillan, 2011.

HUMAN VALUES AND ETHICS

L	T	P	Credits	Marks
2	0	0	2	50

Course Code: SGS101

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 practice 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**

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. Restoring Values (ed.) E. Sreedharan and Bharat Wakhlu, Sage Publications Ltd., New Delhi 2010.
2. Indian Ethos and Values by Nagarajan K, Tata McGraw Hill, 2011
3. Human Values, A N Tripathi, New Age International Publishers, New Delhi, Third Edition, 2009
4. Indian Ethos and Values in Management, 1st Edition by Sankar, Tata McGraw Hill Education Pvt. Ltd.
5. Values and Ethics, Osula, Asian Books, 2001.
6. Professional Ethics, R. Surbiramianian, Oxford University Press, New Delhi, 2013.

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7. Human Values and Professional Ethics, Rishabh Anand, Satya Prakashan, New Delhi, 2012
8. Human Values and Professional Ethics, Sanjeev Bhalla, Satya Prakashan, New Delhi, 2012.
9. Human Values and Professional Ethics, Ritu Soryan Dhanpat Rai & Co. Pvt. Ltd., First Edition, 2010.
10. Human Values and Professional Ethics by Suresh Jayshree, Raghavan B S, S Chand & Co. Ltd., 2007.
11. Human Values and Professional Ethics, Dr. R K Shukla, Anuranjan Misra, A B Publication 2010.
12. Human Values and Professional Ethics, Sharma, Vayu Education of India Language publishers, 2012.
13. Human Values and Professional Ethics, S. Kannan, K. Srilakshmi, Taxmann Publication, Pvt. Ltd., 2009
14. Human Values and Professional Ethics, Smriti Srivastava, S K Kataria & Sons, 2001
15. Human Values and Professional Ethics, Yogendra Singh, Ankur Garg, Aitbs publishers, 2011.
16. Human Values and Professional Ethics, Vrinder Kumar, Kalyani Publishers, Ludhiana, 2013.
17. Human Values and Professional Ethics, R R Gaur, R. Sangal, GP Bagaria, Excel Books, New Delhi 2010.
18. Values and Ethics, Dr. Bramwell Osula, Dr. Saroj Upadhyay, Asian Books Pvt. Ltd., 2011.
19. Complete works of Swami Vivekanand, Advaita Ashram, Calcutta – 1931.
20. Indian Philosophy, S. Radhakrishnan, George Allen & Unwin Ltd., New York: Humanities Press INC, 1929.
21. Essentials of Hinduism, Jainism and Buddhism, A N Dwivedi, Books Today, New Delhi – 1979
22. Light of Truth : Satyarth Parkash, Maharishi Dayanand Saraswati, Arya Swadhyay Kendra, New Delhi, 1975.
23. Dayanand : His life and work, Suraj Bhan, DAVCMC, New Delhi – 2001.
24. Moral and Political Thoughts of Mahatma Gandhi, V. Raghavan, N Iyer, Oxford University Press India, New Delhi, 2000.
25. Guru Nanak Dev's view of life, Amplified by Narain Singh, Published by Bhagat Puran Singh All India Pingalwara Society, Amritsar 2010.
26. Esence of Vedas, Kapil Dev Dwivedi, Katyayan Vedic Sahitya Prakashan, Hoshiarpur, 1990.
27. Vedic Concepts, Prof. B B Chaubey, Katyayan Vedic Sahitya Prakashan, Hoshiarpur, 1990.
28. Mahatma Gandhi: Essays and Reflections on his life and work by Saravapalli Radhakrishnan, Zaico Publication, Mumbai, 1977.
29. Lala Har Dayal, Hints for Self Culture, Jaico Publishing House, Mumbai, 1961.
30. Maharishi Swami Dayanand Saraswati, The Light of Truth (The Satyartha Prakashan), available at URL :
www.aryasamajjammnagar.org/download/satyarth_prakash_eng.pdf
31. Krishnamurti J, The First and Last Freedom, available at URL :
<http://www.jiddu-krishnamurti.net/en/th-first-and-last-freedom/>
32. Sri Raman Maharishi, Who Am I, available at URL :
http://www.sriramanamaharshi.org/resource_centre/publicatins/who-am-i-books/
33. Ramesh S Balsekar, Peace and Harmony in Daily Living, Yogi Impressions; 1st edition

L	T	P	Credits	Marks
2	0	0	2	50

General Knowledge and Current Affairs

Course Code: SGS102

COURSE OBJECTIVES

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 hours**

Indian States and Union Territories,
Important sites and Monuments, Largest-Longest and Highest in India.

General History

Glimpses of India History, Ancient Indian, Medieval India, Modern India, **3 hours**

Various Phases of Indian National Movement, Prominent Personalities.

Glimpses of World History

Important Events of World History, Revolutions and Wars of Independence, **2 hours**

Political Philosophies like Nazism, Fascism,
Communism, Capitalism, Liberalism etc.

Unit — B

General Polity

World Politics – Major Actors and their political relations, **3 hours**

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UNO and other organizations viz: WTO, EU, SAARC, ASEAN, BRICS, WTO, OIC, OAU, OPEC, GCC etc.

Indian Polity: Constitution of India:

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:

The process of liberalization, privatization, globalization and **3 hours**

Major World Issues. Indian Economy, Indian Financial System, Major Economic Issues, Economic Terminology.

Unit — C

General Science:

General appreciation and understandings of science including **3 hours**

the matters of everyday observation and experience. Inventions and Discoveries.

Sports and Recreation :

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

Current Affairs :

National and International Issues and Events in News. Governments **3 hours**

Schemes and Policy Decisions.

India and Neighbours:

Current phase relations with China, Pakistan, Bangladesh, Nepal, Sri Lanka and Afghanistan **2 hours**

Unit — D

Miscellaneous Information

Who is who

Books and Authors, Persons in News, Awards and Honours, **2 hours**

Abbreviations and Sports

SUGGESTED READINGS :

Books

- Advance Objective General Knowledge, R. S. Aggarwal, S. Chand Publisher (2013)
- Concise General Knowledge Manual 2013, S. Sen, Unique Publishers, 2013
- Encyclopedia of General Knowledge and General Awareness by R P Verma, Penguin Books Ltd (2010)
- General Knowledge Manual 2013-14, Edgar Thorpe and Showick Thorpe, The Pearson, Delhi.
- General Knowledge Manual 2013-14, Muktikanta Mohanty, Macmillan Publishers India Ltd., Delhi.
- India 2013, Government of India (Ministry of Information Broadcasting), Publication Division, 2013.
- Manorama Year Book 2013-14, Mammen Methew, Malayalam Manorama Publishers, Kottayam, 2013.
- Spectrum's Handbook of General Studies – 2013-14, Spectrum Books (P) Ltd., New Delhi
- 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

ENVIRONMENT EDUCATION

Course Code: EVS102

L	T	P	Credits	Marks
3	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
- Bio-geographical classification of India

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- 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
- Consumerism and waste products

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- 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)

Reference Books:

1. Botkin, D.B. and Kodler, E.A. *Environmental Studies: The Earth as a living planet*. John Wiley and Sons Inc., New York. 2000.
2. De, A.K. *Environmental Chemistry*. Wiley Eastern Ltd. New Delhi. 1990.
3. Odum, E.P. *Basic Ecology*. Holt Saundurs, International Edition, Japan. 1983.
4. Sharma, P.D. *Ecology and Environment*. Rastogi Publications, Meerut. 2004.
5. Singh, J.S., Singh, S.P. and Gupta, S.R. *Ecology, Environment and Resource Conservation*. Anamaya Publishers, New Delhi. 2006.

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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 1988 (2010)

Unit II

Legal Awareness

10 Hours

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

References Books:

1. De, A.K. *Environmental Chemistry*. Wiley Eastern Ltd. New Delhi. 1990.
2. Sharma, P.D. *Ecology and Environment*. Rastogi Publications, Meerut. 2004.
3. Singh, J.S., Singh, S.P. and Gupta, S.R. *Ecology, Environment and Resource Conservation*, Anamaya Publishers, New Delhi. 2006.

INORGANIC CHEMISTRY

Course Code: CHE253

L	T	P	Credits	Marks
4	0	0	4	100

Course Objectives: This course is intended to learn the basic concepts of Inorganic 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 Inorganic 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.

Instructions for Candidates:

- 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 test 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. The student is expected to provide reasoning/solution/working for the answer. The candidates will attempt all question. 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 test will be taken. Two best out of four objective/MCQ type surprise test 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.

PART A

Atomic Structure and periodic properties

(12 Hrs)

Wave mechanical model of Hydrogen atom, The de Broglie relationship, The uncertainty principle, Schrodinger wave equation and its derivation, Significance of Ψ and Ψ^2 , Quantum numbers, Normal and orthogonal wave functions, Pauli's exclusion principle, Hund's rule of maximum multiplicity, Aufbau principle and its limitations. Concept of extra stability of half and completely filled electronic configuration, Electronic configuration of elements, Penetration and shielding (The Slater's rules). The origin and distribution of the elements, The structure of the periodic table, Atomic parameters and their variation in periodic table, Electronegativity and various scales.

PART B

Ionic Compounds (Bonding and structures)

(12 Hrs)

Properties of ionic substances, Occurrence of ionic bonding, The radius ratio rules, Efficiency of packing, Hexagonal close packing, Cubic close packing, Structures of different crystal lattices, Sodium chloride, Cesium chloride, Wurtzite, Zinc blende, Fluorite, Rutile, Cristobalite, Nickel arsenide, Calcium carbide, Lattice energy, Born-Haber cycle, The calculations of the lattice energy on the basis of Born-Lande equation, Covalent character in predominantly ionic compounds, Imperfections of crystals, Polarizing power and polarizability of ions, Fajan's rule.

PART C

Covalent Bond

(12 Hrs)

The Lewis theory, Valence bond theory - A mathematical approach, Resonance, Valence Shell Electron Pair Repulsion Model (VSEPR theory), Prediction of structures and variation of bond angles on the basis of VSEPR theory, Shortcomings of VSEPR theory. Concept of hybridization, Rules for obtaining hybrid orbitals, Extent of d-orbital participation in molecular bonding (SO_2 , PCl_5 , SO_3), Molecular orbital theory (LCAO method), Symmetry of molecular orbitals, Applications of MOT to homo- and hetero-nuclear diatomic molecules, Molecular orbital energy level diagrams (Be_2 , N_2 , O_2 , F_2 , NO , CO , HCl , NO_2 , BeH_2).

PART D

Coordination chemistry

(8 Hrs)

Werner's theory, nomenclature of coordination complexes, isomerism in coordination complexes, chelating agents, metal chelates and chelate effects, names and abbreviations of important ligands, polydentate ligands, polypyrazolyborates, macrocyclic ligands, macrocyclic effect, ketoenolates, troponates, tripod ligands, conformation of chelate rings, factors determining kinetic and thermodynamic stability.

Suggested Books:

1. Shriver, D.F.C., Atkins, P.W. and Langford, C.H. *Inorganic Chemistry*, ELBS Oxford, 1991.
2. Huheey, J.E. Keiter, E.A. and Keiter, R.L. *Inorganic Chemistry*, 4th edition, Singapore: Pearson Education, 1999.
3. Lee, J.D. *Concise Inorganic Chemistry*, ELBS, Oxford, 1994.

INORGANIC CHEMISTRY LAB
Course Code: CHE254

L	T	P	Credits	Marks
0	0	3	2	50

Course Objectives: This course is intended to learn the basic concepts of Inorganic 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 inorganic 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.

Qualitative Analysis

Identification of cations and anions in a mixture which may contain combinations of acid ions. These must contain interfering acid anions and one, the insoluble.

a) Special Tests for Mixture of anions

- I. Carbonate in the presence of sulphate.
- II. Nitrate in the presence of nitrite
- III. Nitrate in the presence of bromide and iodide.
- IV. Nitrate in the presence of chlorate.
- V. Chloride in the presence of bromide and iodide.
- VI. Chloride in the presence of bromide.
- VII. Chloride in the presence of iodide.
- VIII. Bromide and iodide in the presence of each other and of chloride.
- IX. Iodate and iodide in the presence of each other.
- X. Phosphate, arsenate and arsenite in the presence of each other.
- XI. Sulphide, sulphite, thiosulphate and sulphate in the presence of each other.
- XII. Borate in the presence of copper and barium salts.
- XIII. Oxalate in the presence of fluoride.
- XIV. Oxalate, tartrate, acetate, citrate in the presence of each other.

b) Separation and identification of cations in mixtures

- i) Separation of cations in groups.
- ii) Separation and identification of Group I, Group II (Group IIA and IIB), Group III, Group IV, Group V and Group VI cations.

Suggested Books:

1. Svehla, G. and Sivasankar, B. *Vogel's Qualitative Inorganic Analysis (revised)*, Pearson, 7th edition, 1996.
2. Bassett, R. C., Denney, G. H. and Jeffery, J. Mendham, *Vogel's Textbook of Quantitative Inorganic Analysis (revised)*, 4th edition, Orient Longman, 1978.

PHYSICAL CHEMISTRY

Course Code: CHE353

L	T	P	Credits	Marks
4	0	0	4	100

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.

Instructions for Candidates:

- 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 test 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. The student is expected to provide reasoning/solution/working for the answer. The candidates will attempt all question. 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 test will be taken. Two best out of four objective/MCQ type surprise test 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.

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. Kirchoff'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 .

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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 ΔG , ΔH , ΔS 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*, Wisley/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.

PHYSICAL CHEMISTRY LAB

Course Code: CHE354

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.

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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.

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

Basic Computer Applications

L	T	P	Credits	Marks
4	0	0	3	75

Course Code: CSA253

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
- 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. Kumar, K.M. and Rajkumar, S. *Computer Applications in Business*. 2nd Edition. Tata McGraw Hill. 2009.
2. Kogent Learning Solutions Inc, *Office 2010 in Simple Steps*, DreamTech Press
3. Goel, A. *Computer Fundamentals*. Pearson
4. Silberschatz and Korth, A. *Database System Concepts*. McGraw-Hill, New York.
5. Simpson, A. and Robinson, C. *Mastering Access 2000*. BPB, New Delhi.
6. Taxali, R.K. *P C Software Made Simple*. Tata McGraw-Hill, New Delhi.

Basic Computer Applications Lab
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.

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BASIC MATHEMATICS

L	T	P	Credits	Marks
2	0	0	2	50

Course Code: MTH170

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.

NOTE:

- The question paper for end-semester examination will have a weightage of 25%. It will consist of 60 objective questions. All questions will be compulsory.
- Two pre-announced test will be conducted having a weightage of 25% each. Each pre-announced 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. The student is expected to provide reasoning/solution/working for the answer. The candidates will attempt all question. 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 test will be taken. Two best out of four objective/MCQ type surprise test 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

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

Reference Books:

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

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MICROBIOLOGY

L	T	P	Credits	Marks
4	1	0	4	100

Course Code: MIC101

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.
3. Tortora, G.J., Funke, B. R. and Case, C. L. *Microbiology-An Introduction*. 7th edition. Carson, USA. Benjamin Cummings, 2001. Print.

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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.

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

BASIC IMMUNOLOGY
Course Code: MIC301

L	T	P	Credits	Marks
4	1	0	4	100

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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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

BIOMOLECULES

L	T	P	Credits	Marks
4	1	0	4	100

Paper Code: BCH 101

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

Porphyrim 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.

Recommended 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.

BIOMOLECULES LAB

L	T	P	Credits	Marks
0	0	3	2	50

Paper Code: BCH 102

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.

METABOLISM

L	T	P	Credits	Marks
4	1	0	4	100

Paper Code: BCH 103

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, 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.

Porphyrim Metabolism

Biosynthesis and degradation of porphyrins. Production of bile pigments.

Recommended 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.

METABOLISM LAB

L	T	P	Credits	Marks
0	0	3	2	50

Paper Code: BCH 104

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.