Ist M. Sc (2023-2024)

Biochemistry

Title of the Course	**: BASICS OF BIOCHEMISTRY**		
Category of the Course	**: CORE COURSE**	**Semester**	**: I**
Course Code	**: P1R3BCCC1**	**Nature of the Skill**	**: EMPLOYABILITY**
Marks	**: CIA:25+ Ext: 75 = 100**	**Hrs/Week**	**: 6**
Credits	**: 5**	**Total Inst. Hrs**	**: 90**

Course objectives:

The main objectives of this course are to:

1. Students will be introduced to the structure of biomolecules.
2. The significance of carbohydrates in biological processes will be understood.
3. The structure, properties and biological significance of lipids in the biological system will be studied
4. Students will learn about the concepts of protein structure and their significance in biological processes and creatively comprehend the role of membrane components with their biological significance.
5. Students will gain knowledge about the structures and functional roles of nucleic acids in the biological system

Unit I **20 Hours**

CARBOHYDRATES

Monosaccharides & Disaccharides: structure, occurrence, properties and biological functions. Homo and Hetero: Polysaccharides - occurrence, structure, properties and functions of homoglycans - starch, glycogen, cellulose, dextrin, inulin, chitin, xylans and galactans. Occurrence, structure, properties and functions of hetero glycans - hyaluronic acid, keratan sulphate and chondroitin sulphate. Mucopolysaccharides – bacterial cell walls polysaccharides and sialic acid. Blood group substances. Lectins structure and functions.

Unit II **20 Hours**

PROTEINS

Classification, structure and properties of amino acids, Essential and non-essential amino acids. Non protein amino acids. Proteins - Classification based on solubility, shape, composition function & Properties of proteins. Structure of peptide bonds. Chemical synthesis of polypeptides. Physical interactions that determine the properties of proteins – short range

repulsions, electrostatic forces, van der waals interaction, hydrogen bond and hydrophobic interactions. Protein structure - Primary, secondary – α-helix, β-sheet and β-turns, tertiary and quaternary structures of protein. The Ramachandran plot Pauling and Corey model for fibrous proteins. Structure and biological functions of fibrous proteins (keratins, collagen and elastin), globular proteins (haemoglobin, myoglobin), lipoproteins, metallo proteins, glycoprotein and nucleoproteins.

Unit III **15 Hours**

LIPIDS

Definition and classification of lipids. Fatty acids - classification, nomenclature, structure and properties. Saturated and unsaturated fatty acids. Derived lipids: Phospholipids, glycolipids, structure and function. Cholesterol and Triacylglycerols. Eicosanoids- structure and biological actions of prostaglandins, prosracyclins, thromboxanes, leukotrienes and lipoxins. Lipoproteins- Classification and composition and liposomes.

Unit IV **20 Hours**

NUCLEIC ACIDS

Structure of purines and pyrimidines. Components of nucleic acids - nucleosides, nucleotides, and poly nucleotides. Occurrence and isolation of nucleic acids. Properties of DNA: buoyant density, viscosity, hypochromicity, denaturation and renaturation– the cot curve. DNA: structure of different types (A, B and Z DNA), biological role. DNA binding motifs in proteins – the basic helix loop helix (bHLH) motif, zinc finger, the leucine zipper and helix-loop helix. Structure and role of different types of RNA (mRNA, rRNA, tRNA, sn RNA, hn RNA).

Unit V **15 Hours**

VITAMINS, MINERALS AND PORPHYRINS

Structure and biochemical properties of water soluble and fat soluble vitamins and their coenzyme activity. Macro minerals (Ca, P, Mg, Na, K, Cl) and micro minerals/trace elements (Co, I, Fe, Mn, Zn, and F) - their sources, daily requirements, functions and deficiency diseases symptoms. Porphyrins the porphyrin ring system, chlorophyll, hemoglobin, myoglobin and cytochrome.

Course Outcomes:

Course Name - Basics of Biochemistry		Course Code - P1R3BCCC1	Knowledge Level
After completion of this course, students would be able to			
CO1	Explain the chemical structure and functions of carbohydrates.		K1, K2
CO2	Using the knowledge of lipid structure and function, explain how it plays a role in Signalling pathways.		K3, K4
CO3	Describe the various levels of structural organisation of proteins and the role of proteins in biological system.		K4, K5
CO4	Apply the knowledge of proteins in cell-cellinteractions.		K3, K4
CO5	Applying the knowledge of nucleic acid sequencing in researchand diagnosis.		K2, K3, K4

Reading List

1. https://bio.libretexts.org/Bookshelves/Biochemistry/Book%3A_Biochemistry_Online_(Jakubowski)
2. https://www.thermofisher.com/in/en/home/life-science/protein-biology/protein-biology-learning-center/protein-biology-resource-library/pierce-protein-methods/protein-glycosylation.html
3. https://ocw.mit.edu/courses/biology/7-88j-protein-folding-and- human-disease-spring-2015/study-materials/
4. https://www.open.edu/openlearn/science-maths- technology/science/biology/nucleic-acids-and-chromatin/content-section- 3.4.2
5. https://www.genome.gov/genetics-glossary/Cell-Membrane
6. https://nptel.ac.in/content/storage2/courses/102103012/pdf/mod3.pdf

Recommended Texts

1. David L. Nelson and Michael M.Cox (2012) Lehninger Principles of Biochemistry (6th ed) W.H. Freeman.
2. Voet.D & Voet. J.G (2010) Biochemistry, (4th ed), John Wiley & Sons, Inc.
3. Metzler D.E (2003). The chemical reactions of living cells (2nd ed), Academic Press.
4. Zubay G.L (1999) Biochemistry, (4th ed), Mc Grew-Hill.
5. Lubert Stryer (2010) Biochemistry, (7th ed), W.H.Freeman

6. Satyanarayan, U (2014) Biochemistry (4th ed), Arunabha Sen Books & Allied (P) Ltd, Kolkata.

Relationship Matrix for CO, PO & PSO

Title of the Course: Basics of Biochemistry						**Course Code: P1R3BCCC1**			
Course Outcomes (COs)	**PO**									
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	L	M	S	M	M	M	S	M	M
CO2	S	M	L	S	M	M	M	S	M	M
CO3	S	M	M	S	S	M	L	S	M	M
CO4	S	M	M	S	M	M	M	S	M	M
CO5	S	S	M	S	S	M	M	S	M	M

S-Strong (3) M-Medium (2) L-Low (1)

Title of the Course	**: Biochemical and Molecular Biology Techniques**		
Category of the Course	**: CORE COURSE**	**Semester**	**: I**
Course Code	**: P1R3BCCC2**	**Nature of the Skill**	**: EMPLOYABILITY**
Marks	**: CIA:25+ Ext: 75 = 100**	**Hrs/Week**	**: 6**
Credits	**: 5**	**Total Inst. Hrs**	**: 90**

Course objectives:

Biochemical techniques combine various inter-disciplinary methods in biological research and the course aims to provide students with the following objectives:

1. To understand the various techniques used in biochemical investigation and microscopy.
2. To explain chromatographic techniques.\ and their applications
3. To explain electrophoretic techniques.
4. To comprehend the spectroscopic techniques and demonstrate their applications in biochemical investigations.
5. To acquire knowledge of radio labelling techniques and centrifugation.

Unit I **20 Hours**

General approaches to biochemical investigation, cell culture techniques and microscopic techniques. Organ and tissue slice technique, cell distribution and homogenization techniques, cell sorting, and cell counting, tissue Culture techniques. Cryopreservation, Biosensors- principle and applications. Principle, working and applications of light microscope, dark field, phase contrast and fluorescent microscope. Electron microscope- Principle, instrumentation of TEM and SEM, Specimen preparation and applications-shadow casting, negative staining and freeze fracturing.

Unit II **20 Hours**

Chromatographic Techniques:

Basic principles of chromatography- adsorption and partition techniques. Chiral Chromatography and counter current Chromatography. Adsorption Chromatography – Hydroxy apatite chromatography and hydrophobic interaction Chromatography. Affinity chromatography. Gas liquid chromatography- principle, instrumentation, column

development, detectors and applications. Low pressure column chromatography – principle, instrumentation, column packing, detection, quantitation and column efficiency, High pressure liquid chromatography- principle, instrumentation, delivery pump, sample injection unit, column packing, development, detection and application. Reverse HPLC, capillary electro chromatography and perfusion chromatography.

Unit III **20 Hours**

Electrophoretic Techniques:

General principles of electrophoresis, supporting medium, factors affecting electrophoresis, Isoelectric focusing-principle, ampholyte, development of pH gradient and application. PAGE-gel casting-horizontal, vertical, slab gels, sample application, detection-staining using CBB, silver, fluorescent stains. SDS PAGE-principle and application in molecular weight determination principle of disc gel electrophoresis ,2D PAGE. Electrophoresis of nucleic acids-agarose gel electrophoresis of DNA, pulsed field gel electrophoresis- principle, apparatus, application. Electrophoresis of RNA, curve. Microchip electrophoresis and 2D electrophoresis, Capillary electrophoresis.

Unit IV **15 Hours**

Spectroscopic techniques:

Basic laws of light absorption- principle, instrumentation and applications of UV-Visible, IR, ESR, NMR, Mass spectroscopy, Turbidimetry and Nephelometry. Luminometry (Luciferase system, chemiluminescence). X – ray diffraction. Atomic absorption spectroscopy - principle and applications – Determination of trace elements

Unit V **15 Hours**

Radiolabelling Techniques and Centrifugation:

Nature of radioactivity-detection and measurement of radioactivity, methods based upon ionisation (GM counter) and excitation (scintillation counter), autoradiography and applications of radioactive isotopes, Biological hazards of radiation and safety measures in handling radioactive isotopes.

Basic principles of Centrifugation. Preparative ultracentrifugation – Differential centrifugation, Density gradient centrifugation. Analytical ultracentrifugation - Molecular weight determination.

Course Outcomes:

Course Name - Biochemical and Molecular Biology Techniques		**Course Code – P1R3BCCC2**	**Knowledge Level**
After completion of this course, students would be able to			
CO1	Attain good knowledge in modern used in biochemical investigation and microscopy and apply the experimental protocols to plan and carry out simple investigations in biological research.		K1, K5
CO2	Demonstrate knowledge to implement the theoretical basis of chromatography in upcoming practical course work.		K3, K5
CO3	Demonstrate knowledge to implement the theoretical basis of electrophoretic techniques in research work.		K3, K5
CO4	Tackle more advanced and specialized spectroscopic techniques that are pertinent to research.		K1, K2 & K5
CO5	Tackle more advanced and specialized radioisotope and centrifugation techniques that are pertinent to research work.		K1, K2 & K5

Reading List

Principles and techniques of biochemistry and molecular biology:

1. https://www.kau.edu.sa/Files/0017514/Subjects/principals%20and%20techiniques%20of%20biochemistry%20and%20molecular%20biology%207th%20ed%

Recommended Texts

1. Keith Wilson, John Walker (2010) Principles and Techniques of Biochemistry and Molecular Biology (7th ed) Cambridge University Press
2. David Sheehan (2009), Physical Biochemistry: Principles and Applications (2nd ed), Wiley-Blackwell
3. David M. Freifelder (1982) Physical Biochemistry: Applications to Biochemistry and Molecular Biology,W.H.Freeman
4. Rodney F.Boyer (2012), Biochemistry Laboratory: Modern Theory and techniques,(2nd ed),Prentice Hall
5. Kaloch Rajan (2011), Analytical techniques in Biochemistry and Molecular Biology, Springer

6. Segel I.H (1976) Biochemical Calculations (2nd ed), John Wiley and Sons
7. Robyt JF (2015) Biochemical techniques: Theory and Practice (1st ed), CBS Publishers & Distributors.

Relationship Matrix for CO, PO & PSO

Title of the Course: Biochemical and Molecular Biology Techniques						**Course Code: P1R3BCCC2**			
Course Outcomes (COs)	**PO**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**S**	**L**	**M**	**S**	**S**	**L**	**L**	**S**	**S**	**M**
CO2	**S**	**M**	**M**	**S**	**M**	**L**	**M**	**S**	**S**	**L**
CO3	**S**	**M**	**L**	**S**	**M**	**M**	**M**	**S**	**M**	**L**
CO4	**S**	**S**	**L**	**S**	**S**	**M**	**M**	**S**	**M**	**M**
CO5	**S**	**S**	**M**	**S**	**M**	**M**	**M**	**S**	**M**	**M**

S-Strong (3) M-Medium (2) L-Low (1)

Title of the Course	**: Practical-I Basics of Biochemistry and Biochemical and Molecular Biology Techniques**		
Category of the Course	**: Core Course**	**Semester**	**: I**
Course Code	**: P1R3BCCC3P**	**Nature of the Skill**	**: EMPLOYABILITY**
Marks	**: CIA: 40 + Ext: 60 = 100**	**Hrs/Week**	**: 6**
Credits	**: 4**	**Total Inst. Hrs**	**: 90**

Course objectives:

The main objectives of this course are:

1. To instill skill in students enabling them to apprehend the wider knowledge about principles and techniques to be employed for the biomolecules under investigation.

2.To inculcate the knowledge of various isolation and purification techniques of macromolecules like DNA, RNA, Glycogen and Starch,

3. To perform colorimetric estimations to quantify important metabolites like lactate and tryptophan and minerals like calcium and iron from various sources.

4. To achieve training in subcellular fractionation and to identify them by markers.

5 To achieve training in various chromatographic techniques.

I. Biochemical studies and estimation of macromolecules

1. Isolation and estimation of glycogen from liver.
2. Isolation and estimation of DNA from animal tissue.
3. Isolation and estimation of RNA from yeast.
4. Purification of Polysaccharides –Starch and assessment of its purity.

II. UV absorption

1. Denaturation of DNA and absorption studies at 260nm.
2. Denaturation of Protein and absorption studies at 280nm.

III. Colorimetric estimations

1. Estimation of Pyruvate
2. Estimation of tryptophan.

IV. Estimation of minerals

1. Estimation of calcium

2. Estimation of iron

V. Plant Biochemistry

1. Qualitative analysis Phytochemical screening

2. Estimation of Flavonoids -Quantitative analysis

Group Experiments

1.Fractionation of sub-cellular organelles by differential Centrifugation-Mitochondria and nucleus

2. Identification of the separated sub-cellular fractions using marker enzymes (any one)

3.Separation of identification of lipids by thin layer chromatography.

4.Separation of plant pigments from leaves by column chromatography

5. Identification of Sugars by Paper Chromatography

6.Identification of Amino acids by Paper Chromatography.

Course Outcomes:

Course Name - Practical-I		**Course Code - P1R3BCCC3P**	**Knowledge Level**
After completion of this course, students would be able to			
CO1	The student will be able to acquire knowledge and skill in the techniques used in the isolation, purification and estimation of different biomolecules that are widely employed in research		K1, K2, K4
CO2	The students will get acquainted with Principle, Instrumentation and method of Performing UV absorption studies of DNA, Protein and interpreting the alteration occurred during the process of denaturation		K1, K2, K 3, K4
CO3	The student will be fine-tuning in handling the instruments like colorimeter, spectrophotometer and will be able to estimate the biomolecules and minerals from the given samples.		K1, K2, K4
CO4	The student, in addition to acquiring skill in performing various biochemical techniques can also learn to detect presence of phytochemicals and quantify them in the plant sample.		K1, K2, K3, K4 & K6
CO5	The students will develop skill in analytical techniques like subcellular fractionation, Paper, Column and Thin Layer Chromatography and the group experiments will enable them to build learning skills like team work, Problem solving, Communication ability.		K1, K2, K3, K4 & K6

Reading List

1.https://www.researchgate.net/publication/313745155_Practical_Biochemistry_A_Student_Companion.

2.https://doi.org/10.1186/s13020-018-0177-x

3.https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5368116/

4.https://www.life.illinois.edu/biochem/455/Lab%20exercises/2Photometry/spectrophotometry.pdf

5.https://ijpsr.com/bft-article/determination-of-total-flavonoid-and-phenol-content-in-mimusops-elengi-linn/?view=fulltext

6.https://skyfox.co/wp-content/uploads/2020/12/Practical-Manual-of-Biochemistry.pdf

Self-Study

1. Laboratory Safety Rules, Requirements and Regulations.
2. Preparation of standard solutions and reagent

Books Recommended

1. David Plummer (2001) An Introduction to Practical Biochemistry (3rd ed) McGraw Hill Education (India) Private Ltd
2. Jayaraman, J (2011), laboratory Manual in Biochemistry, New age publishers
3. Varley H (2006) Practical Clinical Biochemistry (6th ed) , CBS Publishers
4. O. Debiyi and F. A. Sofowora, (1978) "Phytochemical screening of medical plants," Iloyidia, vol. 3, pp. 234–246,
5. Prof. Sarin A. Chavhan, Prof. Sushilkumar A. Shinde (2019) A Guide to Chromatography Techniques Edition:1
6. Analytical techniques in Biochemistry and Molecular Biology; Katoch, Rajan. Springer (2011).

Relationship Matrix for CO, PO & PSO

Title of the Course: Practical-I						**Course Code: P1R3BCCC3P**				
Course Outcomes (COs)	**PO**									
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	S	S	M	S	L	S	M	S
CO2	S	S	S	S	M	S	L	S	M	S
CO3	S	S	S	S	M	S	M	S	M	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	S	S	S	S	S

S-Strong (3) M-Medium (2) L-Low (1)

Title of the Course	**: MICROBIOLOGY & IMMUNOLOGY**		
Category of the Course	**: Discipline Specific Elective**	**Semester**	**: I**
Course Code	**: P1R3BCDSE1**	**Nature of the Skill**	**: EMPLOYABILIT**
Marks	**: CIA:25+ Ext: 75 = 100**	**Hrs/Week**	**: 6**
Credits	**: 3**	**Total Inst. Hrs**	**: 90**

Course Objectives:

The main objectives of this course are:

1. To appreciate the classification of microorganisms based on their structure, size and shape with an insight into the ancient scriptures about microbes.
2. To understand the role of microorganisms in environment and also to learn the culture conditions.
3. To recognize the possible contamination of foods by microorganisms, to learn about counteracting preservative measures and to know about probiotic nature of microorganisms.
4. To gain knowledge on pathogenic mediation by microorganisms and preventive measures as well.
5. To comprehend the features of antimicrobial agents, their mechanism of action along with the side effects and also to explore natural remedial measures against microbes.

Unit I **15 Hours**

Taxonomical classification - bacteria, viruses (DNA, RNA), algae, fungi and protozoa. Distribution and role of microorganisms in soil, water and air. Charaka's classification of microbes, lytic cycle and lysogeny. Types of culture media, isolation of pure culture, growth curve and the measurement of microbial growth.

Unit II **20 Hours**

Contamination and spoilage of foods – cereals, cereal products, fruits, vegetables, meat, fish, poultry, eggs, milk and milk products. General principles of traditional and modern methods of food preservation - Removal or inactivation of microorganisms, boiling, steaming, curing, pasteurization, cold processing, freeze drying, irradiation, vacuum packing, control of

oxygen and enzymes. Microbes involved in preparation of fermented foods - cheese, yoghurt, curd, pickles, rice pan cake, appam, ragi porridge (கேழ்வரகு கூழ்) and bread.

Unit III **20 Hours**

Food poisoning- bacterial food poisoning, Salmonella, Clostridium blotulinum (botulism), Staphylococcus aureus, fungal food poisoning – aflatoxin, food infection – Clostridium, Staphylococcus and Salmonella. Pathogenic microorganisms, E. coli, Pseudomonas, Klebsilla, Streptococcus, Haemophilus, & Mycobacterium, causes, control, prevention, cure and safety. Food microbiological screening- Real time PCR, ELISA, Aerobic and anaerobic Plate Count, dye reduction method, anaerobic lactic acid bacteria, anaerobic sporeformers, Hazard analysis critical control point (HACCP)

Unit IV **15 Hours**

Antimicrobial chemotherapy, General characteristics of antimicrobial agents. Mechanism of action – sulfonamides, sulphones and PAS. Penicillin, streptomycin- spectra of activity, mode of administration, mode of action, adverse effects and sensitivity test., Antiviral and antiretroviral agents, Antiviral RNA interference, natural intervention (Natural immunomodulators routinely used in Indian medical philosophy).

Unit V **20 Hours**

Immune system- definition and properties. Cells of the immune system – neutrophils, eosinophils, basophils, mast cells, monocytes, macrophages, dendritic cells, natural killer cells, and lymphocytes (B cells and T cells). Lymphoid organs- Primary and Secondary; structure and functions. Antigens and Complement System: definition, properties- antigenicity and immunogenicity, antigenic determinants and haptens. Antigen - antibody interactions - molecular mechanism of binding. Affinity, avidity, valency, cross reactivity and multivalent binding. Immunoglobulins & Immune Response: Structure, classes and distribution of antibodies. Antibody diversity. Immune system in health & disease, Transplantation immunology- graft rejection and HLA antigens. Immunological techniques, Flow cytometry and its application.

Course Outcomes:

Course Name – Microbiology and Immunology		Course Code – P1R3BCDSE1	Knowledge Level
After completion of this course, students would be able to			
CO1	To classify (by both ancient and modern modes) different types of microorganisms and explain life cycle of the microbes.		K1, K2 & K5
CO2	To recognize the microorganisms involved in decay of foods and will be able to apply various counteracting measures. The students also will be able to relate the role of certain beneficial microbes in day-to- day's food consumption.		K1, K2 & K4
CO3	To understand the common pathogenic bacterial and fungi that cause toxic effects and also will be able to employ curative measures.		K1 & K2
CO4	To analyse various features of wide variety of antimicrobial agents along with their mode of action, in addition, being able to apprehend the valuable potentials of traditional and easily available herbs.		K2, K5 & K6
CO5	To apply knowledge gained in production of industrially important products as both pharmaceutical and nutraceutical.		K2, K4 & K5

Recommended Texts

1. Michael J. Pelczar Jr.(2001) Microbiology (5th ed), McGraw Hill Education (India) Private Limited
2. Frazier WC, Westhoff DC, Vanitha NM (2010) Food Microbiology (5th ed), McGraw Hill Education (India) Private Limited
3. Willey J and Sherwood L (2011), Prescott's Microbiology (8th ed) McGraw Hill Education (India)
4. Anantha narayanan, Paniker and Arti Kapil (2013) Textbook of Microbiology (9th ed) Orient BlackSwan

5. Judy Owen, Jenni Punt Kuby (2013), Immunology (Kindt, Kuby Immunology) (7th ed) W. H. Freeman & Co
6. Brooks GF and Carroll KC (2013) Jawetz Melnick&Adelbergs Medical Microbiology, (26th ed) McGraw Hill Education
7. Greenwood D (2012), Medical Microbiology, Elsevier Health

Relationship Matrix for CO, PO & PSO

Title of the Course: Microbiology and Immunology						**Course Code: P1R3BCDSE1**			
Course Outcomes (COs)	**PO**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**S**	**L**	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**S**
CO2	**S**	**S**	**S**	**S**	**S**	**M**	**L**	**M**	**S**	**S**
CO3	**S**	**M**	**M**	**S**	**M**	**M**	**M**	**M**	**L**	**M**
CO4	**S**	**M**	**M**	**M**	**M**	**M**	**M**	**S**	**S**	**S**
CO5	**S**	**L**	**S**	**S**	**M**	**L**	**L**	**S**	**S**	**S**

S-Strong (3) M-Medium (2) L-Low (1)

Title of the Course : Communications & Scientific writing

Category of the Course	**: Discipline Specific Elective**	**Semester**	**: I**
Course Code	**: P1R3BCDSE2**	**Nature of the Skill**	**: EMPLOYABILITY**
Marks	**: CIA:25+ Ext: 75 = 100**	**Hrs/Week**	**: 6**
Credits	**: 3**	**Total Inst. Hrs**	**: 90**

Course Objectives:

The main objectives of this course are:

1. To understand the types and structure of scientific writing.
2. To understand the method of writing and practice writing.
3. To learn to write a paper or article incorporating all necessary components properly.
4. To Understand the ICT for Presentation.
5. To Learn the viva- voce Procedure for Presentation.

Unit I **20 Hours**

Explain the various types of scientific writing: Papers, Reviews Short communications, articles for newspapers, popular science writing, chapters in a text book, thesis writing etc.

Unit II **20 Hours**

Writing main ideas in research paper and arranging details in logical sequence

Evolution and structure of scientific paper-abstract, title, Review of literature Results and Discussion in detail, Conclusion and References.

Unit III **20 Hours**

PPT Presentation - Practice presentations by 4-5 students, randomly selected, evaluation and discussion of positive and negative aspects.

Unit IV **15 Hours**

Poster Presentation -Formal Power Point for Student Submission, Poster presentation of their chosen scientific project.

Unit V **15 Hours**

Oral presentations at Conferences –Preparation, Planning and Delivery, Importance and procedure of viva- voce.

Course Outcomes:

Course Name - Communications & Scientific writing		**Course Code - P1R3BCDSE2**	**Knowledge Level**
After completion of this course, students would be able to			
CO1	Students would have understood the concepts of research methods in Biological Sciences.		K2
CO2	Students would have learnt to design the Research Paper and arranging details in logical sequence		K3
CO3	Students would have become familiar with the Practice presentations		K2
CO4	Students would have learnt to prepare the PowerPoint poster presentation		K3
CO5	Students would have learnt the art of Oral Presentations Preparation.		K2

Text Books Recommended:

1. Kothari C.R., "Research Methodology Methods and Techniques" (New Delhi: New Age International).

2. Krishnaswamy O.R. & Renganathan M. "Methodology of Research in Social Sciences", (New Delhi: Himalaya Publishing House)

3. Ravilochanan P, "Research Methodology" (Chennai: Margham Publications)

4. Pauline V. Young, "Scientific Social Surveys and Research" (New Delhi: Prentice Hall of India P. Ltd)

5. Patten Chetty, "Research Methodology" (Coimbatore: Rainbow Publications).

Relationship Matrix for CO, PO & PSO

Title of the Course: Communications & Scientific writing										**Course Code: P1R3BCDSE2**
Course Outcomes (COs)	**PO**									
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	S	S	S	M	M	S	S
CO2	L	M	S	L	M	S	M	S	M	S
CO3	S	M	L	S	M	M	S	S	S	M
CO4	M	M	S	M	L	L	M	M	S	M
CO5	S	S	M	S	S	M	M	S	S	S

S-Strong (3) M-Medium (2) L-Low (1)