

VELS INSTITUTE OF SCIENCE, TECHNOLOGY AND ADVANCED STUDIES (VISTAS)

B.Sc. BIOCHEMISTRY

COURSES OF STUDY AND SCHEME OF ASSESSMENT

(MINIMUM CREDITS TO BE EARNED: 140)

Code No.	Course	Hours/Week			Credits	Maximum Marks		
		Lecture	Tutorial	Practical		CA	SEE	Total
SEMESTER 1								
LANG	Tamil I/ Hindi / French	3	0	0	3	40	60	100
ENG	English I	3	0	0	3	40	60	100
CORE1	Biomolecule I	3	1	0	4	40	60	100
CORE2	Basics of Nutrition	3	1	0	4	40	60	100
CORE3	Human Physiology	4	0	0	4	40	60	100
CORE	PRACTICAL1- Qualitative analysis of Biomolecules	0	0	4	2	40	60	100
CORE	PRACTICAL 2- Nutritional Biochemistry	0	0	4	2	40	60	100
AECC	Communication Skills	1	0	2	2	40	60	100
SEC	Orientation/Induction programme / Life skills	-	-	-	-	-	-	-
		17	2	10	24			
SEMESTER 2								
LANG	Tamil II / Hindi / French	3	0	0	3	40	60	100
ENG	English II	3	0	0	3	40	60	100
CORE4	Biomolecules II	3	1	0	4	40	60	100
CORE5	Analytical Biochemistry	3	1	0	4	40	60	100
CORE6	Bioenergetics & Membrane Biology	4	0	0	4	40	60	100
CORE	PRACTICAL 3 – Biomolecule Separation	0	0	4	2	40	60	100
CORE	PRACTICAL 4- Biomolecule Preparation	0	0	4	2	40	60	100
SEC	Soft Skills - I / Sector Skill Council Course	2	0	0	2	40	60	100
SEC	NSS / NCC / Swachh Bharat / Inplant Training	-	-	-	-	-	-	-
		18	2	8	24			
CA - Continuous Assessment					SEE - Semester End Examination			

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Programme: B.Sc. BIOCHEMISTRY

Code No.	Course	Hours/Week			Credits	Maximum Marks		
		Lecture	Tutorial	Practical		CA	SEE	Total
SEMESTER 3								
LANG	Tamil III / Hindi / French	3	0	0	3	40	60	100
ENG	English – III	3	0	0	3	40	60	100
CORE7	Enzymes & Intermediary Metabolism I	4	0	0	4	40	60	100
CORE8	Clinical Biochemistry I	3	0	2	4	40	60	100
CORE9	Cell & Developmental biology	4	0	0	4	40	60	100
AECC	Environmental Studies	2	0	0	2	40	60	100
CORE	PRACTICAL 5- Enzyme & Clinical Biochemistry I	0	0	4	2	40	60	100
SEC	Soft Skills - II / Sector Skill Council Course	2	0	0	2	40	60	100
SEC	Swayam / NPTEL / Value Added Course	-	-	-	-	-	-	-
		21	0	6	24			
SEMESTER 4								
LANG	Tamil IV / Hindi / French	3	0	0	3	40	60	100
ENG	English IV	3	0	0	3	40	60	100
CORE10	Enzymes & Intermediary Metabolism II	4	0	0	4	40	60	100
CORE11	Clinical Biochemistry II	3	0	2	4	40	60	100
CORE12	Hormonal Biochemistry	3	0	0	3	40	60	100
CORE	PRACTICAL 6 – Enzyme & Clinical Biochemistry II	0	0	4	2	40	60	100
CORE	PRACTICAL 7- Methods in Cell Biology	0	0	4	2	40	60	100
SEC	Soft Skills III / Sector Skill Council Course	2	0	0	2	40	60	100
SEC	Internship / Capability Enhancement Programme	0	0	2	1	-	-	-
		18	0	12	24			
CA	- Continuous Assessment				SEE	- Semester End Examination		

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Programme: B.Sc. BIOCHEMISTRY

Code No.	Course	Hour / Week			Credits	Maximum Marks		
		Lecture	Tutorial	Practical		CA	SEE	Total
SEMESTER 5								
CORE	Molecular Biology	3	0	0	3	40	60	100
DSE		3	0	0	3	40	60	100
DSE		3	0	2	4	40	60	100
DSE		3	0	0	3	40	60	100
DSE		3	0	0	3	40	60	100
DSE	PRACTICAL 8	0	0	4	2	40	60	100
DSE	PRACTICAL 9	0	0	4	2	40	60	100
SEC	Internship / Mini Project / Sector Skill Council Course	0	0	4	2	40	60	100
SEC	Skill Enhancement Training / Student Club Activities	-	-	-	-	-	-	-
		15	0	14	22			
SEMESTER 6								
DSE		4	0	0	4	40	60	100
DSE		3	1	0	4	40	60	100
DSE		3	0	2	4	40	60	100
DSE / GE		3	0	0	3	40	60	100
SEC	Entrepreneurship Development	2	0	0	2	40	60	100
DE	Project Work	0	0	8	4	40	60	100
SEC	Technical Seminar / Innovation Council / Start up Initiative	0	0	2	1	40	60	100
		15	1	12	22			
CA - Continuous Assessment					SEE - Semester End Examination			

UGC Recommended Generic Electives

1.Consumer Affairs

2. Disaster Management

3. Universal Human Values

LIST OF DISCIPLINE SPECIFIC ELECTIVE (DSE)

1. Environmental Biochemistry
2. Forensic Biochemistry
3. Protein Biochemistry
4. Immunobiology
5. Biochemistry of Cell Signaling
6. Biotechnology
7. Inheritance biology
8. Lifestyle diseases
9. Stem Cell biology
10. Cancer Biology
11. Plant and tissue culture
12. Neurobiology
13. Plant Biochemistry

LIST OF LANGUAGES

Semester	Title of the Paper
I	a) English I b) Language I/ Hindi Paper –I/ French Paper - I
II	a) English II b) Language II / Hindi Paper –II/ French Paper - II
III	a) English III b) Language III / Hindi Paper –III/ French Paper - III
IV	a) English IV b) Language IV/ Hindi Paper –IV /French Paper – IV

LIST OF SKILL ENHANCEMENT COURSE (SEC)

1. Soft Skills I
2. Soft Skills II
3. Soft Skills III
4. Entrepreneurship Development

LIST OF ABILITY ENHANCEMENT COMPULSORY COURSE (AECC)

1. Communication Skills
2. Environmental Science

CORE COURSES

SYLLABUS

Course Objective

Biomolecules is to study about the structure and biological function of molecule that is present in living organisms including large macromolecules such as proteins, polysaccharides, lipids, and nucleic acids, as well as small molecules such as primary metabolites, secondary metabolites, and natural products.

UNIT I (12)

Classification of carbohydrates, stereoisomerism and optical isomerism of Sugars, anomeric forms and mutarotation. Occurrence, structure and biological importance of monosaccharide, disaccharide and polysaccharides. Reactions of carbohydrates due to the presence of hydroxyl group, aldehyde and ketone groups.

UNIT II (12)

Structure, function and biological importance of important carbohydrate derivatives-chitin, pectin, heparin, proteoglycans, sialic acids, blood group polysaccharides. Bacterial cell wall polysaccharides, Glycoproteins.

UNIT III (12)

Classification and structures of amino acids. Physical and chemical properties of amino acids. Essential and non-essential amino acids. Non protein amino acids. Proteins-Classification based on solubility, shape, composition and function. Properties of proteins. Denaturation and renaturation of proteins. Structure of peptide bond. Isolation and Purification of Proteins.

UNIT IV (12)

Protein structure-Primary, secondary, tertiary and quaternary (helix and pleated sheet) structures of protein. Forces stabilizing the secondary, tertiary and quaternary structures of proteins. Chemical synthesis of polypeptides-solid phase peptide synthesis. Determination of the amino acid sequence of a polypeptide chain. Biologically important peptides-structure and functions.

UNIT V (12)

Vitamins- Definition and classification. Source, Structure and biological role, daily requirement and deficiency manifestation of the fat soluble vitamins A,D,E & K. Water soluble vitamins-Ascorbic acid, thiamine, riboflavin, pyridoxine, niacin, pantothenic acid, lipoic acid, biotin, folic acid and vitamin B12. Antibiotics-Structure and functions of Penicillin, Streptomycin and Chloramphenicol.

(60 hrs)**Course outcome:**

After the completion of this course, the student will be able to

1. Understand biochemistry at the atomic level.
2. Easily Understand on role of biological biomolecules and their functions
3. Demonstrate a broad knowledge of the fundamental concepts of chemistry, biology and physics
4. Identify the different classes of polymeric biomolecules and their monomeric building blocks

5. Analyse and study the chemical and biochemical properties of biomolecules and also Understand the relationships between biological molecules and human health.

Text Books

1. J.L.Jain et al. Fundamentals of Biochemistry by S.Chand and Company 4th edition, 1994.
2. M.N.Chatterjea and Ranashinde Text book of Medical biochemistry Jaypee Brothers Medical Publisher (P) Ltd, 6th edition 2005.

Reference Books

1. Lippincott's illustrated biochemistry – Champe and Harvey; 6th edition 2007.
2. D.Voet and J.G. Voet, Biochemistry, John Wiley & Sons, USA 2004

WEBSITES

1. <https://www.chem.uci.edu/~unicorn/243/papers/MSlec1.pdf>
2. <https://oer.unimed.edu.ng/LECTURE%20NOTES/3/2/RASAQ-NURUDEEN-OLAJIDE-UNIMED-BCH-222-VITAMINS.pdf>

Course objectives

To obtain the knowledge of macronutrients, micronutrients, food, diet, energy and nutrition pattern for normal persons, patients and special cases. Students should also aware about the categories and significance of various forms of foods and to be being healthy.

UNIT 1 Basic concepts of Nutrition (12)

History of Nutrition – introduction to Nutrition science – Definition of nutrition – Under nutrition, Over nutrition and Malnutrition. Nutrition: Nutrients-essential, non-essential-General functions of nutrients. Methods of assessing nutritional status, Anthropometric measurements and indices – linear measurement, height, weight, head, chest and mid upper arm circumference. Recent concepts in nutrition

UNIT 2 Macronutrients (12)

Carbohydrates – Food sources of carbohydrates, requirements, dietary fibre-Types, sources and actions of fibre. Proteins- Food sources, requirements, nutritional classification of amino acids, nutritional value of proteins, effect of protein deficiency and Protein Energy Malnutrition(PEM)- Kwashiorkor and Marasmus-etiology, clinical features, treatment and prevention, dietary management. Lipids- Food sources, requirements, nutritional classification of fats, effect of fat deficiency and excess of fat in the diet.

UNIT 3 Food (12)

Food group- Definition and physiological functions of foods, food pyramid, ICMR committee percent calories supplied by carbohydrates, fats and proteins in average Indian diets – food and energy requirements for different age groups. RDA.

UNIT 4 Energy (12)

Energy units – Kilocalories, Mega joules, Determination of energy value of foods – using a bomb calorimeter, diagram of a bomb calorimeter – gross calorific values, physiological energy, value of foods, relation between oxygen used and calorific value. Determination of energy requirements, Indirect calorimetry – Basal metabolism – definition, determination – Benedict Roth basal Metabolism Apparatus – Factors affecting BMR – determination of energy metabolism during work – energy requirements for various types of activities, factorial methods for calculation of the daily energy requirements for an adult for varying degrees of physical activity-recommended allowances for calories.

UNIT 5 Micronutrients (12)

Vitamins- Sources, Requirement, units of measurement and hyper - vitaminosis Function, Effects of deficiency. Importance of Folic acid, vitamin B₁₂ pyridoxine, Biotin and pantothenic acid to the body. Minerals - Distribution in the body, functions, food sources, requirements and effects of deficiency of (Calcium, Phosphorus, Iron, Copper, Fluorine, Zinc, Iodine, Selenium, Chromium and Cobalt). Water &electrolytes –Distribution in body, functions, requirement, Dehydration - Causes, effects and prevention,

(60 hrs)

Course outcome:

After the completion of this course, the student will be able to

CO1: Explain about nutritional sources, nutritional value, daily requirements, functions, deficiency diseases of various nutrients.

CO2: Discuss about the growth, development, common health problem and complication related to intake of food.

CO3: Formulate his/her own diet in daily life with the help of various concepts of nutritional biochemistry.

CO4: Acquire knowledge to differentiate the food from other.

CO5: Acquire therapeutic uses of nutrition. Apply the essence of nutrition in day to day life to be as a healthy person.

Text Books

1. Swaminathan, Advanced Textbooks of food and Nutrition, Vol 1, 2, BAPPCO Press, 2005
2. Viswanath Sardesai, Introduction to Clinical nutrition, 3rd edition, 2011
3. Shubhangini Joshi. Nutrition and Dietetics. 2nd edition. Tata McGraw Publishing.

Reference Books

1. Geissler C, Powers H. Human Nutrition. Edinburgh: Elsevier Churchill Livingstone, 2010.
2. Roach, J.O. and Benyon, S, Crash course - Metabolism and Nutrition, London: Mosby, 2003
3. Payner and Barker, Advancing Dietetics and Clinical Nutrition, 1st edition, 2010.

Course objectives

The objective is to impart knowledge and understanding of the human body. To understand the inter relationships within and between anatomical and physiological systems of the human body.

Unit 1 Blood and Circulatory System (12)

Blood: Composition and function. Types and function of blood cells. Erythropoiesis. Blood grouping- ABO, Rhesus system and Bombay blood group system. Blood coagulation. Intrinsic and extrinsic pathways. Structure and function- Spleen and lymphatic System. Circulatory system and Heart - Structure and functions of heart and associated blood vessels, Cardiac cycle.

Unit 2 Digestive System & Respiratory system (12)

General structure of digestive system – Digestion and absorption of food in the mouth, stomach and intestines. Various movements of digestive system. Pancreas and Liver – structure and function. Defecation. Outline of various components of respiratory system. Mechanism and chemistry of respiration. Mechanism and chemistry of respiration - considerations, transport of gases, exchange of gases. Bohr effect and role of 2,4 DPG. Muscles -Types of muscle cells and their functions. Mechanism of muscle contraction.

Unit 3 Reproductive System (12)

Structure and functions of male and female reproductive system: Ovulation, menstrual cycle. Spermatogenesis and factors influencing sperm count and viability. Biochemistry of fertilization. Physiological changes during pregnancy, parturition and lactation.

Unit 4 Excretory system (12)

Structure and role of kidney, nephrons. Mechanism of urine formation- Glomerular filtration, tubular secretion and reabsorption

Unit 5 Nervous System (12)

Brief outline of nervous system- types of nerve cells and nerve fibres, brain, spinal cord. Communication: Electrical and chemical communications - Transmission of nerve impulse, neurotransmitters and synapse.

(60 hrs)**Course outcome:**

After the completion of this course, the student will be able to

CO1: Discuss in-depth the structure and physiology of major human organs and explain their role in the maintenance of healthy individuals.

CO 2: Discuss in detail how the activities of organs are regulated for maximum efficiency.

CO 3: Explain in-depth the interplay between different organ systems and how organs and cells interact to maintain biological equilibrium in the face of a variable and changing environment.

CO 4: Identify how changes in normal physiology lead to disease.

CO5: Implement the knowledge of human physiology in clinical biochemistry to predict and understand the disease.

Text Books

1. Guyton AC. Text book of Medical Physiology, 8th Edition. Prism books (pvt), Bangalore, India. TATA McGraw-hill publishing Company, 1991.
2. C.C. Chatterjee, Human Physiology (Vol. I & Vol. II), Medical Allied Agency, Calcutta, 11th edition, 1985.

Reference Books

1. Ganong (Williams) Review of medical physiology 25th edition. 2015. McGraw-Hill.
2. Ross and Wilson. Anatomy and physiology In health and illness. 12th ed, 2014. Elsevier.

Course objectives

This course is concerned with basic lab skills. These skills include the accurate use of pipettes, making solutions, and safety measurements along with the identification of biomolecules such as carbohydrates, proteins and amino acids by suitable tests.

List of Experiments

1. Qualitative analysis of monosaccharides – aldoses
2. Qualitative analysis of monosaccharides – ketoses
3. Qualitative analysis of reducing disaccharides
4. Qualitative analysis of non-reducing disaccharides
5. Qualitative analysis of polysaccharides
6. Qualitative analysis of pentoses
7. Qualitative analysis of aromatic amino acids
8. Qualitative analysis of sulphur containing amino acids
9. Qualitative analysis of basic amino acids
10. General colour reactions of protein
11. Denaturation and precipitation of proteins
12. Hydrolysis of proteins and colour reactions of hydrolysate

(30 hrs)**Course outcome:**

After the completion of this course, the student will be able to

CO 1: Acquire knowledge in the qualitative estimation of biological biomolecules

CO 2: Understand the different chemical reaction & principles of biomolecules

CO 3: Identify the given solution as carbohydrate or amino acid/protein

CO 4: Understand the different chemical preparation and standardization of qualitative analysis of various biomolecules.

CO 5: Learn safety and precautionary measures for working in a laboratory and learn the handling of microscope and other laboratory instruments individually.

Text Books

1. J. Jayaraman, Laboratory Manual in Biochemistry. New Age International Publishers. 2011.
2. S. Sadasivam, A. Manickam, Biochemical Methods. New age publishers. 2009.

Reference Books

1. Harold Varley, Practical Clinical Biochemistry, CBS. 6th edition, 2006.
2. S. K. Sawhney, Randhir Singh, Introductory Practical Biochemistry. Alpha Science International, Ltd. 2 edition, 2005.

WEBSITES

1. http://14.139.61.83/BioChemicalEstimations/qualitativetests_carbohydrates.htm
2. <http://www.chem.boun.edu.tr/wp-content/uploads/2014/04/Chem-415-Experiment-2.pdf>

Course objectives

The goal of this course is to develop laboratory skills required for modern biochemical and molecular studies of nutrition and its role in health and disease. This includes the quantitative analysis and interpretation of results. It is also useful to develop core skills that prepare students for a career in laboratory-based research in the biomedical sciences.

List of Experiments

1. Determination of ash content of food sample
2. Determination of moisture content of food sample
3. Determination of carbohydrate by anthrone method
4. Determination of protein by Lowry method
5. Determination of lipid from plant source
6. Estimation of amino acids by Ninhydrin method
7. Estimation of inorganic phosphorous
8. Determination of iron content from dates
9. Estimation of Vitamin A from plant source
10. Estimation of Vitamin E from plant source
11. Estimation of Vitamin C from plant source
12. Estimation of nucleic acids-DNA/ RNA from tubers

(30 hrs)**Course outcome:**

After the completion of this course, the student will be able to

- CO1: Understand the biological structure and active food ingredient present in different foods. Plan and execute practically in daily life.
- CO2: Understand the methods of reagent preparation and its uses. Confidently demonstrate practical skills.
- CO3: Efficiently Carryout projects in higher studies
- CO4: Logically understand the reaction principle. Understand the nutritional values of different foods.
- CO5: Develop academic as well as research curiosity.

Text Books

1. J.Jayaraman, Laboratory Manual in Biochemistry. New Age International Pvt Ltd Publishers.2011 (Paperback).
2. S. Sadasivam, A. Manickam, Biochemical Methods. New age publishers. 2009 (paperback).
3. S. K. Sawhney, Randhir Singh, Introductory Practical Biochemistry. Alpha Science International, Ltd. 2nd edition, 2005.

Reference Books

1. Harold Varley, Practical Clinical Biochemistry, CBS. 6th edition, 2006.
2. Hans Bisswanger, Practical Enzymology. Wiley VCH.2nd Edition, 2011.
3. Robert Eisenthal, Enzyme Assays: A Practical Approach (Practical Approach Series). Oxford University Press, U.S.A. 2nd edition, 2002.

Course Objective

Biomolecules is to study about the structure and biological function of molecule, that is present in living organisms, including large macromolecules such as proteins, polysaccharides, lipids, and nucleic acids, as well as small molecules such as primary metabolites, secondary metabolites, and natural products.

UNIT I**(12)**

Definition and classification of lipids. Fatty acids - classification, nomenclature, structure and properties. Classification, structure and function of prostaglandins, triacylglycerols. Chemical properties of fats - iodine value, Sap value, acid number, Rancidity, Rm value

UNIT II**(12)**

Chemical properties and functions of phospholipids and their structures. Lecithins, cephalins, phosphatidyl serine, phosphatidyl inositol, plasmalogens, glycolipids (cerebrosides and gangliosides), isoprenoids and sterols (cholesterol and zymosterol), steroids (steroid hormones, bile acids and bile salts). Biological significance of fats.

UNIT III**(12)**

Nature of genetic material. Isolation of RNA and DNA. Composition of RNA and DNA. Structure of purine and pyrimidines, nucleosides and nucleotides.

UNIT IV**(12)**

Size and structure of different types of DNA-A, B, Z types of DNA. Structure and role of different types of RNA. Properties of nucleic acids.

UNIT V**(12)**

Hetero cyclic rings of biologically important compounds. Structure and biological importance of pyridine, pyrrole, quinoline, pyrimidine, purine, pteridine, thiazole, imidazole and indole ring containing compounds. Porphyrin - structure and biologically important compounds containing porphyrin ring, bile pigments - structure and biological importance.

(60 hrs)**Course outcome:**

After the completion of this course, the student will be able to

CO 1: Understand the basic principle of chemistry as well as biology

CO 2: Understand the properties of carbohydrates, proteins, lipids, cholesterol, DNA, RNA, glycoproteins and glycolipids and their importance in biological systems.

CO 3: Interpret the structure-function relationships of the proteins, carbohydrates, lipids, and nucleic acids.

CO 4: Describe the difference between the water soluble and fat soluble vitamins and their key role in the metabolism as coenzymes.

CO 5: Describe the most important heterocyclic ring systems containing heteroatom and their systems of nomenclature and numbering.

Text Books

1. J.L.Jain et al. Fundamentals of Biochemistry by S.Chand and Company 4th edition, 1994.
2. M.N.Chatterjea and Ranashinde Text book of Medical biochemistry Jaypee Brothers Medical Publisher (P) Ltd, 6th edition 2005.

Reference Books

1. Lippincott's illustrated biochemistry – Champe and Harvey; 6th edition 2007.
2. D.Voet and J.G. Voet, Biochemistry, John Wiley & Sons, USA 2004

WEBSITES

1. <https://www.slideshare.net/AsadAfridi5/lipids-notes>
2. <https://bmcchem.biomedcentral.com/articles/10.1186/s13065-019-0625-4>

Course objectives

Analytical biochemistry focuses on the techniques relevant to modern day molecular biology and biochemistry research. To understand the theoretical principles involved and the technical details in Bioinstrumentation. The techniques may be used for the determination of nutrients, major ions and trace elements, biological samples together with the analytical techniques. Some of these techniques are particularly useful for the detailed analysis of recent methodologies used in the chemical analysis of biota as discussed in the chapter.

Unit 1 Homogenisation and Centrifugation (12)

Buffers, pH, pOH. Methods of cell disruption and tissue homogenization: mechanical (homogenizer, sonicator, French press) and non-mechanical methods (physical, chemical and enzymatic methods). Centrifugation: Basic Principles of Centrifugation. Instrumentation and applications of Preparative - Differential and Density Gradient Centrifugation, Analytical Ultracentrifugation – ultra centrifuge, applications.

Unit 2 Chromatography (12)

Chromatographic - introduction, types and modes of separation. Principles and applications of Paper, Thin layer & HPTLC, Gas-liquid, Liquid chromatography, HPLC and FPLC

Unit 3 Electrophoresis (12)

Paper and gel electrophoresis, Agarose gel electrophoresis, Different variants of polyacrylamide gel electrophoresis (PAGE) like native and SDS-PAGE, 2D-PAGE, Isoelectric Focussing, capillary electrophoresis.

Unit 4 Spectroscopy (12)

Spectroscopy: Basic Principles of Electromagnetic Radiation, Beer-Lambert's Law. Principle, instrumentation and applications of Colorimetry, UV-Visible, IR, Raman, NMR and ESR and X-Ray spectroscopy, Spectrofluorimetry, Flame Photometry, AAS, X-Ray Diffraction, Mass spectrometry, Fluorescence spectroscopy.

Unit 5 Radioactivity and Biosensors (12)

Concept of radioactivity, concept of α , β and γ emitters. Applications of radioactive tracers in biology, principles and applications of phosphor imager. Detection and measurements - GM counter, Scintillation counter. γ -ray spectrometers. Safety aspects. Biological applications: assessing the metabolic pathways, radio dating, isotope dilution technique, autoradiography.

Biosensors - Introduction to Biosensors: Concepts and applications. Biosensors for diabetes management. Non-invasive Biosensors in Clinical Analysis.

(60 hrs)

Course outcomes

After the completion of this course, the student will be able to

CO1: Construct broad knowledge in modern analytical instrumentation with deep knowledge its core concepts and its applications.

CO2: Assess and understand the principle, Instrumentation of different types of analytical technologies in biological field.

CO3: Discriminate and acquire knowledge about the different detection counters in radioactivity and biosensor

CO4: Collaborate and understand basics and latest developments in the instrumentation techniques for sedimentation

CO5: Acquire cognitive, technical and creative skills which enables students to gain an established knowledge and practice concerning modern analytical instrumentation and measurement techniques.

Text Books

1. Keith Wilson and John Walker, Principles and techniques of Practical Biochemistry, 2010, Seventh edition, Cambridge University Press
2. Asokan P, Analytical Biochemistry, 2009, Chinna publication.

Reference Books

1. Holme. D. J. and Peck. H., Longman Analytical Biochemistry, 1998, 3rd edition.
2. Chatwal, G & Anand, S, Instrumental methods of chemical analysis, 2005, Himalaya Publishing House
3. S. K. Sawhney & Randhir Singh, Introductory Practical Biochemistry, 2014, Narosa Publications House

Website

1. <https://open.umn.edu/opentextbooks/textbooks/486>
2. <https://ocw.mit.edu/courses/earth-atmospheric-and-planetary-sciences/12-119-analytical-techniques-for-studying-environmental-and-geologic-samples-spring-2011/lecture-notes/>

Course Objectives:

This paper provides the basic concepts of Bioenergetics, mechanisms of oxidative phosphorylation and photophosphorylation. And also gives the knowledge about the composition and structure of bio-membranes, transport mechanisms across biological membranes and will learn the concept and mechanism of ATP synthesis.

Unit 1 Bioenergetics (12)

Concepts of free energy, state functions, equilibrium constant. Coupled reactions, energy charge, ATP cycle, phosphorylation potential. Standard energy of hydrolysis of ATP, PEP, 1,3 BPG and thioesters. Redox reactions, standard redox potentials and Nernst equation. Universal electron carriers.

Unit 2 Bio membranes (12)

Historical background, membrane models. Membrane functions. Composition of bio membranes: Lipids - Phospholipids, Glycolipids, sterols; Proteins-Peripheral Proteins, Integral Membrane Proteins and Lipid-Anchored proteins, and carbohydrates. Comparison of the composition of various cellular and subcellular membranes. Role of Flippase, Floppase and Scramblase.

Unit 3 Membrane fluidity (12)

Lateral, transverse and rotational motion of lipids and proteins. Factors affecting membrane fluidity-composition, barriers (tight junctions), cytoskeleton interactions, microdomains – rafts, caveolae. Fence and gate model. Techniques to study membrane dynamics: FRAP, TNBS, SPT.

Unit 4 Transport across membranes (12)

Simple diffusion and facilitated diffusion. Passive transport- glucose transporter and anion transporter. Primary active transporters- P type ATPases, V type ATPases, F type ATPases. Secondary active transporters – lactose permease, Na⁺ - glucose symporter. ABC family of transporters – MDR and CFTR. Bacteriorhodopsin. Ion channels: voltage-gated ion channels (Na⁺ /K⁺ voltage-gated channel) and ligand-gated ion channels (acetyl choline receptor), and aquaporins. Ionophores: valinomycin, gramicidin.

Unit 5 Phosphorylation (12)

Oxidative Phosphorylation: The electron transport chain - its organization and function. Sequence of electron transport, Peter Mitchell's chemiosmotic theory and Proton gradient. Mechanism of ATP synthesis. Regulation of oxidative phosphorylation. Photophosphorylation, Hill reaction. Photosynthetic pigments and light harvesting complexes in plants. Photosystem I and Photosystem II. Z-scheme of photosynthetic electron flow Photophosphorylation, Cyclic and non-cyclic photophosphorylation and its significance.

(60 hrs)

Course outcomes

After the completion of this course, the student will be able to

CO1: Develop an understanding of the fundamental aspects of composition, structure and functioning of biological membranes and energy transformation in living organisms.

CO2: Explain the basic concepts of Bioenergetics, mechanisms of oxidative phosphorylation and photophosphorylation.

CO3: Summarize the composition and structure of bio-membranes, transport mechanisms across biological membranes.

CO4: Compare the techniques to study membrane dynamics that are used for studies of membrane proteins and biological redox processes.

CO5: Develop a knowledge and understanding of the possibilities to apply methods of studies of biological membranes and bioenergetics to solve fundamental problems in biomedicine and to use for the applied research in biotechnology.

TEXT BOOKS:

1. Lehninger: Principles of Biochemistry (2013) 6th ed., Nelson, D.L. and Cox, M.M., W.H. Freeman and Company (New York), ISBN:13:978-1-4641-0962-1 / I SBN: 10:1-4641- 0962-1.
2. Molecular Cell Biology (2013) 7th ed., Lodish, H., Berk, A., Kaiser, C.A., Krieger, M., Bretscher, A., Ploegh, H., Amon, A. and Scott, M.P. W.H. Freeman & Company (New York), ISBN:13:978-1-4641-0981-2.
3. Biochemistry (2010) 4th ed., Garret, R. H. and Grisham, C.M., Cengage Learning (Boston), ISBN-13:978-0-495-11464-2.
4. Principles of Biochemistry (2008) 3" ed., Voet, D.J., Voet, J.G. and Pratt, C.W., John Wiley & Sons, Inc. (New York), ISBN:13: 978-0470-23396-2

REFERENCE BOOKS:

1. Molecular Cell Biology (2016) 8th ed., Lodish, H., Berk, A., Kaiser, C.A., Krieger, M., Bretscher, A., Ploegh, H., Amon, A. and Scott, M.P., W.H. Freeman & Company (New York).
2. Principles of Biochemistry (2008) 3rd ed., Voet, D.J., Voet, J.G. and Pratt, C.W., John Wiley & Sons, Inc. (New York), ISBN:13: 978-0470-23396-2
3. Lehninger: Principles of Biochemistry (2017) 7th ed., Nelson, D.L. and Cox, M.M., W.H. Freeman and Company (New York).

Course objectives

Aims to isolate and separation of biomolecules from various sources, analyse the presence of specific molecules in isolated sample by different qualitative tests and estimate those molecules in each source.

LIST OF EXPERIMENTS

1. Separation of sugars by ascending paper chromatography.
2. Separation of sugars by descending paper chromatography.
3. Separation of amino acids by ascending paper chromatography
4. Separation of amino acids by descending paper chromatography.
5. Separation of aminoacids by two dimensional chromatography.
6. Separation of amino acids by radial paper chromatography.
7. Separation of sugars by thin layer chromatography.
8. Separation of amino acids by thin layer chromatography.
9. Separation of lipids by thin layer chromatography.
10. Separation of plant pigments by column chromatography.
11. Separation of proteins by Gel Filtration Chromatography. (Demonstration)
12. Separation of lipoproteins by electrophoresis (Demonstration)

(30 hrs)

Course outcome:

After the completion of this course, the student will be able to

- CO1: Describe the instrumentation required for the various separation techniques and their associated operating principles. Understand the significance, quality, and limitations of the results produced by the various separation techniques.
- CO2: Select the operating conditions (mobile phase, temperature, flow rate, program rate, etc.) for the various separation techniques. Gain Knowledge of phase equilibria in two-component and multi-component systems.
- CO3: Analyze the separation system for multi-component mixtures. Get the Ability to design separation system for the effective solution of intended problem.
- CO4: Acquire the Ability to Select appropriate separation technique for intended problem. Evaluate data and properly determine their meaning to make correct and ethical decisions.
- CO5: Chose the operating conditions (mobile phase, temperature, flow rate, program rate, etc.) for the various separation techniques. To develop an appreciation for the difficult task of judging the accuracy and precision of experimental data

Text Books

1. J. Jayaraman, Laboratory Manual in Biochemistry. New Age International Pvt Ltd Publishers. 2011 (Paperback).
2. S. Sadasivam, A. Manickam, Biochemical Methods. New age publishers. 2009 (paperback).

Reference Books

1. Harold Varley, Practical Clinical Biochemistry, CBS. 6th edition, 2006.
2. S. K. Sawhney, Randhir Singh, Introductory Practical Biochemistry. Alpha Science International, Ltd. 2nd edition, 2005.

Website

1. <https://unacademy.com/lesson/biochemical-separation-techniques-a-brief-overview/NV7POVI5>

Course objectives

Aim of this lab is to focus on the separation of biomolecules by different chromatographic techniques like Paper, TLC, Column and subsequent quantification of those molecules in selected source.

LIST OF EXPERIMENTS

1. Preparation of solutions- Normal, Molar, Molal solutions.
2. Preparation of buffers-Tris, Citrate, Acetate and Phosphate Buffers.
3. Preparation of starch from potatoes.
4. Preparation of casein from milk.
5. Preparation of lactalbumin from milk.
6. Preparation of haemoglobin from blood.
7. Preparation of albumin from eggs.
8. Preparation of lecithin from eggs.
9. Isolation of Glycogen from liver tissue.
10. Isolation of chlorophyll from spinach leaves.
11. Isolation of Protein by Ammonium sulphate fractionation.
12. Preparation of cellulose from plant material.

(30 hrs)

Course outcome:

After the completion of this course, the student will be able to

1. Easily identify and separate the solutes or bio molecules present in the given sample.
2. Estimate the level of bio molecules by using quantitative and quantitative methods
3. Gain expertise in the isolation of various biomolecules and organelles
4. obtain hands-on training in basic separation techniques in biochemistry
5. Able to Handle laboratory instruments individually. Planning and carrying out projects efficiently.

Text Books

1. J. Jayaraman, Laboratory Manual in Biochemistry. New Age International Pvt Ltd Publishers. 2011 (Paperback).
2. S. Sadasivam, A. Manickam, Biochemical Methods. New age publishers. 2009 (paperback).

Reference Books

1. Harold Varley, Practical Clinical Biochemistry, CBS. 6th edition, 2006.
2. Hans Bisswanger, Practical Enzymology. Wiley VCH. 2nd Edition, 2011.

WEBSITES

1. <https://www.snc.edu/chemicalhygiene/docs/labsafety/SolutionPrep.pdf>
2. https://fac.ksu.edu.sa/sites/default/files/447_-_1011.pdf

Course objectives

The course was structured to enlighten the importance the enzymes in biological system and to understanding of the kinetics of enzyme catalysed reactions and use of immobilized enzymes.

Unit I Introduction to Enzymes (12)

Introduction - Definition, Enzyme units, Functions of enzymes. Nomenclature of enzymes, Classification of enzymes. Coenzymes, Isoenzymes, Abzymes, metalloenzymes, multienzyme complexes. Enzyme specificity, Active site, Mode of Enzyme action - Lock and key theory and induced fit theory, Factors affecting enzyme activity - pH, temperature, enzyme concentration and substrate concentration.

Unit II Enzyme Kinetics (12)

Derivation of Michaelis - Menton Equation. Enzyme inhibition - Competitive, non- competitive and uncompetitive inhibitions (with reference to Example and graphical representation)

Unit III Carbohydrate metabolism I (12)

Fate of dietary carbohydrates. Glycolysis with energetic & regulation, Cori cycle, Futile cycles in carbohydrate metabolism. Metabolism of Glycogen, TCA cycle - Energetics and its regulation.

Unit IV Carbohydrate metabolism II (12)

Pentose phosphate pathway and its significance. Uronic acid pathway. Gluconeogenesis pathway and significance. Glyoxylate cycle.

Unit V Biological Oxidation (12)

Introduction -free energy - free energy of hydrolysis of ATP and other organophosphates. Role of High energy compounds - Electron transport chain- Components and reactions of ETC. Role of ETC - Oxidative Phosphorylation - Chemiosmotic hypothesis. P/O ratio, uncouplers of oxidative phosphorylation.

Course outcome:

After the completion of this course, the student will be able to

CO1: Discuss the basic structure and functions of enzymes. Describe the chemical nature of enzymes and their function in biochemical reactions.

CO2: Explain how enzyme activity is (a) regulated and (b) affected by temperature, pH, and concentration. Analyze kinetic data and understand the principles of enzyme kinetics.

CO3: Write down the key pathways of metabolism. List stages in the catabolism of food molecules and describe what occurs during each stage.

CO4: Describe terms like glycolysis, gluconeogenesis, glyoxylate cycle, glucogenic amino Acids. Explain and give examples of the strategies of metabolism, emphasizing the role of ATP coupled reactions, and coenzymes that exist in oxidized and reduced form.

CO5: Describe what happens during carbohydrate digestion, glycolysis, glycogenesis, and glycogenolysis. Describe what happens in the citric acid cycle, the electron transport chain and oxidative phosphorylation. Explain the role of each process in energy production. Describe mechanisms of control of these metabolic pathways.

Text Book

1. T. Palmer & P. L. Bonner, Enzymes - Biochemistry, Biotechnology, Clinical Chemistry, 2007, Elsevier Store, Second Edition.

Reference Books

1. Donald Voet and Judith Voet, Fundamentals of Biochemistry, 2006, 2nd edition 2006, Wiley Asia student edition
2. Robert K Murray, Daryl Granner and Victor W Rodwell, Harper's illustrated biochemistry, 2006, 27th edition Mc Graw Hill international edition
3. M.N.Chatterjea and Ranashinde, Text book of Medical biochemistry, 2005, 6th edition Jaypee Brothers Medical Publisher (P) Ltd.
4. Champe and Harvey, Lippincott's illustrated biochemistry, 2007, 4th edition.

Website

1. <https://biochemden.com/intermediary-metabolism-basic-notes/#:~:text=Metabolism%20is%20the%20term%20used,take%20place%20in%20the%20Liver.>
2. <https://www.slideshare.net/tonyscaria/intermediary-metabolism-biochemistry-revision-notes>

Course Objectives

The course aims to provide a conceptual background in Clinical Biochemistry and an advanced understanding of the biochemical mechanisms and pathophysiological processes responsible for common biochemical disorders. The course provides an overall picture with an understanding of various types of diseases and their causes, symptoms, prevention, management and treatment.

Unit I Basic Concepts of Clinical Biochemistry (12)

Scope of clinical biochemistry. A brief review of Units and abbreviations used in expressing concentrations and standard solutions. Specimen collection and processing (blood, urine and feces), anti-coagulants and preservatives for blood and urine. Transport of specimens.

Unit II Disorders of the blood (12)

Hematology - Anemia and its types – anemias related to shape and size of RBC, anemias due to nutritional deficiencies, anemias due to excessive destruction of RBC. Blood clotting mechanism – Intrinsic and Extrinsic pathway. Hemophilias.

Unit III Diseases related to carbohydrate metabolism (12)

Blood glucose regulation, hypo and hyperglycemia. Diabetes mellitus-Types, Causes, Clinical manifestations, Diagnosis and Treatment. Glycogen storage diseases. Lactose intolerance.

Unit IV Diseases related to amino acids and nucleic acid metabolism (12)

Etiology, clinical manifestation, diagnosis and treatment of Cystinuria, Phenyl ketonuria, Alkaptonuria, Maple syrup diseases, Tyrosinemia and Albinism. Gout – etiology, symptoms and treatment.

Unit V Diseases related to lipid metabolism (12)

Serum lipids, Cholesterol – Hypercholesterolemia and Hypocholesterolemia. Clinical features of atherosclerosis. Lipid storage Diseases. Lipoproteins – Hyper lipoproteinemia and Hypolipoproteinemia. Tangier disease and Lecithin – cholesterol acyl-transferase deficiency.

(60 hrs)

Course Outcomes

After the completion of the course, the student will be able to:

CO1: Elaborate on the role of health and its affliction by various diseases/disorders.

CO2: Demonstrate and discuss the fundamental biochemistry knowledge related to health

CO3: Interpret and evaluate the abnormalities which commonly occur in the clinical field.

CO4: Describe the disorders of metabolism and its clinical interpretations.

CO5: Recall the biochemical and clinical features of various metabolic disorders.

Text Books

1. M.N. Chatterjee & Ranashinde, Text Book of Medical Biochemistry. Jaypee Brothers Medical Publisher (P) Ltd. 6th edition (2006).
2. Carl A. Burtis, Edward R. Ashwood and David E. Bruns (eds), Tietz Textbook of Clinical Chemistry and Molecular Diagnosis. 5th edition, 2012.

Reference Books

1. Thomas M. Devlin, Biochemistry with clinical correlation. John Wiley & Sons. 7th Ed, 2010.
2. Allan Gaw, Michael J. Murphy, Rajeev Srivastava, Robert A. Cowan, Denis St. J. O'Reilly, Clinical Biochemistry, 5th edition, 2013.
3. Graham Basten, Introduction to Clinical Biochemistry, Interpreting Blood Results. Book Boon. 2nd edition, 2011.

Course objectives

The course integrates the descriptive, experimental and biochemical approaches into a conceptual framework for the analysis of development. The course deals with key steps in the transformation of the single-celled zygote into the complex, multicellular, adult organisms and links genetics with embryology.

Unit 1 An overall view of cells (12)

Origin and evolution of cells. Cell theory. Classifications of cells- Structure of Prokaryotic and Eukaryotic cells. Cell membrane: Fluid Mosaic Model of membrane structure. Transport across membranes-diffusion, active and passive transport.

Unit 2 Cell Organelles (12)

Endoplasmic reticulum - types, structure and functions. Golgi apparatus- structures and functions. Lysosomes- structure and functions, morphology & functions of peroxisomes and glyoxysomes, ribosomes - types, structure and functions. Mitochondria: Structure and function. Chloroplasts structure and functions. Cytoskeleton: Types of filaments and their functions. Microtubules: Chemistry and function. Nucleus - structure and functions.

Unit 3 Cell cycle (12)

Chromosome-chromatin structure, the cell cycle. Phases of cell cycle. Meiotic and mitotic cell divisions, cell- cell communications, cell recognition, cell adhesion and cell functions.

Unit 4 Overview of Developmental Biology (12)

Fertilization: structure of gametes, recognition of sperm and egg –action at distance and contact of gametes. Cleavage: Patterns of embryonic cleavage, radial holoblastic cleavage, spiral holoblastic cleavage, mechanisms of cleavage –regulation of cleavage cycles. Major model organisms. Availability/ culture and cost; access and micro-manipulation. Examples: *Drosophila*, zebrafish, *Caenorhabditis elegans*, chicks

Unit 5 Embryonic development in plants and animals (12)

Early Embryonic Development in animals, morphogenesis and organogenesis in animals: Blastula formation, Types of Cleavage, Gastrulation and formation of germ layers in animals.

Early Embryonic Development in plants: Gametogenesis, Fertilization, Embryo sac development and double fertilization in plants

(60 hrs)

Course outcomes

After the completion of this course, the student will be able to

CO1: Define clearly what is meant by life and living organisms and explain the mechanisms that underlies the evolution of life on earth. Describe the structural characteristics of prokaryotic and eukaryotic cells. Know about the basic concepts of developmental biology.

CO2: Describe the plasma membrane composition, structure, and function. Describe membrane physiology including transport mechanisms across membranes. Illustrate the organization of the

cell and structure and function of the constituent organelles. Study the components of cell's cytoskeleton and its involvement in cell movement.

CO3: Identify the major cellular events that occur during cell division and cell cycle. Explain the concept of DNA as genetic material and its organization in the nucleus. Describe the different ways in which cells communicate, recognize, and adhere one another.

CO4: Know how fertilization and cleavage occur. Know about the process of differentiation to many different types of cells and tissues.

CO5: Understand the basic concepts of organogenesis, morphogenesis, regeneration, aging, gene expression and regulation. Have fundamental knowledge of animal embryonic development-- that is how an egg develops into an adult.

Text Books

1. Devasena.T, Cell Biology. Oxford University Press India; First edition (2012).
2. Rastogi. S.C, Cell Biology. Newage Publishers (2008).
3. T. Subramoniam, Molecular developmental biology. 2nd Edition, 2011.

Reference Books

1. David L Nelson & Michael M Cox, Lehninger -Principles of biochemistry.W.H. Freeman company New York 4th edition 2007.
2. Karp G, Cell and Molecular Biology: Concepts and Experiments. John Wiley & Sons. Inc. 6th Edition.2010
3. De Robertis E.D.P & De Robertis E.M.F. Cell and Molecular Biology. Lippincott Williams & Wilkins, Philadelphia. 8th edition ,2006

Websites

1. <https://microbenotes.com/category/developmental-biology/>
2. <https://www.le.ac.uk/biology/phh4/teaching/heslopharrisonlecture1introductory.pdf>

Course objectives

The course introduces students to various practical aspects of enzymology, combined with assessment of clinical reasoning skills and stimulates the students interest in learning the structure, function and kinetics of enzyme and their correlation in disease conditions.

LIST OF EXPERIMENTS

1. Determination of Optimum pH of Acid Phosphatase
2. Determination of Optimum temperature of Acid Phosphatase.
3. Determination of specific activity of Acid Phosphatase.
4. Determination of Optimum pH of Alkaline Phosphatase
5. Determination of specific activity of Alkaline Phosphatase
6. Estimation of protein by Lowry method.
7. Estimation of blood glucose by Ortho-Toluidine method.
8. Estimation of blood glucose by Anthrone method.
9. Estimation of serum bilirubin by Malloy & Evelyn method.
10. Estimation of total protein and A: G ratio.
11. Estimation of blood urea by diacetyl monoxime method.
12. Estimation of serum creatinine by Jaffe's method.

(30 hrs)

Course outcome:

After the completion of this course, the student will be able to

CO1: Isolate enzymes from biological sources. Discern optimal conditions of enzyme activity.

CO2: Determine the Optimum pH and temperature of Acid Phosphatase. Assay the specific activity of Acid Phosphatase.

CO3: Determine the Optimum pH and specific activity of Alkaline Phosphatase. Determine the Optimum pH of Salivary Amylase. Assay the specific activity of Salivary Amylase.

CO4: Estimate the enzyme activity of Creatine kinase. Assay the enzyme activity of Lactate Dehydrogenase.

CO5: Estimate the enzyme activity of Adenosine Tri Phosphatase. Assay the enzyme activity of Serum Glutamate Oxaloacetate Transaminase. Determine the enzyme activity of Serum Glutamate Pyruvate Transaminase.

Text Books

1. J. Jayaraman, Laboratory Manual in Biochemistry. New Age International Pvt Ltd Publishers. 2011 (Paperback).
2. S. Sadasivam, A. Manickam, Biochemical Methods. New age publishers. 2009 (paperback).

Reference Books

1. Harold Varley, Practical Clinical Biochemistry, CBS. 6 th edition, 2006.
2. Hans Bisswanger, Practical Enzymology. Wiley VCH. 2nd Edition, 2011.
3. Robert Eisinger, Enzyme Assays: A Practical Approach (Practical Approach Series). Oxford University Press, U.S.A. 2nd edition, 2002.

Course objectives

The course was structured to enlighten the importance the enzymes in biological system and to understanding of the kinetics of enzyme catalysed reactions and use of immobilized enzymes.

Unit I Enzymes (12)

Enzyme regulation: General mechanism of enzyme regulation, feedback inhibition and feed forward stimulation. Covalent modification of enzymes. Allosteric enzymes. Regulation of enzymic activity by products and substrates.

Unit II Applications of enzymes (12)

Industrial uses of enzymes - sources of industrial enzymes, thermophilic enzymes, amylases, glucose isomerases, cellulose degrading enzymes, lipases, proteolytic enzymes in meat and leather industry, detergents and cheese production. Immobilization of enzymes, methods and their applications. A brief account of non-protein enzymes - ribozymes and DNA enzymes.

Unit III Metabolism of Lipids (12)

Fate of absorbed dietary lipids. Oxidation of fatty acids - Beta oxidation, alpha oxidation and omega oxidation. Metabolism of Ketone bodies - Formation, Utilization, Excretion and significance. Biosynthesis of fatty acid. Metabolism of Triglyceride, Phospholipids and cholesterol. Biosynthesis of saturated and unsaturated fatty acids.

Unit IV Metabolism of proteins (12)

Introduction, fate of dietary proteins, catabolism of amino acids - transamination, oxidative and non-oxidative deamination, decarboxylation- urea cycle and its regulation.

Unit V Metabolism of nucleic acids (12)

Introduction, fate of dietary nucleic acids, catabolism of purine and biosynthesis of purine nucleotides- denovo synthesis and salvage pathways. Regulation of purine biosynthesis. Catabolism of pyrimidines and biosynthesis of pyrimidine nucleotides. De novo synthesis and salvage pathways, regulation of pyrimidine synthesis.

(60 hrs)

Course outcome:

After the completion of this course, the student will be able to

CO1: Explain about the digestion of proteins, catabolism of amino acids and the

urea cycle & become familiar with the concept of metabolic maps

CO2: Describe ketogenesis, fatty acid oxidation and synthesis. Compare and contrast the structure and function of cholesterol and cholesterol esters.

CO3: Compare and contrast the life cycle of the various lipoprotein particles with respect to their composition, metabolism and transport.

CO4: Distinguish the disease states associated with Inborn Errors of Metabolism, including (A) the deficient enzyme, (B) relation of the deficiency to the buildup of secondary metabolites, and (C) clinically relevant information related to the disease state.

CO5: Describe the major applications of enzymes in industry, understand the principles of enzyme immobilisation techniques and enzyme extraction procedures. Develop new ideas for the development of enzyme-based drugs. Discuss enzymes that are responsible for energy conversion from nutrition. Discuss various application of enzymes that can benefit human life. Discover the current and future trends of applying enzyme technology for the commercialization purpose of biotechnological products.

Text Book

1. Donald Voet and Judith Voet, Fundamentals of Biochemistry, 2006, 2nd edn, Wiley Asia.

Reference Books

1. Robert K Murra , Daryl Granner and Victor W Rodwell, Harper's illustrated biochemistry, 2006, 27th edition, Mc Graw Hill international edition
2. M.N.Chatterjea and Ranashinde, Text book of Medical biochemistry, 2005, 6th edition, Jaypee Brothers Medical Publisher (P) Ltd.
3. David L Nelson and Michael M Cox, Principles of biochemistry 2007, 4th edition. W.H. Freeman company New York

Website

1. <https://biochemden.com/intermediary-metabolism-basic-notes/#:~:text=Metabolism%20is%20the%20term%20used,take%20place%20in%20the%20Liver.>
2. <https://www.slideshare.net/tonyscaria/intermediary-metabolism-biochemistry-revision-notes>

Course objectives

The course aims to provide an advanced understanding to assess the liver, kidney and gastric functions. The course provides an overview of normal and abnormal metabolic functions, the impact of disorders on metabolic processes, the molecular basis of diseases and novel strategies to prevent the diseases.

Unit 1 Liver Function tests (12)

Liver structure and functions. Metabolism of bilirubin. Jaundice-types, clinical features and tests based on bile pigments level in blood and urine. Differentiation of three types of jaundice. Prothrombin Time. Liver function tests.

Unit 2 Renal function tests (12)

Normal and abnormal constituents in urine. Formation of urine- Glomerular filtration and tubular reabsorption. Clearance tests-urea, creatinine, inulin, PAH test, Concentration and dilution tests.

Unit 3 Gastric function tests (12)

Collection of gastric contents, Tests of gastric function – Examination of gastric residuum, Fractional Test Meal (FTM), Stimulation tests and Tubeless gastric analysis.

Unit 4 Clinical enzymology (12)

Definition of functional and non-functional plasma enzymes. Isoenzymes and diagnostic tests, Enzyme patterns in acute pancreatitis, liver damages, bone disorders, myocardial infarction and muscle wasting.

Unit 5 Diagnosis of tumors (12)

Definition of tumor markers, Markers produced by various tissues, classification and clinical applications. Imaging techniques to diagnose cancer – CT, MRI, PET, SPECT.

(60 hrs)

Course outcomes

On successful completion of the course, the student shall be able to:

CO1: Describe the important laboratory biochemical tests.

CO2: Elucidate the role of enzymes in clinical diagnosis of diseases.

CO3: Create awareness of different lifestyle diseases increasingly found in present day.

CO4: Understand the impact of metabolic processes in disease conditions.

CO5: Summarize the clinical applications of biochemical/clinical tests for disease diagnosis.

Text Books

1. M.N. Chatterjee & Ranashinde, Text Book of Medical Biochemistry. Jaypee Brothers Medical Publisher (P) Ltd. 6th edition (2006).

2. Vasudevan D.M, Sreekumari S and Kannan Vaidyanathan, (2011), Text Book of Biochemistry for Medical Students, 6th ed., JAYPEE Brothers Medical Publishers Pvt.Ltd., New Delhi, 110002.

Reference Books

1. Carl A. Burtis, Edward R. Ashwood and David E. Bruns (eds), Tietz Textbook of Clinical Chemistry and Molecular Diagnosis. 5th edition, 2012.
2. Thomas M. Devlin, Biochemistry with clinical correlation. John Wiley & Sons. 7th Ed, 2010.
3. Teitz Textbook of Clinical Biochemistry 3rd ed. Burtis et al., William Heinmann Medical Books Ltd., 1999.

Course objectives

This paper ascertains that the biochemists get accurate information about various hormones, functions, mechanism of action, and related disorders.

Unit 1 Pituitary Hormones (12)

Hormones – Classification, biosynthesis, transport, modification and degradation. Structure of receptors, Feedback regulation. Mechanism of hormone action. Hypothalamic and pituitary hormones. Hypothalamic releasing factors. Hypothalamic hypophyseal portal system. Anterior pituitary hormones- GH, TSH, ACTH, LH, FSH and PRL biological role, feedback regulation and related disorders of hypo and hyper secretion. Posterior pituitary hormones-oxytocin and vasopressin – biological actions, regulation and related disorders.

Unit 2 Thyroid hormones (12)

Thyroid hormones – synthesis, secretion, regulation, transport, metabolic fate and biological actions. Antithyroid agents. Hyper and hypothyroidism. Hormonal regulation of calcium and phosphate metabolism. Parathyroid hormones-Parathormone and Calcitonin -biological actions, and related disorders-. Hypercalcemia and hypocalcemia, Rickets and osteomalacia.

Unit 3 Adrenal Hormones (12)

Hormones of Adrenal cortex- Synthesis, action, biological role, regulation, transport and metabolism. Adrenal function tests. Disorders of adrenal cortex-Cushing's syndrome, aldosteronism, Congenital adrenal hyperplasia, Adrenal cortical insufficiency. Hormones of Adrenal medulla synthesis, biological role, metabolism, regulation and related disorder- Pheochromocytoma.

Unit 4 Pancreatic hormones (12)

Pancreatic hormones – synthesis, regulation, biological effects and mechanism of action of glucagon, somatostatin and insulin. Insulin receptors. Related Disorders – Diabetes mellitus. Brief account of gastrointestinal Hormones.

Unit 5 Gonadal hormones (12)

Gonadal hormones - Biosynthesis, biological actions, transport, regulation and metabolism of androgens, oestrogen and progesterone., The menstrual cycle. Pregnancy –Biochemical changes and diagnostic tests. Role of hormones during parturition and lactation. Gonadal disorders.

(60 hrs)

Course outcomes

After the completion of this course, the student will be able to

CO1: Understand the positions of the various endocrine glands and their secretions.

CO2: Learn the diverse group of hormones and their specific mechanism of action in the bodily metabolism

CO3: Understand the regulation of hormones action by feedback mechanism

acquire knowledge on the pathophysiology, diagnosis, treatment and management of endocrine disorders

CO4: Identify the class and functions of various types of second messengers and their action.

CO5: Describe the mechanism of hormones and its effects

Text Books

1. Prakash.S.Lohar, Endocrinology, MJP Publishers, 2005
2. R.Radheshyam, Textbook of Endocrinology, Neha Publishers, 2012.

Reference Books

1. Hadley ME, The vertebrate endocrine system, in. Endocrinology, 4th Edition (Prentice Hall, NJ) 1996.
2. C. Guyton, MD and John E. Hall, Textbook of Medical Physiology, 11th Edition, 2006
3. Larsen: Williams Textbook of Endocrinology, 10thed., 2003 Elsevier
4. R.Radheshyam, Behavior endocrinology, Neha Publishers, 2013

WEBSITES

1. <https://biochem.zsmu.zp.ua/wp-content/uploads/2017/04/Biochemistry-of-hormones.pdf>
2. <https://www.ym.edu.tw/~cwluo/protocol/ch45-hormone.pdf>

Course objectives

The course introduces students to various practical aspects of enzymology, combined with assessment of clinical reasoning skills and stimulates the students interest in learning the structure, function and kinetics of enzyme and their correlation in disease conditions.

LIST OF EXPERIMENTS

1. Determination of Optimum pH of Salivary Amylase.
2. Determination of specific activity of Salivary Amylase.
3. Determination of enzyme activity of Lactate Dehydrogenase
4. Determination of enzyme activity of Serum Glutamate Oxaloacetate Transaminase
5. Determination of enzyme activity of Serum Glutamate Pyruvate Transaminase
6. Estimation of serum uric acid by phosphotungstate method.
7. Estimation of serum cholesterol by Zaks method.
8. Estimation of serum triglycerides
9. Estimation of serum phospholipids
10. Qualitative Analysis of Urine for the presence of normal and abnormal constituents.

(30 hrs)**Course outcome:**

After the completion of this course, the student will be able to

CO1: Gain knowledge of biological samples and their collection procedures. Perform biochemical laboratory analysis in blood samples

CO2: Analyse biochemicals in urine samples. Distinguish serum, plasma and whole blood emphasizing the role of anticoagulants

CO3: Assess presence and absence of normal and abnormal constituents in urine by performing qualitative urine analysis.

CO4: Analyze glucose, urea protein, total protein and A/G ratio in blood

CO5: Determine analytes such as creatinine, uric acid, cholesterol and triglycerides in serum. Evaluate and interpret the generated results after analysis in order to determine the likely diagnosis

Text Books

1. J. Jayaraman, Laboratory Manual in Biochemistry. New Age International Pvt Ltd Publishers.2011 (Paperback).
2. S. Sadasivam, A. Manickam, Biochemical Methods. New age publishers. 2009 (paperback).
3. S. K. Sawhney, Randhir Singh, Introductory Practical Biochemistry. Alpha Science International, Ltd. 2nd edition, 2005.

Reference Books

1. Harold Varley, Practical Clinical Biochemistry, CBS. 6th edition, 2006.
2. Hans Bisswanger, Practical Enzymology. Wiley VCH. 2nd Edition, 2011.

Course objectives:

Cell biology practical is an understanding of cell biology as an asset in modern science. It provides knowledge about the composition, structure and function of organelles and other cellular components and their biological activities.

LIST OF EXPERIMENTS

1. Visualization of animal cell by methylene blue
2. Visualization of plant cell by methylene blue.
3. Identification of different stages of mitosis in onion root tip.
4. Identification of different stages of meiosis in grasshopper testis.
5. Micrographs of different cell components (dry lab).
6. Sub-cellular fractionation.
7. Visualization of nuclear fraction by acetocarmine stain.
8. Isolation of mitochondria from rat liver
9. Staining and visualization of mitochondria by Janus green stain.
10. Isolation of WBC
11. Isolation of Platelets
12. Osmotic Fragility Test

(30 hrs)**Course outcomes**

After the completion of this course, the student will be able to

CO1: Separate animal cells and visualize them. Separate plant cells and visualize them

CO2: Visualize different stages of mitosis on onion root tip. Visualize different stages of meiosis.

CO3: Perform sub-cellular fractionation. Gain Knowledge about structure and function of different cell components.

CO4: Understand the over-view of composition of blood. Isolate WBC.

CO5: Understand about osmosis employing osmotic fragility test. Know about the structure and function of mitochondria and chloroplast.

Text Books

1. J. Jayaraman, Laboratory Manual in Biochemistry. New Age International Pvt Ltd Publishers. 2011 (Paperback).
2. S. Sadasivam, A. Manickam, Biochemical Methods. New age publishers. 2009 (paperback).
3. S. K. Sawhney, Randhir Singh, Introductory Practical Biochemistry. Alpha Science International, Ltd. 2nd edition, 2005.

Reference Books

1. Harold Varley, Practical Clinical Biochemistry, CBS. 6th edition, 2006.
2. Hans Bisswanger, Practical Enzymology. Wiley VCH. 2nd Edition, 2011.

Course objectives

Molecular biology deals with nucleic acids and proteins and how these molecules interact within the cell to promote proper growth, division, and development. It is a large and ever-changing discipline. This course will emphasize the molecular mechanisms of DNA replication, repair, transcription, protein synthesis, and gene regulation in different organisms.

Unit 1 Identification of genetic materials**(9)**

Direct evidences for DNA as the genetic material, transformation experiments, identification of the transforming principle, blender experiment, bacterial conjugation, indirect evidences for DNA as the genetic material, evidences for RNA as genetic material of some viruses.

Unit 2 Replication**(9)**

Evidences for DNA as the genetic material. Structural organization and functional elements of eukaryotic chromosomes. Prokaryotic and Eukaryotic replication, Regulation of replication, Mutation, DNA Repair, Recombination.

Unit 3 Prokaryotic Transcription**(9)**

Prokaryotic transcription. Inhibitors of transcription. Post transcriptional processing of rRNA and tRNA. Regulation of transcription in prokaryotes– the lac operon, negative and positive regulation and tryptophan operon.

Unit 4 Eukaryotic Transcription**(9)**

Eukaryotic transcription and regulation. RNA polymerase I,II and III, promoters, transcription factors, Transcription factor motifs, Activators, repressors and enhancers, transcription complex assembly and mechanism of transcription. Post transcriptional processing of mRNA, rRNA and tRNA. Splicing, Alternative splicing, catalytic RNA (ribozymes), RNA editing, Antisense RNA.

Unit 5 Translation**(9)**

Genetic code and translation. The genetic code – general features, Deciphering the code, Wobble Hypothesis. Translation- activation of aminoacids, initiation, elongation, termination in prokaryotes and eukaryotes. Regulation of gene expression in eukaryotes. DNA methylation, chromatin remodelling, DNA response elements, degradation of proteins. Protein sorting, targeting of proteins to mitochondria, chloroplast and nucleus, Receptor mediated endocytosis

(45 hrs)**Course outcomes****After the completion of this course, the student will be able to**

CO1: Speculate the molecular mechanisms regulating, Evidences for the basics of central dogma of life

CO2: Assess the molecular mechanisms behind DNA damage and repair, regulation of replication

CO3: Incorporate the different molecular mechanisms in prokaryotes with a special concern towards the different molecular concepts.

CO4: Incorporate the different molecular mechanisms in eukaryotes with a special concern towards the different molecular concepts.

CO5: Prioritization of the deciphering of the genetic code, understand the targeting of proteins in cellular and molecular level.

CO6: Assessment of the genetic materials, direct and indirect evidences for DNA as genetic material

Text Books

1. De Robertis, Cell and molecular biology. Dhanpat Rai Publisher, 8th Edition, 2001.
2. NaliniChandar, Susan Viselli, Lippincott Illustrated Reviews: Cell and Molecular Biology.LWW : North American Edition (2010).
3. Robert Franklin Weaver, Molecular Biology. Mc-Graw Hill science, 5th edition, 2011.

Reference Books

1. Bruce Alberts, Alexander Johnson, Julian Lewis, Molecular biology of the cell. Garland Science, 6th edition (2014).
2. Benjamin Lewin, Genes IX. Jones & Bartlett Learning; 9th edition (2007).
3. Harvey Lodish, Arnold Berk & Chris A. Kaiser, Molecular Cell Biology. W. H. Freeman; 6th edition (2007).
4. James D. Watson, Tania A. Baker, Stephen P. Bell, Molecular Biology of the Gene. Benjamin Cummings, 7th Edition (2013).

Website

- 1.<https://microbenotes.com/category/molecular-biology/>
- 2.<https://www.easybiologyclass.com/molecular-biology-ppt-free-power-point-presentations-in-molecular-biology/>

The final requirement for awarding the BSc degree is the completion of a substantial and original research project.

The successful completion of this requirement is demonstrated through the production of a dissertation document, describing the research project and its results, and the defense of the project from challenges offered by the members of the student's faculty Dissertation Committee.

The quality of the dissertation and the defense of its thesis are evaluated by the Dissertation Committee in order to determine if the student has successfully completed this final requirement for the BSc degree in Biochemistry.

(60 hrs)

**DISCIPLINE SPECIFIC
ELECTIVE
SYLLABUS**

Course Objectives:

To learn the various issues pertaining to the environment and to combat the environmental issues with efficient strategies. The course will also assess the various existing environmental risk issues

Unit I (9)

Introduction to environmental biochemistry, organisms and stress factors, temperature as a factor – cold exposure and acclimatization. metabolic deification's role of hormone and nervous system. Heat exposure and adaptation to heat. Pressure a factor –Low pressure and its effects. Enzymes, metabolic rhythms and environment.

Unit II (9)

Air pollution: types of air pollutants. Source effects of vegetation animals and human death; control treatment. Water pollution – sources, effect of pollution on lakes and oceans, water quality. Land pollutants and their biochemical effects. Solid waste – characteristics of municipal waste: disposal; hazardous waste. Noise pollution and their biological effects.

Unit III (9)

Industrial pollution: sources, characteristics of industrial effluents; general treatment of industrial effluents; collection and analysis of industrial samples. removal of waste water from sugar industry, paper industry, pesticides and tannery industry. Instruments methods fro monitoring industrial pollutants. Marine pollution – pollutants, sources; effects oil pollution control. Thermal pollution: sources: effects and preservation

Unit IV (9)

Pesticides: systemic and non-systemic pesticides, structure, mode of action and applications. Behavior in soils, degradation of pesticides by microorganisms, problems of pollution by pesticides. Environmental risks of direct and indirect food additives, foot colors and other contaminants. Occurrence of pesticides in foods.

Unit V (9)

Environmental carcinogens – chemical carcinogens, classification and mode of action, reactions of chemical carcinogens with living systems. Environmental teratogens – teratogenic effects, mechanism of action of teratogens. Environmental mutagens and their effects. Effects of radiation – sources of radiation; radioactive wastes; misshape; waste management. Plastics – industrial and laboratory hazards of plastics and their decomposition.

(45 hrs)**Course Outcomes**

After Completion of the course the student will be able to

CO1: Understand the subject of environmental management

CO2: Describe the issues concerned with environmental management

CO3: Analyze the various environmental hazard issues

CO4: Describe the effects of pollution, pesticides and environmental carcinogens

Text Books

1. Environmental pollution and control – Vesilind & peirce
2. Air pollution and control – Mouli&subayya
3. Biotechnology and waste water treatment – Fopster
4. Industrial pollution – Kudesia
5. Environmental pollution – Katyal

Reference Books

1. Concepts in radiation cell biology – Graylwhiston
2. Radiation and life – Eric J hall
3. Biochemical effects of environmental pollutants – SSD.LEE
4. Pesticides – R. Cremlyn
5. Toxicology – Klaasseen

Course objectives

This paper provides a complete understanding of the responses of the human body to toxic agents and the therapeutic approaches to toxicity. The paper also deals with the forensic aspects like legal procedures and types of trauma.

Unit 1 Introduction to Forensic Science (12)

Historical aspects of forensic science. Definitions, Concepts and Scope of forensic science. Tools and Techniques in Forensic Science. Organizational set up of Forensic Science Laboratories in India - Central and State Forensic Science Laboratories, Fingerprint Bureaus, National Crime Records Bureau, Police & Detective Training Schools, Bureau of Police Research & Development. Services of crime laboratories.

Unit 2 Forensic Psychology (12)

Basics of Forensic Psychology - Definition and fundamental concepts of forensic psychology and forensic psychiatry. Ethical issues in forensic psychology. Psychology and Criminal Behaviour - Psychopathology and personality disorder. Psychological assessment and its importance. Detection of Deception - Tools for detection, Polygraphy and Narco analysis and brain electrical oscillation signatures.

Unit 3 Technological Methods in Forensic Science (12)

Instrumentation - Sample preparation for chromatographic and spectroscopic evidence. Fundamental principles and forensic applications of thin layer chromatography, gas chromatography and liquid chromatography. Microscopy - Electron microscope and Comparison Microscope. Forensic applications of microscopy. Forensic photography - Basic principles and applications of photography in forensic science, Crime scene and laboratory photography.

Unit 4 Forensic Biology (12)

Biological Evidence - Nature and importance of biological evidence. Morphology and biochemistry of human hair, Comparison of human and animal hair. Identification of wood, leaves, pollens and juices as botanical evidence. Diatoms and their forensic significance. Forensic Entomology - Basics of forensic entomology. Insects of forensic importance. Collection of entomological evidence during death investigations.

Unit 5 Forensic Toxicology (12)

Basics of Toxicology - Post-mortem Toxicology and Human performance toxicology. Dose-response relationship - Lethal dose 50 and effective dose 50. Poisons - Classification of poisons. Physio-chemical characteristics and mode of action of poisons. Accidental, suicidal and homicidal poisonings. Drugs - Broad classification: Narcotics, stimulants, depressants and hallucinogens. Natural, synthetic and semi-synthetic narcotics, drugs and psychotropic substances. Testing of narcotics, drugs and psychotropic substances.

(60 hrs)

Course outcomes

After the completion of this course, the student will be able to

CO1: Demonstrate an understanding of how forensic scientists operate and use scientific evidence in a legal context.

CO2: Describe the working of the forensic establishments in India and abroad.

CO3: Develop an understanding of the elements of criminal justice system and the consequences of crime in society.

CO4: Develop the skills involving the tools and techniques required for detection of deception and the critical assessment of advanced forensic techniques.

CO5: Develop skills in using various tools and techniques for analysis of different types of crime scene evidence.

TEXT BOOKS:

1. Narayanareddy K. S., The Essentials of Forensic Medicine & Toxicology, 2007Published by K. Sugana Devi, 26th Edition, Hyderabad.
2. Basu, R. Fundamentals of forensic medicine and toxicology. 2009. 2nd Edition. Books and Allied(P) Ltd. Kolkata.

REFERENCE BOOKS:

1. Parikh C.K. Parikh 's Textbook of Medical Jurisprudence and Toxicology, Publishers Bangalore. 6th Edition 1999, Reprint 2007.
2. Franklin, C.A Modi's medical Jurisprudence and Toxicology, published by M. Tripathi Private Limited,,21st Edition. Bombay.
3. Keith Simpson, Bernard Knight, 1988, Forensic Medicine, ELBS. 9th Edition.
4. Pillay V.V., Text book of Forensic Medicine,2009, Paras Publication. Hyderabad5. JB Mukherjee's Forensic Medicine and Toxicology – Volume I and II (combined)- edited by Karmakar, III Edition 2007.

Course Objective

This course aims to provide overview of protein biochemistry since proteins and enzymes are the most versatile functional entities in life with applications in various life sciences research as well as in industry and biomedicine. The course also gives insight to biochemical, structural, functional aspects of proteins and learn about the methods of data retrieval from various databases.

Unit 1 Classification and Structure of Proteins (9)

Proteins - Functions and Properties. Classification of proteins based on solubility, shape, composition and function. Denaturation and renaturation of proteins. Structure of peptide bonds. Biologically important peptides-structure and functions. Protein structures - Primary, secondary, tertiary and quaternary. Forces stabilizing the structures of proteins.

Unit 2 Extraction of Proteins (9)

Solubilization of proteins from their cellular and extracellular locations. Use of simple grinding methods, homogenization, ultrasonication, French press and centrifugation

Unit 3 Separation techniques (9)

Ammonium sulphate fractionation, solvent fractionation, dialysis and lyophilization. Ionexchange chromatography, molecular sieve chromatography, reverse phase chromatography, affinity chromatography, HPLC and FPLC.

Unit 4 Characterization Techniques (9)

Determination of purity, molecular weight, extinction coefficient and sedimentation coefficient, Isoelectric focusing (IEF), SDS-PAGE and 2-D electrophoresis.

Unit 5 Protein structure databases (9)

Introduction - Protein sequence and structure databases (UNIPROT, SWISS-PROT & PDB), Protein sequence file Format (FASTA). Use of sequence and domain information. Molecular Visualization Tools- Rasmol, SWISS PDB viewer.

(45 hrs)

Course Outcomes

On successful completion of the course, the student shall be able to:

CO1: Elaborate the structure and biological functions of proteins.

CO2: Describe the hierarchy of protein structure and recall the classification of proteins.

CO3: Demonstrate the separation techniques and characterization methods of proteins.

CO4: Describe different strategies and methods for the isolation, structure determination and modification of proteins.

CO5: Summarize the interpretation of protein sequences and structures and use such information to predict protein function.

Text books

1. U. Satyanarayana and U. Chakrapani (2013). Biochemistry. Elsevier and Books & Allied (P) Ltd. Kolkata.
2. Garrette R.H and Grisham, C. M (2012), Principles of Biochemistry, 5th ed, Saunders college publishers.
3. Ignatchimuthu, S, (2009), Basic Bioinformatics, Narosa Publishing House Pvt Ltd, New Delhi.

Reference Books

1. Voet, D., Voet, J.G. and Pratt, C.W. (2013), Fundamentals of Biochemistry, Life at the Molecular Level, 4th ed., John Wiley & Sons, New Delhi, 110002.
2. Ambika Shanmugam (2008), Fundamentals of Biochemistry for Medical Students, 7th ed.
3. Ruchi Singh (2014). Bioinformatics: Genomics and Proteomics. S. Chand & Company Pvt. Ltd. New Delhi.

Course Objective:

The paper should give sound knowledge of essential elements of the immunology with special consideration to the importance of the immune system in medicine and the mechanism of action of immune system.

UNIT 1 Introduction to immunology (12)

Introduction to biology of the immune system. Types of Immunity, Antigen, Haptens and Adjuvants, Antibody. Immunoglobins – structure, distribution, function and types of immunoglobulins.

UNIT 2 Cells and Organs of the immune system (12)

Organs of immune system – primary and secondary. Cells of immune system. Activation and differentiation of lymphocytes. Humoral and cell mediated Immune response. MHC structure and function. Antigen processing and presentation. Autoimmunity and Hypersensitivity.

UNIT 3 Immuno-techniques (12)

Introduction to Antigen-antibody interactions. Affinity, avidity, cross reactivity, Precipitation reaction. Radial immune diffusion, Ouchterlony double diffusion. Agglutination reaction. Complement fixation, ELISA, Immunocytochemistry. Monoclonal antibody.

Unit 4 Hypersensitivity (12)

Hypersensitivity reactions – type I, II, III, IV. Immunological tolerances and autoimmune diseases. Vaccines – active and passive immunization, commonly used vaccines – toxoid vaccines, killed vaccines, live attenuated vaccines, bacterial polysaccharide vaccines.

Unit 5 Immune response to Infection (12)

Transplantation immunology – clinical manifestations, bone marrow and organ transplants. Allergy and hypersensitivity. Cancer - immune response to tumours and immunotherapy. AIDS - structure of HIV, destruction of T cells, immunological syndrome of AIDS, AIDS vaccine.

(60 hrs)

Course outcome:

After the completion of this course, the student will be able to

CO1: Describe the development of the various cells and tissues of the human immune system. CO2:

Describe the roles of the immune system in both maintaining health and contributing to disease.

CO3: Describe briefly the immunological response and how it is triggered and regulated.

CO4: Elucidate the reasons for immunization and aware of different vaccination.

CO5: Demonstrate a capacity for problem-solving about immune responsiveness.

Text Books:

1. Roitt, Brostoff, Mal, Immunology, 6th edition, 2001 Reference
2. Panicker, Microbiology, orient Longman, Hyderabad, 6th edition, 2005.
3. Immunology, Kuby, by Kindt, Goldsby, Osborne, Sixth Edition.

Reference Books:

1. M.J.Pelzar, Microbiology, Tata mac hran, Hill New Delhi, 5th edition, 2005.
2. Donald.M.Weir, Immunology, John Stewart, 7th edition, 1993
3. P.M.Lydyard, A.Whelan, M.W. Fanger, Immunology, 2003
4. Jacqueline Sharon, Williams &Williens, Immunology,1998
5. John W, Kimball Maxwell, Introduction to Immunology, Mac Millan International Edition.
6. Ivan M. Roitt and Peter J delves, Essential Immunology, Blackwell Publishing.

Course objectives

To Understand and perform, the most recent and important methods in Molecular Biology and also understand the molecular approach used in research relevant for understanding the development and treatment of human diseases. Hands –on training of the latest molecular biology techniques.

LIST OF EXPERIMENTS

1. Separation of proteins by SDS PAGE.
2. Determination of molecular weight of serum proteins by SDS PAGE
3. Study of enzyme activity on Native PAGE.
4. Isolation of plasmid DNA.
5. Isolation of genomic DNA from plant source.
6. Separation of DNA by Agarose gel electrophoresis.
7. Determination of size of DNA by agarose gel electrophoresis
8. RFLP.
9. Gene amplification by PCR.
10. RT-PCR (Demonstration)
11. Southern hybridization (Demonstration).
12. Western blotting (Demonstration).

(30 hrs)

Course outcomes

After the completion of this course, the student will be able to

CO1: Determine and understand the basic principle involved in isolation of biomolecules from various biological sources

CO2: Isolate and purify DNA and RNA from various sources – viz plant, microbes and animals

CO3: Separate Proteins by SDS PAGE

CO4: Understanding the mobility differences of macromolecules in electrophoresis

CO5: Understand the optimal conditions essential for protein/nucleic acid separation and purification

References

1. Michael R. Green, Joseph Sambrook. Molecular Cloning: A Laboratory Manual, 4th Ed.
2. S.K.Sawhney and Randhir Singh. Introductory practical biochemistry. 2nd edition.2005. .
3. Roger L. Lundblad, Fiona Macdonald. Handbook of Biochemistry and Molecular Biology, 4th Edition. CRC Press, 2010
4. Leland J. Cseke, AraKirakosyan, Peter B. Kaufman, Margaret V. Westfall. Handbook of Molecular and Cellular Methods in Biology and Medicine, 3rd Edition, CRC Press, 2011

Course objectives:

To understand and perform, the most important methods in immunology and to enhance the practical experience on techniques in immunological tests

List of Experiments:

1. Blood film preparation and identification of cells.
2. ABO Blood Grouping.
3. WIDAL test.
4. Single radial immunodiffusion
5. Double immunodiffusion
6. Ouchterlony double diffusion
7. Latex agglutination test.
8. Immunoprecipitation.
9. Immuno-electrophoresis.
10. Rocket immuno-electrophoresis.
11. Detection of antigens or antibodies by ELISA (Indirect/Sandwich ELISA).
12. CLIA assay (Demo)

(30 hrs)

Course outcome:

After the completion of this course, the student will be able to

CO1: Develop an understanding of the scope of immunology.

CO2: Describe the principle involved in the immune responses.

CO3: Describe the various mechanisms involved in the immune response and their importance in the clinical diagnosis of infection and disease.

CO4: Interpret the basic types of serological reactions and significance of use in clinical laboratories.

CO5: Compare and discuss the diseases relevant to the immune system.

CO6: Develop an understanding about the basic serological techniques in disease diagnosis and to recognize the importance of obtained laboratory data and correlation to disease processes.

Text Books:

1. Roitt I, Male, Brostoff. Immunology, Mosby Publ., 2002.
2. Kuby J, Immunology, WH Freeman & Co., 2000.
3. Ashim K. Chakravathy, Immunology, TataMcGraw-Hill, 1998.
4. Jayaraman. J. (1992), Laboratory Manual in Biochemistry, 4th reprint, Wiley Eastern Ltd, New Delhi
5. Gupta. R.C and Bhargava. S. (1992), Practical Biochemistry, CBS Publishers and Distributors, New Delhi.
6. David. T. Plummer, (1995), An Introduction to Practical Biochemistry, Tata McGraw Hill Publishing Company Ltd, New Delhi.

Course objectives

The course was designed in such a way to impart knowledge of signalling mechanisms taking place at cellular level and to assess the mechanism of signalling molecules in transduction process.

Unit 1 Membrane Transport (12)

Membrane assembly – importins and exportins. Membrane transport: Diffusion (passive and facilitated). Active transport – symport, antiport, Na⁺ K⁺ ATPase. Ion gradients, ion selective channels, group translocations. Endocytosis and exocytosis.

Unit 2 Cell Signalling I (12)

Fundamental concepts and definitions of signal, ligands, and receptors, Endocrine, paracrine and autocrine signalling. Receptors and signalling pathways – cell surface receptors, ion channels G protein coupled receptors, receptor kinases (tyr, ser/thr).

Unit 3 Cell Signalling II (12)

Signal transduction through cytoplasmic and nuclear receptors. The Ras – raf – MAP kinase cascade. Second messengers – cyclic nucleotides, lipids and calcium ions. Crosstalk in signalling pathways.

Unit 4 Cell cycle (12)

Cell Cycle: - Overview of cell cycle. Cell cycle Control in mammalian cells, Checkpoints in cell-cycle regulation.

Unit 5 Cancer (12)

Cell cycle and cancer: - Apoptosis (Programmed cell death) -- Pathways, regulators & effectors in apoptosis. Cancer: Properties of tumor cells & Genetic basis and onset of cancer. Tumor suppressor genes and functions of their products. Carcinogenic effect of chemicals and radiation. Molecular diagnosis of cancer.

(60 hrs)

Course outcomes

CO1: Understand the basics of “Cell Biology”. Comprehend the historical and current understanding of cell membrane structure and function.

CO2: Demonstrate membrane structure and functions. Demonstrate the types of transport mechanisms on membranes.

CO3: Encompass the basic concepts of co-ordination and integration in multicellular organisms with respect to metabolic events.

CO4: Encompass the fundamentals of ligand and receptor interactions. Understand the basics and different types of signalling pathways.

CO5: Gain knowledge on signal transduction and Gain knowledge on the role of second messengers. Understand Basics of cell cycle as well as apoptosis. Know about cancer, its development and types.

Text Book

1. Lodish et al. Molecular Cell Biology. Scientific 5th ed. Freeman.2003

Reference Books

1. De Robertis and De Robertis. Cell and Molecular Biology, Lea and Febiger. 8th ed. 2006
- 2.Karp G. Cell and Molecular Biology. 3rd ed. John Wiley and Sons. 2002.
- 3.Lodish et al. Molecular Cell Biology. Scientific 5th ed. Freeman.2003
4. Twyman. Advanced Molecular Biology. Viva books. 2nd ed. 1998
5. 6. Alberts et al. Molecular Biology of the Cell. 4th ed. Garland Sci. 2002.
7. Murray et al. Harper's Biochemistry. 26th ed. McGraw Hill. 2003 (for Unit–II).

Websites

- 1.<https://www.khanacademy.org/science/ap-biology/cell-communication-and-cell-cycle/cell-communication/a/introduction-to-cell-signaling>
2. <http://dosequis.colorado.edu/Courses/MCDB3145/Docs/Karp-617-660.pdf>

Course objectives

The content of the syllabus consist of basic and new biotechnology tools, techniques and their applications and products such as cell lines, transgenic animals, transgenic plants are being developed by biotechnologists. Genetic engineering and nanotechnology are useful in research, agriculture, industry and in medical field.

Unit 1 Biotechnological Tools and Cloning Vectors**(12)**

Biotechnology: Definition, scope, types and branches of biotechnology. Role of enzymes: Restriction endonucleases, DNA ligases, Reverse transcriptase, DNA polymerase. Use of Linkers and Adapters, homopolymer tailing. Cloning vectors – Plasmids, M 13 phage, cosmids, Yeast artificial vectors (YAC), SV40.Plasmid Copy number. PCR – principle, types and applications. Crispr-cas9 gene editing tool/technology.

Unit 2 Techniques**(12)**

Recombinant DNA technology: Basic techniques – cutting and joining of DNA molecules, various type of gene transfer methods in animal cells, plant cell and microbes (physical, chemical and biological), Selection and screening of recombinants. Insertional inactivation. Blotting techniques - Southern, Northern and Western blotting. RNA interference. Next Generation Sequencing.

Unit 3 Animal biotechnology**(12)**

Animal biotechnology: Cell culture and organ culture, Tissue Engineering, 3D bioprinting and animal cloning. Production of medically important biomolecules – Insulin, growth hormone, monoclonal antibodies and interferon.

Unit 4 Plant biotechnology**(12)**

Plant biotechnology: Trans-grafting Technique, Cisgenesis and Intragenesis. Principle and importance of Genetic engineering of plants for pest resistance, herbicide resistance, stress tolerance and nitrogen fixation.

Unit 5 Nanotechnology**(12)**

Nanotechnology – Introduction and application of nanoparticles/nanocomponents. Nanotechnology in tissue engineering, nucleic acid, enzymes, cancer and organ transplantation and biosensors.

(60 hrs)**Course outcome:**

After the completion of this course, the student will be able to

CO1: Explain the tools and techniques that are being used in medically related research laboratories and industries.

CO2: Describe the applications of biotechnology in industry and clinical research.

CO3: Explain the laboratories that use new tools and technologies.

CO4: Illustrate and develop the molecular and genetics related laboratory techniques and experiments.

CO5: Explain the different approaches used in plant and animal biotechnology

Text Books

1. Sathyanarayana, Biotechnology, Books and allied Publishers, 3rd edition, 2006
2. RC Dubey, Text book of Biotechnology, S. Chand & Co, 2009

Reference Books

1. Brown TA “Gene cloning: An introduction” Nelson Thornes, 3rd edition, 1995
2. William.J. Thieman, Michael A. Pallidino. Introduction to biotechnology. Pearson Publication. 2nd edition, 2013
3. SS Purohit. Biotechnology Fundamentals and applications. Agrobios Publication. 4th edition. 2007
4. SB Primrose & R Twyman. Principles of gene manipulation and genomics. Blackwell publishing. 7th edition. 2006.

Course objectives

This course covers the ecological and genetic core of evolutionary including plants and human beings. It discusses the maintenance of genetic variability, the rôle of chance in evolution, the origins of species and theories of evolution beyond the species level. The usefulness of evolutionary biology in disease and pest control, and in conservation also plays a part.

Unit 1 Genetics (12)

Gene concept and interaction of genes. Molecular structure of genes and chromosomes. Mendel's work on heredity, Mendel's mono and dihybrid experiments. Mendel's Laws, Linkage and crossing over, coupling and repulsion hypothesis, sex linked inheritance. Non-chromosomal inheritance.

Unit 2 Molecular Genetics (12)

Identification of genetic materials, Chemical nature of genetic materials, Organization of genetic materials, Plasmids, IS elements, Transposons and retroelements, Multigene families, Messenger RNA, rRNA and tRNA, Phenotypic expression of genes. Regulation of gene action in prokaryotes and Eukaryotes

Unit 3 Population genetics (12)

Mendelian population, Gene pool and gene frequency, Panmixis, Hardy- Weinberg law and its applications, deviations of Hardy- Weinberg Equilibrium, Genetic Polymorphism, Population genetics and Evolution, Cytoplasmic or Extra nuclear inheritance

Unit 4 Origin of Life (12)

Special creation theory, Origin and evolution of RNA, origin of plasma membrane, DNA, adaptive radiation in progenote, retrograde evolution, evolution in Eukaryotes, endosymbiotic hypothesis, invagination of surface membrane hypothesis, molecular evolution, evolution of proteins, insulin, hemoglobin, cytochrome c, natural theory of protein evolution.

Unit 5 Evolutionary Biology (12)

Development of the idea of organic evolution. Direct and indirect evidences of evolution, Theories of organic evolution, Types of natural selection, Adaptation, Adaptive radiation, Microevolution, Macroevolution, Megaevolution, Isolation and speciation.

(60 hrs)

Course outcomes

After the completion of this course, the student will be able to

CO1: Infer the basics of heredity population genetics and master fundamental genetic calculation

CO2: Interpret the synthesis of DNA, RNA and the post transcriptional and post translational modifications

CO3: Predict how gene expression is regulated at different levels, how tissue-specific expression is achieved and exemplify how gene expression can be manipulated and studied experimentally

CO4: Relate the molecular mechanisms regulating and controlling cell division and the cell cycle and exemplify how extracellular signals affect cell division. Hypothesize the molecular mechanisms behind damage and repair at molecular level.

CO5: Explain and compare different principles of how extracellular signals can reach the cell interior, be amplified, transmitted and terminated, and exemplify how signal routes are integrated and how specificity can be achieved

Text Books

1. De Robertis, Cell and molecular biology. Dhanpat Rai Publisher, 8th Edition, 2001.
2. Robert Franklin Weaver, Molecular Biology. Mc-Graw Hill science, 5th edition, 2011.
1. Evolution: A Theory in Crisis (1985) book by Michael Denton

Reference Books

1. Genetics, P.S.Verma and V.K.Agarwal, 12th edition (2010).
2. Benjamin Lewin, Genes IX. Jones & Bartlett Learning; 9th edition (2007).
3. Gerald Karp, Cell and Molecular Biology: Concepts and Experiments, Wiley; 7th Edition edition (2013).

Website

1. <https://www.cliffsnotes.com/study-guides/biology/biology/>
2. <https://ocw.mit.edu/courses/biology/7-03-genetics-fall-2004/lecture-notes/>

Course objectives

The course was designed in such a way to get hands on training in the Biochemical methods in the aspect of doing research and to impart the knowledge of Statistics to the students. The course will also serve as a prerequisite for post graduate and specialized studies and research.

UNIT-I Diagrammatic and Graphical representation of data

Introduction – Scope and Limitations of Statistical methods-Diagrammatic representation of data- Simple bar diagram, Multiple bar diagram, Percentage bar diagram and Pie diagram- Graphical representation of data- Histogram, Frequency polygon and curves- Ogives. **09**

UNIT-II Measures of Central tendency

Introduction-Types of Averages- Mean, Median, Mode– Measures of Dispersion- Range, Quartile Deviation, Standard Deviation and Coefficient of variation. **09**

UNIT-III Measures of Dispersion

Introduction- Measures of Dispersion- Range, Quartile Deviation, Standard Deviation and Coefficient of variation. **09**

UNIT-IV Measures of Skewness and Kurtosis

Introduction-Types of skewness- Karl Pearson's coefficient of skewness-Bowley's coefficient of skewness-Kurtosis-simple problems. **09**

UNIT –V Testing of Hypothesis

Introduction- Concept of Sampling and Sampling Distribution –Parameter and Statistics- Standard error – Tests of Significance for small samples: t-test for Single mean - difference of means, F-test (variance –Ratio test), Chi-Square tests for Goodness of fit and test for independence of attributes in contingency table. **09**

Total 45 Hours**Course Outcome:**

At the end of the course the students will be able to

CO1: Understand the key terminology, concepts tools and techniques used in Statistical analysis

CO2: Evaluate the underlying assumptions of analysis tools of measures of central tendency and dispersion

CO3: Evaluate the underlying assumptions of analysis tools of measures of dispersion

CO4: Analyze statistical data using measures of skewness

CO5: Analyze the uses and limitations of Testing of hypothesis

TEXT BOOKS

1. S.P. Gupta, Statistical Methods. Sultan Chand & Sons, New Delhi
2. S.C. Gupta and V.K. Kapoor, Fundamentals of Applied Statistics, Sultan Chand & Sons, 3rd Edition, 2001.

REFERENCE BOOKS

1. P.R. Vital, Business Statistics, Margham Publications, Second Edition, 2012.
2. Beri G, Business Statistics, Tata McGraw Hill Publishing Company Limited, 2009.
3. S.P. Rajagopalan and R. Sattanathan, Business Statistics and Operations Research, Vijay Nicole Pvt. Ltd.

WEBSITE LINKS

1. <https://d3bxy9euw4e147.cloudfront.net/oscms-prodcms/media/documents/IntroductoryBusinessStatistics-OP.pdf>
2. <http://www.ddegjust.ac.in/studymaterial/mcom/mc-106.pdf>

Course objectives

This paper aims to provide thorough information on the basic properties of stem cells and the regulation at molecular level. It also describes the application of stem cell technology in the therapy of different diseases.

Unit 1 Introduction to Stem Cells (9)

Definition, Classification and Sources. Embryonic Stem Cells. adult, haematopoietic, fetal, cord blood, placenta, bone marrow, primordial germ cells, cancer stem cells, induced pluripotent stem cells.

Unit 2 Stem cell characterizations (9)

Isolation & characterizations, markers & their identification, growth factor requirements and their maintenance in culture. Feeder and feeder free cultures. Cell cycle regulators in stem cells. Molecular basis of stem cell renewal and differentiation, Metaplasia and trans differentiation. Molecular basis of pluripotency and stem cell niche.

Unit 3 Genetic and Epigenetic Gene Regulation in Stem Cells (9)

Chromatin modification and transcriptional regulation, chromatin modifying factors, epigenetic regulation – expression of receptors, chromosomal inactivation, imprinting mechanism in Drosophila, C. elegans and mammals. Hypoxic condition and gene expression (pre implantation stage), stem cell communications – gap junctions, cell fusion, HOX genes, upstream transcriptional factors, embryonic genes.

Unit 4 Application of Stem Cells (9)

Overview of embryonic and adult stem cells for therapy Neurodegenerative diseases; Parkinson's, Alzheimer, Spinal Cord Injuries and other brain Syndromes; Tissue system Failures; Diabetes; Cardiomyopathy; Kidney failure; Liver failure; Cancer; Hemophilia etc.

Unit 5 Regulations and Ethics (9)

Human Embryonic Stem Cells and Society, Human stem cells research: Ethical consideration; Stem cell religion consideration; Stem cell based therapies: Pre clinical regulatory consideration and Patient advocacy.

(45 hrs)**Course outcome:**

After the completion of this course, the student will be able to

CO1: Understand the inter relationships of stem cells

CO 2: Describe the structure of stem cells and their characterization

CO 3: Explain the interplay between genetic and epigenetic gene regulation.

CO 4: Describe the applications of stem cells.

CO5: List the regulations and ethics of stem cell in the society.

Text Books

1. Kiessling, A.A. Human Embryonic Stem cells. Jones & Barlett Publishers. (2nd Ed.) 2006
2. Lanza, R. Essentials of Stem Cell Biology. Academic Press. (1st Ed.) 2005.

Reference Books

1. Turksen, K. Adult Stem Cells. Humana Press, Inc., 1st Ed, 2004
2. Thomson, J et al. Handbook of Stem Cells: Embryonic/ Adult and Fetal Stem cells (Vol. 1 & 2). Academic Press., 1st Ed, 2004.
3. Institute of Medicine (Corporate author). Stem cells and the future of regenerative medicine. National Academy Press. 1st Ed. 2002.

Course objectives

This curriculum is designed to provide students a broad understanding of the molecular, genetic, cell biological and pathobiological aspects of cancer. Students will also learn about the current state of clinical diagnosis, treatment of human cancers, and hurdles to overcome to realize its potential.

Unit 1 Introduction**(9)**

Growth characteristics of cancers cells; neoplasia, anaplasia, metaplasia and hyperplasia, types of cancer benign, malignant, metastatic cancers. Carcinomas, sarcomas, adenomas, haemopoietic cancers. Characteristics of cancer cells, changes in cell membrane structure and functions.

Unit 2 Oncogenes**(9)**

Provirus, proto virus, oncogenes and proto oncogenes. Mechanism of carcinogenic transformation by oncogenes, viral oncogenes. Tumor suppressor genes - properties, mechanism of tumor suppressor genes in cancer induction with special reference to P53 gene.

Unit 3 Carcinogenesis**(9)**

Principles of carcinogenesis- chemical carcinogenesis, stages in chemical carcinogenesis -Initiation, promotion and progression. Physical carcinogenesis – X-ray radiation. Viral carcinogenesis. Free radicals and antioxidants in cancer.

Unit 4 Tumour markers**(9)**

Tumour markers- types of tumour markers. Apoptosis in cancer Cell death by apoptosis role of caspases. Death signalling pathways mitochondrial and death receptor pathways.

Unit 5 Diagnosis and Treatment**(9)**

Cancer screening diagnosis and treatment. RIA and ELISA. Strategies of anticancer drug therapy chemotherapy, gene therapy, Immunotherapy and radiotherapy.

(45 hrs)**Course outcome:**

After the completion of this course, the student will be able to

CO1: Have better understanding of terminologies of ‘Molecular Biology’. Have basic understanding of ‘Genetics’.

CO2: Gain knowledge on cell cycle as well as apoptosis. Have knowledge about cancer, its development and types.

CO3: Have knowledge about genes with reference to cancer formation and mechanism. Have basic understanding of carcinogens and carcinogenesis

CO4: Have elementary knowledge about tumor markers. Know about the role of tumor suppressor genes.

CO5: Understand the signaling of cancerous cells. Have basic understanding of diagnostic tools for cancer and therapies available.

Text Books

1. Vincent.T, Devita, Cancer-Principles & practice of oncology, 3rd edition, 2014.
2. MomnaHejmadi, Introduction to Cancer Biology. 2nd edition.

Reference Books

1. Kinnell Parchment G. Mc. R. E, Perantoni. The Biological Basis of Cancer, Cambridge University Press, 2nd Edition, 2006
2. Lauren Pecorino, Molecular Biology of Cancer: Mechanisms, Targets, and Therapeutics Oxford University Press; 3rd edition, 2012.

Course objectives

The course provide deep insights about the basic and recent techniques involved in plant and animal cell culture and its potential application

Unit 1 Basics of animal cell culture**(9)**

Animal Cell Culture: Historical Background, Importance and progress in Animal Cell Culture Technology, Biology of Animal Cell; Laboratory setup and equipments, aseptic technique, different cell culture media and supplements, Importance of Serum and Serum Free Media, preparation and sterilization of cell culture media and supplements. Conventional plant breeding, tissue culture media, Sterilization and agents of sterilization, initiation and maintenance of callus and suspension cultures.

Unit 2 Cell culture techniques**(9)**

Different tissue culture techniques; Disaggregation of tissue and primary culture; Types of primary culture; Chicken embryo fibroblast culture; Chicken liver and kidney culture; Secondary culture; Trypsinization; Cell separation; Continuous cell lines; and Anchorage independent cells and cultures; Organ culture.

Unit 3 Plant tissue culture**(9)**

Protoplast isolation, culture and fusion; Organogenesis, somatic embryogenesis. Transfer and establishment of whole plants in soil. Shoot tip culture, and production of virus free plants, embryo culture and embryo rescue. Selection of hybrid cells and regeneration of hybridplants; Symmetric and asymmetric hybrids, cybrids, anther, pollen and ovary culture for production of haploid plants and homozygous lines. Somaclonal variation. Cryopreservation and DNA banking for germplasm conservation.

Unit 4 Gene transfer methods**(9)**

Measurement of viability and cytotoxicity; characterization of cultured cell; cell cloning and selection; Cell synchronization; Transfection and transformation of cell;. Plant transformation technology- Basis of tumor formation; Hairy root; Features of Ti and Ri plasmids; Use of Ti and Ri as Vectors; Binary vectors; Methods of nuclear transformation; viral vectors; vector less or direct DNA transfer Particle bombardment, electroporation, micro injection

Unit 5 Applications**(9)**

Commercial scale production of animal cells, stem cells &their application; Over view of embryonic and adult stem cells for therapy; Neuro degenerative disease; Parkinsons, Alzheimer,Spinal cord injuries and other brain syndromes; Tissue system failures; Diabetes;Cardiomyopathy; Kidney failure; Liver failure, Cancer, Hemophilia, Application of cell culture technology in production of human and animal vaccines and pharmaceutical proteins.

(45 hrs)**Course outcome:**

After the completion of this course, the student will be able to

CO1: Understand the basics of animal cell culture

CO 2: Describe the gene transfer methods

CO 3: Explain the applications of plant and animal tissue culture

CO 4: Describe the cell culture techniques.

CO5: List the levels of organization of culture and the characteristics of each.

Text Books

1. Bhojwani, Sant Saran, Dantu, Prem Kumar. Plant Tissue Culture: An Introductory Text. Springer 2013
2. Adrian Slater, Nigel Scott, and Mark Fowler. Plant Biotechnology. The Genetic Manipulation of Plants 2nd edition, 2008. Oxford University Press.
3. SS Purohit. Biotechnology Fundamentals and applications. 4th ed. Agrobios Publication. 2007

Reference Books

1. Biotechnology and genomics. PK Gupta. Rastogi Publication. 2nd reprint. 2006
2. Roberta H. Smith. Plant Tissue Culture. 3rd Edition. 2013. Academic press.

Course objectives

This paper aims to provide a basic understanding of the nervous system, Structure and functional relationship and integration of the nervous tissue networking and Insights into neurotransmission

Unit 1 Nervous System (9)

Neuron - Neurocellular anatomy, neural membrane, classification of neuron, nerve fibers, axonal transport, neural growth, neuroglia, nervous system, blood brain barrier, cerebrospinal fluid

Unit 2 Signalling (9)

Neuronal signalling - Membrane potentials, ion channels, recording neuronal signals, ionic basis of resting potential and action potential, propagation of action potential.

Unit 3 Synapse (9)

Synaptic transmission - Synapse, Electrical synapse transmission, chemical synaptic transmission, Synaptic transmitter release, synaptic potentials, synaptic delay, synaptic plasticity, molecular mechanism of synaptic transmission, myoneuronal junction

Unit 4 Neurotransmitters (9)

Neurotransmitters - Chemistry, synthesis, storage, release, receptors and function- acetylcholine, catecholamines, serotonin, histamine, glutamate, aspartate, GABA, glycine, neuropeptides, nitric oxide

Unit 5 Disorders (9)

Neural processing and neurodegenerative disorders- Learning and memory, neurochemical basis of drug abuse, neurodegenerative disorders, Parkinson's disorder, Alzheimer's disorder, Amyotrophic Lateral Sclerosis, Senile Dementia

(45 hrs)

Course outcome:

After the completion of this course, the student will be able to

CO1: Explain about the nervous system and its anatomy

CO 2: Describe the signalling pathways and its potential

CO 3: Explain the synaptic transmission

CO 4: Describe the chemistry, synthesis and functions of neurotransmitters.

CO5: Describe about the various disorders of neurons.

Text Books

1. Arthur C. Guyton and John E Hall, Text book of medical physiology 11th Edition; 2006
2. Bruce Alberts, Alexander Johnson, Juliana Lewis, Martin Raff, Keith Roberts and Peter Walter, Molecular biology of the cell, 4th Edition; 2004
3. David Nelson and Michael Cox, Lehninger Principles of Biochemistry, 4th edition; 2005

Reference Books

1. Gordon Shepherd, Neurobiology, 3rd Edition; 1994
2. Mark F Bear, Barry W Connors and Michael A Paradiso, Neuroscience: Exploring the brain, 4th Edition; 2015

Course objectives

This paper provides insights into the primary metabolic pathways occurring in plants, the types of plant metabolites and the industrial potential of those metabolites and the role of hormones in plant growth.

Unit 1 Photosynthesis (9)

Ultra-Structure and organization of chloroplast membranes, lipid composition of chloroplast membranes, electron transport chain. Thylakoid membrane protein complexes Calvin cycle: Biochemistry of RuBp Carboxylase or oxygenase, Hatch and slack pathway, CAM plants; productivity of C4 plants.

Unit 2 Nitrogen Metabolism (9)

Nitrogen fixation, nitrogenase complex, electron transport chain and mechanism of action of nitrogenase. Structure of 'NIF' genes and its regulation, Hydrogen uptake and bacterial hydrogenases, Nitrate Metabolism: Enzymes of nitrate metabolism, Ammonium assimilation enzymes: glutamine synthetase, glutamate synthase and GDH.

Unit 3 Plant Hormones (9)

Plant growth regulators: Auxins; gibberellins, cytokines, abscisic acid and ethylene – biosynthesis and their metabolic functions, synthetic growth hormones, inhibitors. Stress response in Plants.

Unit 4 Secondary metabolites (9)

Major chemical classes of secondary metabolites: A brief account of the following classes: Alkaloids, terpenoids, flavonoids, Phenolics and phenolic acids, steroids, coumarins, quinines, acetylenes, cyanogenic glycosides, amines and nonprotein amino acids, gums, mucilages, resins etc.

Unit 5 Uses of secondary metabolites (9)

Importance of secondary metabolites: Uses of secondary metabolites to man: as drugs, precursors of drugs in pharmaceutical industry, as natural pesticides/insecticides; other uses of secondary metabolites.

(45 hrs)

Course outcome:

After the completion of this course, the student will be able to

CO1: Understand the process of photosynthesis

CO 2: Describe the metabolism of nitrogen.

CO 3: Explain about the plant hormones, metabolites, and its regulation.

CO 4: Describe the general function of secondary metabolites.

CO5: Explain the uses of secondary metabolites.

Text Books

1. Plant Metabolism by H.D Kumar and H.N Singh. Publisher. Macmillan, ISBN-10:0333256387: ISBN-13:978-0333256381.1st Ed, 1980.

2. Biotechnology: Secondary Metabolites by K.G Ramawat, (2000) Publisher: Science Publishers, U.S. ISBN-10: 1578080576 ISBN-13: 978-1578080571, 1st Ed., 2000.

Reference Books

1. Plant Biochemistry by P.M Dey and J.B. Harborne (Editors) (1997) Publisher: Academic Press ISBN-10:0122146743, ISBN-13:978-0122146749, 1st Ed, 1997.

2. Plant Metabolism by Prof David T. Dennis, Prof David H. Turpin, Dr Daniel D. Lefebvre and Dr David B. Layzell (Editors) publisher: Longman; ISBN-10: 0582259061, ISBN-13:978-582259065, 1st Ed, 1997

**SKILL ENHANCING
COURSE
SYLLABUS**

Course Objective:

- To enable participants Business Communication Skills
- To enhance participants E-mail writing skills
- To impart Leadership and Team Bonding skills

Credit Hours**UNIT I: EFFECTIVE COMMUNICATION SKILLS****06**

Talking about your company – Making Polite requests – Introducing yourself and others –
Socialising with others – Talking about work activities – Talking about your job –
Communication practice – Role plays

UNIT II: WRITTEN BUSINESS COMMUNICATION**06**

Essential Email writing skills – Formal and Informal E-mails – Usage of formal language –
Report Writing – Writing project reports – Extended writing practice – Email Etiquette –
Understanding Business E-mails

UNIT III: TELEPHONE ETIQUETTE**06**

The basics of Telephone Etiquette – Customer Service – Being courteous – Making
arrangements – Giving clear and concise information – Tone and Rate of speech – Pronunciations
– Summarisation – Mock Telephonic Conversations

UNIT IV: LEADERSHIP SKILLS**06**

Essential Leadership Skills – Interpersonal Skills – Team Building – Team work – Do's and
Don'ts of Leadership skills – Importance of communication in Leadership – Delegating and
Handling of Projects

UNIT V: LISTENING AND ANSWERING QUESTION**06**

Listening for the main ideas – Listening for details – Listening for specific information –
Predicting and listening for opinions – Recognising context – Listening for sequence –
Understanding Pronunciation – Listening practice

Total**30 Hours****Course Outcome:**

- | | |
|-----|--|
| CO1 | To enhance participant's Business Communication Skills |
| CO2 | To enhance the participant's Reading, Speaking, Listening and Writing capabilities |
| CO3 | To engage in a conversation with others to exchange ideas |
| CO4 | To impart leadership qualities among the participants |
| CO5 | To express opinions to enhance their social skills |

Books Prescribed

- Raman, M. & Sangeeta Sharma. Technical Communication.OUP.2008
- Taylor, Grant.English Conversation Practice. Tata McGraw Hill Education Pvt. Ltd. 2005

- Tiko, Champa& Jaya Sasikumar. Writing with a Purpose.OUP. New Delhi. 1979

Web Sources:

- <https://www.skillsyouneed.com/ips/communication-skills.html>
- <https://blog.smarp.com/top-5-communication-skills-and-how-to-improve-them>
- <https://blog.hubspot.com/service/phone-etiquette>

Course Objective:

- To enable students to develop their communication skills effectively
- To enhance students Reading, Writing, Listening and Speaking skills
- To develop their self-confidence through communication

Credit Hours**UNIT I: READING COMPREHENSION AND VOCABULARY****06**

Reading Techniques – Types of Reading – Skimming – Scanning – Reading for detail – Identifying key words – Underlining unfamiliar key words – Vocabulary Building – Reading Comprehension practice

UNIT II: PRESENTATION SKILLS**06**

Presentation Methods – Preparation and Practice – Organising content – Do's and Don'ts of a Presentation – Presentation Techniques – Mock Presentation

UNIT III: GROUP DISCUSSION**06**

Introduction to Group Discussion – Preparation for GD – Structure of GD's – Do's and Don'ts – Tips and Strategies – Etiquette and Practice – Body Language and Posture – Sharing Ideas with respect – Understanding Opinions – Mock GD Practice

UNIT IV: CONVERSATIONAL SKILLS**06**

Introduction to Small talk – How to start and end a conversation – Exchanging ideas – Expressing Interests – Giving Opinions – Social skills and Etiquette – Informal Conversations – Formal Meetings – Group Practice

UNIT V: SELF – INTRODUCTION AND ROLE PLAY**06**

Introducing oneself – Exchange of Greetings – Appropriate Greetings – Usage of Vocabulary – Rapport Building – Handshakes and First Impressions – Basic Etiquette

Total**30 Hours****Course Outcome:**

- | | |
|-----|--|
| CO1 | To get students to understand the importance of communicating in English |
| CO2 | To understand effective communication techniques |
| CO3 | To increase self-confidence through regular practice |
| CO4 | To encourage active participation in their regular class |
| CO5 | To enable participants to face large group of audience with confidence |

Books Prescribed

- English for Competitive Examinations by R.P.Bhatnagar&Rajul BhargavaMacmillan India Ltd. Delhi.
- Carnegie, Dale. The Quick and Easy Way to Effective Speaking. New York: Pocket Books, 1977.
- Kalish, Karen.How to Give a Terrific Presentation. New York: AMACOM, 1996

Web Sources:

- <https://www.skillsyouneed.com/ips/communication-skills.html>
- <https://venngage.com/blog/presentation-skills/>
- <https://gdpi.hitbullseye.com/Group-Discussion.php>

Course Objective:

- To enable students to develop their soft skills and Body Language
- To enhance students Reading, Writing, Listening and Speaking skills
- To develop their self-confidence to excel at Interviews

Credit Hours**UNIT I: SKILL ENHANCEMENT****06**

Time Management – Planning and Organisation – Scheduling – Prioritization – Delegation – Task Management – Stress Management – Overcoming anxiety – Confidence Building – Body Language

UNIT II: RESUME / COVER LETTER WRITING**06**

SWOT Analysis – Details and Resume Writing – Resume Examples – Building Resume using SWOT – Writing Resume – Writing Cover Letter – Resume Correction – Resume Feedback

UNIT III: INTERVIEW SKILLS**06**

Interview Do's and Don'ts – First Impression – Grooming – Body Language – Frequently asked questions – Useful Language – Mock Interview

UNIT IV: QUANTITATIVE ABILITY**06**

Permutation & Combinations – Probability – Profit & Loss – Ratio Proportions & Variations – Cubes – Venn Diagrams – Logical Reasoning – Critical Reasoning

UNIT V: REVISIONARY MODULES**06**

Group Discussions – HR Process – Interview Process – Mock Group Discussions

Total**30 Hours****Course Outcome:**

- | | |
|-----|---|
| CO1 | To develop participants social and professional skills |
| CO2 | To help participants manage time effectively |
| CO3 | To build a strong resume to suit corporate requirements |
| CO4 | To face interviews confidently |
| CO5 | To enhance their aptitude abilities |

Books Prescribed

- Meena. K and V.Ayothi (2013) A Book on Development of Soft Skills (Soft Skills: A Road Map to Success) P.R. Publishers & Distributors.
- Soft Skills – Know Yourself & Know the World, S.Chand& Company LTD, Ram Nagar, NewDelhi
- Prasad, H. M. How to Prepare for Group Discussion and Interview. NewDelhi: Tata McGraw-Hill Publishing Company Limited, 2001.
- Pease, Allan. Body Language. Delhi: Sudha Publications, 1998.

Web Sources:

- <https://www.skillsyouneed.com/ips/communication-skills.html>
- <https://www.businessnewsdaily.com/5836-top-interviewing-skills.html>
- <https://gdpi.hitbullseye.com/Group-Discussion.php>

COURSE OBJECTIVE:

- To develop and strengthen entrepreneurial quality and motivation in students
- To impart basic entrepreneurial skills and understanding to run a business efficiently and effectively.
- To understand the concept and process of entrepreneurship and its contribution in and role in the growth and development of individual and the nation.

UNIT I ENTREPRENEURSHIP**6**

Entrepreneur – Personality characteristics of successful entrepreneur – Types of Entrepreneurs – Knowledge and skills required for an entrepreneur – Difference between Entrepreneur and Intrapreneur

UNIT II BUSINESS**6**

Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – Market Survey and Research – Techno Economic Feasibility Assessment

UNIT III BUSINESS PLAN PREPARATION**6**

Sources of product for business – Pre-feasibility study – Criteria for selection of product – Ownership – Capital – Budgeting project profile preparation – Matching entrepreneur with the project – Feasibility report preparation and evaluation criteria.

UNIT IV SUPPORT TO ENTREPRENEURS**6**

Sickness in small Business – Concept, Magnitude, Causes and Consequences, Corrective Measures – Business Incubators – Government Policy for Small Scale Enterprises – Growth Strategies in small industry.

UNIT V ENTREPRENEURSHIP DEVELOPMENT PROGRAMME**6**

Meaning, Objectives – Phases of EDP – steps in EDP – Strategies for Entrepreneurship development – Institutions in aid of Entrepreneurship Development Programme – Use of IT enabled services in entrepreneurship - E Licensing, E filing.

Total 30 hrs**COURSE OUTCOMES:**

At the end of the course, a student will be able to

CO – 1: Understand the concept of Entrepreneurship

CO – 2: Identify, create and analyze entrepreneurial opportunities.

CO – 3: Assess techno economic feasibility of a Business Plan

CO- 4 - Create Business Plans

CO-5: State various statutory institutions involved in the process of Entrepreneurship development

TEXT BOOKS:

1. Hisrich R D, Peters M P, "Entrepreneurship" 8th Edition, Tata McGraw-Hill, 2016
2. Khanka S.S., "Entrepreneurial Development" S Chand & Company; edition, 2016

REFERENCE BOOKS:

1. Sharma, "Entrepreneurship Development", PHI LEARNING PVT LTD, (2017)
2. Abhinav Ganpule&Aditya Dhobale, "Entrepreneurship Development", Kindle Edition, Jatayu Publication; 1 edition ,2018.
3. Sangeeta Sharma, "Entrepreneurship Development", 10th Edition, Kindle Edition PHI Learning, 2018

WEBSITES

1. <http://www.simplynotes.in/e-notes/mbabba/entrepreneurship-development/>
2. <https://openpress.usask.ca/entrepreneurshipandinnovationtoolkit/chapter/chapter-1-introduction-to-entrepreneurship/>

WEBSOURCES

1. <https://articles.bplans.com/10-great-websites-for-entrepreneurs/>
2. <https://www.entrepreneur.com/article/272185>

INTERNSHIP

Course objective

To earn academic credit and develop new skills at the same time. Internship must take place outside a university research lab.

Course outcome

- CO1: Enhancing learning in a professional environment
- CO2: Gaining experience with current technology
- CO3: Contributing to significant projects
- CO4: Building personal skills
- CO5: Networking with people working in the science community
- CO6: Developing a resume that highlights desirable skills

**ABILITY ENHANCEMENT
COMPULSORY COURSES
SYLLABUS**

Course Objective:

- This course is to subject the students to practise the components in various units.
- To make students ready for placement interviews within campus.
- To infuse confidence to face job situations.

	Credit Hours
UNIT I	06
<ul style="list-style-type: none"> • Resume and CV Writing • Complaint Letter • Social Correspondence • Letter of Enquiry 	
UNIT II	06
<ul style="list-style-type: none"> • Short Essay Writing 	
UNIT III	06
<ul style="list-style-type: none"> • Explaining Proverbs 	
UNIT IV	06
<ul style="list-style-type: none"> • Use of Prepositions 	
UNIT V	06
<ul style="list-style-type: none"> • Synonymous Words 	
Total	30 Hours

Course Outcome:

- | | |
|-----|--|
| CO1 | To enhance learners' confidence level. |
| CO2 | To make learners' feel the assimilation of skills. |
| CO3 | To engage in a conversation with others to exchange ideas. |
| CO4 | To impart leadership qualities among the participants. |
| CO5 | To express opinions to enhance their social skills. |

Books Prescribed

- For Unit I – V Effective Communication For You – V. Syamala
Emerald Publishers, Chennai.
- Cameron, David. Mastering Modern English, Hyderabad: Orient Blackswan, 1978 (rpt. 1989, 1993, 1995, 1998).
- Freeman, Sarah. Written Communication in English, Hyderabad: Orient Blackswan, 1977 (21st Impression, 2007).
- Singh, Vandana R. The Written Word. New Delhi: Oxford university Press, 2003 (3rd Impression, 2007)
- Seely, John. Oxford Guide to Effective Writing and Speaking. New Delhi: Oxford University Press, 2000 (4th Impression, 2008)

Web Sources:

- <https://www.myperfectresume.com/career-center/resumes/how-to/write>
- <https://www.englishgrammar.org/>
- <https://www.thesaurus.com/browse/>

Course Objective

To inculcate the importance of environmental pollution, preservation of nature and environmental management for human welfare.

Unit-I Multidisciplinary nature of environmental studies, Natural Resources**06**

Definition, scope and importance, need for public awareness. Renewable and non-renewable resources - Natural resources and associated problems. a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest 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.

Unit-II Ecosystems, Biodiversity and its conservation (06)

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, oceans, estuaries)

Introduction–Definition,genetic, species and ecosystem diversity. Biogeographical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, National and local levels. India as a mega-diversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Unit-III Environmental Pollution (06)

Definition, Cause, 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 hazards. 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.

Unit-IV Social Issues and the Environment (06)

From Unsustainable to Sustainable development, Urban problems 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. Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act - Issues involved in enforcement of environmental legislation. Public awareness.

Unit-V Human Population and the Environment (06)

Population growth, variation among nations. Population explosion – Family Welfare Programme. Environment and human health. Human Rights. Value Education. HIV/AIDS. Women and Child Welfare. Role of Information Technology in Environment and human health. Case Studies.

Field work - 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.

Total: 30 hrs

Course Outcome

- To understand the nature and facts about environment.
- To find and implement scientific, technological, economic solutions to environmental problems.
- To know about the interrelationship between living organisms and environment.
- To understand the integrated themes and biodiversity, natural resources, pollution control and waste management.
- To appreciate the importance of environment by assessing its impact on the human world.

Text Books

1. De AK, Environmental Chemistry, Wiley Eastern Ltd.
2. Bharucha Erach, 2003. The Biodiversity of India, Mapin Publishing Pvt. Ltd, India.
3. Brunner RC, 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480pgs.
4. Clark RS, Marine Pollution, Clanderson Press, Oxofrd (TB).

Reference Books

1. Agarwal KC, 2001. Environmental Biology, Nidi Publishers Ltd. Bikaner.
2. Gleick HP, 1993. Water in Crisis, Pacific Institute for Studies in Development, Environment and Security. Stockholm Environmental Institute, Oxford University Press, 473pgs.
3. Heywood VH, and Watson RT, 1995. global Biodiversity Assessment. Cambridge University Press 1140pgs.
4. Jadhav H and Bhosale VM, 1995. Environmental Protection and Laws. Himalaya Publishing House, Delhi 284pgs.
5. Miller TG, Jr. Environmental Science, Wadsworth Publishing CO. (TB)

Web link and we source

<https://easyengineering.net/ge6351-environmental-science-and/>

<https://learnengineering.in/ge8291-environmental-science-and-engineering/>

LANGUAGES

SYLLABUS

Course Objective:

- To enable students to develop their communication skills effectively. To make students familiar with usage skills in English Language.
- To enrich their vocabulary in English
- To develop communicative competency.

Credit Hours

UNIT I

09

1. Dangers of Drug Abuse - Hardin B Jones
2. Tight Corners - E. V. Lucas

UNIT II

09

3. Futurology - Aldous Huxley
4. If You are Wrong, Admit it - Dale Breckenridge Carnegie

UNIT III

09

5. Industry - Dr.M.Narayana Rao &Dr.B.G.Barki
6. Turning Point of My Life - A.J Cronin

UNIT IV

09

7. Excitement - Mack R. Douglas
8. The Kanda Man Eater - Jim Corbett

UNIT V

09

9. Vocabulary and Exercises under the Lessons

Total

45 Hours

Note: Lessons prescribed are from various anthologies and respective exercises therein will be taught.

Course Outcome

At the end of this course students will be able to,

- CO1 Examine the language of prose.
- CO2 Utilize instructions on fundamentals of grammar
- CO3 Develop their own style of writing after studying diverse prose essays.
- CO4 Classify different essays on the basis of their types.
- CO5 Critically comment on the textual content of prose.

Books Prescribed:

- English for Communication Enrichment: by JeyaSanthi June 2015.
- Dr. M. Narayana Rao and Dr. B. G. Barki – Anu's Current English for Communication (AnuChitra). June 2012.
- Dr. Ananthan, R. Effective Communication. Ed. Chennai: Anu Chithra Pub. 2010.

Web Sources:

- <https://www.gradesaver.com/>
- <https://www.enotes.com/>
- <https://www.jstor.org/>
- <https://www.sparknotes.com/>
- <https://www.cliffsnotes.com/>

Course Objective:

- To enable students to develop their communication skills effectively.
- To enrich their vocabulary in English
- To develop communicative competency.

Credit Hours

UNIT I

09

1. Growing Old - Winston Farewell
2. Ecology - A. K. Ramanujan

UNIT II

09

3. Stopping by Woods on a Snowy Evening - Robert Frost
4. Our Casuarina Tree - Toru Dutt

UNIT III

09

5. Goodbye Party for Miss Pushpa T.S. - Nissim Ezekiel
6. The Bull - Ralph Hodgson

UNIT IV

09

7. If - Rudyard Kipling
8. The Drowned Children - Louise Glück

UNIT V

09

9. Australia - A.D.Hope
10. A Far Cry from Africa - Derek Walcott

Total

45 Hours

Course Outcome

At the end of this course students will be able to,

- CO1 Learn to employ Poetic expressions in the course of daily speech.
- CO2 Prove their better communicative ability.
- CO3 Prove their skill in writing sentences with poetic impact.
- CO4 Develop different sensibilities in approaching life.
- CO5 Solve life's problems as highlighted in the selections.

Books Prescribed:

- Selections from Caribbean Literature. Mahaam Publishers, Chennai.
- Our Casuarina Tree - Vasan Publication By Dr.AShanmugakani

Web Sources:

- <https://www.gradesaver.com/>
- <https://www.enotes.com/>
- <https://www.jstor.org/>
- <https://www.sparknotes.com/>
- <https://www.cliffsnotes.com/>

Course Objective:

- To train students in the use of English language in varied literary and non-literary contexts.
- To teach them soft skills and strengthen their foundation in grammar and composition.
- To evaluate their comprehension skills.

	Credit Hours
UNIT I	09
<ul style="list-style-type: none"> • Introduction to Drama. 	
UNIT II	09
<ul style="list-style-type: none"> • Shakespeare: Funeral Oration (Act III Scene II Julius Caesar) & • Monkey's Paw - W.W.Jacobs 	
UNIT III	09
<ul style="list-style-type: none"> • Comprehension 	
UNIT IV	09
<ul style="list-style-type: none"> • Precis -Writing and Note Taking 	
UNIT V	09
<ul style="list-style-type: none"> • General Essay on Current Topics 	
Total	45 Hours

Course Outcome

At the end of this course students will be able to,

- CO 1 Estimate the dramatic scenes in the light of appeal of values.
- CO 2 Prioritize pragmatic day- to - day communication through comprehension.
- CO 3 Develop dramatic skill after reading the scenes of plays.
- CO 4 Improve their own style of writing after an expose to the prescribed dramatic pieces.
- CO 5 Adapt themselves to life - context wherein soft skill demonstration is a must.

Books Prescribed:

- An Introduction to Drama. IInd Edition by George Whitfield
- Reading Comprehension for College Students Paperback – Import, 1984
by Reinhart G. Kussat (Author)
- The Monkey's Paw By W. W. Jacobs Publisher: Perfection Learning

Web Sources:

- <https://www.gradesaver.com/>

- <https://www.enotes.com/>
- <https://www.jstor.org/>
- <https://www.sparknotes.com/>
- <https://www.cliffsnotes.com/>

ENGLISH IV - PRACTICAL ENGLISH (CONVERSATION PRACTICE) - 3 0 0 3

Course Objective:

- To train students in the use of English language in varied literary and non-literary contexts.
- To teach them soft skills and strengthen their foundation in grammar.
- To evaluate students to sensitivity in conversational competency.

	Credit Hours
UNIT I	09
i. At the Airport	
ii. In a Bank	
iii. On a Bus	
UNIT II	09
iv. In Flight	
v. In a Hotel	
vi. In a Library	
UNIT III	09
vii. Tea Time	
viii. On a Train	
ix. In a Restaurant	
UNIT IV	09
x. On a Picnic	
xi. In a Police station	
xii. In a Post office	
UNIT V	09
xiii. In a travel agency	
xiv. Asking the way	
xv. At the theatre	
Total	45 Hours

Course Outcome

At the end of this course students will be able to,

- CO1 Feel confident to speak in different situations.
- CO2 Learn befitting vocabulary words.
- CO3 Have the ability to visualize speaking situations.
- CO4 Be conversant with other conversational situations.
- CO5 Categorize the nature of questions asked usually in interviews.

Books Recommended:

- English Conversation Practice, D.H. Spencer, Oxford.

- Communicative English by Department of English, National College(Autonomous), Trichy.

Web Sources:

- <https://self-publishingschool.com/how-to-write-dialogue/>
- <https://www.masterclass.com/articles/how-to-write-dialogue>

HINDI

I year-I Sem (Prose,official Letter writing& Technical words)

Course Objective:

- To enable the students to develop communication skills
- To train students in official language
- To enrich their knowledge in Hindi literature
- To teach them human values & create awareness towards exploitation

Unit I	- 'Ek atuut kadi' by shri Rajkishore letter writing (application), Technical words (prashasanik vakyansh:1-50).	9
Unit II	'Devi singh' by agyeya , letter writing (bank A/C opening&closing), Technical words (prashasanik vakyansh:51-100).	9
Unit III	'kabiraa ki kaashi 'by Kumar Ravindra	9
Unit IV	'bharathiyavigyan ki kahaani - 'hamnediyaa ,hamneliyaa' 'by Gunakarmule, letter writing (shikayathpathra, gyapan) Technical words: takniki shabd-25.	9
Unit V	letter writing (sarkaripathra, ardhasarkaari pathra, kaaryalayaadesh), Technical words: takniki shabd-25.	9
Total hours	45	

Course Outcome

At the end of this course

- CO 1 Students will be familiar with official letter writing
- Co 2 will understand their responsibility in the society
- CO 3 students will be moulded with good character understand human values
- CO 4 students will gain knowledge about ancient &, rich culture of India
- CO 5 will know the equivalent Hindi words for scientific terms

Text Book GadyaKhosh ,Prashasanikshabdavali, Patra lekhan

Weblinks:

<http://www.hindisamay.com/content/1321/1/%E0%A4%B0%E0%A4%BE%E0%A4>

<http://gadyakosh.org/gk/%E0%A4%A6%E0%A5%87%E0%A4%B5%E0%A5%80%E0>

<http://gadyakosh.org/gk/%E0%A4%A6%E0%A5%87%E0%A4%B5%E0%A5%80%E0>

http://gadyakosh.org/gk/%E0%A4%A6%E0%A5%87%E0%A4%B5%E0%A5%80%E0%A4%B8%E0%A4%BF%E0%A4%82%E0%A4%B9_/_%E0%A4%85%E0%A4%9C%E0%A5%8D%E0%A4%9E%E0%A5%87%E0%A4%AF

http://gadyakosh.org/gk/%E0%A4%A6%E0%A5%87%E0%A4%B5%E0%A5%80%E0%A4%B8%E0%A4%BF%E0%A4%82%E0%A4%B9_/_%E0%A4%85%E0%A4%9C%E0%A5%8D%E0%A4%9E%E0%A5%87%E0%A4%AF

HINDI
I year-II Sem (kahani, Natak&Translation)

Course Objective:

- To train students in translation
- To develop reading & writing skills
- To create interest towards reading different types of literature

Unit I	- 'idgah' by Premchand' (<u>kahani</u>), Translation- Definition,Types	9
Unit II	'pitha ' by gyanranjan (kahani), Translation - Anuvadakke gun	9
Unit III	- jamun ka ped by Krishna chander' (kahani) , Translation Practice	9
Unit IV	- adhi rath kebaad by Shankar shesh (<u>naatak</u>),Translation Practice	9
Unit V	- adhi rath kebaad by Shankar shesh (<u>naatak</u>), Translation Practice	9

Total Hours :45

Course Outcome

At the end of this course

- CO 1 Students will know the importance & process of translation
- Co 2 understand the values of elders in a family & extend their support
- CO 3 will know the different writing skills of authors
- CO 4 gain knowledge in Hindi literature
- CO 5 will acquire knowledge in Hindi Sahithya

Text book: Gadyakhosh

Weblinks:

<https://premchandstories.in/eidgaah-story-munshi-premchand-pdf/>
<https://www.google.com/search?q=pitha+by+gyan+ranjan&oq=pitha+by+gya&aqs=chrome.1.69i57j0i13j0i22i30.10387j0j4&sourceid=chrome&ie=UTF-8>
<http://db.44books.com/2020/04/%e0%a4%86%e0%a4%a7%e0%a5%80-%e0%a4%b0%e0%a4%be%e0%a4%a4-%e0%a4%95%e0%a5%87-%e0%a4%ac%e0%a4%be%e0%a4%a6.html>

http://gadyakosh.org/gk/%E0%A4%A6%E0%A5%87%E0%A4%B5%E0%A5%80%E0%A4%B8%E0%A4%BF%E0%A4%82%E0%A4%B9_/_%E0%A4%85%E0%A4%9C%E0%A5%8D%E0%A4%9E%E0%A5%87%E0%A4%AF

http://gadyakosh.org/gk/%E0%A4%A6%E0%A5%87%E0%A4%B5%E0%A5%80%E0%A4%B8%E0%A4%BF%E0%A4%82%E0%A4%B9_/_%E0%A4%85%E0%A4%9C%E0%A5%8D%E0%A4%9E%E0%A5%87%E0%A4%AF

HINDI

II year-III SEM (Ancient& medieval poetry,Hindi sahitya ka Ithihas)

Course Objective:

- To enrich the knowledge of students through Tamil literature
- Enable them to learn ancient poems
- To develop interest in learning history of hindi literature

Unit I	- ‘Thirukkural’, Hindi Sahitya ka ithihas (aadikal)	9	
Unit II	- ‘Kabir ke pad’, Hindi Sahitya ka ithihas (aadikal)	9	
Unit III	- ‘Sur ke pad’, Hindi Sahitya ka ithihas (bhakthikal)	9	
Unit IV	- Thulsikepad, <u>Hindi</u> Sahitya ka ithihas (bhakthikal)	9	_____
Unit V	- Rahim ke dohe , <u>Hindi Sahitya ka</u> ithihas (Rithikal)	9	

Total Hours :45

Course Outcome

At the end of this course

- CO 1 Students will know the valuable messages in Thirukkural
- Co 2 will be interested in knowing ancient poems.
- CO 3 Gain knowledge in Hindi literature
- CO 4 will know the difference between Hindi & the languages used by ancient poets
- CO 5 will be familiar with different styles of poetry writing

Reference books:

Thirukkural translation by Venkata krishnan

Hindi Sahitya ka Ithihas by Dr.Nagendra,Dr.Hardayal mayur paper bags Noida

Weblinks:

<http://gadyakosh.org/gk/%E0%A4%A6%E0%A5%87%E0%A4%B5%E0%A5%80%E0%A4%B8%E0%A4%BF%E0%A4%82%E0%A4%B9 / %E0%A4%85%E0%A4%9C%E0%A5%8D%E0%A4%9E%E0%A5%87%E0%A4%AF>

http://gadyakosh.org/gk/%E0%A4%A6%E0%A5%87%E0%A4%B5%E0%A5%80%E0%A4%B8%E0%A4%BF%E0%A4%82%E0%A4%B9_/_%E0%A4%85%E0%A4%9C%E0%A5%8D%E0%A4%9E%E0%A5%87%E0%A4%AF

http://gadyakosh.org/gk/%E0%A4%A6%E0%A5%87%E0%A4%B5%E0%A5%80%E0%A4%B8%E0%A4%BF%E0%A4%82%E0%A4%B9_/_%E0%A4%85%E0%A4%9C%E0%A5%8D%E0%A4%9E%E0%A5%87%E0%A4%AF

HINDI

II year-IV SEM (Modern Poetry, Hindi sahitya ka ithihas

–Adhunikkal, Advertisement writing)

Course Objective:

- To develop interest in modern poetry
- To teach them the development of Modern Hindi poetry
- To train them in advertisement writings

Unit I	- Sansar by Mahadevi varma, Hindi Sahitya ka ithihas (adhunikkal)	9
Unit II	- ‘Mouunnimanthran’ by Sumithranandanpanth, Hindi Sahitya ka ithihas (adhunikkal)	9
Unit III	- ‘rah rahkar Tuutthaa rabkaa kahar’ by Dharmendra kumar nivathiya Hindi Sahitya ka ithihas (adhunikkal)	9
Unit IV	‘samarpan’ by Subhadra kumara chouhan , Advertisement writing	9
Unit V	- ‘panthrahagasthkiipukaar’ by atalbiharivajpayee, Advertisement writing	9

Total Hours: 45

Course Outcome

At the end of this course

- CO 1 Students will be familiar with modern poetry
- Co 2 Students will understand the importance of protecting atmosphere
- CO 3 will know the real meaning of patriotism & the value of freedom.
- CO 4 will get the ability to write various types of advertisement
- CO 5 will understand the different methods adopted in writing them

Reference books:

Padyakhosh

Hindi patrakaritha ekparichaya

Weblinks:

http://gadyakosh.org/gk/%E0%A4%A6%E0%A5%87%E0%A4%B5%E0%A5%80%E0%A4%B8%E0%A4%BF%E0%A4%82%E0%A4%B9_%E0%A4%85%E0%A4%9C%E0%A5%8D%E0%A4%9E%E0%A5%87%E0%A4%AF

http://gadyakosh.org/gk/%E0%A4%A6%E0%A5%87%E0%A4%B5%E0%A5%80%E0%A4%B8%E0%A4%BF%E0%A4%82%E0%A4%B9_%E0%A4%85%E0%A4%9C%E0%A5%8D%E0%A4%9E%E0%A5%87%E0%A4%AF

http://gadyakosh.org/gk/%E0%A4%A6%E0%A5%87%E0%A4%B5%E0%A5%80%E0%A4%B8%E0%A4%BF%E0%A4%82%E0%A4%B9_%E0%A4%85%E0%A4%9C%E0%A5%8D%E0%A4%9E%E0%A5%87%E0%A4%AF

http://gadyakosh.org/gk/%E0%A4%A6%E0%A5%87%E0%A4%B5%E0%A5%80%E0%A4%B8%E0%A4%BF%E0%A4%82%E0%A4%B9_/_%E0%A4%85%E0%A4%9C%E0%A5%8D%E0%A4%9E%E0%A5%87%E0%A4%AF

TAMIZH

பாடக்குறியீட்டுஎண்: 21LTA001

பருவம்-1, தமிழ்மொழிப்பாடம்-1, பகுதி-1, தகுதிப்புள்ளி: 3,

வாரப்பாடநேரம்: 3.

தாள்-1

இக்காலக் கவிதைகள் – உரைநடை – பண்பாடு – மொழித்திறன்

அலகு 1: மரபுக்கவிதை

9மணிநேரம்

1. பாரதியார்- பாரததேசம் என்னும் தலைப்பில் ஆறு பாடல்கள்.
(பாடல்எண்கள் 1, 6, 7, 9, 12, 13)
2. பாரதிதாசன்-தமிழுக்கும் அமுதென்று பேர் என்னும் தலைப்பிலான கவிதை.
3. தேசிகவிநாயகம்பிள்ளை - உடல்நலம் பேணல் என்னும் தலைப்பிலான கவிதை
4. முடியரசன்-காவியப்பாவை – “புண்படுமா” என்னும் கவிதை.

அலகு 2: புதுக்கவிதை

9மணிநேரம்

1. நா.காமராசன்- **கறுப்புமலர்கள்** தொகுப்பில் **காகிதப்பூக்கள்** என்னும் தலைப்பிலான கவிதை.
2. அப்துல்ரகுமான்- **ஆலாபனை** தொகுப்பில் **போட்டி** என்னும் தலைப்பிலான கவிதை
3. ஈரோடுதமிழன்பன் - **ஒருவண்டிசென்றியு** தொகுப்பில் தேர்ந்தெடுக்கப்பட்ட சென்றியுகவிதைகள்
4. ஆண்டாள்பிரியதர்ஷினி-**முத்தங்கள்** **தீர்ந்துவிட்டன** தொகுப்பில் **'இங்கேவரும்போது'** என்னும் தலைப்பிலான கவிதை

அலகு 3: உரைநடை

9மணிநேரம்

1. மாணாக்கரும் தாய்மொழியும் - திரு.வி.க.,
2. மனவலிமைவேண்டும்- மு.வரதராசனார்
3. செம்மொழித்தமிழின் சிறப்புகள்
4. பண்டைத்தமிழரின் சாதனைச்சுவடுகள்

அலகு 4: தமிழர்வாழ்வும் பண்பாடும்

9மணிநேரம்

பண்பாடு-வாழ்வியல்முறை - அகம், புறம் - உணவுமுறை - விருந்தோம்பல் - நம்பிக்கைகள்-விழாவும் வழிபாடும் - கலைகள் - கட்டடம் - சிற்பம் - ஓவியம் - இசை-கூத்து- தொழிலும் வணிகமும் - அறிவியல்நோக்கு.

அலகு 5: மொழித்திறன், இலக்கியவரலாறு, இலக்கணம்

9மணிநேரம்

1. எழுத்துப்பிழை, தொடர்ப்பிழைகள்
2. வேற்றுமை இலக்கணம்
3. செய்யுள்நலம் பாராட்டல்
4. பாடம் தழுவிய இலக்கிய வரலாறு (மரபுக்கவிதை, புதுக்கவிதை, உரைநடை)

மொத்தம்: 45மணிநேரம்

பார்வை நூல்கள்

1. தமிழர் நாகரிகமும் பண்பாடும், டாக்டர் அ.தட்சிணாமூர்த்தி, ஐந்திணைப் பதிப்பகம்
2. தவறின்றித் தமிழ் எழுதுவோம், மா. நன்னன், ஏகம் பதிப்பகம்
3. தவறின்றித் தமிழ்எழுத-மருதூர்அரங்கராசன் ஐந்திணைப்பதிப்பகம்
4. தமிழ்இலக்கியவரலாறு, வரதராசன், மு., புதுதில்லி : சாகித்திய அகாடெமி ,
5. புதியதமிழ் இலக்கிய வரலாறு, நீல. பத்மநாபன், சிற்பி பாலசுப்ரமணியம், சாகித்திய அகாடெமி
6. செம்மொழி தமிழின் சிறப்பியல்புகள் – முனைவர் மறைமலை இலக்குவனார்; <https://www.youtube.com/watch?v=HHZnmJb4jSY>
7. பாடநூல்தேடலுக்கான இணையம் - <https://archive.org/>

பருவம்-2, தமிழ்மொழிப்பாடம்-2, பகுதி-1, தகுதிப்புள்ளி: 3,
வாரப்பாடநேரம்: 3.

தாள்-2

அறஇலக்கியம் – சிற்றிலக்கியம் – சிறுகதை – பயன்பாட்டுத்தமிழ்

அலகு 1: அறஇலக்கியங்கள்

10மணிநேரம்

1. திருக்குறள்- வான்சிறப்பு(அறம்), ஊக்கமுடைமை(பொருள்), குறிப்பறிதல்(இன்பம்) –மூன்று அதிகாரங்கள் முழுமையும்.
2. நாலடியார் – மூன்றுபாடல்கள். (2, 3, 5)
3. பழமொழிநானூறு – மூன்று பாடல்கள் (74, 75, 78)
4. திரிகடுகம் – மூன்று பாடல்கள் (10, 12, 22)
5. இனியவைநாற்பது – மூன்று பாடல்கள் (1, 12, 16)

அலகு 2: சிற்றிலக்கியம்

10மணிநேரம்

1. முத்தொள்ளாயிரம்
சேரன் – வீரம் 14, 15 பாடல்கள்
சோழன் – காதல் 23, 24 பாடல்கள்
பாண்டியன் –நாடு87, 88 பாடல்கள்
2. தமிழ்விடுதாது – முதல் 20 கண்ணிகள்
3. திருக்குற்றாலக்குறவஞ்சி – மலைவளம் கூறுதல் – முதல்5 பாடல்கள்
4. முக்கூடற்பள்ளு – மூத்தபள்ளி நாட்டுவளம் கூறுதல் 3 பாடல்கள், இளையபள்ளி நாட்டுவளம் கூறுதல் 3 பாடல்கள்.
5. கலிங்கத்துப்பரணி – பாலை பாடியது – முதல் 5 பாடல்கள்

அலகு 3: சிறுகதை

9மணிநேரம்

1. அறிஞர்அண்ணா – செவ்வாழை
2. புதுமைப்பித்தன் – கடவுளும் கந்தசாமிப்பிள்ளையும்
3. ஜெயகாந்தன் – யுகசந்தி
4. கு.அழகிரிசாமி – காற்று
5. அம்பை – காட்டில்ஒருமான்

அலகு 4: பேச்சுத் தமிழ்

மணி நேரம்

பேச்சுத்திறன் – விளக்கம் – பேச்சுத்திறனின் அடிப்படைகள் –
வகைகள் – மேடைப்பேச்சு – உடையாடல் - பயிற்சிகள்

அலகு5: எழுத்துத்தமிழ், இலக்கியவரலாறு, இலக்கணம்
8மணிநேரம்

1. கலைச்சொல்லாக்கம் – தேவைகள் – கலைச்சொற்களின்
பண்புகள் – அறிவியல் கலைச்சொற்கள் – கடிதம் – வகைகள் –
அலுவலகக்கடிதங்கள் – உறவுமுறைக் கடிதங்கள்.
2. பாடம்தமிழியஇலக்கியவரலாறு (அறஇலக்கியம், சிற்றிலக்கியம்,
சிறுகதை)
3. அணிஇலக்கணம்
4. விண்ணப்பக்கடிதம் எழுதுதல்

மொத்தம்: 45மணிநேரம்

பார்வைநூல்கள்

1. பேசும்கலை, முனைவர்கு.ஞானசம்பந்தன் விஜயா பதிப்பகம்
2. தமிழ்இலக்கியவரலாறு, வரதராசன், மு., சாகித்தியஅக்காதெமி
,புதுதில்லி
3. தமிழ்நடைக்கையேடு, மொழிஅறக்கட்டளை
4. பயன்பாட்டுத்தமிழ், முனைவர்அரங்கஇராமலிங்கம்,
முனைவர்ஒப்பிலாமதிவாணன், சென்னைபல்கலைக்கழகம், 2007
5. மொழிபெயர்ப்பியல் அடிப்படைகள், கா.பட்டாபிராமன்,
யமுனைப் பதிப்பகம், திருவண்ணாமலை

6 பாடநூல் தேடலுக்கான இணையம்

- <http://www.tamilvu.org/library>
- <https://archive.org/>

பாடக்குறியீட்டுஎண்: 21LTA003

பருவம்-3, தமிழ்மொழிப்பாடம்-3, பகுதி-1, தகுதிப்புள்ளி: 3,
வாரப்பாடநேரம்: 3.

தாள்-3

பக்தி இலக்கியம் – காப்பியம் – புதினம் - மொழிபெயர்ப்பு

அலகு 1:பக்திஇலக்கியம்

10மணிநேரம்

1. **மாணிக்கவாசகர்**- திருவாசகம் – மூன்று பாடல்கள்
 - ✓ புல்லாகி பூடாகி (சிவபுராணம்)
 - ✓ எல்லாப்பிறப்பும் (சிவபுராணம்)
 - ✓ உற்றாரையான் வேண்டேன்(திருப்புலம்பல்)
2. **ஆண்டாள்**- திருப்பாவை – மூன்று பாடல்கள் (1, 3, 4)
 - ✓ மார்கழித்திங்கள் ... (பாசுரம்1)
 - ✓ ஓங்கி உலகளந்த... (பாசுரம் 3)
 - ✓ ஆழிமழைக்கண்ணா... (பாசுரம்4)
3. **வீரமாமுனிவர்** - தேம்பாவணி – மூன்று பாடல்கள்
 - ✓ நீஒருதாய்; ஒருதாதையும்நீ (698 – சூசை இறைவனின் தாயைப் போற்றுதல்)
 - ✓ அணிக்கலத்துஅழகுஅழுந்திய (1089 – வானவர் இயேசு நாமத்தைப் போற்றி வணங்கிய செய்தி)
 - ✓ வான்புறத்துஇலகும்செஞ்சுடர்காண (3510 – இறைவன் சூசை முனிவர்க்கு ஏழுமணிகள் புறத்தில் ஒளிவிடும் முடியைச் சூட்டுதல்)
4. **குணங்குடிமஸ்தான்சாகிபு**- பராபரக்கண்ணி 1-10 கண்ணிகள்
5. **திருமூலர்** - திருமந்திரம் – மூன்று பாடல்கள்
 - ✓ உடம்பார் அழியின் உயிரார் அழிவர் (திருமந்திரம்:724)
 - ✓ படமாடக்கோயில் பகவற்கு ஒன்று ஈயில்(திருமந்திரம்: 1857)
 - ✓ மரத்தை மறைத்தது மாமதயானை (திருமந்திரம்: 2290)
6. **இராமலிங்கஅடிகள்** - திருவருட்பா- மூன்றுபாடல்கள்
 - ✓ எத்துணையும் பேதமுறா... (5297)
 - ✓ ஒருமையுடன் நினது திருமலரடி நினைக்கின்ற(2938)
 - ✓ கோடையிலே... (4091)

அலகு 2:காப்பியம்-1

9மணிநேரம்

1. சிலப்பதிகாரம் – அடைக்கலக்காதை
(தெரிவுசெய்யப்பட்டபாடல்அடிகள் 120-199)
2. சீவகசிந்தாமணி – விமலையார்இலம்பகம்
(தெரிவுசெய்யப்பட்டபாடல்கள்)

அலகு 3:காப்பியம்-2

9மணிநேரம்

1. கம்பராமாயணம் – மந்தரைசூழ்ச்சிப்படலம்
(தெரிவுசெய்யப்பட்டபாடல்கள்)
2. பெரியபுராணம் – பூசலார்நாயனார்புராணம்
(தெரிவுசெய்யப்பட்டபாடல்கள்)

அலகு 4:புதினம்

8மணிநேரம்

1. கல்மரம் - கோ.திலகவதி

அலகு 5:மொழிபெயர்ப்பு, இலக்கணம், இலக்கியவரலாறு

9மணிநேரம்

1. அலுவல்சார் மொழிபெயர்ப்பு
2. இலக்கணக்குறிப்பு
3. பாடம் தழுவிய இலக்கியவரலாறு (பக்திஇலக்கியம், காப்பியம், புதினம்)

மொத்தம்: 45மணிநேரம்

பார்வைநூல்கள்

1. தமிழ் இலக்கியவரலாறு, வரதராசன், மு., சாகித்தியஅக்காதெமி, புதுதில்லி
2. தமிழ்நடைக்கையேடு, மொழி அறக்கட்டளை
3. பயன்பாட்டுத்தமிழ், முனைவர்அரங்கஇராமலிங்கம், முனைவர்ஒப்பிலாமதிவாணன், சென்னைபல்கலைக்கழகம், 2007
4. மொழிபெயர்ப்பியல்அடிப்படைகள், கா.பட்டாபிராமன், யமுனைப் பதிப்பகம், திருவண்ணாமலை

5 பாடநூல் தேடலுக்கான இணையம்

- <http://www.tamilvu.org/library>
- <https://www.tamildigitallibrary.in/book>

பாடக்குறியீட்டுஎண்: 21LTA004

பருவம்-4, தமிழ்மொழிப்பாடம்-4, பகுதி-1, தகுதிப்புள்ளி: 3,
வாரப்பாடநேரம்: 3.

தாள்-4

சங்கஇலக்கியம் – நாடகம் – வளர்தமிழ் - பொதுக்கட்டுரை

அலகு1:சங்கஇலக்கியம்-1

10மணிநேரம்

1. புறநானூறு (மூன்று பாடல்கள் - 183, 184, 192)
2. பதிற்றுப்பத்து (இரண்டு பாடல்கள்-14, 69)
3. பட்டினப்பாலை (காவிரியின் சிறப்பு பாடல் அடிகள்01-07,
சோழநாட்டுவளம்பாடல்அடிகள்20-28,
பல்பொருள்வளம்பாடல்அடிகள்183-193)
4. மதுரைக்காஞ்சி (பாண்டியர் பரம்பரை பாடல் அடிகள் 01-23,
மன்னர்க்குமன்னன்பாடல்அடிகள்64-74,
பாண்டியன்புகழ்பாடல்அடிகள்197-209).

அலகு 2:சங்கஇலக்கியம்-2

9மணிநேரம்

1. நற்றிணை (இரண்டு பாடல்கள் - 1, 172)
2. குறுந்தொகை (மூன்று பாடல்கள் - 3, 40, 135)
3. ஐங்குறுநூறு(மூன்று பாடல்கள் - 281, 283, 286)
4. அகநானூறு (இரண்டு பாடல்கள்- 4, 86)
5. கலித்தொகை (இரண்டு பாடல்கள் - 9, 133)

அலகு 3:நாடகம்

8மணிநேரம்

1. ஆட்டனத்தி ஆதிமந்தி - கவிஞர்கண்ணதாசன்

அலகு 4:வளர்தமிழ்

9மணிநேரம்

1. ஊடகத்தமிழ் – கணினித்தமிழ்அறிமுகம்

ஊடகத்தமிழ்:அச்சுக்கலை - இதழியல் - ஊடகவகைகள் - அச்சு ஊடகங்கள் - மின்னணு ஊடகம் -இதழியல் முன்னோடிகள் - அச்சு ஊடகங்களில் தமிழ் -கருத்துப் பரிமாற்றம் - மொழிநடையின் தன்மை - நாளிதழ்கள்- வார, மாதஇதழ்கள் - மின்னணு ஊடகங்களில் தமிழ் - வானொலி- தொலைக்காட்சி- திரைப்படம்.

கணினித்தமிழ்: கணினித்தமிழின் அடிப்படையும் பயன்பாடும்- கணிப்பொறியின் வரலாறும் வளர்ச்சியும், கணினியும் தமிழும், விசைப்பலகை(Keyboard) - எழுத்துருக்கள்(Fonts) -தமிழைத் தட்டச்சு செய்ய உதவும் மென்பொருள்கள், தமிழைத் தட்டச்சு செய்யும் முறைகள் -தமிழ்த்தட்டச்சுப்பயிற்சி - இணையமும்

தமிழ்ப்பயன்பாடும் - தேடுபொறி(Search) -வலைப்பூ(Blog),
மின்னுலகம்(Online e-Library), -மின்னகராதி
(e-Dictionary), -மின்செய்தித்தாள் - e-Paper, -
இணையவழித்தமிழ்க்கற்றலும்-கற்பித்தலும்- மின்வழிக்கற்றல் –
e Learning.

அலகு 5: பொதுக்கட்டுரை, இலக்கிய வரலாறு, இலக்கணம்

9மணிநேரம்

1. பொதுக்கட்டுரை வரைதல்
2. பாடம் தழுவிய இலக்கியவரலாறு (சங்கஇலக்கியம், நாடகம், வளர்தமிழ்)
3. இலக்கணம் (பொருளிலக்கணம்) திணை, துறைவிளக்கம்.

மொத்தம்: 45மணிநேரம்

பார்வைநூல்கள்

1. கணினித்தமிழ், முனைவர்இல.சுந்தரம், விகடன்பிரசுரம்
2. கணிப்பொறியில்தமிழ், த.பிரகாஷ், பெரிகாம்
3. தமிழ்க்கணினிஇணையப்பயன்பாடுகள்,
முனைவர்துரை.மணிகண்டன், மணிவானதிபதிப்பகம்
4. இதழியல்கலை, டாக்டர்மா. பா. குருசாமி, குரு - தேமொழிபதிப்பகம்,
திண்டுக்கல்
5. அச்சுக்கலைவழிகாட்டி, பாலசுப்பிரமணியன், ஆ., சென்னை :
தனசு பதிப்பகம், 1966
6. தொலைக்காட்சிக்கலை, முனைவர்வெ. நல்லதம்பி,
மங்கைப்பதிப்பகம், சென்னை42

8 பாடநூல் தேடலுக்கான இணையம்

- <http://www.tamilvu.org/courses/nielit/Chapters/Chapter1/11.pdf>
- <https://www.tamildigitallibrary.in/>

FRENCH I

OBJECTIVE: To introduce French language.

To enable the students to understand and to acquire the basic knowledge of French language with elementary grammar.

UNIT: I INTRODUCTION 12

Introduction-Alphabet-comment prononcer, écrire et lire les mots-base: les prénoms personnel de 1er , 2eme et 3eme personnes-conjugaisons les verbes être et avoir en forme affirmative, négative Et interrogative.

UNIT II- LECON 1-3 12

Leçon 1: Premiers mots en français- 2. Les hommes sont difficiles 3. Vive la liberté-Réponses aux questions tires de la leçon-Grammaire: Les adjectives masculines ou féminines-Les article définies et indéfinis-Singuliers et pluriels.

UNIT III-LECON 4-6 12

Leçons 4. L'heure c'est l'heure 5. Elle va revoir sa Normandie 6. Mettez-vous d'accord groupe de nom-Réponses aux questions tires de la leçon-Grammaire :A placer et accorder l'adjectif en groupe de nom-Préposition de lieu-A écrire les nombres et l'heure en français

UNIT: IV-LECON 7-9 12

Leçon 7. Trois visage de l'aventure , 8. A moi Auvergne 9.Recit de voyage-Réponses aux questions tires de la leçon- Grammaire : Adjectif processif- Les phrases au présent de l'indicatif-Les phrases avec les verbes pronominaux au présent.

UNIT: V- COMPOSITION : 12

A écrire une lettre a un ami l'invitant a une célébration différente ex: mariage-A faire le dialogue-
A lire le passage et répondre aux questions.

Text Book:

Jack GIRARDER & Jean Marie GRIDLIG, <<Méthode de Français PANORAMA>>, Clé Internationale, Goyal Publication, New Delhi Edition 2014.

Reference Books:

DONDO Mathurin, "Modern French Course", Oxford University Press, New Delhi Edition 2014.

Nithya Vijayakumar get ready French grammar-Elementary Goyal publications, New Delhi Edition 2014.

FRENCH II

OBJECTIVE: To fortify the grammar and vocabulary skills of the students. To enable the students have an idea of the French culture and civilization

UNIT: I LECON 10-11 12

Leçons :10 Les affaires marchent,11 un repas midi a problèmes- Réponses aux questions tires de la leçon-grammaire ;présent progressif passe récent ou future proche-complément d'Object directe-complément d'objet

UNIT II- LECON 12-13 12

Leçons 12: tout est bien qui fini bien, -13 aux armes citoyens-réponses aux questions tires de la leçon-grammaire: les pronoms<<en ou y>> rapporter des paroles-Les pronoms relatifs que, qui ou ou.

UNIT III-LECON 14-15 12

Leçons 14. Qui ne risque rien n'a rien-15.la fortune sourit aux audacieux-réponses aux questions tires de la leçon-grammaire: comparaison-les phrases au passe compose.

UNIT: IV-LECON 16-18 12

Leçons 16 la publicité et nos rêves 17 la France la monde 18 campagne publicitaire réponses aux questions tires de la leçon-grammaire: les phrases a l'imparfait-les phrases au future

UNIT: V- COMPOSITION: 12

A écrire une lettre de regret//refus a un ami concernant l'invitation d'une célébration reçue-a écrire un essai sur un sujet générale-a lire le passage et répondre aux questions.

Text Book:

Jack GIRARDER & Jean Marie GRIDLIG, <<Méthode de Français PANORAMA>>, Clé Internationale, Goyal Publication, New Delhi Edition 2014.

Reference Books:

DONDO Mathurin, "Modern French Course", Oxford University Press, New Delhi Edition 2014.

Nithya Vijayakumar get ready French grammar-Elementary Goyal publications, New Delhi Edition 2014.

FRENCH III

OBJECTIVE:

To strengthen the Grammar and Composition in French language.

To train the students to enhance his skills in French language for communication

UNIT: I LECON 11

09

AIM: Is to impart the basics of french culture and civilisation.

CONTENT: **Leçon 16**-La famille Vincent. Page 44-Grammaire :Passe compose. **Leçon 29**-Vers l'hôtel.Page80- Grammaire :Impératif, a mettre phrases Singulier, Pluriel.

OUTCOME: The content of the unit 1 aids the students to explore the basics of the new french culture and civilisation.

UNIT II- LECON 12-13

09

AIM: Is to impart the french poetry and intermediate grammar.

CONTENT: **Leçon 40**-L'Épicerie les Légumes et les Fruits. Page 112-Grammaire; Présent de l'indicatif. **Leçon 44** La poste. Page-124 l'Grammaire :Amettre les phrases a l'impératif

OUTCOME: The content of the unit 2 aids the students to know about the french poetry and grammar.

UNIT III-LECON 14-15

09

AIM: Is to impart the french habitat and daily norms and activity.

CONTENT: **Leçon 51**-Le café et tabac page142- Grammaire: A changer les phrases eninterrogatif. **Leçon 58**-La chasse et la pêche. Page160-Grammaire: Le plus que parfait.

OUTCOME: The content of the unit 3 aids the students to adapt to the french society.

UNIT: IV-LECON 16-18

09

AIM: Is to impart the importance of francophonie

CONTENT: **Leçons 61**-Un mariage a la campagne. Pagé-170 -grammaire: a changer au participeprésent.

OUTCOME: The content of the unit 4 aids the students to know about francophonie.

UNIT: V- COMPOSITION:

09

AIM: Is to impart the production ecrit and lire

CONTENT: A écrireunelettre a un ami l'invitation d'une célébration différente ex: Mariage-a faire un essaie sur un sujet générale-a lire le passage et répondre aux questions.

OUTCOME: The content of the unit 5 aids the students to acquire the language proficiency.

TEXTBOOK:

Les leçons ont été choisis et tirés de i & ii degré de gauger << Cours de Langue et de Civilisation Française >> The Millennium, Publication Hachette, édition 2002

REFERENCE BOOKS:

DONDO Mathurin, "Modern French Course", Oxford University Press, New Delhi Edition 2014

WEB SITE RESOURCES LINK;

<https://www.thoughtco.com/french-reading-tips-1369373>

<https://www.bnf.fr/fr>

<https://www.laits.utexas.edu/tex/>

FRENCH IV

OBJECTIVE:

To strengthen the Grammar and Composition in French language.

To train the students to enhance his skills in French language for communication.

UNIT: I

09

AIM: To teach about the advanced grammar and slam poetry.

CONTENT: Leçon 20: Une grande Nouvelle-Grammaire Le future.

Leçon46: Lemètre ;l'autobus-Grammaire-A former ou a changer L'adjectifmasculinouféminine a l'adverbe-Trouvez les noms qui correspondent aux verbessuivants.

OUTCOME: This unit enables the student to know about the french poet and poetry.

UNIT: II

09

AIM: To teach about the advanced grammar and the civic responsibility.

CONTENT: Leçon 48: A la préfecture de police-Grammaire Les pronomsrelatifs.

Leçon63: les sports-Grammaire le conditionnelprésent.

OUTCOME: This unit enables the student to know about the french poet and poetry.

UNIT: III

09

AIM: To teach about the advanced grammar and the french monuments.

CONTENT: Leçon :56 A Biarritz la page-Grammaire le future antérieure.

OUTCOME: This unit enables the student to know about the french poet and poetry.

Leçon :57 Dans les Pyrénées-Grammaire le future antérieure suite.

UNIT: IV

09

AIM: To teach about the advanced grammar and french topographies.

CONTENT: Leçons 65-a fin des vacances Grammaire-a changer les phrases du pluriel au singulier, le présent du subjonctif.

OUTCOME: This unit enables the student to know about the french topographies.

UNIT: V

09

AIM: To teach about the advanced grammar and formal letter drafting.

CONTENT: Grammaire et composition: Transduction - réponses aux questions sur les passage-essaie sur un sujetgénérale,; lettre :Ecrireunelettre a une amie.

OUTCOME: This unit enables the student to know about the formal letter drafting.

TEXTBOOK:

Les leçonsontétéchoisi et tire de i& ii degré de gauger<<Cours de Langue et de Civilisation Française>> The Millenium, Publication Hachette, édition 2002

REFERENCE BOOKS:

DONDO Mathurin, “Modern French Course”, Oxford University Press, New Delhi Edition 2014

WEB SITE RESOURCES LINK;

<https://www.thoughtco.com/french-reading-tips-1369373>

<https://www.bnf.fr/fr>

<https://www.laits.utexas.edu/tex/>