J.J. COLLEGE OF ARTS AND SCIENCE (Autonomous)

DEPARTMENT OF BIOCHEMISTRY

B.Sc BIOCHEMISTRY

Proposed Course Structure under Autonomous Status
Under Choice Based Credit System
(Applicable for the candidates admitted from academic year 2019-2020 onwards)

B.Sc BIOCHEMISTRY PROGRAMME OBJECTIVES

The core objectives of our under graduate programme is:

- To provide a summarized fundamental understanding of Biochemistry and its relation to various biological and chemical sciences
- To gain an understanding of the basic mechanisms inherent to living systems
- To provide practical exposure (hands-on training) to learners in handling laboratory equipments and clinical samples.
- To understand the scientific basis of life processes at the molecular level & orientation towards the application of knowledge acquired in solving medical problems.
- To develop learners to become health care professionals for services in various fields of clinical Biochemistry, laboratory management, academics, research, industry, and community service.

SEM	Part	Course code	Course Title	Hrs/ Week	Credit	Exam Hours	Marks Int	Marks Ext	Total Marks
I	I	U1R1TL1/ HL1/FL1	Language Course – I	6	3	3	25	75	100
	II	U1R1EL1	English Language course – I	6	3	3	25	75	100
	III	U1R1BCCC1	Biomolecules	6	5	3	25	75	100
		UIR1BCCC2P	Major Practical-I(Covering CC1)	5	5	3	40	60	100
		U1R1BCAC1	Allied Chemistry-I	4	3	3	25	75	100
		U1R1BCAC2P	Allied Chemistry Practical-I	3	*	-	-	-	-
TOTAL				**30**	**19**				**500**
II	I	U2R1TL2/ HL2/FL2	Language Course – II	5	3	3	25	75	100
	II	U2R1EL2	English Language course – II	5	3	3	25	75	100
	III	U2R1BCCC3	Analytical Techniques	6	5	3	25	75	100
		U2R1BCCC4P	Major Practical-II(Covering CC3)	5	5	3	40	60	100
		U2R1BCAC2P	Allied Chemistry Practical-II	3	3	3	40	60	100
		U2R1BCAC3	Allied Chemistry-III	4	3	3	25	75	100
		U2REVS	Environmental Studies	2	2	3	25	75	100
TOTAL				**30**	**24**				**700**

SEM	Part	Course code	Course Title	Hrs/ Week	Credit	Exam Hours	Marks Int	Marks Ext	Total Marks
III	I	U3R1TL3/ HL3/FL3	Language Course – III	5	3	3	25	75	100
	II	U3R1EL3	English Language course – III	5	3	3	25	75	100
	III	U3R1BCCC5	Enzymology	5	5	3	25	75	100
		U3R1BCCC6P	Major Practical-III(Covering CC4 and CC5)	5	5	3	40	60	100
		U3R1BCAC4	Allied Fundamentals of biology-1	4	3	3	25	75	100
		U3R1BCAC5P	Allied Biology Practical-II(Covering AC-4 and AC-6)	3	*	-	-	-	-
		U3R1VE	Value Education	2	2	3	25	75	100
TOTAL				**30**	**21**	**-**	**-**	**-**	**600**
IV	I	U4R1TL4/ HL4/FL4	Language Course – IV	5	3	3	25	75	100
	II	U4R1EL4	English Language course – IV	5	3	3	25	75	100
	III	U4R1BCCC7	Clinical Biochemistry	5	5	3	25	75	100
		U4R1BCCC8P	Major Practical-IV(Covering CC7)	5	5	3	40	60	100
		U4R1BCAC5P	Allied Fundamentals of Biology Practical-II	3	3	3	40	60	100
		U4R1BCAC6	Allied Fundamentals of Biology-III	4	3	3	25	75	100
	IV	U4R1BCSBE1	Skill based Elective Course –I	3	2	3	25	75	100
TOTAL				**30**	**24**	**-**	**-**	**-**	**700**

SEM	Part	Course code	Course Title	Hrs/ Week	Credit	Exam Hours	Marks Int	Marks Ext	Total Marks
V	II	U5R1BCCC9	Molecular Biology	5	5	3	25	75	100
		U5R1BCCC10	Intermediary Metabolism	5	5	3	25	75	100
		U5R1BCCC11	Human Physiology	5	5	3	25	75	100
		U5R1BCCC12P	Major Practical-V (Covering CC9 and CC10)	5	5	3	40	60	100
		U5R1BCMBE1	MAJOR BASED ELECTIVE COURSE Course – I	4	4	3	25	75	100
		U5R1BCSBE2	Skill based Elective Course – II	4	2	3	25	75	100
	IV	U5R1BCIDC1	Inter disciplinary Course - I	2	2	3	25	75	100
TOTAL				**30**	**28**	**-**	**-**	**-**	**700**
VI	III	U6R1BCCC13	Immunology	5	5	3	25	75	100
		U6R1BCCC14	Plant Biochemistry	5	5	3	25	75	100
		U6R1BCMBE2	MAJOR BASED ELECTIVE COURSE Course – II	5	4	3	25	75	100
		U6R1BCMBE3	MAJOR BASED ELECTIVE COURSE Course – III	5	4	3	25	75	100
	IV	U6R1BCSBE3	Skill based Elective Course – III	2	2	3	25	75	100
		U6R1BCIDC2	Inter disciplinary Course - II	2	2	3	25	75	100
	V		Gender Studies		1	3	25	75	100
			Extension activities		1				
TOTAL				**30**	**24**	**-**	**-**	**-**	**700**
Grand Total				**140**					**3900**

*Carried over Paper – Exam at the end of the next semester

CC-Core Course / AC – Allied Course /MBE – MAJOR BASED ELECTIVE COURSE / SBE – Skill based Elective/ IDC – Inter disciplinary course/P – Practical* / T – Theory

Total Credit – 140 / Total Marks – 3900

Extension activities shall be outside the instruction hours.

MAJOR BASED ELECTIVE COURSE papers (Any three from the list)

1. Microbiology
2. Biotechnology and Genetic Engineering
3. Endocrinology
4. Plant Biochemistry and Plant Therapeutics
5. Pharmaceutical Biochemistry

Skill Based Elective Courses (any three from the list)

1. Hospital Management and First Aid Management
2. Pain Relief formulation and Cosmetics
3. Nutrition and Dietitics
4. Plant and Animal Biotechnology
5. Nanobiotechnology

Inter disciplinary course (offered by the department)

1. Public Health and Hygiene
2. First Aid Management and Safety measures
3. Tannery technology

B.Sc BIOCHEMISTRY PROGRAMME OUTCOME

A student after completing B.Sc Biochemistry programme successfully would

- Comprehend fundamental concepts in modern biology to meet the emerging trends
- Handle microbial, cellular and biochemical systems
- Facilitate placement in various clinical laboratories and biological research institutes
- Procure hands on real time experience in industries
- Contribute to the betterment of the society by inculcating expertise in healthcare sector

SEMESTER- I
CORE COURSE – I
COURSE TITLE : BIOMOLECULES

COURSE CODE: U1R1BCCC1	**TOTAL MARKS:100**
TOTAL HOURS: 72	**INTERNAL MARKS:25**
CREDIT: 5	**EXTERNAL MARKS:75**
	HOURS/WEEK: 6

Course Objectives:

The student will be able to

- Understand and demonstrate how the structure of biomolecules determines their chemical properties and reactivity
- Understand the amino acid structures, describe their physical and chemical properties
- Understand and analyse the primary, secondary, tertiary and quaternary structure in proteins and identify the types of interactions.
- Understand the structure of nucleic acids: DNA, and RNA.
- Evaluate the structural and conformational freedom of biomolecules including proteins, DNA/RNA, carbohydrates and key metabolites/co-factors.

UNIT: I **(14 Hours)**

CARBOHYDRATES

Introduction: Natural occurrence and physiological importance, classification - aldoses and ketoses, mono, oligo and polysaccharides. Reactions of carbohydrates due to glycosidic OH, alcoholic OH and functional (aldehyde and ketone) groups.Disaccharides: Occurrence, structure and physiological importance of maltose, sucrose, lactose, cellobiose, trehalose and raffinose.Polysaccharides: Occurrence, structure and physiological importance of starch, glycogen, cellulose, hemicellulose, dextrin, chitin, inulin, pectin. Glycosaminoglycans - occurrence, structure and physiological importance of hyaluronic acid, heparin and chondroitin sulfates. Sugar derivatives of biological importance - cell-wall polysaccharides, blood group polysaccharides.

UNIT: II **(14 Hours)**

AMINO ACIDS AND PROTEINS **(ICT Learning)**

Introduction to amino acids and proteins: Structure and classification of amino acids (common amino acids of proteins), Essential amino acids - their structure and importance. The acid base properties of amino acids (amphoteric nature of amino acids, titration curve of acids), color reactions of amino acids, physical properties and chemical properties of amino acids. Proteins: Peptide bonds - formation and chemical nature. Classification of protein based on structure– (fibrous and globular proteins); based on function (simple, conjugated and derived proteins). Structure of protein: Primary, secondary, tertiary and quaternary structure of proteins. Ramachandran plot-basic concepts.

UNIT III **(14 Hours)**

LIPIDS

Nomenclature, classification and Biological significance. Simple lipids: types of fatty acids, triglycerides, waxes, steroids, prostaglandins and their properties. Compound lipids: Phospholipids, sphingolipids and glycolipids. Lipoproteins. Analysis of oils: Reichert-Meisel value, Iodine number, saponification value, acid number and acetyl value.

UNIT IV **(14 Hours)**

NUCLEIC ACIDS **(Digital Learning)**

Introduction to nucleic acids: DNA and RNA - their difference and similarities, structure of nitrogen bases – Purines and Pyrimidines. Nucleosides and nucleotides, physical and chemical properties of RNA and DNA. RNA –Types. DNA polymorphism, different forms of DNA (A,B&Z), Watson – Crick model of DNA.

UNIT V **(11 Hours)**

VITAMINS AND MINERALS

Source, biological role, daily requirement and deficiency manifestation of the fat soluble vitamins and water soluble vitamins. Minerals: requirement, essential micro and macro minerals, sources and functions.

UNIT VI **(5 Hours)**

LATEST LEARNINGS (For CIA Only)

Latest development related to course during the concerned semester.

Text book:

1. J.L. Jain, (2005): Fundamentals of Biochemistry, 6th Revised Edition, Sultan Chand and Company, New Delhi

Reference books:

1.P.L. Soni and Mohan Katyal[2000] – Text Book of Inorganic Chemistry (a Modern Approach) Sultan Chand and sons , New Delhi.
2.R.K. Murray, D.K. Granner and P.A. Mayes(2003): Harper's Illustrated Biochemistry, 25th edition, New Delhi: Tata McGraw Hill Publishing Company Ltd.
3.A.L. Lehninger, D.L. Nelson and M.M. Cox(1993) : Principles of Biochemistry, 2nd edition, CBS Publishers and Distributors.
4.David Rawn, J., (2004) : Biochemistry, Panima Publishing Corporation, New Delhi.
5.E.S. West, W.R. Todd and H.S. Mason(1974): Text book of Biochemistry, 4th Edition, New Delhi, Oxford and IBH.
6.Zubay,G.L. 1998. Biochemistry, Wm.C. Brown Publishers.
7.Pankaja Naik, Essentials of Biochemistry, 2017, 2nd editions, Jaypee Brothers.

e-books:

1.Textbook of Biochemistry,2011 by Thomas M. Devlin
2. lippincotts-biochemistry-6th-edition,2014 by Ferrier, Denise R.

Course Outcomes:

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

- Explain the significance of hydrophobic and hydrophilic forces for the structure of biomolecules with examples.
- Explain the significance of steric effects for the structure of biomolecules and give examples. Discuss the four structure levels of proteins.
- Draw the basic structure of carbohydrates, nucleic acids, peptides/proteins and lipids. Name the functional groups in carbohydrates, nucleic acids, peptides/proteins and lipids.

SEMESTER I
CORE COURSE - II
COURSE TITLE: MAJOR PRACTICAL-I

COURSE CODE: U1R1BCCC2P	**TOTAL MARKS:100**
TOTAL HOURS: 60	**INTERNAL MARKS:40**
CREDIT: 5	**EXTERNAL MARKS:60**
	HOURS/WEEK: 5

Course Objectives

The student will be able to:

- Understand the biological functions of biomolecules.
- Identify and analyse the chemical and biochemical properties of biomolecules. Understand principles, theory and calculations of each experiment
- Perform quantitative and qualitative analysis of known standards as well as unknown samples develop problem-solving skills and to nurture professional attitudes.
- Understand the applicability of the biochemical methods to realistic situations.

I. Qulatitative Analysis

1. Analysis of Sugars

a) Monosaccharides
Glucose,Fructose,Galactose,Mannose,Pentose
b)Disaccharides-Sucrose,Maltose and Lactose
c)Polysaccharides-Starch and Dextrin

II.Analysis of Amino Acids

a)Histidine b)Tyrosine
c)Tryptophan d)Methionine
e)Cysteine f) Arginine

2. Lipid Analysis

a)Saturated and Unsaturated fatty acids
b) Glycerol
c)cholesterol

II. Preparation

1.Preparation of Starch From Potatoes
2.Preparation of Casein From Milk

III. Quantitative Analysis

1.Estimation of Reducing Sugar by Benedicts Titrimetric Method
2.Estimation of Amino Acids by Formal Titration Titration method
3.Estimation of AscorbicAcid by Titrimetric Method Using 2,6-Dichlorophenol-Indophenol Dye.
4.Determination of Acid Number of an edible oil.
5.Determination of Saponification number 6.Determination of Iodine number

Reference Books:

1.David T.Plummer,An Introduction to Practical Biochemistry
2.Pattabiraman,Laboratory Manual in Biochemistry
3.J.Jayaraman,Practical Biochemistry

Course Outcomes:

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

- Carry out qualitative and quantitative analysis of all the biomolecules.
- Extract biomolecules from various biological sources.
- Estimate the amount of biomolecule present in the given unknown sample.

SEMESTER I
ALLIED COURSE-I
COURSE TITLE : ALLIED CHEMISTRY-I

COURSE CODE: U1R1CHAC1	**TOTAL MARKS:100**
TOTAL HOURS: 48	**INTERNAL MARKS:25**
CREDIT: 3	**EXTERNAL MARKS:75**
	HOURS/WEEK: 4

Course Objectives:

- To understand the concept of chemical bonding
- To learn the Chemistry of hydrocarbon
- To know the terms of solutions and chemical kinetics
- To learn the concepts of colloids and its types

UNIT – I Chemical Bonding (10 Hrs)

Ionic bond- Nature of Ionic bond – structure of NaCl, KCl & CsCl- Factors influencing the formation of ionic bond.**Covalent bond**- nature of covalent bond –VSEPR theory - shapes of $BeCl_2$, BF_3, CH_4, PCl_5, IF_7, NH_3 & H_2O.**Coordinate Bond** – Nature of coordinate bond, Werners' theory and structure of some complexes $Ni(CO)_4$, $[Co(NH_3)_6]Cl_3$, $K_4[Fe(CN)_6]$**Hydrogen bonding**-Theory of Hydrogen bonding- one example for inter and intra molecular hydrogen bonding- consequences of hydrogen bonding.Van der Waals and London Dispersive forces in simple molecules.

UNIT- II Chemistry of Hydrocarbons (9 Hrs)

Hydrocarbons: Classification- aliphatic, aromatic, saturated, unsaturated cyclic, acyclic compounds **Alkanes-** nomenclature, isomerism, preparation, properties (halogenation, nitration, sulphonation, oxidation) and uses Alkenes-nomenclature, isomerism, preparation, properties (hydrogenation, halogenation, hydroxylation) and uses. Alkynes - nomenclature-preparation, properties (hydrogenation, halogenation, polymerization) and uses.**Chemistry of benzene:** Preparation, properties (nitration, sulphonation, oxidation , Friedel – Crafts alkylation & acylation) and uses any two methods of preparation).

UNIT- III Solutions (9 Hrs)

Mole Concept-Normality–Molarity –parts per million - Simple problems on concentration terms Primary and secondary standards and preparation of standard solutions and simple problems. **Acids and bases:** Arrhenius, Lowry- Bronsted, Lewis concepts- strong and weak acids and Bases.- pH , pKa ,pKb, buffer solutions. Henderson – Hasselbalch equation.

UNIT- IV Chemical Kinetics and Catalysis (9 Hrs)

Chemical kinetics: rate of reaction, order, molecularity, first order rate law, half life period and derivation of the first order equation.**Catalysis** – homogeneous and heterogeneous catalysis, intermediate complex and adsorption theories of catalysis, promotors and poisons, applications.

UNIT- V Colloids (9Hrs)

Colloids – Types with examples – classification based on affinity (Lyophilic & Lyophobic).Optical and Kinetic properties of colloids – electrophoresis- electroosmosis – peptization –Coagulation-Applications of colloids.

UNIT -VI: Latest Learning's (For CIA only) (2 Hrs)

Latest development related to the course during the semester concerned

Text Books

1. B.K. Sharma, Industrial Chemistry, Goel Publishing Co., 1997
2. Puri B.R., Sharma L. R., Kalia K.K, Principles of inorganic Chemistry- (31 st edition), New Delhi, Shoban Lal Nagin Chand & Co., 2013
3. Bahl B and Arun Bahl, Organic Chemistry,12th edition, New Delhi, Sultan Chand and Co.,2016
4.B.R.Puri, L.R.Sharma and Madan. S. Pathania, Principles of Physical Chemistry -42nd Edition, Vishal Publishing Co., Jalandhar, 2007
5. B.S. Bhal G.D. Tuli and Arun Bhal, Essentials of Physical Chemistry, S. Chand & Co., NewDelhi, 2010

Reference Books

1. R.T. Morrison & R.N.Boyd, Study Guide to Organic Chemistry, Prentice Hall, New Delhi, 2010.
2. R.L. Madan and G.D. Tuli, Inorganic Chemistry, S. Chand Co., Ltd., New Delhi, 2007.

Course Outcome:

At the end of the course, the learners will be able to

- Understand the basic concepts of chemical bonding and chemistry of hydrocarbon
- Learn the terms of solution and chemical kinetics
- Understand the nature of colloids and its types

SEMESTER I
ALLIED COURSE-II
COURSE TITLE: ALLIED CHEMISTRY PRACTICAL

COURSE CODE: U2R1CHAC2P	**TOTAL MARKS:100**
TOTAL HOURS: 36	**INTERNAL MARKS:40**
CREDIT: 3	**EXTERNAL MARKS:60**
	HOURS/WEEK: 3

Course objectives:
The students will be able to

- Know the methods available for analysis of organic compounds
- Understand the volumetric analysis methods
- Identify the functional groups of organic compounds

I. Volumetric Analysis

1. Estimation of HCl by NaOH using a standard oxalic acid solution
2. Estimation of Na_2CO_3 by HCl using a standard Na_2CO_3 solution
3. Estimation of oxalic acid by $KMnO_4$ using a standard oxalic acid solution
4. Estimation of Iron (II) sulphate by $KmnO_4$ using a standard Mohr's salt solution.
5. Estimation of Ca (II) by $KmnO_4$ using a standard oxalic acid solution.
6. Estimation of $KmnO_4$ by thio using a standard $K_2Cr_2O_7$ solution.
7. Estimation of Fe (III) by using $K_2Cr_2O_7$ using a standard Mohr's salt solution using internal and external indicators.
8. Estimation of copper (II) sulphate by $K_2Cr_2O_7$ solution
9. Estimation of Mg (II) by EDTA solution
10. Estimation of Ca (II) by EDTA solution

II .Organic Analysis:

a) Identification of acidic, basic, phenolic and neutral organic substances
b) Detection of N, S and halogens
c) Test for aliphatic and aromatic nature of substances.
d) Test for saturation and unsaturation.
e) Identification of functional groups
   i. Carboxylic acid
   ii. Phenols
   iii. Aldehydes
   iv. Ketones
   v. Esters
   vi. Carbohydrates
   vii. Primary amines
   viii. Amides

Reference Books :

1. Sundaram, Krishnan, Raghavan, Practical Chemistry (Part II), S. Viswanathan Co. Pvt., 1996.
2. N.S. Gnanapragasam and G. Ramamurthy, Organic chemistry – Lab manual, S. Viswanathan, Co. Pvt. Ltd., 1998.
3. J.N. Gurtu and R. Kapoor, Advanced Experimental Chemistry (Organic), S. Chand and Co., 1987.

Course outcome:
At the end of the course, the learners will be able to

- ❖ Apply the principles of tritrimetry and Familiarize the concepts of indicator
- ❖ Determine the concentration of different solution and various functional group

SEMESTER II
CORE COURSE - III
COURSE TITLE: ANALYTICAL BIOCHEMISTRY

COURSE CODE: U2R1BCCC3	**TOTAL MARKS:100**
TOTAL HOURS: 72	**INTERNAL MARKS:25**
CREDIT: 5	**EXTERNAL MARKS:75**
	HOURS/WEEK: 6

Course Objectives:

The student will be able to

- Learn the tools of Biochemistry used in industries and clinical Lab.
- Study the biochemical applications of analytical methods
- Gain the knowledge about radiation and its applications.
- Understand about the principle of spectrophotometer
- Understand about the role of buffers in the body

UNIT I **(14 Hours)**

Biophysics

Acids and bases, Hydrogen ion concentration (pH), Henderson-Hasselbatch equation. pH meter. Buffers- Bicarbonate buffer, Phosphate buffer and Proteins as buffer. Solutions- Parts per million, Molarity, Molality and Normality. Osmosis and osmotic pressure, Gibbs-Donnan membrane equilibrium, Viscosity. Diffusion and Surface tension.

UNIT II **(14 Hours)**

Chromatography **(Lab Oriented)**

Principle and classification of chromatography. Partition chromatography- Paper chromatography, Thin layer chromatography and Gas-liquid chromatography. Adsorption chromatography- Column chromatography. Ion-exchange chromatography, Molecular exclusion chromatography, Affinity chromatography, High-performance liquid chromatography .

UNIT III **(14 Hours)**

Electrophoresis and Centrifugation

Electrophoresis: Principle and types. Factors affecting electrophoretic mobility.Paper electrophoresis. SDS-PAGE electrophoresis, Isoelectric focusing, Agarose gel electrophoresis, pulsed-field gel electrophoresis. Immunoelectrophoresis. Centrifugation: Types of centrifuges, rotors. Differential centrifugation, Density-gradient centrifugation. Analytical centrifugation- Applications in the determination of molecular weight of macromolecules.

UNIT IV **(14 Hours)**

Spectrophotometry **(ICT Learning)**

Absorption spectrum, visible spectrum, wave length and wave number. Molar-extinction coefficient. Beer-Lambert's Law. Instrumentation and applications of Colorimeter, UV-Visible spectrophotometer. Spectrofluorimetry, Flame photometry-Atomic emission and absorption flame photometry. Nuclear magnetic resonance spectrometry (NMR), Electron spin resonance spectrometry (ESR), Mass spectrometry.

UNIT V **(11 Hours)**

Radioactivity

Radioactive decay, Half-life of radioactive elements, UNITs of Radioactivity, types of radiation. Isotopes-stable and radioactive isotopes. Measurement of Radioactivity - GM counter, liquid and solid Scintillation counter, Scintillation cocktails. Radioactive tracer technique and its applications. Applications of Radio isotopes in biological and medical sciences. Safety aspects of radioisotopes. Auto radiography.

UNIT VI **(05 Hours)**

LATEST LEARNINGS (For CIA Only)

Latest development related to course during the concerned semester.

Text Books:

1.Keith Wilson, Kenneth H. Goulding, 3rd Edition 1992, A Biologists guide to principles and Techniques of practical Biochemistry. Cambridge University Press.

2.Upadhyay, Upadhyay and Nath.Biophysical Chemistry - Principles and Techniques., 3rd Edition, 2002. Himalaya Publishing House.

Reference Books:

1.Sharma B.K. (1981) 11 th Edition. Instrumental method of chemical analysis. Goel Publishers

2.David T. Plummer,3 rd Edition (1998), An Introducation to practical Biochemistry. Tata McGraw-Hill publishing company limited,New Delhi.

3.Jessica Carol, Analytical Biochemistry, 2016, Syrawood Publishing House.

e-Books

1.Analytical Biochemistry 1998 by David Holme & Hazel Peck

2. Physical Chemistry Third Edition, 2008 by Robert G.Mortimer

Course Outcomes:

At the end of the course the student will be able to:

- Characterize and purification of biological samples
- Understand the therapeutic role of radioisotopes
- Know the importance of buffer in our body

SEMESTER - II
CORE COURSE - IV
COURSE TITLE: MAJOR PRACTICAL - II

COURSE CODE: U2R1BCCC4P	**TOTAL MARKS:100**
TOTAL HOURS: 60	**INTERNAL MARKS:40**
CREDIT: 5	**EXTERNAL MARKS:60**
	HOURS/WEEK: 5

Course Objectives:

The student will be able to

- Understand the practical aspects of analytical techniques in Biochemistry
- This is the back bone for the basics of Downstream Processing.
- Preparation of molarity and normality solution
- Understand the principle of pH
- Gain the knowledge on chromatography

I. Buffer and pH

1. Preparation of Buffer – citrate buffer, bicarbonate buffer and phosphate buffer
2. pH Measurements Using pH Meter.
3. Normality solution preparation
4. Molarity solution preparation 5.Molality solution preparation

II. Analytical methods

1. Calculation of Rf for given amino acids and unknown sample by TLC
2. Separation of Amino acids and Sugars by Thin layer chromatography
3. Separation of Amino acids and Sugars by Paper Chromatography
4. Separation of plant pigments by Column Chromatography
5. Separation of Serum Proteins by Electrophoresis
6. Separation of cellular organelles by differential centrifugation
7. Titration Curve of Amino acids
8. Verification of Beer – Lambert's Law

Reference Books:

1.Manuals in Biochemistry,DrJ.Jeyaraman
2.Practical Biochemistry,Warley
3.Practical Biochemistry,Plummer
4.Practical clinical Biochemistry,Herald varley

Course Outcome(s):

After completing this course, the student will be able to:

- Describe the working principles of pH meter, pH indicator and estimation of macromolecules
- Explain the principles and instrumentation of colorimetry and spectroscopy
- Describe the principles and instrumentation of centrifugation methods
- Classify electrophoretic separation methods
- Understand the principles and instrumentation of chromatography methods

SEMESTER - II
ALLIED COURSE - III
COURSE TITLE: ALLIED CHEMISTRY- III

COURSE CODE: U2R1CHAC3	**TOTAL MARKS:100**
TOTAL HOURS: 48	**INTERNAL MARKS:25**
CREDIT: 3	**EXTERNAL MARKS:75**
	HOURS/WEEK: 4

Course Objectives:

- To understand the chemistry of biomolecules and water
- To learn the elementary concepts of chemical analysis
- To learn the principles of analytical techniques of chromatography and colorimetry.

UNIT– I: Chemistry of Biomolecules (10 Hrs)

Classification - carbohydrates, glucose and fructose - preparation –properties – mutarotation, interconversion of glucose and fructose, manufacture of sucrose, test for sugars.**Amino acids**– preparation and properties of glycine and alanine, peptides (elementary treatment) - proteins- classification based on physical properties and biological functions- structure of proteins – primary and secondary –Test for proteins. **Coordination compounds:** biological role of haemoglobin and chlorophyll.

UNIT–II: Chemistry of Water (9 Hrs)

Water - universal solvent – hardness of water- permanent and temporary hardness, disadvantage of hard water- DO, BOD and COD -definition, determination (any one method). **Water Softening methods** - zeolite process, reverse osmosis. Preparation of Deionised water- Distilled water – Double Distilled water – Packaged drinking water.

UNIT–III : Basics of Quantitative Analysis (9 Hrs)

Error analysis: accuracy, precision, determinate and indeterminate errors, relative error, absolute error,**Quantitative analysis:** Titrimetry- principle, acid-base titrations and redox titrations with examples -End point and equivalence points.**Theory of Indicators-** Types of indicators - Quinanoid theory

UNIT-IV: Analytical Techniques (9 Hrs)

Chromatography-introduction-principle, sampling and applications of paper, thin layer and column chromatography. **Colorimetry:** Beer-Lambert's Law, components of a colorimeter (Block diagram), application (estimation of iron).

UNIT- V: Types of Reactions (9 Hrs)

Types of chemical reactions –substitution (one example for Nucleophilic and electrophilic with mechanism) Addition (Addition of HBr on alkenes) – Elimination (Dehalogenation of alkyl halides) – Condensation (formation of ester) – Polymerisation (Formation of Poly vinyl Chloride) – Reduction reaction (Hydrogenation of oil)- Oxidation ($KMnO_4$ for conversion of benzaldehyde to benzoic acid) . **Types of intermediates-** Electrophiles – nucleophiles – free radicals.

UNIT -VI: Latest Learning's (For CIA only) (2 Hrs)

Latest development related to the course during the semester concerned

Text Books

1. Tiwari K.S., Melhotra S.N., Vishnoi N.K, A Text book of Organic Chemistry, Vikas Publishing House Pvt. Ltd., New Delhi, 2006
2. R. Gopalan, P. S. Subramanian and K. Rengarajan, Elements of Analytical Chemistry, Sultan Chand and Sons, New Delhi, 1997
3. Puri B.R., Sharma L. R., Kalia K.K, Principles of Inorganic Chemistry-23rd edition, New Delhi, Shoban Lal Nagin Chand & Co, 1993
4. R.T. Morrison & R.N.Boyd, Study Guide to Organic Chemistry, Prentice Hall, New Delhi,2000

Reference Books

1.R.L. Madan and G.D.Tuli, Inorganic Chemistry, S. Chand Co., Ltd., New Delhi, 2003
2.Gurdeep Raj, Advanced Physical Chemistry, Goel Publishing House, Meerut, 2000

Course outcome:

At the end of the course, the learners will be able to

- ❖ Know the chemistry of biomolecules and water and concepts of chemical analysis
- ❖ Learn the principles of analytical techniques and concept of chemical reactions

SEMESTER - III
CORE COURSE - V
COURSE TITLE: ENZYMOLOGY

COURSE CODE: U3R1BCCC5	**TOTAL MARKS:100**
TOTAL HOURS: 72	**INTERNAL MARKS:25**
CREDIT: 5	**EXTERNAL MARKS:75**
	HOURS/WEEK: 6

Course Objectives:
The student will be able to:

- Learn about enzymes and their kinetics
- Study the applications of enzymes in various industries
- Know about the characterization of enzymes
- Understand about the mechanism of action of enzymes
- Gain the knowledge on applications of immobilized enzymes

UNIT I **(14 Hours)**

Enzymes

Nomenclature, classification, chemical nature and UNITs of enzyme activity. Structure, properties and functions of coenzymes-NAD, FAD, CoA. Metallo enzymes and metal activated enzymes. Isoenzymes of lactate dehydrogenase. Multienzyme complex-pyruvate dehydrogenase complex and fatty acid synthase complex enzyme. Non protein enzymes-Ribozymes and abzymes.

UNIT II **(14 Hours)**

Mechanism of Enzyme Action **(Digital Learning)**

Active site, models of enzyme-substrate complex formation- Lock and Key model, induced fit model and Substrate strain model. Mechanism of enzyme catalysis: Acid-Base catalysis covalent catalysis, Substrate strain and Entropy effect. Enzyme specificity-group specificity and optical specificity. Mechanism of action of chymotrypsin and lysozyme.

UNIT III **(14 Hours)**

Enzyme Kinetics

Theories of enzyme kinetics- Derivation and significance of Michaelis-Menton equation. Transformation of MM equation - Line weaver-Burk plot, the Eadie-Hofstee plot and the Hanes-Woolf plot. Factors influencing enzyme activity. Enzyme inhibition- types of inhibition - Competitive, Noncompetitive, Uncompetitive,Feedback and Allosteric inhibition.

UNIT IV **(14 Hours)**

Characterization of Enzymes **(ICT Learning)**

Identification of sources of enzymes, methods of isolation of enzymes- use of hydrolytic enzymes, homogenization by homogenizer, use of hypotonic solutions, ultrasonic vibrations. Methods of purification- methods depending on size or mass, methods depending upon charge, methods based on changes in solubility and methods based on specific binding sites. Criteria of purity of enzymes. Preservation of purified enzymes.

UNIT V **(11 Hours)**

Applications of enzymes

Immobilization of enzymes-methods and applications. Diagnostic importance of enzymes: Diagnosis of plasma functional and Non-functional enzymes. Serum enzymes in the diagnosis of diseases. Enzymes in diagnosis of myocardial infarction, liver diseases, muscle diseases and cancers. Industrial applications of enzymes. Biosensors and Biochips.

UNIT VI **(05 Hours)**

LATEST LEARNINGS (For CIA Only)

Latest development related to course during the concerned semester.

Text books :

1.Trevor palmer,3rd edi,1991.understading enzymes. Ellis horwood limited.
2.Dr.N.S.Kulkarni and M.S.Despande.First edition 2007. General Enzymology. Himalaya Publishing House Pvt. Ltd.,Mumbai-400 004
3.Dr.U.Sathyanarayana,U.Chakrapani. Reprint 2009. Biochemistry. Books and Allied Private Limited Kolkata-700 010.

Reference Books:

1.Dixon, M. and Webb, E.C. (1964) Enzymes. 2nd Edition, Academic Press, New York.
2.Chaplin, M.F. and Bucke, C.(1990) Enzyme technology. Cambridge University Press, Cambridge.
3.Alan Welshman (1993),Hand book of enzyme biotechnology (2nd Ed.), Brown Publishers, New Delhi.

e-Books

1.Clinical Chemistry and Enzymology 2011 by Jaromir Kotyza.
2.Methods in enzymology 2006 by SIDNEY P. COLOWICK

Course Outcomes:

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

- Synthesize drugs using enzyme inhibition studies.
- Characterize and purification of enzymes.
- Produce enzymes used in industrial purposes.

SEMESTER - III
CORE COURSE - VI
COURSE TITLE: MAJOR PRACTICAL - III

COURSE CODE: U3R1BCCC6P	**TOTAL MARKS:100**
TOTAL HOURS: 60	**INTERNAL MARKS:40**
CREDIT: 5	**EXTERNAL MARKS:60**
	HOURS/WEEK: 5

Course Objectives:

The student will be able to:

- Enhance the understanding of enzymes
- Understand the mechanism of action of enzymes
- Understand the kinetics of enzymes
- Understand the purification and characterization of enzymes
- Gain the knowledge in enzyme isolation

I. Salivary amylase

1.Determination of optimum pH
2.Determination of optimum temperature
3.Determination of substrate concentration
4.Determination of specific activity

II.Acid Phosphatase

1.Determination of optimum pH
2.Determination of optimum temperature
3.Determination of substrate concentration
4.Determination of specific activity

III.Alkaline Phosphatase

1.Determination of optimum pH
2.Determination of optimum temperature
3.Determination of substrate concentration
4.Determination of specific activity

IV.Urease

1.Determination of optimum pH
2.Determination of optimum temperature
3.Determination of substrate concentration
4.Determination of specific activity

V.Catalase

1.Determination of optimum pH
2.Determination of optimum temperature
3.Determination of substrate concentration
4.Determination of specific activity

Reference Books:

1.Manuals in Biochemistry,DrJ.Jeyaraman
2.Practical Biochemistry,Warley
3.Practical Biochemistry,Plummer
4.Practical clinical Biochemistry,Herald varley

Course Outcomes:

At the end of the course, students would be able to

- Explain the characteristics and catalytic mechanisms of enzymes
- Characterize enzymes and design enzyme assays
- Describe immobilization techniques, and their principles, advantages

SEMESTER-III
ALLIED COURSE - IV
COURSE TITLE: FUNDAMENTALS OF BIOLOGY – I

COURSE CODE: U3R1BCAC4	**TOTAL MARKS:100**
TOTAL HOURS: 48	**INTERNAL MARKS:25**
CREDIT: 3	**EXTERNAL MARKS:75**
	HOURS/WEEK: 4

Course Objectives:
The student will be able to

- Learn about the lower and primitive groups of Plants and animals
- Enlighten the students about the diverse forms of plants and animals present around us.
- Distinguish various Plants and animals
- Understand the role of cellular organelles in the body
- Classify the plants and animals

UNIT I **(09 Hours)**
Taxonomy **(Field Visit)**
Taxonomy – Concepts of species of hierarchical taxa, biological nomenclature, classical and quantitative methods of taxonomy, classification of plants. Two Kingdom and Five Kingdom systems - Salient features of various Plant Groups: Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms.

UNIT II **(09 Hours)**
Cell Biology **(Digital Learning)**
Cell Biology- structure of plasma membrane, lipid bilayer, active transport, electrical properties of membranes.Structure and function of cellular organelles – cell wall, nucleus, mitochondria, golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, vacuoles, chromosomes, chromatin, mitosis and meiosis and cell cycle.

UNIT III **(09 Hours)**
Inheritance Biology
Inheritance Biology – Mendelian principle, allele, multiple allele, pseudo allele, codominance, incomplete dominance, pleiotropy, linkage and crossing over, sex linkage, sex limited and sex influenced characters. Inheritance of Mitochondrial and chloroplast genes, maternal inheritance.

UNIT IV **(09 Hours)**
Developmental Biology
Developmental Biology – Animal: Production of gametes, zygote formation, blastula, gastrula and formation of germ layers in animals, embryogenesis. Programmed cell death, ageing and senescence.

UNIT V **(09 Hours)**
Evolutionary Biology
Evolutionary Biology – Lamarck; Darwin–concepts of variation, adaptation, struggle, fitness and natural selection; Spontaneity of mutations; the evolutionary synthesis. The evolutionary time scale; Eras, periods and epoch; Origins of unicellular and multi cellular organisms; Hardy – Weinberg law.

UNIT VI **(03Hours)**
LATEST LEARNINGS (For CIA Only)
Latest development related to course during the concerned semester.

Text Books

1.General, organic and Biochemistry, 2nd edition, Ira blei & George Odian, W.H. Freeman Company, New York 2006.
2.Molecular Biology of the cell- 4rd ed. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter. New York: Garland Science; 2002.
3.Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, P.S.Verma & V.K. Agarwal, S. Chand & Company Ltd, New Delhi, 2004
4.Environmental Biology (Principles of Ecology) P.S. Verma & V.K. Agarwal, S. Chand & Company Ltd, New Delhi, 2012.
5.Cell Biology, C.B. Powar, Himalaya Publshing House, 2010.

Reference Books:

1.Plant Biochemistry,4thed,Hans-walterHeldt, Academic press, Elsevier Publications, 2010.
2.Plant Physiology 4th ed, SN Pandey, BK Sinha, Vikas Publishing House, New Delhi, 2009.
3.Introductory Modern Biology, S.Sundara Rajan, Anmol Publications Pvt. Ltd, New Delhi.
4.Text Book of Plant Physiology, V. Verma, Ane Books Pvt. Ltd, New Delhi, 2011.
5.Essentials of Modern Bology, R.C. Sobti, V.L. Sharma, Ane Books India, 2009.

e-Books

1. In Developmental Biology by Scott F. Gilbert, published by 2010 by Susan R. Singer
2.Introduction to botany , 2016 by Alexey Shipunov

Course Outcomes:

At the end of the course the student will be able to:

- Explain the Systematic Position of Plants and Animals
- Understand the Classification of Plants and Animals.
- Explain the Cell organelle and functions
- Understand the Coordination & Control in animals & plants
- Understand the developmental process and Evolutionary Significance

SEMESTER- IV
CORE COURSE – VII
COURSE TITLE: CLINICAL BIOCHEMISTRY

COURSE CODE: U4R1BCCC7	**TOTAL MARKS:100**
TOTAL HOURS: 60	**INTERNAL MARKS:25**
CREDIT: 5	**EXTERNAL MARKS:75**
	HOURS/WEEK: 5

Course Objectives:

The student will be able to:

- Understand the collection and preservation of biological specimens
- Learn about the inherited disorder of our body
- Study the various tests were used to understand the functions of body
- Gain the concept on role of organs in the body
- Know about the latest texhniques used in clinical lab.

UNIT I **(11 Hours)**

Biological Specimens **(Clinical Lab Visit)**

Collection and choice of blood specimens, Anticoagulants, Avoiding hemolysis, Protein precipitants in blood, Preservation of blood specimens. Collection of urine, normal and abnormal constituents of urine, preservatives for urine. Collection of faeces. Preservation of faeces. Collection, composition and functions of CSF. Diagnostic importance of amniotic fliud. Quality control-internal and external quality control.

UNIT II **(11 Hours)**

Disorders of Carbohydrate Metabolism

Homeostasis of blood glucose, Abnormalities in blood glucose level- hyperglycemia, hypoglycemia. Glycosuria–Hyperglycemic,renal glycosuria. Diabetes mellitus- classification, complications, managemen and diagnosis. Glucose tolerance test- types and value. Glycogen storage diseases- types, biochemical findings and management. Galactosemia, Fructosuria - enzyme defect, biochemical findings, diagnosis.

UNIT III **(11 Hours)**

Disorders of Lipid Metabolism

Lipid storage diseases - Types, enzyme defect, symptoms. Hypercholesterolemia-causes, complications, control. Disorders of plasma lipoproteins - Hyperlipoproteinemia and hypolipoproteinemia. Disorders of fatty acid oxidation- SIDS, Zellweger syndrome, Refsum's disease. Fatty liver -types, causes, development, management. Obesity - causes, complications,treatment. Atheroscelrosis-causes. Complications, prevention. Ketoacidosis.

UNIT IV **(11 Hours)**

Disorders of Aminoacid and Nucleic acid Metabolism

Disorders of urea cycle: hyperammonemia, hyperarginemia. Disoders of glycine : glycinuria, hyperoxaluria. Disoders of phenyl alanine metabolism: phenylketonuria, alkaptonuria, albinism. Disorders of tryptophan metaboliam: hartnup's disease. Inborn errors of sulfur amino acid metabolism: cystinuria,cystinosis, Homocystinuria. Maple syrup urine diseases. Disorders of purine and pyrimidine metabolism: Gout, orotic aciduria, porphyria.

UNIT V **(11 Hours)**

Organ function tests **(ICT Learning)**

Liver function tests: Tests based on bile pigment metabolism, detoxification, excretory function, serum enzymes of liver. Kidney function test: Glomerular, Tubular function test. Thyroid function tests: tests based on measuring blood levels and metabolic effects of thyroid hormones. Gastric function tests : fractional gastric analysis, tubeless gastric analysis. Pancreatic function tests: tests used to assess the pancreatic enzymes lipase and amylase.

UNIT VI **(05 Hours)**

LATEST LEARNINGS (For CIA Only)

Latest development related to course during the concerned semester.

Text books:

1. Chatterjee, M.N. and Rana Shinde.Text book of Medical. Biochemistry, , 8th ed. Jaypee Medical Publishers, 2012

2.U.Sathyanarayana,U.Chakrapani.Reprint2009.Biochemistry.Booksand Allied Private Limited,Kolkata.

3. Harold Varley. Practical Clinical Biochemistry New York, Interscience Publishers, Inc., 1954, 558

Reference Books:

1.Teitz NW.,fundamentals of clinical chemistry,W.B.saunders company,second edition,1994

2.Montgometry,Conway,spector,biochemistry-A case oriented approach.the C.V.moshby company,5th edition, 1990.

e-Books

1.Clinical biochemistry 2016 by Racek, Jaroslav

2.Clinical Biochemistry and Metabolic Medicine 2011 by Martin A Crook

Course Outcomes:

At the end of the course the student will be able to:

- Test the biological samples in the clinical lab.
- Prevent the development of inherited disorder in future.
- Utilize the knowledge of organ function tests
- understand the normal and abnormal functioning of organs.

SEMESTER - IV
CORE COURSE – VIII
COURSE TITLE: CLINICAL BIOCHEMISTRY

COURSE CODE: U4R1BCCCC8P
TOTAL HOURS: 60
CREDIT: 5

TOTAL MARKS:100
INTERNAL MARKS:40
EXTERNAL MARKS:60
HOURS/WEEK: 5

Course Objectives:

The students will be able to

- Perform the collection of urine and blood
- Analyze the given biological samples in the clinical lab.
- Identify the level of hemoglobin and RBC
- Identify the blood groups.
- Understand the role of ESR in the diagnosis of diseases

I Qualitative analysis of urine

1. Glucose
2. Urea
3. Uric acid
4. Creatinine
5. Calcium
6. Phosphrous
7. Cholesterol

II Urine Analysis

1. Estimation of Urea by DAM Method
2. Estimation of Uric Acid by Caraway Method

II. Blood Analysis

1. Estimation of Urea by DAM Method
2. Estimation of Uric Acid by Caraway Method
3. Estimation of Cholesterol in Serum by Zaks Method

III. Kit Method

1. Estimation of Hemoglobin
2. Identification of Blood Group
3. Enumeration of RBC
4. Enumeration of WBC
5. Erythrocyte sedimentation rate

REFERENCE BOOKS:

1. Manuals in Biochemistry,DrJ.Jeyaraman
2. practical Biochemistry,warley
3. Practical Biochemistry,Plummer
4. Practical Clinical Biochemistry,Herald varley

Course Outcome :

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

- Discuss the biochemistry and pathophysiology associated with tests performed in a clinical biochemistry laboratory
- Compare and contrast the basic differences between carbohydrate, lipid and protein metabolism abnormalities.
- Describe and identify the main characteristics of diagnosis, screening, and prognosis of disease.
- Critically evaluate the role of clinical biochemistry in diagnosis, monitoring and treatment.Applications of biochemistry on health, medical diagnostics and pharmacy.

SEMESTER - IV
ALLIED COURSE - V
COURSE TITLE: ALLIED BIOLOGY PRACTICAL - II

COURSE CODE: U4R1BCAC5P	**TOTAL MARKS:100**
TOTAL HOURS: 36	**INTERNAL MARKS:40**
CREDIT: 3	**EXTERNAL MARKS:60**
	HOURS/WEEK: 3

Course Objectives:
The student will be able to

- Train them to prepare micro preparation of plant materials
- Train them to do different vegetative propagation methods
- Make them aware of commercially important of plants and animals.
- Dissection of cockroach and frog
- Dissection of plants

1. Study of morphological characteristics of plants.
2. Examination of cross sections of stem, root, leaf of dicots and monocots.
3. Effect of CO_2 concentration on photosynthesis in Hydrilla.
4. Observation of stomata in dicot leaf.
5. Micro preparation of plants mentioned in plant diversity part of the syllabus
6. Section cuttings and submission of slides – Selaginella and Pinus.
7. Spotters – Identification of specimens of slides from Algae, Fungi,
8. Bryophytes, Pteridophytes and Gymnosperm included in the syllabus.
9. Spotters - Identification of Plant Diseases mentioned in the syllabus
10. Spotters – Callus, Growth Hormones – Auxin and Gibberellin,
11. Mushroom- Oyster
12. Biofertilizer – Rhizobium and Azolla

Dissection:

1. Cockroach: Digestive and Nervous system
2. Qualitative estimation of excretory products- Nitrogenous waste: Ammonia – fishes.

Spotters:

1. Invertebrates: Amoeba, Paramecium,Plasmodium, Tapeworm, Neries, Earthworm,Taenia-Scolex, Ascaris, Leech, Crab, Cockroach, Mosquito, Prawn, freshwater mussel and Star fish.
2. Chordates: Shark, Teleost Fish, Frog, pigeon, snake, and Rat.
3. Species of animals used in Vermiculture- Eisenia fetida and Lampito mauritii
4. Apiculture – Apis indica, Sericulture – Bombyx mori, Aquaculture – Major carps: Catla, Rohu and Mirgal.
5. Study of histological slides of animal tissues:Epithelial Tissue- Columnar Epithelium, Squamous Epithelium,; Muscle, cardiac muscle, skeletal muscle, Blood Vessels - arteries, veins.

SEMESTER - IV
ALLIED COURSE - VI
COURSE TITLE: FUNDAMENTALS OF BIOLOGY – III

COURSE CODE: U4R1BCAC6	**TOTAL MARKS:100**
TOTAL HOURS: 48	**INTERNAL MARKS:25**
CREDIT: 3	**EXTERNAL MARKS:75**
	HOURS/WEEK: 4

Course Objectives:

The student will be able to:

- Learn about the Genetic characters and Mendel's Laws of Inheritance
- Enlighten the students about the Biology in human welfare
- know the Economic Importance of beneficial animals.
- Understand about the economical importance of fish
- Help our students to know the Economic Importance of beneficial animals.

UNIT I **(09 Hours)**

Biodiversity **(Field Visit)**

Taxonomic systems : Introduction to Taxa - Species concept – Methods of Taxonomy - Phenetic methods - Identification keys - Cytotaxonomy - Chemotaxonomy - Palaeotaxonomy - Nomenclature methods. Animal groups : Methods of grouping animals - Major Phyla - General characters with appropriate examples - Protozoa - Porifera – Coelenterata - Platyhelminthes - Aschelminthes - Annelida - Arthropoda - Mollusca - Echinodermata - Chordata.

UNIT II

Genetics **(09 Hours)**

Concept of Heredity and Variation - Mendel's Laws of Inheritance – Chromosomal basis of Inheritance - Intermediate Inheritance (Incomplete Dominance) – Epistasis. Chromosomes - structure and types - genes and genomes – linkage and crossing over - gene mapping - recombination of chromosomes - mutation - chromosomal aberrations.

UNIT III (**09 Hours)**

Biology in Human Welfare **(ICT Learning**

Food production – breeding experiments – improved varieties and role of biofertilizers. Crop diseases and their control – biopesticides – genetically modified food – biowar – biopiracy – biopatent – sustained agriculture and medicinal plants including microbes. Economic importance – food yielding (rice) – oil yielding (groundnut) – fibre yielding (cotton) and timber yielding (teak) plants.

UNIT IV (**09 Hours)**

Economic Zoology

Beneficial animals : Corals - Earthworm - Vermiculture – Beneficial insects - Prawns - Lobsters - Crabs - Pearl oysters - Fishes - Guano - Aquarium - Vivarium-Planaria-Regeneration studies. Harmful animals : Disease causing organisms - Vectors – Poisonous organisms - Fouling organisms - Pests

UNIT V **(09 Hours)**

Applied biology

Livestock and Management-Dairy-Breeds of cattle-Milch breed- Draught breed-Dual purpose-Common diseases and control-Exotic and cross breeds- Techniques adopted in cattle breeding. Poultry-Farming techniques-Breeds. Farming methods-Poultry diseases-Economic value. Pisciculture-Fish farming-Edible fishes of Tamilnadu.

UNIT VI **(03 Hours)**

LATEST LEARNINGS (For CIA Only)

Latest development related to course during the concerned semester.

Text Books:

1. General, organic and Biochemistry, 2nd edition, Ira blei & George Odian, W.H. Freeman Company, New York 2006.
2. Molecular Biology of the cell- 4rd ed. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter. New York: Garland Science; 2002.
3. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, P.S.Verma & V.K. Agarwal, S. Chand & Company Ltd, New Delhi, 2004
4. Environmental Biology (Principles of Ecology) P.S. Verma & V.K. Agarwal, S. Chand & Company Ltd, New Delhi, 2012.
5. Cell Biology, C.B. Powar, Himalaya Publshing House, 2010.

Reference books

1. Plant Biochemistry, 4th ed, Hans-walter Heldt, Academic press, Elsevier Publications, 2010.
2. Plant Physiology 4th ed, SN Pandey, BK Sinha, Vikas Publishing House, New Delhi, 2009.
3. Text Book of Plant Physiology, V. Verma, Ane Books Pvt. Ltd, New Delhi, 2011.
4. Essentials of Modern Bology, R.C. Sobti, V.L. Sharma, Ane Books India, 2009.

e-Books

1. Elementary botany, 2009 by Groom, Percy,
2. Invertebrate zoology 2012 by Robert W. Hegner

Course Outcomes:

At the end of the course the student will be able to:

- Explain the Growth and Reproduction of Plants and Animals
- Understand the Coordination & Control in animals & plants
- Understand the Hormonal actions of Plants
- Understand the Mechanism of Nutrition and transport of Animals

SEMESTER - V
CORE COURSE - IX
COURSE TITLE: MOLECULAR BIOLOGY

COURSE CODE: U5R1BCCC9	**TOTAL MARKS:100**
TOTAL HOURS: 60	**INTERNAL MARKS:25**
CREDIT: 5	**EXTERNAL MARKS:75**
	HOURS/WEEK: 5

Course objectives:

- To have a detailed knowledge on the structure and function of cell and the organelles.
- To know about the gene and its function
- Acquiring knowledge on the functioning of the cell
- Understand the chemical nature and properties of DNA
- Learn the regulation of gene expression in the body

UNIT I **(11 Hours)**

Genes, Genomes and DNA **(Digital Learning)**

DNA as the genetic material–Organization of prokaryotic and eukaryotic genomes, supercoiling, repetitive DNA–Levels of DNA packaging in Eukaryotes– Histone and its types.

UNIT II **(11 Hours)**

Replication

Replication of DNA- replication in prokaroytes and eukaryotes.enzymes involved in replication.types of replication-semiconservative,conservative and dispersive.evidence of mode of replication-meselson and stahls experiment.cairns autoradiographic experiment. mechanim of replication.models of DNA replication-carins,yoshikawa and rolling circle model.repair replication.inhibitors of DNA replication.

UNIT III **(11 Hours)**

Transcription **(ICT Learning)**

Overview and requirements of Transcription. Transcription in prokaroytes and eukaryotes. phases of transcription. Types of RNA transcripts. post transcriptional modifications of RNA in prokaroytes. Processing of RNA transcripts. Reverse transcription. Inhitors of transcription.

UNIT IV **(11 Hours)**

Translation

Genetic code: Characteristics,types and role. Protein biosynthesis in prokaryotes and eukaryotes. Inhibitors of protein biosynthesis. Chaperones and protein folding. Protein targeting and degradation. Post translational modifications of proteins.

UNIT V **(11 Hours)**

Regulation of gene expression

Principles of gene regulation. Gene expression in eukaryotes.Regulation of gene action in prokaryotes-transcriptional,translational and post translational control. Regulation of gene action in eukaryotes-regulation at the level of genome,transcription,post-transcriptional and translational control.Hormonal control of gene expression.Mutation-point and frame shift mutation.DNA damage repair.Cancer cells- an over view.

UNIT VI **(05 Hours)**

LATEST LEARNINGS (For CIA Only)

Latest development related to course during the concerned semester.

Text Books:

1.Sundara Rajan- Cell and Molecular Biology, Anmol publication PVT., LTD., 2003.
2.Rastogi S.C- Cell and Molecular Biology, New age International publisher, 3rd edition, 2011.
3.Dr.P.Asokan-Molecular Biology, Chinnaa publications, 1st edition, 2005.

Reference Books:

1.Lewis J. Kleinsmith, Valerie M.Kish - Principles of Cell and Molecular Biology, Harpercollins College Publishers, 2nd edition, 1995.
2.Lodish et-al., Molecular Cell Biology,W.H.Freeman and company, 3rd edition, 1995.
3. David 3.Freifelder-Molecular Biology,Narosa publishing house, 2nd edition, 2008.
4. Gerald Karp - Cell and Molecular Biology, John Wiley and Sons, Inc., 5th edition, 2008.

e-Books

1.Molecular Cell Biology 2003 by Lodish
2. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology 2011 by PS Verma

Course Outcomes:

At the end of the course the student will be able to:

- Describe replication, repair and recombination of DNA, in both prokaryotic and eukaryotic organism.
- Explain the structure and function of RNA polymerase and how they are involved in Transcription.
- Understand the concept of Post-transcriptional modification, splicing, various patterns of gene expression.
- Understand genetic code, types of ribosome, RNA and how they are involved in translational machinery of an organism

SEMESTER - V
CORE COURSE - X
COURSE TITLE: INTERMEDIARY METABOLISM

COURSE CODE: U5R1BCCC10	**TOTAL MARKS:100**
TOTAL HOURS: 60	**INTERNAL MARKS:25**
CREDIT: 5	**EXTERNAL MARKS:75**
	HOURS/WEEK: 5

Course Objectives:

The students will be able to

- Know about the energy-yielding and energy-requiring reactions in life.
- Understand the diversity of metabolic regulation
- Understand and analyze how these biochemical processes are not isolated but tightly integrated, with specific control sites and key junctions.
- Apply and evaluate the various reactions which decide the fate of carbohydrates, lipids, amino acids and its derivatives required for the functioning of cells.
- Analyse and evaluate the fate of purine and pyrimidine nucleotides through their synthesis and breakdown mechanisms

UNIT I **(11 Hours)**

BIOENERGETICS

Laws of Thermodynamics, High energy phosphates and their role in redox reaction. Enzymes involved in biological oxidation- redox potential, Role of respiratory chain in mitochondria; in energy capture; respiratory control. Mechanism of Oxidative phosphorylation ;Chemiosmotic theory; uncouplers of oxidative phosphorylation. Inhibitors of electron transport chain and oxidative phosphorylation.

UNIT II **(11 Hours)**

METABOLISM OF CARBOHYDRATES **(ICT Learning)**

Fate of absorbed carbohydrates. Glycolysis pathways and energetics: oxidation of pyruvate to acetyl CoA. TCA Cycle: - pathway and energetics: anaplerotic reaction . Gluconeogenesis; Glycogenesis and glycogenolysis. Pentose phosphate pathway. Glucuronic acid cycle and glyoxylate cycle pathways.

UNIT III **(11 Hours)**

METABOLISM OF LIPIDS

Oxidation of fatty acid - Carnitine cycle; beta oxidation . Alpha oxidation and omega oxidation. Biosynthesis of saturated fatty acids, degradation- lecithin, triacylglycerol and plasma lipoproteins. Cholesterol metabolism and Ketogenesis.

UNIT IV **(11 Hours)**

METABOLISM OF AMINO ACIDS **(ICT Learning)**

Overview of biosynthesis and degradation of amino acid- phenyl alanine, methionine, tyrosine and alanine Catabolism of amino acid: Oxidative deamination, non-oxidative deamination, transamination, amino acid decarboxylation. Urea cycle.

UNIT V **(11 Hours)**

INTEGRATION AND NUCLEOTIDE METABOLISM

Biosynthesis (denova and salvage pathway) of purines and pyrimidines with reference to the sources of atoms in the purine and pyrimidine molecules. Catabolism of purines and pyrimidines.Interrelation between carbohydrates, fat and protein metabolism in well fed state and starvation conditions. Metabolic integration between organs.

UNIT VI **(05 Hours)**

LATEST LEARNINGS (For CIA Only)

Latest development related to course during the concerned semester.

Text books:

1.Lehninger et al.Principles of Biochemistry.2nd edition CBS Publishers,1993.
2.Murray et al.Harpers Biochemistry,21st edition,1998,Mc Graw Hill publication

Reference Books :

1.Mathews,Freeland and Miesfeld-Biochemistry-a short course.wiley & sons.1996.
2.Garrett and Grisham-Biochemistry.Saunders college publishers,1995.

e-Books

1.Textbook of Biochemistry , 2011·by Thomas M. Devlin, Ph.D
2.Biochemistry,2004 by Strayer

Course Outcomes:

At the end of the course the student would have

- Understood the general design of metabolic pathways based on bioenergetic principle
- Become aware of how carbohydrates, lipids and nitrogenous compounds are synthesized and degraded
- Known how metabolic pathways are regulated and recognize the biochemical basis of some diseases arising defects in metabolism
- A holistic view on metabolism, and recognize how different pathways are functionally interlinked and how they are regulated by extracellular and intracellular signals
- Recognized how metabolism can be related to various issues in lifestyle, health and disease.

SEMESTER - V
CORE COURSE - XI
COURSE TITLE: HUMAN PHYSIOLOGY

COURSE CODE: U5R1BCCC11	**TOTAL MARKS:100**
TOTAL HOURS: 60	**INTERNAL MARKS:25**
CREDIT: 5	**EXTERNAL MARKS:75**
	HOURS/WEEK: 5

Course Objectives:

- To describe the structure and function of different organs found in the body systems
- Explain concisely basic physiological principles effect of hormone on body function
- Study about the circulatory system of the body
- Learn the secretions of digestive juices in the body
- Understand the role of lungs in the body

UNIT I **(11 Hours)**

Digestive system

Parts of the digestive system- secretion, properties, compostion and functions of saliva, gastric juice, pancreatic juice, Bile and succus entericus. Digestion and absorption of carbohydrates, lipids and proteins.

UNIT II **(11 Hours)**

Respiratory system **(ICT Learning)**

Respiration- types, structure and functions of respiratory tract. Pulmonary circulation, mechanism of respiration, exchange and transport of respiratory gases, regulation of respiration. Disturbances in respiration.

UNIT III **(11 Hours)**

Circulatory system **(Digital Learning)**

Structure and Functions of the heart, Properties of the Cardiac muscles, divisions of circulation. cadiac cycle., Electrocardiogram (ECG). Cardiac output Measurement of Blood Pressure, coronary circulation.

UNIT IV **(11 Hours)**

Excretory System

Structure and Functions of Kidney. Structure of the Nephron- Mechanism of urine formation- glomerular filtration, tubular reabsorption and tubular secretion. Physical properties and Chemical Composition of normal urine, mechanism and abnormalities of Micturition, Renal regulation of acid base balance,Abnormal Renal Function.

UNIT V **(11 Hours)**

Nervous and Reproductive system

Structure of neuron, resting potential and action potential, Propagation of nerve-impulses, Synaptic transmission (electrical and chemical theory). Structure of Neuro muscular junction and mechanism of neuro muscular transmission, neuro transmitters.Male reproductive system-structure and functions of testis,Nature,properties and composition of semen.female reproductive system-structure and functions of ovary.menstrual cycle.

UNIT VI **(05 Hours)**

Latest Learnings (For CIA Only)

Latest development related to course during the concerned semester.

Text Books:

1.Chatterjee ,C.C- Human Physiology
2.Saradha Subramaniam.Text book of human physiology.
3.Guyton,Text book of Medical physiology.
4.K. Sembulingum, Prema Sembulingum,Essentials of Medical Physiology,Second Edition

Reference Books:

1.Chatterjee. C. Text book Medicinal Chemistry
2.Agarwal G.R. & Agarwal B.P. Text book of Biochemistry
3.Murray.R.G. Harper `s Biohemistry 24 th Edition
4.Lecture notes on human physiology, M,M Muthiah Vol II, 1991.

e-Books

1.Essentials Human Physiology, 2004 by Laurie J. Kelly
2. Essentials of Anatomy and Physiology 2007 by Valerie C.Scanlon

Course Outcomes:

At the end of the course the student will be able to:

- Explain the major organ systems, and list the organs associated with each.
- Describe the structure of major human organs and explain their role in the maintenance of healthy individuals.
- Explain the interplay between different organ systems and how organs and cells interact to maintain biological equilibria.
- Explain how the activities of organs are integrated for maximum efficiency Explain the role of sex organs in the process of reproduction

SEMESTER-V
CORE COURSE - XII
COURSE TITLE: MAJOR PRACTICAL – V

COURSE CODE: U5R1BCCC12P	**TOTAL MARKS:100**
TOTAL HOURS: 60	**INTERNAL MARKS:40**
CREDIT: 5	**EXTERNAL MARKS:60**
	HOURS/WEEK: 5

Course Objectives:

The student will be able to

- Get a comprehensive knowledge of the equipments used in Life sciences
- Understand the working principles, tools and techniques of various analytical methods
- Understand and analyze the principles and applications of centrifuge, electrophoresis and chromatography in research and related experiments.
- Apply the knowledge for the separation of proteins/peptides by selecting appropriate separation techniques.
- Apply the principle of spectrophotometry to understand certain functionalities of Biomolecules.

Molecular Biology Practical

1. Isolation of Squamous Epithelial cells
2. Determination of Chromosomal aberrations
3. Isolation of protoplast from plant leaves
4. Estimation of nucleic acids
5. Isolation of plasmid DNA from bacteria
6. Agarose gel electrophoresis
7. Preparation of competent cells and transformation
8. Isolation of genomic DNA from plant
9. Separation of Proteins – SDS PAGE

Microbiology Practical

1. Laboratory safety and sterilization Techniques
2. Pure culture techniques.
3. Simple staining and Gram's staining
4. Growth in selective and differential media.
5. Effects of temperature and pH on bacterial growth.
6. Antibiotic disc sensitivity test.
7. Effect of disinfectants on microbial flora.
8. Isolation and identification of microorganisms from soil, Water and milk

Text books:

1.Pelczar MJ,Chan ECS,Krieg NR -Microbiology -Tata McGraw Hill, India, 2010 (7th Edition).
2.Prescott LM, Harley JP- Microbiology - Wm. C. Brown Publishers, 2008 (7th Edition).

Reference Books:

1.Tortora GJ, Funke BR and Case CL - Microbiology: An Introduction Benjamin Cummings - Pearson - 2016 (12th Edition).
2.Jeffrey C Pommerville - Jones Alcamo's Fundamentals of Microbiology - Bartlett Publishers - 2011 (9th edition).

Course Outcomes:

At the end of the course, students would be able to:

- Describe diversity, classification and identification methods of microorganisms.
- Explain the structure and function of bacterial cell including other organisms like fungi, viruses, algae etc.

- Explain the bacterial physiology and basic genetic systems of bacteria, bacteriophage and plasmids.
- Demonstrate skills in medical microbiology and pathogen interaction with the host, identification and application of antibiotics.
- Demonstrate the knowledge as to how microorganisms interact with their environment and interaction between humans and microorganisms.

SEMESTER-VI
CORE COURSE - XIII
COURSE TITLE: IMMUNOLOGY

COURSE CODE: U6R1BCCC13	**TOTAL MARKS:100**
TOTAL HOURS: 60	**INTERNAL MARKS:25**
CREDIT: 5	**EXTERNAL MARKS:75**
	HOURS/WEEK: 5

Course Objectives:
The student will be able to:

- Understand the types of immunity and lymphoid organs and lymphocytes
- Understand antigen, immunoglobulins and role of vaccines and apply their role in vaccination Understand the various immune response and types of immunity
- Understand the types of hypersensitivity and apply the mechanism of autoimmunity
- Apply the principles behind various immunological techniques.

UNIT: I **(11 Hours)**
ORGANS AND CELLS OF IMMUNE SYSTEM
Types of immunity: Innate and acquired, Passive and active. Lymphoid organs: Primary and secondary lymphoid organs-thymus, bone marrow, bursa fabricius, spleen, lymph node, GALT & BALT. Lymphocytes: Macrophages, T and B cells –origin, differentiation and functions. Role of lymphokines and cytokines in an immune response.

UNIT:II **(11 Hours)**
COMPONENETS OF IMMUNE SYSTEM **(ICT Learning)**
Antigen: Super Antigen, haptens – structure, general properties and functions. Tumour antigens properties. Immunoglobulin: structure, types & functions. Genetic basis of Antibody diversity. Vaccines and Toxoids, preparation and immunization. Complements: Components, mode of activation, classical and alternate pathway and its functions.

UNIT:III **(11 Hours)**
IMMUNE RESPONSES
Acquired Immune Response: Primary and Secondary immune response. Humoral immunity: Antigen recognition, cell interactions, clonal proliferation, interleukins, antibody synthesis, regulation of antibody synthesis. Cell mediated immunity: Role of cyototoxic T lymphocytes, TD cells, NK cells and macrophages. Immunity to infection: Mechanism, Antigenic drift, antigenic shift, antigen mimicry, antigenic masking, antigenic variation.

UNIT: IV **(11 Hours)**
IMMUNE REACTIONS
HLA: structure & functions, HLA typing, organ transplantation **Autoimmunity**: Concept, mechanism & autoimmune diseases viz., Grave's diseases, SLE, serum sickness and Rheumatoid arthritis. **Hypersensitivity**: Definition, mechanism & types with example.

UNIT:V **(11 Hours)**
IMMUNOLOGICAL TECHNIQUES **(Clinical Lab Visit)**
Production of antisera, Agglutination and Precipitation reactions, Immunodiffusion, Immunoelectrophoresis and Immunofluorescent techniques. Principle, technique and applications of RIA, ELISA.

UNIT VI **(05 Hours)**
LATEST LEARNINGS (For CIA Only)
Latest development related to course during the concerned semester

Text Books:

1.Ian R Tizard-Immunology-an introduction, Thomson, 4th edition, 1995.
2.Dr Rajeshwar Reddy K -Text book of immunology, AITBS publishers, 2nd edition, 2011.
3.Lydyard P.M.,Fanger M.W – Instant notes in immunology,Viva Books Private Limited, 2002.
4.Rastogi S.C- Immunology, CBS Publishers and distributors, 2005.
5.Shastri N.V -Principles of Immunology, Himalaya Publishing house ,2005.

Reference Books:

1.Ivan Roitt, Jonanthan Brostoff David Male-Immunology, Mosby, 8th edition 2012.
2.Janis Kuby – Immunology, 7th edition, 2014
3.Donald M. Weir, John Steward- Immunology, Churchill Livingstone, 8th edition, 1997.

e-Books

1. Textbook of Biochemistry 2011 by Thomas M. Devlin, Ph.D
2. Principles of Biochemistry 2004 by Lehninger

Course Outcomes:

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

- State the role of the immune system in the human body.
- Describe the function of phagocytes in the non-specific immune system.
- Define the role of B-lymphocytes in the humoral response.
- Describe antigen presenting cells and define their purpose.
- Define the major histocompatibility complexes type 1 and 2 and explain their functions.
- Explain how T-cells aid in eliminating pathogens from the body.
- List the symptoms of the inflammatory response and explain their causes.

SEMESTER-VI
CORE COURSE - XIV
COURSE TITLE: PLANT BIOCHEMISTRY

COURSE CODE: U6R1BCCC14	**TOTAL MARKS:100**
TOTAL HOURS: 60	**INTERNAL MARKS:25**
CREDIT: 5	**EXTERNAL MARKS:75**
	HOURS/WEEK: 5

Course Objectives:

The student will be able to:

- Have fundamental knowledge of biochemical pathways taking place in plants.
- Acquire an insight into biochemical mechanisms of stress management in plants
- Describe about plant growth and secondary metabolites
- Describe about plant hormone and Photoperiodism, short day plants, long day plants.
- Describe the photosynthesis C_3 and C_4 pathways and ATP synthesis.

UNIT I **(11 Hours)**

Photosynthesis and Electron transport system in plant **(ICT Learning)**

Photosynthetic apparatus, pigments of photosynthesis, role of carotenoids, photosystems I and II, their location; Hill reaction, photosynthetic electron transport and generation of NADPH & ATP, cyclic and non-cyclic photophosphorylations, complexes associated with thylakoid membranes; light harvesting complexes, path of carbon in photosynthesis – C3, C4 and CAM pathway of carbon reduction and its regulation, PhotorespirationETC - oxidative phosphorylation, mitochondrial respiratory complexes order and organization of electron carriers, electrochemical gradient, chemiosmotic theory and ATP synthesis.

UNIT II **(11 Hours)**

Photoperiodism and Transpiration

Photoperiodism, short day plants, long day plants, Day neutral plants, short-long day plants, long-short day plants. Uptake, transport and translocation of water, ions, solutes and macromolecules from soil, through cells, across membranes, through xylem and phloem; transpiration; mechanisms of loading and unloading of photoassimilates

UNIT III **(11 Hours)**

Plant hormones **(Digital Learning)**

Biosynthesis, storage, physiological effects and mechanism of action of auxins, gibberellins, kinetin cytokinin, ethylene, abscisic acid.

UNIT IV **(11 Hours)**

Secondary metabolites

Introduction, classification, biosynthetic pathways. Isoprenoids (Terpenes)- classification, biosynthesis monoterpenes, sesquiterpenes, diterpenes, triterpenes (steroids), polyterpernes. Alkaloids, Flavanoids anthocyanins, flavanoes and flavonols, isoflavonoids(Isoflavanes). Tannins.

UNIT V **(11 Hours))**

Dormancy and Senescence

Introduction, factors responsible for dormance, the mechanism of dormancy, methods of breaking the dormancy of seeds. Types of senescence, biological significance of senescence, mechanism of senescence sequential leaf senescence, synchronous leaf senescence, senescence of detached leaves, senescence of flowers, whole plant senescence, senescence of a cell.

UNIT VI **(05 Hours)**

LATEST LEARNINGS (For CIA Only)

Latest development related to course during the concerned semester

Text Books:

1.Srivastava, H.S. and Shankar, N. (2008) Plant physiology and Biochemistry, First Edition,Rastogi Publications, Meerut.

2.Pandey, S.N. and Sinha, B.K.(2008) Plant Physiology, Fourth Edition, VIKAS publishing House Pvt Ltd, New Delhi.

3.Buchanan, B., Gruissem, W. and Jones, R (2002).Biochemistry and Molecular Biology of Plants,First Edition, Wiley-Blackwell Publishers, USA.

Reference Books:

1.Heldt, H. and Piechulla, B.(2011) Plant Biochemistry, Fourth Edition, Academic Press, USA.

2.Taiz, L. and Zeiger, E. (2003) Plant Physiology, Third Edition, Panome Publishing Corporation, New Delhi.

3.Kumar, A. and Purohit, S.(2003) Plant Physiology- Fundamentals and Applications, Second Edition, Agrobios, India.

e-Books

1. Handbook of Plant and Crop Physiology 2002 by A. D. McLaren and G. H. Peterson

2. Plant Biochemistry 2011 by Hans-Walter Heldt

Course Outcomes:

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

- Understand the basic concepts of photosynthesis
- Explain the role of respiration and photorespiration
- Discuss the importance of transpiration and photo assimilation biofuels.
- Describe about stress physiology and secondary metabolites
- Infer the different types of plant hormones

MAJOR BASED ELECTIVE COURSE - I
MICROBIOLOGY

TOTAL HOURS: 48	**TOTAL MARKS:100**
CREDIT: 4	**INTERNAL MARKS:25**
	EXTERNAL MARKS:75
	HOURS/WEEK: 4

Course Objectives:

The student will be able to

- Analyze the diversity of microorganisms, bacterial cell structure and function, microbial growth and metabolism.
- Understand and apply the major taxonomic groups when classifying microorganisms.
- Evaluate and apply the most appropriate sterilization or disinfection approach for controlling the growth of microorganisms and explain how they work.
- Explain the role of microorganisms in food and industrial production and preservation.
- Know the scope and application of Industrial microbiology

UNIT: I **(09 Hours)**

HISTORY AND SCOPE OF MICROBIOLOGY:

Scope of Microbiology, History – Discovery era; Transition period; Golden age; twentieth century. Classification of Microorganism- Haeckel's and Whittaker's, differences between Prokaryotes and Eukaryotes. Carl Woese-3 domain Concept. An introduction to microscopy- A brief account on Compound, Dark field, Bright field, Phase contrast, Fluorescent and Electron microscope.

UNIT: II **(09 Hours)**

BACTERIA - MORPHOLOGY AND ITS GROWTH CHARACTERISTICS:

Bacteria: Nomenclature, morphology and fine structure; Brief and general account: Archaebacteria, Eubacteria, Cyanobacteria, Mycoplasmas, Rickettsiae, Chlamydia, Myxobacteria, Actinomycetes, protozoa, Algae, Fungi and Viruses. Nutritional requirements, nutritional types; Growth curve; Types of Culture medium.

UNIT: III **(09 Hours)**

CONTROL OF MICROORGANISMS:

Physical Agents - High temperatures, Low temperatures, Desiccation, Radiation, Filtration. **Chemical Agents** – Characteristics of an ideal antimicrobial chemical agent, Phenols, Alcohols, Halogens, Heavy metals, Dyes, Detergents, Aldehydes, Gaseous agents. **Antibiotics**- Classification based on their mode of action- Penicillin, Streptomycin, and antibiotic resistance.

UNIT: IV **(09 Hours)**

FOOD MICROBIOLOGY **(ICT Learning)**

Food spoilage, food preservation, fermented foods. Infected foods and human illness- botulism, Clostridium welchi poisoning, Staphylococus poisoning, Salmonella- infection. Dairy microbiology- contamination of milk by bacteria. Pasteurization and sterilization, fermented milk products, cheese.

UNIT: V **(09 Hours)**

INDUSTRIAL MICROBIOLOGY: **(Field study)**

Production and importance – Alchoholic beverages (Beer and Wine), Fermented products of milk cheese, antibiotic production – penicillin, single cell protein – Spirulina. Fermentors – types and components. Production of Biofertilizer and Biocontrol agent.

UNIT VI **(03 Hours)**

LATEST LEARNINGS (For CIA Only)

Latest development related to course during the concerned semester

Text book:

1.Ananthanarayan.R. and Jeyaram Paniker C.K. (1986) Text Book of Microbiology, Orient Longman Limited Madras.
2.Sharma P.D. (1993) Microbiology, Rastogi and Co., Meerut.
3.Purohit S.S (1992) Microbiology-Fundamentals and applications, Agro Botanical Publishers, India.

Reference books:

1.Pelczer M.J. Chan E.C.S. Noel R. Krieg (1993 Microbiology), Fifth Edn., Tata McGraw Hill publishing company Ltd., New Delhi.
2.Frazier W.G. (1958) Food Microbiology. McGraw Hill Book of Company New York.
3.Power C.B. & Daginawala H.F. (1996) General Microbiology Volume I & II. Himalaya Publishing House , Bombay.
4.Stainer R.Y. Ingraham JL.Wheels M.L. & Painter P.R. (1992) General Microbiology, Macmillan, London.

e-Books

1. Fundamentals of Microbiology, 2008 by Pelczar, Reid and Chan
2.Essentials of Medical Microbiology 2013 by Rajesh Bhatia

Course Outcomes:

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

- Explain the processes used by microorganisms for their replication, survival, and interaction with their environment, hosts, and host populations;
- Describe diversity of microorganisms, bacterial cell structure and function, microbial growth and metabolism, and the ways to control their growth by physical and chemical means
- Explain the general bacteriological and microbial techniques
- Understand the basic microbial structure and function and study the comparative characteristics of prokaryotes and eukaryotes.
- Understand the food preservation, fermented foods and Production and importance bio products

MAJOR BASED ELECTIVE COURSE - II
BIOTECHNOLOGY AND GENETIC ENGINEERING

	TOTAL MARKS:100
TOTAL HOURS: 60	**INTERNAL MARKS:25**
CREDIT: 4	**EXTERNAL MARKS:75**
	HOURS/WEEK: 5

Course Objectives:
The student will be able to:

- Develop skills in biotechnology
- Have a brief knowledge in cloning vectors
- Also know the methods if plant and animal technology
- Have knowledge of application of biotechnology in medicine and agricultural industries.

UNIT: I **(11 Hours)**

INTRODUCTION TO RECOMNBINANT DNA TECHNOLOGY

Definition and scope, over view of recombinant DNA technology-Restriction and modification systems, restriction endonuclease and other enzymes used in manipulating DNA molecule, separation of DNA by gel electrophoresis. Extraction and purification of plasmid and bactriophage DNA.

JOINING of DNA: Ligation of DNA molecules- DNA ligase, sticky ends, blunt ends, linkers and adapters. Synthetic oligo nucleotide synthesis and its applications.

UNIT:II **(11 Hours)**

TOOLS OF GENETIC ENGINEERING **(ICT Learning)**

Bacterial plasmid vector;pBR322, $_{p}$UC vectors , $_{p}$ACYC184 Agarobactrium- based plasmids, Ti plasmid, gene transfer, YCP (yeast centeromeric plasmid),YAC(yeast artificial chromosome),BAC (bacterial artificial chromosome).

UNIT : III **(11 Hours)**

TRANSFER OF DNA INTO CELLS AND SELECTION OF RECOMBINANTS:

Cloning strategies- Cloning with single standard DNA vectors.C-DNA cloning, C –DNA library and gene library.Recombinant selection and screening methods.Expression of cloned gens –probelems and solution.Shuttle vectors, DNA sequencing methods- Sangers and Gilbert methods.PCR-principle,methods,types, and application. DNA hybridization- southern,Northern and Western Blotting.

UNIT : IV **(11 Hours)**

PLANT AND ANIMAL BIOTECHNOLOGY **(Industrial Study)**

Plant biotechnology: Media composition, nutrients and growth regulators, Ms-M5 medium. Cell suspension culture, initiation and differentiation of PTC. Fusion of protoplast, regeneration of plants from protoplast.**Animal biotechnology:** Mammalian cell culture; Requirements for invitro growth; cell transformation- properties of transformed cell, cell separation and mass cultivation, IVF(in vitro fertilization) , the human genome project.

UNIT : V **(11 Hours)**

APPLICATION OF GENETIC ENGINEERING

Application in medicine; production of site directed mutagenesis, production of recombinant pharmaceuticals such as insulin, human growth hormone, factor VIII. Recombinant gene vaccines and therapy, transgenic animals.**Application in agriculture:** plant genetic engineering; herbicide resistant crops, problems with genetically modified plants, safety concerns, transgenic plants.

UNIT VI **(05 Hours)**

LATEST LEARNINGS (For CIA Only)

Latest development related to course during the concerned semester

Text books:

1.Dubey R.C- Book on Biotechnology , S. Chand and company PVT.LTD., 5th edition, 2014.
2.Singh B.D- Biotechnology, Kalyani Puplishers, 3rd edition, 2007.
3.Jogand S.N –Gene Biotechnology, Himalaya Puplishing House, 2nd edition, 2006.

Reference books:

1.Wulf Crueger, Annelise Crueger- Biotechnology ,Panima puplishing corporation,2nd edition.
2.Tyagi I.D - Biotechnology And Genetic Engineering, Jain Brothers, 1st edition, 2005
3.Mohan P.Arora- Biotechnology,Himalaya puplishing,2004.
4.Dr. Ignacimuthu S. Immunology, Tata McGraw Hill Puplishing Company limited,13th edition, 2006

e-Books

1. Introduction to biotechnology and genetic engineering 2007 by Vishal Nanda
2.Molecular Biology and Biotechnology 5th Edition 2009 by John M Walkerse

Outcomes:

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

- Understand principles of animal culture, media preparation.
- Explain Invitro fertilization and embryo transfer technology.
- Get insight in applications or recombinant DNA technology in agriculture, production of therapeutic proteins.
- Understand the steps involved in recombinant DNA technology.
- Explain the construction of DNA & c DNA library and their applications.

MAJOR BASED ELECTIVE COURSE - III
ENDOCRINOLOGY

TOTAL HOURS: 60	**TOTAL MARKS:100**
CREDIT: 4	**INTERNAL MARKS:25**
	EXTERNAL MARKS:75
	HOURS/WEEK: 5

Course Objectives:
The student will be able to:

- Learn about endocrine system of our body
- Study the major role of hormones in our body
- Enrich the knowledge of the hormonal imbalance of the body
- Understand the hormonal disorder found in the body
- Gain the knowledge on pancreas and spleen in the body

UNIT I **(11 Hours)**

Hormones

Chemical Structure, classification and Synthesis of Hormones. Secretion, Transport of Hormones in the Blood. Clearance of Hormones from the Blood. Mechanisms of Action of Hormones. Secondary Messengers - Mechanism for Mediating Intracellular Hormonal Functions. Feedback Control of Hormone. Measurement of Hormone in the Blood.

UNIT II **(11 Hours)**

Pituitary hormones **(ICT Learning)**

Divisions of pituitary gland, hormones secreted by anterior pituitary - Growth hormone, Thyroid-stimulating hormone, Adrenocorticotropic hormone and Follicle-stimulating hormone, Luteinizing hormone and prolactin. Hormones of posterior pituitary-Antidiuretic hormone, oxytocin. Disorders of pituitary gland -Gigantism, Acromegaly, Cushing Disease. Dwarfism and Acromicria. SIADH, Diabetes insipidus.

UNIT III **(11 Hours)**

Thyroid Hormones

Hormones of thyroid gland- Thyroxine, triiodothyronine, calcitonin. Synthesis, Regulation and Functions of thyroid hormones. Disorders of thyroid gland: Hyperthyroidism-Graves' Disease, Thyroid Adenoma, Exophthalmos. Hypothyroidism - Myxedema, Cretinism, Goiter. Parathormone-Synthesis, Regulation of Parathormone secretion. Disorders of parathyroid glands-hypoparathyroidism , hyperparathyroidism.

UNIT IV **(11 Hours)**

Adrenal hormones **(ICT Learning)**

Hormones of adrenal cortex: mineralocorticoids, glucocorticoids: synthesis, transport, mode of action, fate, regulation and functions of mineralocorticoids and glucocorticoids. Disorders of adrenal cortex: cushing's syndrome, hyperaldosteroidism, addison's disease, congenital adrenal hyperplasia. Hormones of adrenal medulla: synthesis, mode of action, regultion and functions of catecholamines.Disorders of adrenal medulla- pheochromocytoma

UNIT V **(11 Hours)**

Pancreatic and Gonadal hormones

Pancreatic hormones: Insulin, Glucagon, Somatostatin -synthesis,mode of action, biological actions, regulation.Abnormalities of pancreatic hormone - Diabetes mellitus. Gonadal

hormones:Androgens,Estrogens, Progesterone-Chemistry, synthesis, mode of action, regulation and metabolic role.Abnormalities of gonadal hormones – Cryptorchidism, Hypergonadism,hypogonadism in males,Amenorrhea,Dysmenorrhea in females.

UNIT VI **(05 Hours)**

LATEST LEARNINGS (For CIA Only)

Latest development related to course during the concerned semester

Text Books:

1.Sembulingam, PremaSembulingam.(2012).In:Textbook on essentials of medical physiology, JP Medical Ltd, London.pp.300-325

2.Guyton AC.(2006).In:Textbook of Medical Physiology,11th edi. Elseveir Saunders Company USA, Philadelphia, Pennsylvania.pp.311-324.

3.Chatterjee, M.N. and Rana Shinde.Text book of Medical. Biochemistry, , 8th ed. Jaypee Medical Publishers, 2012.

Reference Books:

1.Williams, Robert Hardin,Wilson, Jean D, 1932-Foster, Daniel W.William`s Text book of endocrinology 8 th edition. Philadelphia : Saunders, c1992.

2.Emil Smith, Robert Hill, Robert Legman.Principles of Biochemistry: Mammalian Biochemistry Published by McGraw-Hill Book Co (1964).

e-Books

1. Textbook of Biochemistry 2011 by Thomas M. Devlin, Ph.D
2. Principles of Biochemistry 2004 by Lehninger

Course Outcomes:

At the end of the course the student will be able to:

- Promote the physical activity to enhance the activity of the hormone.
- Analyse the hormonal disorder in the body .
- Use hormone study to prevent inherited disorder.

MAJOR BASED ELECTIVE COURSE - IV
PLANT BIOCHEMISTRY AND PLANT THERAPEUTICS

	TOTAL MARKS:100
TOTAL HOURS: 60	**INTERNAL MARKS:25**
CREDIT: 4	**EXTERNAL MARKS:75**
	HOURS/WEEK: 5

Course Objectives

- To learn the biochemistry of therapeutic applications of plants
- To study the principles of antioxidant mechanisms of plants
- To understand the role of plant hormones
- To gain the concept on secondary metabolites of plants.
- To know about the role of minerals and vitamins of plants

UNIT I **(11 Hours)**

Plant cell **(Digital Learning)**

Structure and functions.photosynthesis:photosynthetic pigments-chlorophyll,carotenoids and phycobilin.light reactions-two kinds of chemical system-photo system I and II-evidences in support of light reaction-hills reaction,arnons work and emerson effect.dark reaction-calvins cycle(c3 plants) hatch-slack cycle(c4 cycle) and CAM plants.photo respiration.

UNIT II **(11 Hours)**

Cycles of elements: Nitrogen cycle

Ammonification,nitrification,nitrate reduction and denitrification,nitrogen fixation.sulphur cycle,phosphorus cycle and carbon cycle.plant nutrition:specific roles of essential elements and their deficiency symptoms in plants.macro nutrients;carbon,hydrogen,oxygen,nitrogen, sulfur, phosphorus, calcium,potassium,magnesium and iron.micro nutrients: manganese,boron, copper,zinc,molybedenum and chlorine.

UNIT III **(11 Hours)**

Plant growth regulators **(ICT Learning)**

Chemistry,biosynthesis,mode of action and practical applications of auxins,gibberellins, cytokinins, abscicic acid and ethylene.plant growth inhibitors and retardants.

UNIT IV **(11 Hours)**

Photomorphogenesis

Photoperiodism.phytochrome-function in growth and development of plant.biochemistry of seed germination.senescence: biochemical changes during senescence. Senescence process in life cycle of plants.

UNIT V **(11 Hours)**

Secondary metabolites

Nature, distribution and biological functions of alkaloids, terpenes, flavonoids, polyphenols, tannins and steroids. Role of Secondary metabolites in pathogens, insects, animals and mankind.

UNIT VI **(05 Hours)**

LATEST LEARNINGS (For CIA Only)

Latest development related to course during the concerned semester

Text book

1. Plant physiology-Devlin N.Robert and francis H.witham,CBS publications.
2. Introduction to plant physiology-William G.Hopkins,john wiley and sons

Reference Books

1.Plant biochemistry and molecular biology –Lea and Lea wood, john wiley and sons,1997.
2.John.W.anderson and John brardall. An introduction to plant biochemistry,black well scientific publishers,1994.

e-Books

1.Introduction to Plant Physiology, 4th Edition by William G. Hopkins
2.Plant physiology and Biochemistry by Dr.Anupama Goyal

Course Outcomes:

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

- Describe the plant cell and its organelles.
- Use the various secondary metabolites for various treatments.
- Extract the secondary metabolites from the plants.

MAJOR BASED ELECTIVE COURSE - V
PHARMACEUTICAL BIOCHEMISTRY

	TOTAL MARKS:100
TOTAL HOURS: 60	**INTERNAL MARKS:25**
CREDIT: 4	**EXTERNAL MARKS:75**
	HOURS/WEEK: 5

Course Objectives :

- To provide knowledge of general methodology of drug synthesis
- To understand the impact of metabolism and pharmacokinetics in design
- To learn about the metabolism of drugs
- To study about the antibiotics used in the clinical lab.
- To know about the Anesthetics used in hospital

UNIT I **(11 Hours)**

Classification of administration

Mode of administration, site of action, absorption of drug, Drugs distribution and elimination, Role of kidney in elimination.

UNIT II **(11 Hours)**

Drug metabolism **(ICT Learning)**

Chemical pathways of drug metabolism. Phase I and Phase II reactions, role of cytochrome P450, non microbial reaction of drug metabolism, drug metabolizing enzyme.

UNIT III **(11 Hours)**

Chemotherapy **(Digital Learning)**

Biochemical mode of action of antibiotics-Penicillin and Chloramphenical.Action of alkaloids, antiviral and antimalarial substance. Biochemical mechanism of drug resistance .

UNIT IV **(11 Hours)**

Adverse response and side effects of drugs Allergy, Drug intolerance, Drug addiction, drug abuse and their biological effects.

UNIT V **(11 Hours)**

Anesthetics

General and local, gaseous anesthetics, ether and vinyl ether, hydrocarbons like chloroform, intravenous anaesthetics thropentanesosium and cocaine.Organic pharmaceutical-their role as preservatives and food additivives.

UNIT VI **(05 Hours)**

LATEST LEARNINGS (For CIA Only)

Latest development related to course during the concerned semester

Text books:

1.Jeyashree Ghosh,`The Book of Pharamacetical Chemistry,Second Edition 1999,
2.A text book Pharamacology and Pharamacotherapeutics by R.S. Satoskar, S.D Bandarkar Ainapure.

Reference Books:

1.W.O.Foye " Principles of medicinal chemistry 2.Satoskar " Pharmacology

e-Books

1.Pharmaceutical biochemistry, 2015 by DR. SIPOS KATALIN
2. Bio pharmaceuticals Biochemistry and Bio technology 2004 by Gary Walsh

Course Outcomes:

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

- Administer drug
- Identify the various side effects of drugs.
- Know about chemotherapy and anesthesia.

SKILL BASED ELECTIVE COURSE - I
HOSPITAL MANAGEMENT AND FIRST AID MANAGEMENT

TOTAL HOURS: 36	**TOTAL MARKS:100**
CREDIT: 2	**INTERNAL MARKS:25**
	EXTERNAL MARKS:75
	HOURS/WEEK: 3

Course Objectives:
The student will be able to

- Understand the how to maintain the medical records.
- Understand the knowledge about pharmacy service and
- Understand the relationship between management and patient care.
- Understand their role as an emergency first aider.
- Understand the use of risk assessments for health and safety purposes
- Understand how to respond to accidents and sudden illnesses and analyze the different treatment methodologies.

UNIT :I **(6 Hours)**
Medical Records **(Clinical Lab Visit)**
Introduction – Definition – Purpose – Planning organizing and Staffing - Physical facilities – Processing of Records and their flow – Coding and Indexing – storage and Retrieval – Reports and Returns – Medico legal aspect of medical Records.

UNIT :II **(7 Hours)**
Fire Hazards and Fire Manual Guideline:
Introduction – Elements of fire – Fire hazard – Cause of Hospital Fire - Classification of fire – Fire protection – Fire points and Escape Route – Risk evaluation – meaning of fire manual – Guideline – Elements of Fire safety – Fire safety training – Do's and Don'ts for electrical fire prevention – Action to be taken in case of fire in a Hospital.

UNIT :III **(7 Hours)**
Integrated Hospital and Patient Care Information System: **(Case study)**
Meaning – objectives – Need – Designs of HIS – Application of HIS – Stages of computerisation – HIS Design objectives and consideration - Conceptual Database Design – meaning of Patient Care information System – elements of Patient Care information System – Direct Care Process - Efficiency of care providers – Improved information access – in Patient Care.

UNIT: IV **(7 Hours)**
PRINCIPLES OF FIRST AID MANAGEMENT
Principles and objectives of First Aid, casualty assessment. Priorities of First Aid. Patient management and care.

UNIT: V **(7 Hours)**
INJURIES AND FIRST AID IN EMERGENCIES **(Case study)**
Internal and external bleeding injuries to muscles, back, chest, abdomen, joints and bones, stroke and head injury and eye irrigation. Sudden illness-poisoning, Bites and Stings.
Accident reporting, breathing emergencies, Cardiac emergencies. Oxygen therapy –resuscitation, defibrillation – Heart attack. Common gastrointestinal sickness, Altitude sickness.

UNIT VI **(2 Hours)**
LATEST LEARNINGS (For CIA Only)
Latest development related to course during the concerned semester

Reference books:

1. Hospital and Health Services Administration – Principals and Practice – Syed Amin Tabish – Oxford University Press.
2.Essential for Hospital Support Services and Physical Instructions – Sharma – Jaypaee Brothers – New Delhi.
3.Management in Health Care, 2Nelson Thrones
4.Health Care Provisions, 2nd Ed, Nelson Thrones West Bengal University of Technology.
5. John A Eastman,(2007). First Aid to the Injured – Authorized manual of St. John's Ambulance, Red Cross Road, New Delhi.
6.Subramanian. R. (2006) First aid Home nursing, 1st edn, Bharat printers Trichy.

e-Books

1.Integrated Clinical Risk Management in Hospitals 2016 by Prof.Dr.Rainer Sibbel
2. Approach to Internal Medicine: A Resource Book for Clinical Practice 2011 by David Hui
3.First Aid Management and Accident Prevention - The Carter Center 2007 by Desta Workneh
4.First Aid Management for Burns 2007 by Kua tawhiti ke to haerenga mai,

Course outcome:

At the end of the course the student will be :

- Aware of management or administration of hospitals.
- Know the direct connection between health care services and those supplying the services they require.
- Responsible for education, overall patient care, research & commUNITy health care related to the organization.
- Identify the most important action one can take in a life-threatening emergency.
- Identify the major structures of the respiratory, circulatory, nervous, and musculoskeletal systems.
- Explain why one should follow the emergency action steps/principles in any emergency.

SKILL BASED ELECTIVE COURSE - II
PAIN RELIEF FORMULATION AND COSMETICS (PRACTICAL)

TOTAL HOURS: 48	**TOTAL MARKS:100**
CREDIT: 2	**INTERNAL MARKS:40**
	EXTERNAL MARKS:60
	HOURS/WEEK: 4

Course Objective:

- Self assess knowledge and skill in pain management.
- Identify areas for further study.
- Understand and perform assessment of pain and function.
- Understand and be able to select between various techniques.
- They serve as cosmetics for the care of body and its parts and (ii) the botanical ingredients present therein influence biological functions of skin and provide nutrients necessary for the healthy skin or hair.

PREPARATION OF

1. Turpentine liniment
2. Soap liniment
3. Pain balm preparation.
4. Simple ointment & Sulphur ointment
5. Calamine lotion
6. Calamine Benzoate Lotion
7. Cold cream
8. Vanishing cream
9. Hair cream
10. Liquid tincture of liquorices
11. Compound Tincture of Benzoin
12. Tincture of Orange
13. Shampoo
14. Nail bleach
15. Cuticle remover
16. Compound syrup of ferrous phosphate
17. Commercial cough syrup
18. Talcum powder
19. Baby powder
20. Tooth powder.

REFERENCE BOOK:

1.Arthur J. Winfield, R. Michael and E. Richard, Pharmaceutical Practice (2000),3 rd edition, Elsevier Publication

Course Outcomes:

Upon completion of this program the student will:

- Know to apply the knowledge of preparing conventional dosage
- formulations. Know to prepare the natural cosmetics products and their usage.

SKILL BASED ELECTIVE COURSE - III
NUTRITION AND DIETETICS

TOTAL HOURS: 24	**TOTAL MARKS:100**
CREDIT: 2	**INTERNAL MARKS:25**
	EXTERNAL MARKS:75
	HOURS/WEEK: 2

Course Objectives

- To know about the nutrition
- To make the student aware of the importance of various nutrients.
- Acquiring the knowledge about the inter relationship between the age and nutrition.
- To learn about the biological value of foods

UNIT I **(5 Hours)**

Nutrition **(ICT Learning)**

Introduction to the science of nutrition-function of foods and its relation to nutritional and clinical health, essential nutrients, analysis of food, composition, food habits and food groups.

UNIT II **(4 Hours)**

Nutrients

Kinds,functions, food sources. Fats-kinds, functions, food sources, essential fatty acids and cholesterol. Proteins-kinds, functions, food sources, complete and incomplete proteins.

UNIT III **(4 Hours)**

Biological Value

Net protein utilization energy, Basal metabolism, measurement of BMR, factors affection BMR, regulation of body temperature, energy needs, total energy requirements, estimation of energy requirements and value of foods. Balanced diet formulation-Assessment of nutritional status.

UNIT IV **(4 Hours)**

Mineral nutrition

Essential-micro and macro mineral nutrients, distribution, sources, functions and abnormalities. Vitamins- Definition, classification, sources, distribution, functions and abnormalities.

UNIT V **(4 Hours)**

Diets at various stages of life: **(Digital learning)**

Nutrition at various stages of growth and development: diets for infants, children, adolescents, pregnant women, lactating mothers and older persons. Nutrition challenges of the future-food production and food storages, future foods, new protein and new fat foods and changing food habits.

UNIT VI **(3 Hours)**

LATEST LEARNINGS (For CIA Only)

Latest development related to course during the concerned semester

Text Books:

1.Principles of Nutrition and Dietetics, Dr.M.Swaminathan, The Bangalore printing and publishing Company limited, Bangalore.
2.Advanced Text book on Food and Nutrition-Vol 1. Dr. M.Swaminathan, Second edition.
3.Advanced Text book on Food and Nutrition-Vol 2. Dr. M.Swaminathan, Second edition.

Reference book:

1.Normal and Therapeutic Nutrition-Corine Robinson

e-Books

1.Introduction to Human Nutrition 2nd Edition 2009 by Michael J Gibney
2. Handbook of Nutrition and Pregnancy 2008 by Carol J. Lammi-Keefe

Course Outcomes:

Upon completion of this program the student would have:

- Aquired knowledge in the biological value of foods.
- Obtained awareness regarding the nutritive value of various food

SKILL BASED ELECTIVE COURSE - IV
PLANT & ANIMAL BIOTECHNOLOGY

TOTAL HOURS: 24	**TOTAL MARKS:100**
CREDIT: 24	**INTERNAL MARKS:25**
	EXTERNAL MARKS:75
	HOURS/WEEK: 2

Course Objectives:

- To study about the various methods adopted in tissue culture.
- To learn to transfer gene into cell.
- To acquire knowledge about gene therapy
- To understand about the culture of mammalian cells
- To know about the genetic engineering used in plants.

UNIT-I **(5 Hours)**

Plant tissue culture: -Media composition, nutrients & growth regulators, MS medium & B5 medium. Cell & suspension culture. Initiation & differentiation of PTC. Micropropagation:- Methods, Production of haploid plants, phytochemicals from plant tissue culture.

UNIT-II **(4 Hours)**

Protoplast technology: **(ICT Learning)**

Isolation, fusion of protoplasts, Electroporation, Biolistics, Regeneration of plants from protoplasts. Gene Transfer in plants: - Ti plasmid vectors, mechanism of T- DNA transfer, Vir genes. Transgenic plants:- Herbicide, Virus, Pest resistance plants, Male infertility, Genetic engineering of plant oils.

UNIT-III **(4 Hours)**

Mammalian cell culture:

Establishment of cell in culture: Requirements for invitro growth; importance of serum. Cell-lines; cell transformation –properties of transformed cells, cell separation, Mass cultivation of cells: suspension culture; immobilized cultivation.

UNIT-IV **(4 Hours)**

Genetic Engineering of Animal cells: **(ICT Learning)**

Mammalian cell culture in protein production. Gene transfer into mammalian cells, Selectable markers. pSV Plasmids; retroviral vectors; Expression vectors; reporter genes.

UNIT-V **(4 Hours)**

Animal Biotechnology:

Artificial insemination and embryo transfer, Invitro fertilization (IVF): embryo cloning. Human embryo research, transgenic mice, Gene therapy; the Human Genome project. Recombinant proteins from cell cultures:- Interferons, Viral vaccines, Hybridoma technology – Monoclonal antibodies – Production and applications.

UNIT VI **(3 Hours)**

LATEST LEARNINGS (For CIA Only)

Latest development related to course during the concerned semester

Text Books:

1.D. Balasubramanian and others, Concepts in Biotechnology, Universal press India 1996.
2.BIOTOL series, Invitro cultivation of animal cells- Butler worth Heineman, 1993.

Reference Books

1.Walsh Gary and Headon R.Denis, Protein Biotecnology. John Willey publisher,1994.
2.Plant tissue culture;Razdon;Oxford IBH publisher, 1994. Freshney; animal cell culture; IRL press.

e-Books

1. Introduction to biotechnology and genetic engineering 2007 by Vishal Nanda
2. Molecular Biology and Biotechnology 5th Edition 2009 by John M Walkerse

Course Outcomes:

Upon completion of this program, the student would have:

- Obtained knowledge in plant and animal tissue culture.
- Become aware of genetic engineering technologies.

SKILL BASED ELECTIVE COURSE - V
NANOBIOTECHNOLOGY

	TOTAL MARKS:100
TOTAL HOURS: 36	**INTERNAL MARKS:25**
CREDIT: 2	**EXTERNAL MARKS:75**
	HOURS/WEEK: 3

Course Objectives:

- **To acquire basic knowledge about nanotechnology.**
- **To learn the various tools available in nanotechnology.**
- **To study about the nanostructures of proteins**
- **To understand about the synthesis of nanoparticles**
- **To know the role of nanotechnology used in industry**

UNIT- I **(7 Hours)**

History

Interdisciplinary areas of Biotechnology and Nanoscience. Cells, celluar components. Nucleic acids and proteins refinement and application of instrument – to generate and manipulate nanostructure materials to basic and applied studies.

UNIT-II **(7 Hours)**

Interphase system

Interphase system pertaining to biocompatible inorganic devices for medical implants - microfluidic system – microelectronic silicon substrates.

UNIT –III **(7 Hours)**

Protein based nanostructures **(Digital Learning)**

Building blocks and templates – Proteins as transducers and amplifiers of biomolecular recognition events – nanobioelectronic devices and polymer nanocontainers – microbial production of inorganic nanoparticles – magnetosomes.

UNIT-IV **(6 Hours)**

DNA based nanostructures **(ICT Learning)**

Topographic and Electostatic properties of DNA and proteins – Hybrid conjugates of gold nanoparticles – DNA oligomers – use of DNA molecules in nanomechanics and computing.

UNIT-V **(5 Hours)**

Synthesis of nanoparticles

Quantum dots, synthesis of nanoparticles, Bio and Nano bio nanomaterials. Nano devices- sensors, photon counters, nano electrodes, Nano medicine-medical uses of nano medicine, health and environmental implications of nanotechnology**.**

UNIT VI **(4 Hours)**

LATEST LEARNINGS (For CIA Only)

Latest development related to course during the concerned semester

Reference Books:

1.Nanotechnology-Basic science and Emerging Technologies-Rohit Majumdar.
2.Nanotechnology-Fundamentals and Applications-Mansi Karkare
3.Nanoscience and technology-K.P.Mathar.

e- Books

1.Introduction to nanotechnology 2005 by Charles P Poole, Jr., Frank J. Owens
2.Introduction to nanomaterials and nanotechnology 2007 by Vladimir Pokropivny & Rynno Lohmus

Course Outcomes:

Upon completion of this program the student would have:

- Acquired knowledge in protein and nucleic acid structure.
- Developed skill in synthesing nanoparticles.

INTER DISCIPLINARY COURSE – I
PUBLIC HEALTH AND HYGIENE

TOTAL HOURS: 24	**TOTAL MARKS:100**
CREDIT: 2	**INTERNAL MARKS:25**
	EXTERNAL MARKS:75
	HOURS/WEEK: 2

Course Objectives:

- To help the students know the importance of nutrition in health
- To import basic knowledge about food and health in life
- To learn about the environmental hazards
- To understand the mental health and disorder
- To study the importance of breast breeding

UNIT I **(4 Hours)**

Concepts of health:who definition of health;positive health;determination of health;responsibility for health. Health service philosophies;health case;health system;levels of health case. Concepts of disease and concept of causation-germ theory of disease.

UNIT II **(4 Hours)**

Nutrition and health-food. Classification of foods.Nutrients - sources and function of proteins, fats, carbohydrates.Sources and functions of vitamins and minerals. Nutritional profiles of cereals,millets,vegetables,fruits,milk and milk products.

UNIT III **(4 Hours)**

Environment and health-water-sources and uses of water,water pollution,water related diseases and purification of water. Air –composition and cause of discomport,air pollution-source,air pollutants,need for proper ventilation.

UNIT IV **(4 Hours)**

Maternal and child health-mother and child –one unit, intranatal care, post natal child care-care of the mother, complications of post portal period, restoration of mother to optimum health, breast feeding, congenital malformations-definition, incidence, risk factors, prenatal diagnosis and prevention.

UNIT V **(4 Hours)**

Mental health-types and causes of mental illness-preventive aspects,alcoholism and drug dependence-definition,agent factors,host factors,symptoms,environmental factors, prevention, treatment and rehabilitation.National AIDS control programme and national immunization programme.

UNIT VI **(4 Hours)**

LATEST LEARNINGS (For CIA Only)

Latest development related to course during the concerned semester

Text books

1.Park.K.social and preventive medicine,bhanot publishers,18th edition,2005 2.dash BN.,health and physical edition,2003.

Reference Books

1.Ashtekar S.health and healing-A manual of primary health care,orient Longmans publishers.2001.
2.Patil RS.practical commUNITy health,vora medical publishers,1995.

Course Outcomes:

Upon completion of this program, the student would have:

- Acquired knowledge about the health concepts.
- Developed skill in identifying various health problems.

INTER DISCIPLINARY COURSE - II
FIRST AID MANAGEMENT AND SAFETY MEASURES

	TOTAL MARKS:100
TOTAL HOURS: 24	**INTERNAL MARKS:25**
CREDIT:2	**EXTERNAL MARKS:75**
	HOURS/WEEK: 2

Course objectives :

- To understand their role as an emergency first aider.
- To understand the use of risk assessments for health and safety purposes
- To understand how to respond to accidents and sudden illnesses
- To gain the knowledge on poisoning and bites
- To learn the first aid kids used in clinical

UNIT-I **(4 Hours)**

Priniciples and objectives of First Aid, causality assessment. Priorities of first Aid. Patient management and care.

UNIT: II **(4 Hours)**

Management: Management of common illness and thermal illness.Risk assessment and risk reducations – Fainting, Anaphylaxix,Asthma,Epilepsy,Diabetes,burns ans Scalds.

UNIT;III **(4 Hours)**

Injuries: Interanl ans external bleeding injuries to muscles, back, chest abdomen, joints,,and bones, strokes and head injury and eye irrigation. Sudden illness-poisoning, Bites and Stings

UNIT IV **(4 Hours)**

Accident reporting : Breathing emergencies, cardiac emergencies. Oxygen therapy-resuscitation, defibrillation-Heart attack. Common gastrointestinal sickness, Altitide

UNIT V **(4 Hours)**

First Aid rooms and equipments
First aid kits, cleaning of wounds and dressing injury assesssemnt.

UNIT VI **(4 Hours)**

LATEST LEARNINGS (For CIA Only)
Latest development related to course during the concerned semester

Text Book

1.John A Eastman (2007) First Aid to the Injured-Authorized manunal of st john`s Ambulance ,Red Cross Road, New Delhi

Reference Book

1.Subramanian.R. First aid home nursing,1st Edition, Bharat printers Trichy.

Course Outcomes:

Upon completion of this program the student will be able to:

- Identify the most important action one can take in a life-threatening emergency.
- Identify the major structures of the respiratory, circulatory, nervous, and musculoskeletal systems.
- Explain why one should follow the emergency action steps/principles in any emergency.

INTER DISCIPLINARY COURSE – III
TANNERY TECHNOLOGY

	TOTAL MARKS:100
TOTAL HOURS: 24	**INTERNAL MARKS:25**
CREDIT: 2	**EXTERNAL MARKS:75**
	HOURS/WEEK: 2

Course Objectives:

- To know about tannery industry
- To learn about the properties of tannery
- To study about tannery effluent treatment
- To understand the tanning salts
- To gain the knowledge on vegetable tannins

UNIT-I **(4 Hours)**

Introduction:

Types of tanneries available in India. Their nature and composition. Present methods of collection and utilisation.

UNIT-II **(4 Hours)**

Tannery effluent:

Recovery of salt from tannery effluent . Its treatment and re-use. Theoretical and practical aspects of recovery of chrome. Protein and biogas from tannery effluent. Recovery of fat, proteins, chemical and glue and their use. Pre Treats, finished splits, gloves, washers etc.

UNIT-III **(4 Hours)**

Vegetable Tannins

Chemistry of vegetable tannins, extraction criteria for vegetable tannins, solid- liquid ratio for extraction, chemical modification and blending of vegetable tannins.

UNIT-IV **(4 Hours)**

Tanning Salts

Types of mineral tanning salts, chemistry of Basic chromium sulphate preparation, basicity and masking systems, factors influencing exhaustion of chromium (III) during tanning.

UNIT-V **(4 Hours)**

Treatment of effluent

Tannery effluent as pollutant-Treatment of tannery effluent – Microbes employed- Treatment Plant – stages of treatment- Discharge of treated effluent and its utility.

UNIT VI **(4 Hours)**

LATEST LEARNINGS (For CIA Only)

Latest development related to course during the concerned semester

Text Books

1.Mann, I. " Process of Utilisation of Animal by Products ", FAO Rome, 1962.
2.Scaria.K.J. Mahendrakumar and Divakaran, S. " Animal by Products - Their processing and utilisation " CLRI, Madras, 1961.
3.Taiganides, E.P. " Animal Wasters ", Applied Science Publishers Ltd., Essex, 1977.
4."Low Cost Waste Treatment ", NEERI, Nagpur, 1972.

Reference Books

1.Cawe, M.C. et. al. " Environment and Tannery Centre Technique der Cuir, Lyon, France. Myers, R.R. and Long, J.S. " Treatise on Coatings ", vols., Marcel Dekker, New York, 1975.
2.SAP Board of Consultants and Engineers, " Synthetic resins and their industrial applications ", Small Business Publications No.57.
3.Rajadurai, S. and Kulasekaran, S. " Acrylics and their uses in leather manufacture ", CLRI, Madras, 1982.

Course Outcomes:

Upon completion of this program, the student will be able to:

- Acquire knowledge in tannery industry.
- Know the various processes for the treatment of effluent