RVS COLLEGE OF ARTS AND SCIENCE

Autonomous and Affiliated to Bharathiar University, Approved by AICTE

Re Accredited with 'A+' Grade by NAAC

Sulur, Coimbatore – 641 402.

DEPARTMENT OF BIOCHEMISTRY

M.Sc. BIOCHEMISTRY

(Effective from the Academic Year 2023- 2025)

HOD **PRINCIPAL** **COE**

VISION

Quality Education for Digital Era.

MISSION

To impart a need – based quality education through comprehensive curriculum by adopting apt technologies and progressive teaching, learning and research processes.

ABOUT THE DEPARTMENT

The Department of Biochemistry was established in 1996. The department is functioning with under graduate, Post graduate and Research programs with a team of 11 faculty members.

The Biochemistry focuses on life processes at the molecular level, that emphasis on the biochemistry and molecular biology of cellular metabolism and Bioenergetics.

The curriculum is designed for students seeking preparation for graduate studies, for the health-care professions, or for entry-level positions in science-related industries. The teaching and learning process is well executed properly and reveals with sophisticated instruments.

EXECUTIVE MEMBERS

CHAIRMAN

Dr. K.V. Kupusamy

MANAGING TRUSTEE

Dr. K. Senthil Ganesh

CORRESPONDENT

Mrs. S. Srividyalakshmi Senthil Ganesh

SECRETARY

Prof. Saramma Samuel

PRINCIPAL

Dr. T. Sivakumar

VICE PRINCIPAL

Dr. M.P. Ayyappadas

CONTROLLER OF EXAMIATIONS

Ms. G. Jeyalakshmi

HEAD OF THE DEPARTMENT

Dr. S.Shamina

Department: BIOCHEMISTRY

Programme: M.Sc., BIOCHEMISTRY

Programme code: 1PBC

PROGRAMME OUTCOMES (POs)

PO1	Domain Knowledge
PO2	Communicative Competence
PO3	Digital Strategic Knowledge
PO4	Multi-Cultural Competence
PO5	Critical Thinking and Problem Solving
PO6	Research and Analytical Skills
PO7	Moral, Ethical and Professional Responsibilities
PO8	Leadership and Lifelong Learning

PROGRAMME SPECIFIC OUTCOMES: (PSOs)

Upon completion of Master of Biochemistry, STUDENTS are able to achieve the following outcomes.

PSO1	Assess the fundamental concepts of experimental and theoretical techniques in Molecular Gene expression, Proteomics, Pathology, Clinical research and Nano-sciences.
PSO2	Demonstrate and operate the technologies and thereby gaining insights from clinical data to make cognizant predictions.
PSO3	Research oriented learning to develop methodical and integrative problem-solving approaches in the biochemical industries and to validate effective projects for lifelong learning.
PSO4	Construct and formulate pre-clinical studies to invent innovative ideas to develop their employability and entrepreneurial skills.

RVS COLLEGE OF ARTS AND SCIENCE (Autonomous)

2023- 2025 BATCH

Semester	Course Opted	Course Name	D	L	T	P	CIA	SEE	Marks	Credits
SEMESTER II	**M-V**	Metabolic Regulation	3	4	-	-	25	75	100	4
	M-VI	Advanced Clinical Biochemistry	3	4	-	-	25	75	100	4
	M-VII	Plant Biochemistry and phytotherapeutics	3	4	-	-	25	75	100	4
	M-VIII	Stem cells and Cancer Biology	3	4	-	-	25	75	100	4
	MP-I	Lab in Quantitative analysis of Biological Compounds	6	-	-	5	25	75	100	4
	MP-II	Lab in Enzymology, Plant Biochemistry and Plant Tissue Culture	6	-	-	5	25	75	100	4
	EL-I	Elective - I	3	4	-	-	25	75	100	4
	ES	Employability skills		2		-				
	Total			**32**					**700**	**28**

Semester	Course Opted	Course Name	D	L	T	P	CIA	SEE	Marks	Credits
SEMESTER I	**M-I**	Biochemical Techniques	3	4	-		25	75	100	4
	M-II	Human Cell Molecular Biology	3	4	-		25	75	100	4
	M-III	Enzymes and Enzyme Technology	3	4	-		25	75	100	4
	M-IV	Human physiology, Hormones and signal transduction	3	4	-		25	75	100	4
	MP-I	Lab in Quantitative analysis of Biological Compounds	-	-	-	5	-	-	-	-
	MP-II	Lab in Enzymology, Plant Biochemistry and Plant Tissue Culture	-	-	-	5	-	-	-	-
	MP-III	Lab in Computational and Molecular modeling	3	-		4	25	75	100	4
	ES	Employability skills		2						
	Total			**32**					**500**	**20**

Semester	Course Opted	Course Name	D	L	T	P	CIA	SEE	Marks	Credits
SEMESTER III	**M- IX**	Pharmaceutical Biochemistry	3	4	-		25	75	100	4
	M-X	Industrial Biochemistry	3	4	-		25	75	100	4
	M-XI	Immunology and Immuno Techniques	3	4	-		25	75	100	4
	M-XII	Clinical Research and Clinical Data analytics	3	4	-		25	75	100	4
	MP-IV	Lab in Immunology and Recombinant DNA technology	-	-	-	5	-	-	-	-
	MP-V	Lab in Research Techniques in Biochemistry	-	-	-	5	-	-	-	-
	EL-II	Elective II- Internship / Mini Project *Viva Voce*	-	-	-	-	25	75	100	5
	EL-III	Elective III- EDC	3	4	-	-	25	75	100	4
	ES	Employability skills		2					GRADE	2*
	Total			**32**					**600**	**25**

Semester	Course Opted	Course Name	D	L	T		CIA	SEE	Marks	Credits
SEMESTER IV	**M- XIII**	Biostatistics and Research Methodology	3	4	-		25	75	100	4
	MP-IV	Lab in Immunology and Recombinant DNA technology	6	-	-	5	25	75	100	4
	MP-V	Lab in Research Techniques in Biochemistry	6	-	-	5	25	75	100	4
	PV	Major Project Report & Viva Voce	-	-	-		25	75	100	5
	Total			**14**					**400**	**17**
TOTAL									**2200**	**90+2***

M - Major Paper
MP- Major Practical
EL – Elective
EDC - Extra Disciplinary Course
PV- Major Project Report & Viva Voce
ELECTIVE – I : 1. Recombinant DNA technology 2. Bioinformatics
ELECTIVE – II : 1. Internship 2. Mini Project Viva Voce
ELECTIVE – III : EDC - Hospital Management
Employability Skills (ES) classes are held in first three semesters.
Exams will be conducted at the end of the III semesters.wc .
Two Extra Credits will be given. This is mandatory to get a degree.

Course Title : **BIOCHEMICAL TECHNQUIES (T)**	Course Code : 13A
Semester :**I**	Course Group : **M- I**
Teaching Scheme in Hrs (L:T:P) : (**4:0:0)**	Credits : **4 Credits**
Map Code: -	Total Contact Hours: **60**
CIA: **25 Marks**	SEE # : **75 Marks**
Programme: **MSC-BIOCHEMISTRY**	**# - Semester End Exam**

No	**Course Outcome (Cos): After completion of this course, the students will be able to**	**PSOs**	**CL.ses.**	**BLOOM'S TAXONOMY LEVEL**
CO1	Demonstrate and illustrate working principle and instrumentation of pH meter and centrifugation technique	PS01	12	AP
CO2	Detect and distinguish chromatographic technique and its application.	PS02	12	AN
CO3	Apply and the role of electrophoresis techniques in separation of molecules.	PS03	12	AP
CO4	Assess the spectroscopic techniques and its application.	PS02	12	E
CO5	Categorize the theoretical principles of radioactivity in clinical aspects.	PS04	12	AN

UNIT-I (LECTURE HOURS-12)

BUFFERS

Introduction-(Basics of acidity & basicity)

pH –(Definition,determination of pH using indicators

HendersonsHasselbach equation - Relatioship between pKa& Ph)

pH meter – (Working principle and instrumentation)

Types of electrodes – (Principle & working of calomel,silver/silver chloride, hydrogen electrodes)

Centrifugation

(Introduction - Basic principles of centrifugation-Relative centrifugal force)

Preparative and Analytical centrifugation – (Differential centrifugation, density gradient centrifugation, Basic principlesof sedimentation

Ultracentrifuge - Rotors-types,analytical ultra centrifuge,applications)

Activity

- Differentiate the solutions given based on its pH using pH meter and pH paper .
- Group discussion on different types of centrifugation

UNIT-II (LECTURE HOURS-12)

CHROMATOGRAPHY

Introduction – (Definition, stationary phase, mobile phase, retardation factor)

Paper chromatography. – (Ascending,descending, Circular -Principle, Technique& applications)

Thin layer chromatography – (Adsorbents,solvents used,Principle, Technique& applications

Ion exchange chromatography - Ion exchangers- anion & cation exchange resins. Principle, Technique& applications)

Molecular sieve chromatography – (Types of gels, Principle, technique& applications, Molecular weight determinationof proteins.

Affinity chromatography - Types of ligands, Principle, Technique & applications)

GLC – (Carrier gas, columns, Principle, Technique & applications.

HPLC-Pumping systems, column packing Principle, Technique & applications)
HPTLC- (Principle, Technique & applications)
Activity

- Packing of column using burette, cotton, sand and silica gel -
- Quiz on Chromatography techniques using Kahoot app

UNIT –III (LECTURE HOURS-12)

ELECTROPHORESIS
Introduction – (Definition, migration of ions in electric field, factors affecting electrophoretic mobility.
Paper electrophoresis - Types (Horizontal, vertical) Principle, Technique& applications.
Gel electrophoresis and Immuno electrophoresis - Types of gel electrophoresis-Agarose, SDS –PAGE)
2D Gel electrophoresis.
Pulse field Gel electrophoresis – (Principle, Technique& applications
Immunoelectrophoresis-Single radial immunodiffusion,Ouchterlony double diffusion, Rocket immune electrophoresis.
Isoelectric focusing - Ampholytes Principle, technique& applications)
Blotting
(Southern blot – Principle, Techniques for DNA detection
Northern and western blot – Principle, Techniques for RNA and protein detection).
Activity

- Chart work to differentiate Horizontal electrophoresis and Vertical electrophoresis.
- Using paper model for blotting techniques- Capillary, electro transfer and semi-dry blotting.

UNIT-IV (LECTURE HOURS-12)

SPECTROMETRY
Introduction - Basic principles,laws of absorption,Beer Lamberts law.
Colorimetry – Principle,Instrumentation & applications
UV-Visible spectrophotometry – Principle,Instrumentation & applications
Flame spectrophotometry - Emission flame & Atomic absorption spectrophotometry
Advanced Techniques – ICP-MS, ICP-OES (Instrumentation & applications.)
Spectrofluorimetry–(Fluorescence, phosphorescence) Techniques, Instrumentation & applications.
FTIR (Fourier Transform Infrared Spectroscopy) – Principle, Instrumentation & applications.
Activity

- Demonstration on principle and working of colorimeter (selection of filter using coloured solution).
- Interpretation on the reports submission of UV- VIS/ FTIR.

UNIT -V (LECTURE HOURS-12)

ISOTOPES
Introduction – (Definition, radioactive decay-negatron, positron, alpha emission, electron capture, gamma rays).
Radioactivity
(Units of radioactivity - Curie,Bequerel,specific activity).
Measurement of radioactivity methods
(Gas ionization - GM counter, proportion counter
Excitation - Scintillation counting)
Photographic method – (Autoradiography)
Clinical applications – (Tracer techniques, Diagnosis, Therapy).
Activity

- Collect related literatures on environmental disasters of radioactive isotopes and methods of disposal of radioactive waste .
- Prepare a chart to categorize the isotopes used for cancer studies.

Text Books :

T1-Analytical Techniques in Biochemistry and Molecular Biology - Authors: Katoch, Rajan, 2011.

T2- Principles and Techniques of Biochemistry and Molecular biology – Edition 7th - Keith Wilson and John Walker, 2016.

T3 - An introduction to Practical Biochemistry- Edition 3rd - David Plummer- 2017.

Reference Books:

R1 –Biophysical chemistry, Avinash Upadhyay and Kakoli Upadhyay,4thEdition 2019.

R2- Introduction to Principles and Techniques of Biochemistry and Molecular Biology , Wilson and Walker's - Edition 8th 2018

Course Title :**HUMAN CELL MOLECULAR BIOLOGY (T)**	Course Code : 13B
Semester :**I**	Course Group :**M- II**
Teaching Scheme in Hrs (L:T:P) : (**4:0:0)**	Credits : **4 Credits**
Map Code: -	Total Contact Hours: **60**
CIA: **25 Marks**	SEE # : **75 Marks**
Programme: **MSC-BIOCHEMISTRY**	**# -**

UNIT-I (Lecture Hours: 12)

No	**Course Outcome (Cos): After completion of this course, the students will be able to**	**PSOs**	**Cl.Ses**	**BLOOM'S - TAXONOMY LEVEL**
CO1	Illustrate and compute the structure and function of the cell organelles.	PS01	12	AP
CO2	Demonstrate and illustrate mechanisms of cell-cell interaction.	PS02	12	AP `
CO3	Categorize the concept of DNA replication process.	PS03	12	AN
CO4	Examine and compare prokaryotic and eukaryotic transcription mechanism.	PS04	12	AN
CO5	Validate the concept of translation,and post translation modifications.	PS03	12	E

STRUCTURE AND FUNCTION OF CELL

Cell –(Structure of a typical cell, Differences between prokaryotic and eukaryotic cells).
Cell Organelles – (Plasma membrane, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast)
Structure and organization of membrane – (structure of fluid mosaic model, membrane lipids, membrane proteins, and membrane fluidity)
Membrane Transport –(Diffusion (passive and facilitated).Symport, antiport and uniport systems.Active transport – Na^+, K^+ ATPase, Ca^{2+} ATPase, secondary active transport- group translocation of glucose, ions selective channels**)**
Internalization of macromolecules – (Endocytosis, pinocytosis, phagocytosis and exocytosis. Receptor mediated endocytosis)
Activity

1. Make a model on Prokaryotic and Eukaryotic cell
2. Demonstration of membrane transport

UNIT-II (Lecture Hours: 12)

Cell Division & Cell Signalling

Cytoskeleton- (Microtubules, Micro filaments and intermediary filaments - structure and functions.Cell junctions – types, cell adhesion molecules (cadherins and selectins) cell matrix adhesion (integrin's and Desmosome) ECM components – collagen and fibronectin).

Cell Division – (Phases of eukaryotic cell cycle, check points – cyclins, maturation promoting factor (MPF), Cyclin dependent kinases, growth factors, inhibition of cell cycle progression).
Cell Signaling –(Signaling mechanism, signal molecules, signal receptors, forms of inter cellular signaling. Cell surface receptors– G protein coupled receptors, Cyclic AMP, and Cyclic GMP)

Activity

1. Quiz on Cellsignalling by kahoot
2. Group Discussion on cell signaling

UNIT-III (Lecture Hours: 12)

ORGANIZATION OF GENETIC MATERIAL

Introduction – (Central Dogma, Structural organization of prokaryotic and eukaryotic chromosome)

GENOME REPLICATION

Introduction – (Definition and Types. Messelson and Stahl's semi-conservative replication model,Conservative model and dispersive model)
Enzymology of DNA replication – (DNA polymerases, Role of Topoisomerases, DNA ligases, helicases, SSB proteins primase and Telomerase).
REPLICATION IN E.coli- (Origin, initiation, replication fork movement, elongation and termination, uni directional and bidirectional replication)

RNA REPLICATION

Replication of RNA genomes – (RNA replicase and reverse transcriptase)

Activity

1. Animation on central dogma
2. Demonstration of Replication

UNIT-IV(Lecture Hours: 12)

TRANSCRIPTION IN PROKARYOTES

Transcription signals – (In prokaryotes and eukaryotes. RNA polymerases and transcription factors - Structure and function. Process of Transcription in Prokaryotes - Initiation, elongation and termination of transcription in E. coli. Reverse Transcription)

TRANSCRIPTION IN EUKARYOTES

(Classes of RNA - mRNA, rRNA, tRNA, snRNA, hnRNA. RNA Polymerases, Initiation, elongation and termination)

Posttranscriptional modifications.- (Alternative splicing & mRNA processing)

Activity

1. Debate on difference between Prokaryotic and Eukaryotic transcription
2. Preparation of Model of prokaryotic transcription

UNIT-V (Lecture Hours: 12)

Genetic Code – (Salient features, Deciphering the genetic code - Wobble hypothesis)

TRANSLATION IN PROKARYOTES

Process of Translation – (Initiation, chain elongation and termination of polypeptide synthesis in *E. coli*.)

TRANSLATION IN EUKARYOTES

Process of Translation – (Initiation, chain elongation and termination Differences - Binding of aminoacyl t -RNA, Peptide Bond Formation and Translocation)
Post-translational modifications – (Glycosylation of protein,Protein sorting and targeting)
Regulation of gene expression in prokaryotes- (operon concept (lac, tryptophan and arabinose), DNA repair and mutation).

Activity

1. Making a video on Genetic code
2. Making a PowerPoint slides on post translational modifications

REFERENCES

TEXTBOOKS

1. Lehninger Principles of Biochemistry: International Edition – 2017 by David L. Nelson and Michael Cox; Publisher: WH Freeman; 7th ed. 2017 edition
2. Advances in Cell Biology: Volume 2, 2013 by David M. Prescott
3. Cell and Molecular Biology – DeRobertis and Saunders, 8th edition (2017).
4. Molecular Biology | Edition:5 | Mc Graw Hill Higher Education, Moscow. | HEDRICK W PHILIP AND WEAVER F ROBERT,2012

REFERENCE BOOKS

1. Molecular Cell Biology– 2016 by Arnold Berk, Chris A. Kaiser, Harvey Lodish, Angelika Amon, HiddePloegh, Anthony Bretscher, Monty Krieger and Kelsey C. Martin; Publisher: WH Freeman; 8 edition.
2. Molecular Biology of the Cell – 2014 by Bruce Alberts, Alexander D. Johnson, Julian Lewis, David Morgan, Martin Raff, and Keith Roberts; Publisher: W. W. Norton & Company; 6 edition.
3. Molecular Biology of the Gene – 2017 by James D. Watson, A. Baker Tania, P. Bell Stephen, Gann Alexander, Levine Michael and Losick Richard; Publisher: Pearson Education; Seventh edition.
4. Biochemistry – 2015 by Jeremy M. Berg, LubertStryer, John L. Tymoczko and Gregory J. Gatto; Publisher: WH Freeman; 8th ed. edition.
5. Lewin's GENES XII – 2017 by Jocelyn E. Krebs, Elliott S. Goldstein and Stephen T. Kilpatrick; Publisher: Jones and Bartlett Publishers, Inc; 12th Revised edition edition.
6. The Cell: A Molecular Approach -2013 by Geoffrey M. Cooper, and Robert E. Hausman;

CourseTitle: **ENZYMES AND ENZYME TECHNOLOGY(T)**	CourseCode :13C
Semester:**I**	CourseGroup :**M- III**
TeachingSchemeinHrs (L:T:P): (**4:0:0)**	Credits **4**
MapCode: -	TotalContactHours: 60
CIA: **25Marks**	SEE# :**75Marks**
Programme:**MSC-BIOCHEMISTRY**	**#-Semester End Exam**

No	CourseOutcome(Cos): After completion of this course,the students will be able to	PSOs	Cl.Ses	BLOOM'S TAXONOMYLEVEL
CO1	Organize classification of enzymes, isolation and purification of enzymes.	PS01	12	AN
CO2	Categorize the structure of coenzymes and their role in various metabolic function.	PS02	12	AN
CO3	Distinguish the mechanism of enzyme kinetics and enzyme inhibition in enzyme catalytic reaction	PS02	12	AN
CO4	Conclude the mechanisms involved in covalent modification of Glycogen Phosphorylase and Glutamine synthetase	PS03	12	E
CO5	Construct the methods of immobilizations and its applications in pharmaceutical and food industry.	PS04	12	C

UNIT-I (Lecture Hours: 12)

ENZYME-INTRODUCTION, NOMENCLATURE AND 2CLASSIFICATION

Introduction–(Definition, properties and history of enzyme)

Nomenclature and classification-(International Union of Biochemistry(IUB)–6 Major Enzymes and subdivision of enzymes with examples).

Intracellular localization of enzymes–(Location of enzymes in cellular and sub cellular organelles)

ISOLATIONANDPURIFICATIONOFENZYMES

Methods of homogenization-(Mammalian tissue, Plant,Fungal and Bacterial material homogenization)

METHODSOFSEPARATIONANDPURIFICATIONOFENZYMES

Methods that depend on size or mass- (Gelfiltration Centrifugation.-Ultracentrifugation and Dialysis –Membrane centrifugation of enzymes).

Methods based on polarity- (Ionexchangechromatography,Electrophoresis and Isoelectric focusing).

UNIT OF ENZYME ACTIVITY:

Turn over number of an enzyme – (Definition and Reaction)

International Unit of enzyme:(Definition and Reaction) –**Katal-(**Definition and Reaction)

SPECIFICITYOFENZYME ACTIVITY

Typesofspecificity-.Absolute specificity,Stereo specificity,Group specificity or Relative specificity and Reactionspecificity with suitable examples.

Activity

1 .Animations illustrating on localization of enzymes in the cell

2 .Group discussion on the topic how"Enzymes Help Us Digest Food"

UNIT-II (Lecture Hours: 12)

COENZYME

Introduction- (Organic compounds-prosthetic groups-Integral part of activesite).

Nicotinamide coenzymes-($NAD^+$and $NADP^+$)

:**Flavin nucleotides**- (Structure and functions FMN and FAD+-

Coenzyme A- (Structure and functions CoA.SH-Structure and

functions)

Biotin-(Free biotin,Protein bound biotin.-Structure and functions)

Folate coenzymes–(THF-Structure and functions)

Lipoicacid – (Coenzyme in decarboxylation of pyruvate.- Structure and functions)

TPP-Thiamine Pyrophosphate- (Structure and

functions)

Pyridoxalphosphate- (Structure and functions)

ACTIVESITE:

Introduction-(Binding sites and catalytic sites.-Characteristic features of Active sites).

Mode of action – (Lock and Key model and Induced fit theory,)

Determination of active site residues-(Identification of substrate and inhibitors action in enzyme catalytic reaction)

Activity

1 Model presentation for Lock and Key and Inducedfit theory

2 Team work for making chart preparation for Coenzymes.

UNIT-III (Lecture Hours: 12)

ENZYMEKINE
TICS

Steady state theory – (Definition, Rate of formation of ES, Rate of dissociation and Graph, , Km - Michaelis constant.andVmax)

MichaelisMentenDerivation-(Derive the equation and significance of M.Mequation).

LBPlot,Eadie Hoftsee and Hanesplot-.(Graph and significance)

MECHANISMOFBISUBSTRATEREACTION:

Single displacement and Double displacement Reaction:

Random- order mechanism- (Ternary complex formation)

Ping-pong mechanism- (Non sequential mechanism)

FACTORS INFLUENCING OR AFFECTING ENZYME CATALYTIC REACTION-(Effect of pH, Temperature
,Enzyme Substrate and Time–Mechanism and Graph).

ALLOSTERIC INHIBITION AND FEEDBACK INHIBITION

Allosteric Inhibition – (Introduction and mechanism- Binding action of enzyme in Allosteric site –Allosteric activator and Allosteric inhibitors).

Feedback Inhibition(-Mechanism of action-CTP and L-Isoleucine act as a feedback inhibitor for feedback inhibition).

REVERSIBLE AND IRREVERSIBLE INHIBITION:

Reversible Inhibition:(Introduction and Types-

Competitive, Non-competitive and Uncompetitive

inhibition)

Competitive Inhibition –(Substrate analogue

mechanism Example- Malonate reaction in TCA

cycle.

Allopurinol reaction in Purine catabolism-Substrate analogue drug for Gout treatment–Reaction for inhibiting the synthesis of Uricacid).

Non competitive inhibition- (Mechanism with suitable examples- Metal ions – Lead, Mercury, Cyanide and Arsenic in Non-competitive inhibition.

Role of Non-competitive inhibitor-Cyanide in Respiratory chain reaction. (ETC))

Uncompetitive Inhibition– (Mechanism with suitable example)

Activity

1. Working model presentation on Ping-Pong mechanism.

2-Making poster presentation on reversible inhibitors in enzyme catalytic reaction.

UNIT-IV (Lecture Hours: 12)

COVALENT MODIFICATION OFENZYMES

Glycogen phosphorylase- (Phosphorylation and Dephosphorylation reaction in animal muscle cells).

Glutamine synthetase- (Covalent modification mechanism in *E.coli* bacteria).

ISOENZYMES- (Introduction and features of Isoenzymes)

Lactate Dehydrogenase- (Introduction,Types- LDH1-5and applications of LDH)

MULTI ENZYME COMPLEX

Pyruvate Dehydrogenase–(Introduction and mechanism of action of PDH–Steps involved in PDH reaction).

PROTEIOLYTICENZYME:

Chymotrypsin-(Mechanism of action of proteolytic enzyme- Cleavage to specific aminoacid residues).

Carboxypeptidases- (Mechanism of action of cleavage of carboxy terminal endof protein compounds.Action of Zn in carboxypeptidase).

Lysozyme- (Mechanism of action-Digestion process of bacterial cellwall).

Ribozyme- (Non protein enzyme– Mechanism)

Abzyme- Catalyticantibody–(Mechanism of action in immune system)

Activity

1-Quiz-Kahoot on the topic for Proteolytic enzymes.

2. Making clay model presentation for covalent modification of enzymes

UNIT- V (Lecture Hours: 12)

ENZYME
IMMOBILIZATION
Methods of immobilization:Types:
–(Adsorption,Crosslinking,CovalentBonding,Entrapment and Encapsulation)
Advantage sand application of immobilized enzymes–(Food industry and pharmaceutical aspects).

INDUSTRIALUSESOFENZYMES
Textile and Food industries-(Baking of bread,brewing industries.Washing powders,immobilized glutamate dehydrogenase linked to alcoholdehydrogenase).
ROLEOF ENZYME IN DIAGNOSIS AND TREATMENT
Serum Marker enzyme– (ALT,AST,LDH,CPK,ACP)
ALP,Cancer markerenzymes-
(Prostatic acid phosphatase(PAP),
Alkaline phosphatase
And Neuron-specific enolase)
Covid-19 Viral disease-
(Angiotensin Converting Enzyme-2 receptor action-ACE-2)
(Therapeutic enzymes-Asparaginase,Collagenase,Streptokinase,Urokinase,Penicillinase etc.)
ANTIOXIDANTENZYMES: Roleinfreeradicalscavengingactivity.
-SOD,Catalase,and Glutathione peroxidase

ROLEOF ENZYME IN GENETIC ENGINNEERING ASPECTS:
Enzymes in rDNA technology-Future prospects-(Restriction endonucleases,Polymerase,Ligase,Helicase,Topoisomerase for Genetic Engineering aspects).

Activity
1 –Debate on different methods of enzyme immobilization
2 –Making a PPT presentation on industrial application of enzymes.

Text Books:
T1 - Fundamentals of Enzymology | Edition:2 | Oxford Science Publications, Newyork. | Nicholas c. price, Lewisstevens2010
T2-Enzymes- Biochemistry, Biotechnology, Clinicalchemistry.|Edition:3|EastwestPressPvtLtd,NewDelhi.|TREVOR PALMER.and PHILIPBONNER (2014)

Reference Books:

R1–Lehninger Principles of Biochemistry,David.L.Nelson,MichaelM.Cox.Eight edition,2021.

R2-Harper'sIllustrated Biochemistry,Victor Rodwell,David Bender,Kathleen Bothamand Peter Kennelly,Thirt y FirstEdition -May-2018.

R2-Enzyme Chemistry: Impact and Applications,3rdEdition by ColinJSucklingand Gibson Colin.L-2010

Course Title HUMAN PHYSIOLOGY,HORMONES AND SIGNALTRANSDUCTION	Course Code : 13D
Semester :**I**	Course Group : **M- IV**
Teaching Scheme in Hrs (L:T:P) : (4**:0:0)**	Credits: **4**
Map Code: -	Total Contact Hours: 60
CIA: **25 Marks**	SEE # : **75 Marks**
Programme: **MSC- BIOCHEMISTRY**	**# - Semester End**

No	**Course Outcome (Cos): After completion of this course, the students will be able to**	**PSOs**	**Cl. Ses**	**BLOOM'S TAXONOMY LEVEL**
CO1	Illustrate structure and functions of digestive system and blood compositions.	PS01	12	AP
CO2	Distinguish structure and functions of respiratory, circulatory and excretory system	PS02	12	AN
CO3	Demonstrate the mechanism of nerve impulse conduction and neurotransmitters	PS02	12	AP
CO4	Apply the mechanism, function ofanterior and posterior pituitary hormones	PS03	12	AP
CO5	Examine physical understanding of hormonal signal recognition	PS03	12	AN

HUMAN PHYSIOLOGY,HORMONES AND SIGNALTRANSDUCTION

UNIT-I (LECTURE HOURS: 12)

DIGESTIVE SYSTEM AND BLOOD SYSTEM:

Human physiology- (Homeostasis - Mechanism of homeostasis) –(Maintenance of equilibrium of ions and other body fluids) **Digestive System**- (Introduction and physiological process) Secretion of digestive juices – Mechanism of secretion of pepsinogen and HCl.(Mechanism and action) **Digestion and absorption of Carbohydrates**, Proteins and Fats. (Process ofdigestion and absorption in carbohydrates, proteins and fats). **Gastro- Intestinal hormones**. – (Introduction, Receptor mechanism of GI hormones)- Action of Cholecystokinin, Disease- Gastric ulcer and Gastritis – (Introduction, etiology. mechanism and treatment) .

Blood- Composition and function- (Introduction and types of blood) - RBC- Hemoglobin- (Introduction and structure) **Disease state**- Polycythemia, Anemia (Definition, symptoms and treatment) Leucocytes- WBC -Disease state - Leukemia, leucopenia, (Definition,symptoms and treatment) **Platelets- (**Introduction, properties Adhesion, aggregation and agglutination)**Blood coagulation** – (Introduction and Mechanism – stages and Factors involved in blood coagulation) **Disease state** –(Hemophilia- Introduction, etiology andsymptoms)

Activity

1.Plasma and serum - Blood - Separation of plasma & serum.

2.Microscopic observation- WBC, RBC, Platelets.

UNIT-II (LECTURE HOURS: 9)

RESPIRATORY,CIRCULATORY AND EXCRETORY SYSTEM

Respiratory system: Introduction – (Inspiration and Expiration) Transport and exchange of respiratory gases - Transport of gases -Mechaniam (Transport of oxygen and carbondioxide) and exchange of gases between lungs and blood , between blood and tissue (Partial pressure and Diffusion method).

Buffer system - Action of oxyhemoglobin (Buffer system Bicarbonate buffer)

Circulatory System –
(Introduction, Heart as a pump-(Systolic and diastolic actions) Blood pressure.- Normal value –(Systolic and Diastolic pressure)
ExcretorySystem – (Kidney - Structure of nephron, composition)
Urine formation – (Mechanism of urine formation, Glomerular filteration, Tubular reabsorption and Tubular secretion).
Micturition- (Introduction and Mechanism)
Activity
1.Heart and Kidney - Display the Heart Model.
2. Structure of Nephron - chart preparation.

UNIT-III (LECTURE HOURS: 12)

NERVOUS SYSTEM AND NERVE CELL SIGNALING
Nervous system: (Nerve Cell – Introduction -Neuron – Structure and properties of neuron) **Signal transduction** – (Introduction and Mechanism, Definition, signals, ligands and receptors) **Nerve impulse transmission-** (Introduction and mechanism) (Nerve cells - Synapses, Resting membrane potential, action potential, voltage gated ion-channels, impulse transmission**)**. **Neurotransmitters** – (Introduction, properties and types). **Criteria and mode of action of NT Acetyl Choline, Serotonin and Catacholamine** – (Introduction and mechanism of action). **Role of G-proteins in vision** – (Introduction and mechanism,G-protein visual cycle).
Activity
1.Neurotransmitters - Animation on the Nerve transmission - Mechanism.
2.Chart preparation on Neurotransmitters.
UNIT-IV (LECTURE HOURS: 12)
HORMONES -ANTERIOR AND POSTERIOR LOBE OF PITUTORY HORMONES
Introduction, classification of hormones – (Hormones - Introduction ,Chemical messengers and Classification). **Hormones of the hypothalamus and pituitary** - (chemical nature, Anterior and Posterior lobe of Pitutory Hormone - secretion, release and their biological functions.) **Mechanism of Hormone Action** – (Hormone Receptors, Signal Transduction. Mechanism of Hormone Action - **Steroid hormones and glyco protein hormones** – (General principles concerning nature and mechanism of action of steroid hormones and glyco protein hormones)
Activity
1.Hormones - Chart Preparation - on Hormonal regulation of body mass, eating and drinking.
2.Group discussion onHormones, biological clocks and daily and seasonal rhythms.
UNIT-V (LECTURE HOURS: 12)

RECEPTOR ACTION- NUCLEAR RECEPTOR , STERIOD RECEPTOR , RAS RECEPTOR AND TYROSINE RECEPTOR
Signaling by nuclear receptors: (Ligands, nuclear and orphan receptors – (Structure andfunctions).**Steroid hormone receptor** – (Mechanism of action, Signaling pathway of the steroid hormone receptor). **Signal Transduction** –(Signal Transduction by G proteins, Ras and Receptor Tyrosine Kinases. (Introduction and mechanism). **Disease** – (Signal Transduction in Human Disease- -Introduction, aetiology and mechanism).
Activity
1.Receptor - Animation on Receptor mechanism
2.Model on Receptor ligand binding - signaling action.
Text Books :
T1 Medical Physiology | Edition:5 | JP | Dr.SembulingamL AND SembulingamPrema(2012)
T2 Medical Physiology | Edition:11 | Arun printers | ChatterjeeCC(2003)

Reference Books :
R1 Endocrinology | Edition:1 | MJP | Prakash S. Lohar(2005)
R2 Molecular cell biology | Edition:6 | W.H.freeman | LodishHarvey(2007)

Course Title	: **LAB IN QUANTITATIVE ANALYSIS OF BIOLOGICAL COMPOUNDS**	Course Code	: 23P
Semester	: **I & II**	Course Group	: MP-**I**
Teaching Scheme in Hrs (L:T:P) : (**0:0:5)**		Credits	: **4 Credits**
Map Code	: -	Total Contact Hours	: **150**
CIA	:**25 Marks**	SEE	: **75 Marks**
Programme: M.Sc-**BIOCHEMISTRY**			

List of Experiments:

UNIT I
QUANTITAIVE ANALYSIS

Isolation and Estimation of Starch - Anthrone method

Isolation and Estimation of Glycogen - Colorimetry method

Estimation of Protein - Lowry's method

Estimation of Phenol - Colorimetry method

Estimation of Calcium - Titrimetry method

Estimation of Chloride - Titrimetry method

Estimation of Vitamin - C - Colorimetry method

Estimation of Phosphorous - Fiske - Subbarow method

Estimation of Total Protein, Albumin: Globulin ratio

Estimation of phenol by colorimetry method

Estimation of chloride by titrimetry method

Extractions of lipids from egg

Estimation of Apolipoprotein

Estimation of Thiamine / Riboflavin from cereals by fiuorimetry methods

DETERMINATION OF LIPID PROFILE

Determination of Total Cholesterol

Determination of Phospholipids

Determination of Triglycerides

Determination of HDL Cholesterol

Determination of LDL Cholesterol

SEPERATION TECHNIQUES
CHROMATOGRAPHIC ANALYSIS

Paper chromatography (ascending)

Thin layer chromatography

column chromatography

ELECTROPHORESIS

Agarose gel electrophoresis

SDS gel electrophoresis

UNIT V

Seperation of Sub Cellular organells by differential centrifugation and Density Gradient centrifugation

Isolation & Estimation of DNA

Isolation & Estimation of RNA

Text Books :

Biochemical Methods | Edition:2 | New Age International Publishers | S. Sadasivam A. Manickam(2005)

Reference Books :

Principles and Techniques of Practical Biochemistry | Edition:5 | Cambridge University Press | KeithWilsonJohn M. Walke(2001)

Course Title: **LAB IN ENZYMOLOGY, PLANT BIOCHEMISTRYAND PLANT TISSUE CULTURE**	Course Code : 23Q
Semester : **I& II**	CourseGroup :MP-**II**
Teaching Scheme in Hrs(L:T:P) : **0:0:5**	Credits :**4 Credits**
Map Code : **-**	TotalContactHours:**150**
CIA : **25Marks**	SEE :**75 Marks**
Programme:M.Sc - **BIOCHEMISTRY**	

DETERMINATIONOFACIDPHOSPHATASEACTIVITY

Effect of pH on Acid Phosphatase activity

Effect of Temperature on Acid Phosphatase activity

Effect of Substrate concentration on Acid Phosphatase activity

ENZYMATICASSAYSINLIVERANDSERUM

Assay of SGPT in Serum

Assay of SGPT in Liver

Assay of SGOT in Serum

Assay of SGOT in Liver–

Determination of Serum Acid Phosphatase activity

Determination of Serum Alkaline Phosphatase activity

Determination of Catalase from plant source – Effect of pH & Temperature

DETERMINATION OF WATER CONTENT IN DIFFERENT PARTS OF PLANTS

a. WholeLeafMethod

b. LeafDiscMethod

SEPARATIONOFCHLOROPHYLLPIGMENTS

a) Separation by Paper chromatography

b) Separation by Thin Layer chromatography

TISSUE CULTURE TECHNIQUES – PLANT TISSUE CULTURE

a. Callus culture for different plants - Bacopa monnieri – Neer Brahmi plant
b. Micropropagation – Protoplast fusion techniques in plants

TextBooks:

BiochemicalMethods|Edition:1|NewAgeInternational|S. SadasivamA. Manickam(1996)

ReferenceBooks:

PrinciplesandTechniquesof PracticalBiochemistry|Edition:5|CambridgeUniversity Press|KeithWilsonJohnM.Walker(2001)

Course Title : **LAB IN COMPUTATIONAL AND MOLECULAR MODELLING**	Course Code : 13P
Semester : **I**	Course Group : MP - III
Teaching Scheme in Hrs (L:T:P) : **0:0:5**	Credits : **4 Credits**
Map Code : -	Total Contact Hours : 60
CIA :**25Marks**	SEE : **75 Marks**
Programme: **MSC-BIOCHEMISTRY**	

1.Understanding PubMed database

2. Analysis of protein sequence from protein database.

3. Analysis of gene sequence from nucleotide database.

4. Getting and analysis of primary protein structure.

5. Secondary structure analysis of protein.

6. Tertiary protein structure analysis using Rasmol.

7. Introduction of various bibliographic databases.

8. Getting the gene sequences by exploring and querying the nucleic acid databases.

9. Identification of Drug Target using pathways- KEGG.

10. Introduction of National Center for Biotechnology Information (NCBI).

11. Introduction of biological search engine- Entrez

12. Introduction to literature database at NCBI and querying the PUBMED central database
using the ENTREZ search engine

13. BLAST and Clustal W- NCBI blast via the NCBI web server

14. A brief visit to Ensembl

15. Construction of phylogenetic trees

16. Sequence and Structural Database

17. Gene Prediction using GenMark and GenScan

18. Molecular Docking

19. Molecular binding - Crisper

Course Title :Metabolic Regulation	Course Code : 23A
Semester :**II**	Course Group : M- V
Teaching Scheme in Hrs (L:T:P) : **4:0:0**	Credits : **4 Credits**
Map Code: -	Total Contact Hours: 60
CIA: **25 Marks**	SEE # :**75 Marks**
Programme: **MSC-BIOCHEMISTRY**	**# - Semester**

No	Course Outcome (Cos)	PSOs	Cl.Ses	BLOOM'S TAXONOMY LEVEL
CO1	Explain the metabolic pathway of carbohydrates and its regulations.	PS01	12	AP
CO2	Illustrate lipid metabolic pathway and its regulations.	PS01	12	AP
CO3	Conclude the metabolic pathway of amino acids and Illustrate the catabolic pathway of protein metabolisms such as urea cycle and its regulations	PS03	12	AN
CO4	Demonstrate the Porphyrin metabolism and understand the mechanism of absorption, metabolism and significance of essential minerals and trace elements in our body	PS02	12	U
CO5	Apply the metabolism of Purine and Pyrimidine biosynthesis by Denovo and Salvage pathway	PS03	12	AP

UNIT - I (LECTURE HOURS: 12)

Carbohydrate metabolism

Glycolysis –(Introduction, Pathway and reactions).

Regulation of glycolysis – (Hexokinase, Phosphofructokinase and pyruvate kinase as regulatory enzymes in glycolysis hormone regulation)

TCA cycle – (Steps: Regulation at branch points, pyruvate dehydrogenase complex, citrate synthase and alpha - ketoglutarate dehydrogenase).

Gluconeogenesis – (Regulation by allosteric and substrate level control mechanisms)

Glycogen metabolism – (Regulation of glycogen phosphorylase, glycogen synthase by effectors, covalent modification and hormones).

HMP shunt –(Steps and regulation)

Activity :

Compare the Carbohydrate Metabolic Pathways by Model presentation

UNIT-II (LECTURE HOURS: 12)
LIPID METABOLISM
Lipid metabolism
Fattyacid biosynthesis – (Lipogenesis pathway and reactions)
Fatty acid degradation- - (Beta oxidation
Regulation of saturated fatty acid synthesis: - Acetyl COA carboxylase and Fatty acid synthetase complex. Role of hormones, effect of diet on fatty acid synthesis)
Ketone bodies – (Formation and utilization)
Biosynthesis – (Triacylglycerols, Cholesterol and Phospholipids)
Biosynthesis of Prostaglandins – (Eicosanoids, Thromboxanes, and Leukotrienes).

Actvity
Compare the Lipid Metabolic pathways
Group discussion about Inborn errors of metabolism

UNIT - III (LECTURE HOURS: 12)
OVERVIEW OF AMINO ACID METABOLISM

Overview of Amino acid metabolism-(Transamination, Deamination, Oxidative deamination)
Urea cycle – (Pathway, reactions & regulation).
Metabolism of Individual Aminoacids – (Glycine ,Phenylalanine, Tyrosine and Methionine)
An overview of integrated metabolic pathways –(Major metabolic pathways & control sites. Food intake and starvation induced metabolic change)
Interrelations between Carbohydrate, Protein and Lipid Metabolism

Activity
Amino acids – Preparation of chart of conversion of amino acids to its end product Group discussion about Inborn errors of metabolism

UNIT - IV (LECTURE HOURS: 12)
PORPHYRIN METABOLISM AND MINERAL METABOLISM

Porphyrin metabolism- (Hemoglobin - Biosynthesis, degradation & regulation)
Mineral metabolism
Calcium – (Sources, absorption, metabolism, biological roles and clinical significance),
Phosphate – (Sources, absorption, metabolism, biological roles and clinical significance)
Iron – (Sources, absorption, metabolism, biological roles and clinical significance)
Trace elements
Copper – (Sources, absorption, metabolism, storage and transport)
Fluoride – (Sources, absorption, metabolism, storage and transport)

Activity
Minerals in diet - Preparing a chart model to illustrate the importance of the minerals metabolism

UNIT - V (LECTURE HOURS: 12)
NUCLEIC ACID METABOLISM

Nucleic acid metabolism
Purine biosynthesis – (De novo and salvage pathways. Degradation).
Pyrimidine biosynthesis –(De novo and salvage pathways. Degradation)
Regulation of purine biosynthesis – (PRPP aminotransferases)
Regulation of pyrimidine biosynthesis – (Aspartate carbamoyl transferase)
Activity
Nucleic acid metabolism – (Compare the Salvage and Denovo Pathways of Purine and Pyrimidine metabolism)

Text Books :
T1 - ROBERT .K MURRAY ,**Harpers illustrated Biochemistry** ,2003 , Edition:26 ,McGraw Hill publication .
T2 – DAVID L NELSON MICHAEL M COX ,**Principles of Biochemistry** ,2021, Edition 8,,W. H. Freeman.

T3 - LUBERT STRYER , JEREMY M BERG, **Biochemistry** | 2003, Edition:5 | W.H.Freeman&company,New York.

T4 – U. SATYANARAYANA and U. CHAKRAPANI , **Biochemistry** –2017, Edition -5, Elsevier RELX India Pvt Ltd .

Reference Books :

R1- DONALD VOET G.JUDITH VOET , Biochemistry ,2021,Edition 4, Wiley Publishers .
R2- PAMELA C. CHAMPE, RICHARD A. HARVEY , **Lippincott's Illustrated Review of Biochemistry,**2009 ,Edition 3 , J.B.Lippincott's Publication.

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Course Title : **ADVANCED CLINICAL BIOCHEMISTRY**	Course Code : 23B
Semester : **II**	Course Group : **M- VI**
Teaching Scheme in Hrs (L:T:P) : **4:0:0**	Credits : **4 Credits**
Map Code: C(THEORY – APPLICATION)	Total Contact Hours: **60**
CIA: **25 Marks**	SEE # : **75**
Programme: **MSC-BC**	**# - Semester**

No.	Course Outcome	PSOs	Cl. Ses	CL
CO1	Outline the difference between plasma, Serum and the normal and abnormal constituents in various body fluids.	PSO 1	12	U
CO2	Demonstrate the types, clinical pathology and diagnosis of disorders of carbohydrate metabolism	PSO 2	12	AP
CO3	Analyze the etiology, types, clinical manifestations, diagnosis and treatment of various amino acid and the nucleic acid metabolism disorders.	PSO 2	12	AN
CO4	Compare the clinical manifestations of lipids including triglycerides, cholesterol and phospholipids in diseases.	PSO 1	12	AP
CO5	Examine the diseases result from imbalance in certain enzymes and helps in diagnosis of liver, gastrointestinal, kidney diseases.	PSO 3	12	AN

UNIT - I (LECTURE HOUR 12)
LABORATORY ANALYTICAL PERFORMANCE

Laboratory Analytical Performance

Introduction - (Automation in clinical biochemistry laboratory and factors in quality control)
Specimen collection and processing- (Blood collection methods, anticoagulants, Collection of urine - urine preservatives, Timed urine specimens)
Tests and Clinical significance of urinary compounds –(with reference to sugars, proteins, ketone bodies, bilirubin and porphyrins)
Stool – (chemical examination and clinical significance).
CSF – (collection and composition, chemical examination and clinical significance)

Amniotic fluid: (Origin, collection, composition and analysis of amniotic fluid)

Activity

Make a chart on methods of collecting blood and urine samples
Group discussion on Laboratory Analytical and Specimen collection

UNIT - II (LECTURE HOUR 12)

DISORDERS OF CARBOHYDRATE METABOLISM

Carbohydrates- (Introduction)
Disorders of carbohydrate metabolism – (Introduction)
Diabetes Mellitus(DM) – (type I, II and gestational DM. metabolic abnormalities, diagnosis and management, acute and long term complications of long term DM. Glycogen storage diseases (Type I to X) and Mucopolysaccharidoses).
Hyperglycemia, Hypoglycemia, Glucose Tolerance Test (GTT), **Glycosuria**

Activity

Make a flow chart on most common errors of carbohydrate metabolism
Quiz on patho physiology of Diabetes Mellitus

UNIT –III (LECTURE HOUR 12)
DISORDERS OF AMINO ACID AND NUCLEIC ACID METABOLISM

Aminoacid- (Introduction)
Disorders of amino acid and Nucleic acid metabolism- Introduction
(Inborn errors metabolism: Alkaptonuria, Phenyl ketonuria, Maple syrup urine disease, and albinism)
Disorders of Nucleic acid metabolism: (Purine and Pyrimidine metabolism – Hyper uricemia, Hypouricemia, Gout, Lesch Nyhan syndrome and hereditary Ortotic aciduria)

Activity

Display the images of inborn errors of Amino acid metabolism
Prepare a models on Disorders of Nucleic acid metabolism

UNIT – IV
DISORDERS OF LIPID METABOLISM
Lipids – (Introduction)
Lipoproteins and their functions – (lipid profile, clinical disorder of lipid metabolism)
Disorders of lipid metabolism-
(Clinical disorder of lipid metabolism – Hyperlipidemias, Hypolipidemias)

Lipid storage diseases – (Taysach's and Niemann picks diseases, fatty liver, Hypercholestrolemia, Hypocholesterolemia and lipoproteinemias)
Atherosclerosis – (clinical features and complications)
Xanthoma – (clinical features and complications)

Activity
Quiz on different lipid storage diseases
Group discussion on 4 major classes of lipoproteins and what are their functions

UNIT-V
FUNCTIONAL TESTS OF LIVER, KIDNEY AND GASTRO INTESTINE

Functional tests of liver, kidney and Gastro intestine- (Introduction)
Liver diseases – (Jaundice, hepatitis, gall stones, cirrhosis and fatty liver).
Liver function test: (Biochemical diagnosis of diseases by enzymatic assays-AST, ALT, ALP and GGT. Serum Bilirubin test: Van den berg reaction, Prothrombin time)
Renal function test: (clearance tests, tests for renal blood flow, concentration and dilution tests. Acute and chronic renal failure, glomerulonephritis, nephrotic syndrome, urinary calculi and dialysis)
Gastro intestinal function test: (fractional gastric analysis, stimulation tests. Diagnosis of Achlorhydria, Hypochlorhydria, Hyperchlorhydira and achylia gastric)
Activity
Collect the goat liver samples and perform the Liver function test
Chart work on Gastro intestinal function test

Text Books
1. M.N. Chatterjee & Ranashinde, Text Book of Medical Biochemistry. Jaypee Publisher. 6th edition, 2006.
2. Nanda Maheshwari, Clinical Biochemistry. JPB. First edition, 2008.
3. Nessar Ahmed, Clinical Biochemistry, . Oxford University Press. 1st Edition, 2011.

Reference Books
1. Carl A. Burtis, Edward R. Ashwood and David E. Bruns (eds), Tietz Textbook of Clinical Chemistry and Molecular Diagnosis. 5th edition, 2012.
2. Thomas M. Devlin, Biochemistry with clinical correlation. John Wiley & Sons. 7th Edition, 2010.
3. Allan Gaw, Michael J. Murphy, Rajeev Srivastava, Robert A. Cowan, Denis St. J. O'Reilly, Clinical Biochemistry. 5th edition, 2013.
4. Graham Basten, Introduction to Clinical Biochemistry, Interpreting Blood Results. BookBoon. 2 nd edition, 2011.
5. Lawrence A. Kaplan, Amadeo J. Pesce, Clinical Chemistry: Theory, Analysis, Correlation .Mosby. 5 edition, 2009.

Course Title : Plant Biochemistry And Phytotherapeutics	Course Code : 23C
Semester :II	Course Group : M - VII
Teaching Scheme in Hrs (L:T:P) : 4:0:0	Credits : 4
Map Code: C(THEORY – CONCEPT)	Total Contact Hours: 60
CIA: 25 Marks	SEE # : 75 Marks
Programme: MSC-BC	# -Semester End Exam

No	Course Outcome (Cos): After completion of this course, the students will be able to	PSOs	Cl.Ses	BLOOM'S TAXONOMY LEVEL
CO1	Summarize an insight into the various transport mechanism in plants.	PSO 1	12	U
CO2	Relate students with skills and techniques related to plant diseases	PSO 1	12	U
CO3	Make use of basic knowledge about growth hormones and its regulation	PSO 2	12	AP
CO4	Tell the mechanism of various CAM pathways and metabolic processes in plants	PSO 3	12	U
CO5	Model the concept of natural medicine for various diseases.	PSO 3	12	AP

UNIT I - (LECTURE HOUR 12)

PLANT CELL

Structure. (Composition and functions of plant cell organelles),

cell wall and cell membranes. (Biosynthesis of cell wall. Plant cell and tissue culture.

Transport

mechanisms: (water movement, ascent of sap) **mechanisms for movement of solutes**- (Translocation in xylem and phloem)

Activity

Prepare a chart on plant cell organelles

Animation work on xylem and phloem

UNIT II - (LECTURE HOUR 12)

PHOTOSYNTHESIS

Structure and composition (of photosynthetic apparatus - light and dark reactions- Cyclic and Non Cyclic)

Photophosphorylation; (Carbon dioxide fixation - C3, C4and CAM pathways).

Biosynthesis of sucrose and starch, (Factors affecting the rate of photosynthesis).

Photorespiration- (Photosynthesis and plant productivity),

Carbon cycle, **Nitrogen cycle**, (interrelationship between carbon and nitrogen metabolism),

ATP synthesis (in chloroplast)

Activity

Quiz on Biosynthesis of sucrose and starch

Chart work on Carbon and Nitrogen cycle

UNIT III - (LECTURE HOUR 12)

GROWTH REGULATORS

Auxins, Gibberellins, cytokinins, ABA- (Ethylene Metabolism, function and mechanism of action).

Plant growth inhibitiors, (Plant Stress, Plant responses to abiotic and biotic stresse)s

Phytochemistry: (Plant chemicals and their significance storage carbohydrates, proteins and fats).

Secondary plant products (and their economic importance – waxes; essential oils, phenolic glycosides, flavoens, anthocyanins and alkaloids).

Activity

Give a structure of Auxins, Gibberellins, cytokinins

Assignment on Secondary plant products and their economic importance

UNIT IV - (LECTURE HOUR 12)

BIOCHEMISTRY OF PLANT DISEASES

Plant pathogenesis- (initial stages of pathogenesis, mechanisms of pathogenesis – Mechanism of attack).

Responses of plants to pathogens – (pathological effects of respiration, photosynthesis, cell wall enzymes and water uptake).

Disease-(resistance mechanisms; phytoalexins).

Biochemistry of pathogen specificity. (Photomorphogenesis: Photoperiodism – phytochrome, its function in physiology)

Biochemistry of plant growth and development. (Physiology of flowering. Physiology and biochemistry of fruit ripening).

Physiology and biochemistry of senescence.,

Biochemistry of seed germination

Activity

Chart work on Photomorphogenesis

Model work on Biochemistry of seed germination**.**

UNIT V

PHYTOMEDICINE

Natural source of Drugs- (Crude drugs, Classification of Crude drugs, Collection)

Processing of Crude drugs- system of medicine- Siddha, ayurvedha, unani and homeopathy).

Phytoconstituents of therapeutic value, (General methods of phytochemicals and biological screening**),**

Natural sources,-(Extraction, isolation and purification of Primary and Secondary metabolites).

Study of some herbal formulation techniques (as drug cosmetics).

Role of herbal medicine (for antidiabetic, Hepato protectetive and anticancer activity).

Activity

Assignment on Role of herbal medicine for antidiabetic, hepatoprotectetive and anticancer activity

Quiz on herbal formulation techniques as drug cosmetics

References:

1. A Textbook of Fundamentals Of Plant Biochemistry And Biotechnology As Per Icar New Syllabus (Paperback, Bishun D. Prasad, Sangita Sahni,

2. Plant Fundamentals of Plant Physiology by V.K. Jain - 2013

3. Plant Biochemistry and Molecular Biology SK Verma | Mohit Verma · 2008

Semester :**II**	Course Group :M- **VIII**
Teaching Scheme in Hrs (L:T:P) : **4:0:0**	Credits : **4 Credits**
Map Code: C(THEORY – APPLICATION)	Total Contact Hours: 60
CIA: **25 Marks**	SEE # :**75 Marks**
Programme: **MSC-BC**	**# - Semester End Exam**

No	Course Outcome (Cos): After completion of this course, the students will be able to	PSOs	Cl.Ses	BLOOM'S TAXONOMY LEVEL
CO1	Demonstrate the key features of the origin the basics, properties and types with their derivatives of stem cells	PS01	12	U
CO2	Explain the types of stem cells and analyses stem cell in aging	PS01	12	U
CO3	List the future challenges associated with stem cell applications.	PS01	12	AN
CO4	Illustrating the interruption of carcinogens and mutagens in the normal cell cycle.	PS01	12	U
CO5	Explain the types of cancer and its treatment through stem cell therapy	PS01	12	AN

UNIT-1 (LECTURE HOURS: 12)

STEM CELLS

Introduction – (Definition, Undifferentiated biological cells, Inner cell mass)

History of stem cells – (Potential in the field of medicine, ethics)

Concept of stem cells –(Symmetric stem cell division, asymmetric stem cell division and progenitor division)

(Properties - Unipotent, oligopotent, totipotent, pluripotent)

Adult stem cells &haematopoietic stem cells

Adult stem cells – (Generation and culturing)

Haematopoietic stem cells – (Generation and culturing

Isolation - Production and Culture of stem cells , Preparing medium, Monolayer culture)

(Advantage and disadvantage of stem cell - Attributes, Limitations and Oppostion)

ACTIVITY

- Making clay models of different stem cells -
- Exhibiting cartoon way of representing a stem cell -

UNIT-2 (LECTURE HOURS: 12)
TYPES OF STEM CELLS- PRIMAL, EMBRYONIC AND ADULT STEM CELLS
(Primal cells - Introduction, Types of stem cells, Cord blood
Embryonic stem cells - Embryo, Inner cells mass, Invirto fertilization
Adult stem cells - Pluripotent, Haemotopoietc stem cells)
Neural and derived stem cells
(Neural stem cell - Introduction, multipotent cells
Derived stem cells - Ectoderm derived stem cell and Endoderm derived stem, Development
Neurodegenerative diseases - Introduction Implications and causes)
Stem cell in aging
(Aging - Introduction, Aging, Decline in stem cell function)
ACTIVITY
- To download animations illustrating working of neural cells -
- To label images on a worksheet in differentiating Stem Cells for Research -

UNIT-3 (LECTURE HOURS: 12)
STEM CELL THERAPIES
(Skin replacement - Introduction, Skin replacement, Grafting, Complications and therapy using stem cells)
Brain cell Transplantation – (Repairing damaged cells of CNS, Brain injury and therapy)
Diabetes – (Types, Replacement of Pancreatic cells and therapy)
Heart failure – (Heart attacks and potential stem cell-based therapies)
Future challenges and ethical issues
(Issues related to stem cells - Ethical and legal issues, Challenges in stem cell usage)

ACTIVITY
- Debate on the merits and demerits of stem cell therapies and its ethical issues -
- Article collection of recent stem cell research from journals -

UNIT-4 (LECTURE HOURS: 12)
CELL CYCLE AND CANCER

(Introduction of cell phases - Mitotic phase, Interphase, Centromere, Chromatids

Cell cycle -G 1 phase, M phase, G2 phase).
Cancer – (Tumor, Metastasis, Neoplasmas)
Apoptosis –(Introduction, Engulfment, Necrosis, Dendrites)
(Cancer symptoms - Early symptoms, APC, tumor suppressor cells)
Leukemia
(Introduction - Definition, Reciprocal translocation
History and causes - Genetics, origin of cancer)
Cancer cells
(Cancer stem cells - Introduction and its nature)
ACTIVITY

- Debate on life after cancer -
- To download animations illustrating Apoptosis -

UNIT-5 (LECTURE HOURS: 12)
CAUSES AND TYPES OF CANCER

(Causes of cancer - Physical and Biological factors, Carcinogen, Radiation exposure, Tumour promoters)
(Types of cancer - Tumour, Benign tumour, malignant tumour, Metastasis)
Properties of cancer cells
(Properties - Transformation of normal cells, Apoptosis failure)
Treatment and therapies of cancer
(Types - Biological therapy, Radiation therapy, Targeted cancer therapy , Immunotherapy)
ACTIVITY

- To make a Group discussion on causes, control measures of Cancer cells.
- Prepare a chart differentiating normal and a cancer cell

Text Books :
Mary Clarke and Jonathan Frampton, **Stem Cells Biology and Application;**2020, 1st Edition; Garland Science

Mehmet R. Topcul, Idil Cetin, **Stem Cells in Cell Therapy and Regenerative Medicine,** 2018, 2nd Edition;Published by OMICS International

Reference Books :
Robert Lanza, Anthony Atala; **Essentials of Stem Cell Biology;** 2014, Third Edition, Academic Press

Pezzella, **Oxford Textbook Of Cancer Biology,** 2020; Oxford UP

Paperback, Ruddon Raymond W. **Cancer Biology,** 2007, Oxford University Press Inc

Course Title : RECOMBINANT DNA TECHNOLOGY	Course Code : 23E
Semester :II	Course Group : EL- I
Teaching Scheme in Hrs (L:T:P) : 4:0:0	Credits : 4
Map Code: C(THEORY – CONCEPT)	Total Contact Hours: 60
CIA: 25 Marks	SEE # : 75 Marks
Programme: MSC-BC	# - Semester End Exam

No	Course Outcome (Cos): After completion of this course, the students will be able to	PSOs	Cl.Ses	BLOOM'S TAXONOMY LEVEL
CO1	Summarize the basic techniques involved in recombinant DNA manipulations including DNA restriction, ligation, transformation and selection of recombinant plasmid.	PSO 1	12	U
CO2	List the functions of several vectors used in cloning and Devise their own cloning strategies for DNA	PSO 1	12	U
CO3	Organize creative use of modern tools and techniques for manipulation and analysis of genomic sequences.	PSO 1	12	AP
CO4	Utilize the application of recombinant DNA technology in biotechnological research and Construct cDNA and genomic DNA libraries	PSO 2	12	AN
CO5	Apply the strategizing research techniques employing in recombinant DNA technology and gene sequences	PSO 2	12	AP

UNIT I (LECTURE HOURS: 12)

INTRODUCTION TO RECOMBINANT DNA

Definition, (Recombinant DNA and evolution - Host controlled restriction modification)

(The range of manipulative enzymes)

DNA polymerase, (Polynuceotide kinase – Functions)

T4 DNA ligase – (Joining DNA molecules
Terminal deoxynucleotidyl I transferase – Functions)
Reverse transcriptase (and Topoisomerase – Functions)
Restriction endonucleases (Type I, II & III - Characteristics of Type II Restriction endonuclease, nomenclature, restriction sites)

Activity
DNA manipulating enzymes - 1. Group discussion on various DNA manipulating enzymes
DNA Polymerase - 2. Download animation of mechanism of DNA Polymerase

UNIT II (LECTURE HOURS: 12)
Vectors- (Definition, Properties and its types
Vectors - Definition, Properties of good vectors)
Plasmids and Cosmids – (Plasmids- Types, Structural and Functional Organization of Plasmids, Cosmids- Principle and cloning)
Bacteriophage vector – (Lambda phage, M13 single strand phage vector yeast cloning vectors - YAC, YEP)
Animal viral vector – (SV 40
Plant viral vector - Cauliflower mosaic virus vector (CaMV), AdenoViral vector)

Activity
E.coli vector EcoRI - 1.Use paper models to simulate the process of inserting insulin gene of interest into your E.coli vector EcoRI
Vectors - 2.Display the images of different vectors and make a comparison chart mentioning the difference in vector size and gene holding capacity

UNIT III (LECTURE HOURS: 12)
INTRODUCTION OF THE VECTOR INTO SUITABLE HOST- (Gene transfer techniques
Introduction of the vector into suitable host: - Properties of good host, preparation of competent cells)
Transformation of DNA to bacterial, **plant and animal cells** – (Transformation -Calcium mediated transformation)
Microinjection – (Gene transfer to animal cell, plant cell)
Lipofection –(Gene transfer to Animal cell)
Electroporation – (Gene transfer to animal cell, plant cell and bacterial cell Nuclear transplantation - Transgenic sheep)

Homologous recombination – (Recombinant virus
Natural genetic engineering by Agrobacterium - Ti plasmid, binary vector strategy)

Activity

microinjection - 1.Demonstration of microinjection method using models.
Gene transfer methods - 2. Animation depicting the various methods used for introducing vector into suitable host

UNIT IV (LECTURE HOURS: 12)

SCREENING OF RECOMBINANTS

Reporter genes (and selectable marker genes - Neomycin , hygromycin, green fluorescence protein)

Selection of clones having specific DNA insert –(colony hybridization, hybrid arrested translation, nucleic acid hybridization, complementation)

Immunochemical methods for screening – (colony/plaque screening with antibodies)

Gene library and Functional genomics

(Gene library - Construction cDNA library and genomic library)

Functional genomics – (DNA chips and microarray gene screen technology; site directed mutagenesis)

Activity

Microarray - 1.Demonstrate the mechanism of microarray gene screen technology by powerpoint presentation
Screening methods - 2.Group discussion on screening methods for Recombinants

UNIT V (LECTURE HOURS: 12)

TECHNIQUES IN RECOMBINANT DNA TECHNOLOGY

Blotting Techniques –(Southern, Northern, Western blotting immunological techniques - Enzyme linked Immunoabsorbant Assay)

PCR – (Making multiple copies of DNA)

DNA Finger printing using RFLP – (Digesting the DNA and mapping, Applications)

RAPD – (Randomly Amplified Polymorphic DNA
Chromosome walking and jumping - Identification of neighboring sequences

DNA sequencing - Chemical and enzymatic method)

Hazards of Recombinant DNA technology (and regulations
Hazards of rDNA technology and regulations. - Rules and regulation to control the hazards of genetically modified organisms).

Activity

ELISA - 1.Animation depicting the antigen and antibody reaction in ELISA
DNA Fingerprinting - 2.Case study: A person was murdered by an unknown

person. How will you find the accused using DNA finger printing

Text Books :

T1-Gene Cloning by T.A.Brown | Edition:5 | BlackWell Publishers, London | T.A.Brown(2006)
T2-Principles of Gene ManipulationEdition | Edition:3 | Blackwell Scientific Publication | S.B.Primrose AND R.W.Old (2006)
T3-Biotechnology | Edition:3 | Book and Allied Kolkata | U Sathyanarayan (2005)
T4-From Genes to Clones | Edition:2 | Panima Publishers | E.L.Winnecker(2003)
T5-Genes VI | Edition:3 | Oxford University Press | B.Lewin(2000)
T6-Recombinant DNA technology and molecular cloning | Edition:2 | Scientific American Publication Black well publica | Kary B. Mullis (1996)
T7-Immunology | Edition:5 | WH Freeman andcompany NY | Richard AGold boy AND Thomas JKindt(2003)

Reference Books :

R1-Molecular Cloning | Edition:3 | Cold Spring Harbour laboratory | Kaaren AJanssen AND NinaIrwin(2001)

Course Title : **PHARMACEUTICAL BIOCHEMISTRY**	Course Code : 33A
Semester :III	Course Group : M- IX
Teaching Scheme in Hrs (L:T:P) : 4:0:0	Credits : 4
Map Code: C(THEORY – CONCEPT)	Total Contact Hours: 60
CIA: 25 Marks	SEE # : 75 Marks
Programme: MSC-BC	# - Semester End Exam

No	Course Outcome (Cos)	PSOs	Cl.Ses	BLOOM'S TAXONOMY LEVEL
CO1	Explain the Pharmacodynamics and Pharmakinetics property of the drug	PS01	12	U
CO2	Relate the Receptor concept of the drug availability	PS01	12	AP
CO3	Organize the mechanism of Drug Metabolism and Elimination.	PS02	12	AP
CO4	Categorize the action of chemotherapy of various drugs	PS03	12	AN
CO5	Explain and outline the various drugs acting on CNS, Cardiovascular, GI tract	PS03	12	AN

UNIT - I (LECTURE HOUR 12)
INTRODUCTION, PHARMACODYNAMICS AND KINETICS.

Introduction (and History of drugs) **Classification of drugs**, (Routes of drug administration), **Passage of drugs across biological membrane**, (Binding of drugs to plasma proteins. Absorption, Metabolism, Distribution and Elimination (ADME) of drugs), **Factors influencing drug absorption** (and elimination of drugs). **Toxicity assessment:** (Acute, Sub chronic, Chronic exposure)

Activity

1. Chart work on routes of drug administration

2. Prepare a model on ADME

UNIT II (LECTURE HOUR 12)

RECEPTOR CONCEPT

Definition of receptor,(Agonist and Antagonist), **Drug receptor interaction**. (Receptor types- G-Protein coupled receptor, Receptors with intrinsic ion channel, Enzymatic receptors), **Receptors regulating gene expression**(Receptor theories, Isolation of receptors), **Consequences of drug receptor interaction**, (Binding forces in drug receptor interaction).

Activity

1. Discuss about Agonist and Antagonist

2. Explain about the consequences of drug

UNIT - III (LECTURE HOUR 12)

DRUG METABOLISM AND ELIMINATION.

Phase Ⅰ and phase Ⅱ reactions. (Metabolism via hydroxylation, N-Oxidation, Azo and nitro reduction, Oxidative deamination, Purine oxidation, Dehalogenation, Hydrolysis, Action of choline esterase). **Physiological importance of xenobiotic metabolism**. **Elimination of drugs from the body with reference to renal system**.

Activity

1. Prepare a chart work on Drug metabolism and elimination

2. Discuss in detail about the elimination of drugs

UNIT - IV (LECTURE HOUR 12)
CHEMOTHERAPY AND PLANT DERIVED DRUGS.

C**hemotherapy**: (Mode of action of sulfonamides, anti-metabolites of folate, purines and pyrimidines.) **Mode of action of Antibacterial (**ampicillin, tetracycline and erythromycin;) **Antifungal agents**- (undecylenic acid and amphotericin; Antiviral- Acyclovir, Zidovudine, Interferon**) Antimalarial** – (Chloroquine and Amodiaquine;) **Anti-tubercular drugs** – (Streptomycin and rifampicin). **Cancer chemotherapy**- (cytotoxic drugs. Immunosuppressive drug

therapy). **Natural products**: (Alkaloids - cocaine, nicotine, quinine, atropine; Terpenoids terpenoid, menthol, diterpene; Flavonoids - anthocyanin, Concept of Personalized medicine).

Activity

1. Explain in detail about the plant derived drugs

2. Discuss about the concept of personalized medicine

UNIT - V (LECTURE HOUR 12)
DRUGS ACTING ON CNS, CARDIOVASCULAR, GI TRACT AND ADR.

CNS (mode of action of barbiturates, salicylates, MAO inhibitors and drugs for Parkinson's disease with an example**). Cardio-vascular disease** (mode of action of diuretics, ACE inhibitors, ß blockers, aldosterone antagonists, heparin, cardiac glycosides with an example). **GI tract (**mode of action of antacids, drugs for peptic ulcer, diarrhea, and constipation with an example). **Adverse responses and side effects of drugs**: (Allergy, drug intolerance, drug addiction, drug abuses and their biological effects).

Activity

1. Prepare a model on CNS

2. Chart work on cardiovascular &GI tract

Text Books:

1. Satoskar, R.S., Nirmala N. Rege, Bhandarkar, S.D., 2015, " Pharmacology and Pharmacotherapeutics", 24th Edition, Popular Prakashnan Pvt. Ltd., Mumbai.
2. Tripathi, K.D., 2019, "Essentials of Medical Pharmacology", 7th edition, Jaypee Brothers, Medical Publishers, New Delhi.

References:

1. David A Williams, and Thomas L Lemke, 2017, "Foye's Principles of Medicinal Chemistry", 7th Edition, Lippincott Williams & Wilkins, United States.
2. Palmer, M., Chan, A., Diekmann T., Honek, J., 2012, "Biochemical Pharmacology", 1st edition, Wiley, United states.
3. Patrick L. Graham, 2013, "An introduction to medicinal chemistry", 5th edition, Oxford University Press, United Kingdom.
4. Brunton, L. Knollmann, B. and Hilal-Dandan, R. 2022, "Goodman and Gilman's the Pharmacological Basis of Therapeutics", 13th edition, McGraw Hill Education, New York.

Course Title :INDUSTRIAL BIOCHEMISTRY	Course Code : 33B
Semester :III	Course Group : M- X
Teaching Scheme in Hrs (L:T:P) : 4:0:0	Credits : 4
Map Code: C(THEORY – CONCEPT)	Total Contact Hours: 60
CIA: 25 Marks	SEE # : 75 Marks
Programme: MSC-BC	# - Semester

Course outcome: (Cos)

No.	Course Outcome (Cos)	PSOs	Cl. Ses	BLOOM'S TAXONOMY LEVEL
CO1	Explain the classification and types of Bioreactors and its process	PSO 1	12	AN
CO2	Illustrate the concept of Fermentation and its application	PSO 2	12	AN
CO3	Apply the industrial enzymes for food and agriculture.	PSO 1	12	AP
CO4	Demonstrate the concept of food preservation and its techniques	PSO 3	12	AP
CO5	Distinguish the phenomenon of bioremediation and waste water treatment for environmental renewable aspects.	PSO3	12	AN

UNIT-I (LECTURE HOURS: 12)

BIOPROCESS TECHNOLOGY

Introduction (Classification of reactors), **Types of Bioreactors**-(Stirred Tank, Recycle reactors, discontinuous, semi continuous and continuous), **Parameters for Bio process** (Bio mass, Substrates, product, O_2 and CO_2, Temperature, agitation), **Bio process monitoring** (energy transfer, rate of utilization, efficiency and computer base monitoring), **Downstream processing**(process for product recovery, recycling of residual raw, by product recovery, waste/effluent treatment)

ACTIVITY

1. Preparation and extraction of Dates Essence
2. Disposal and recycling of organic waste

UNIT-II (LECTURE HOURS: 12)

FERMENTATION

Introduction-(Primary and secondary of microbes, inoculums preparation, fermentation media, industrial sterilization, strain improvement, metabolic and genetic regulations during fermentations, pure and mix culture fermentations), **Products from microorganisms - enzymes** (Amylases, Proteases, Pectinases), **Primary metabolites**, Antibiotics (Penicillin), **Pigments** (Carotenoids), Sweeteners, **Beverage**s (wine, Beer). **Fuels from microbes**(microbial polymers and microbial steroid bio transformations).

ACTIVITY

1. Preparation of Cheese making by fermentation
2. Preparation of fermented bakers products

UNIT-III (LECTURE HOURS: 12)

INDUSTRIAL PRODUCTION OF ENZYMES

Introduction –(Isolation & Purification),**Enzymes**(Source identification, isolation, recovery, concentration), **Partial/total purification** (by salting in, salting out, precipitation, ion exchange, dialysis, ultra filtration, column chromatography ,Gel filtration, Affinity, HPLC), **Protein characterization**(functional studies, evidence of purity,Mass spectroscopy)

ACTIVITY

1. Extraction of papain from Papaya
2. Extraction of Amylase enzyme from silkworm

UNIT-IV (LECTURE HOURS: 12)

FOOD PRESERVATION

Factors causing food spoilage –(Food Preservation General principles of food preservation Preservation by use of high and low temperatures, drying, radiations, chemical preservatives, inert gases, mechanical preservation techniques (vacuum packaging, tetra packs). **Adulteration& Determination of shelf** –(Food Adulteration – Common food adulterants, their harmful effects and physical and chemical methods for their detection). **Milk adulteration and adulteration in edible oils-** (Class I and II preservatives). **Role of ISI**, (Agmark, FDA & Food Safety and Standards Authority of India (FSSAI), Food and Agricultural Organization (FAO) in food industry).

ACTIVITY

1. Physical adulteration test for cooking ingredients
2.Adulteration detection in food products

UNIT V (LECTURE HOURS: 12)

ENVIRONMENTAL BIOCHEMISTRY

Bioremediation: (Introduction and types of bioremediation, **bioremediation of surface soil and sludge**, -(bioremediation of subsurface material), (In situ and Ex-situ technologies, Phytoremediation). **Chemical toxicology**: (Biochemical effects of heavy metals (Pb, As, Hg, Cd)), **pesticides, insecticides, herbicides, weedicides, larvicides**. (Biomining and bioleaching).

Wastewater treatment – (BOD, COD, aerobic, anaerobic, suspended and attached growth systems).

ACTIVITY

1. Prepare a chart model for Bioremediation
2. Make a working model demonstration for waste water management

REFERENCE

R1:Pelczar MJ, Chan ECS, Kleig NR, 1993, Microbiology, Tata McGraw Hill.
R2:Tom Betsy, & Jim Keogh, 2005, Microbiology Demystified, McGraw Hill.
R3: R C Tilton, 2002, Microbiology, 10th ed, McGraw Hill.
R4: Stuart Hoggy, 2005, Essential Microbiology, Wiley.
R5. Peter stanbuy, Allan Whitaker, stephen j. Hall. Principles of Fermentation third Edition
2016.
R6. Food Processing: Principles and Applications" by J Scott Smith and Y H Hui 2019.
Second edition
R7. Biotechnology of Microbial Enzymes: Production, Biocatalysis and IndustrialApplications 1st Edition, Kindle Edition by Goutam Brahmachari (Author), Arnold
L Demain (Editor), Jose L Adrio (Editor) 2016

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Course Title :IMMUNOLOGY AND IMMUNOTECHNIQUES	Course Code : 33C
Semester :III	Course Group : M- XI
Teaching Scheme in Hrs (L:T:P) : 4:0:0	Credits : 4
Map Code: C(THEORY – CONCEPT)	Total Contact Hours: 60
CIA: 25 Marks	SEE # : 75 Marks
Programme: MSC-BC	# - Semester End E

No	Course Outcome (Cos): After completion of this course, the students will be able to	PSOs	Cl.Ses	BLOOM'S TAXONOMY LEVEL
CO1	Rephrase and summarize the mechanisms of B and T Cell maturation, activation, and differentiation, in antibody mediated immune responses	PSO1	12	U
CO2	Develop and construct the knowledge of immunological processes at a cellular and molecular level common immunological laboratory procedures used to detect and measure the immune response	PSO 3	12	AP
CO3	Demonstrate and utilize the applications of the complement system and transplantation	PSO3	12	AP
CO4	Examine and categorize hypersensitivity and allergy derive from "mis-direction" of normal adaptive immune responses.	PSO4	12	AN
CO5	Inspect and Infer the significance of different types of vaccines and the latest information on important development in clinical vaccinology and the use of vaccines.	PSO2	12	AN

UNIT I (LECTURE HOURS: 12)

BASIC CONCEPTS OF IMMUNITY

Introduction & types of immunity (Definition of Immunology, Antigens and Antibody) **Cellular Components of the immune system**- (B cells, Plasma Cells-Structure and functionT cell subsets (Structure and Function Maturation and development of B and T (Th and Tc) lymphocytes) NK cells (Structure and Function) Macrophages & Leukocytes (Structure and Function, Leukocyte extravasation) **Organization and structure of the lymphoid organs (**Primary lymphoid organs (Thymus and Bone Marrow) Secondary lymphoid organs – (Spleen, Lymph node, Peyers Patches, CALT & MALT)

Activity

1. Debate on the benefits and adverse effects of Vaccination
2. Chart/ Model of cells of the Immune System

UNIT II (LECTURE HOURS: 12)
ANTIGENS

Introduction(Definition, Properties and Types) Soluble and Particulate, antigenic determinants, **Antigen recognition and presentation** (MHC Class I and II Molecules, Pattern Recognition receptors, Activation of B&T cells)Antibodies Introduction (Definition, Properties and types) **Classification and its function** (IgG, IgA, IgM, IgE and IgD) **Immune Response** (Primary and Secondary immune response), **Humoral and cell mediated immunity**. (Immune responses against bacterial, viral, fungal and parasitic agents. Evasion of infectious agents from immune system) **Precipitation Techniques**: (Radial Immuno-diffusion (Single and Double), Agglutination : Blood grouping), **Radio-Immuno Assay**, (Enzyme Linked Immunosorbent Assay (ELISA) and Western Blotting), **Immunofluorescence assay** : (Sorting of cells based on immune surface protein using Florescence activated cell sorter (FACS) technique).

Activity

1. Animations on Humoral and Cell mediated immunity
2. Discussion on the secretory Ig and largest populated Ig in blood

UNIT III (LECTURE HOURS: 12)
COMPLEMENT SYSTEM

Complement system (Classical, alternate pathway and lectin pathway Complement fixation test - Direct and Indirect) **Immunogenetics** (Major histo-compatibility complex MHC I & MHC II) **Transplantation immunology**

(Autograft, Isograft, Allograft and Xenograft). **Introduction and its Mechanism** (Bone marrow transplantation, organ transplants, immuno-suppressive therapy). **Hybridoma technology** (and monoclonal antibodies), **Xenograft** (transplantation from various species).

Activity

1. Animations on Transplantation Immunology
2. Submission of report on how MHC provides self and non-self-cell discrimination.

UNIT IV (LECTURE HOURS: 12)
HYPERSENSITIVITY

Hypersensitivity Types 1 & 2 (Mechanism, assay and treatment) **Types 3, 4 & 5** (Mechanism, assay and treatment)**Various aspects of Immunology** (Immunological disorders) (Immunotolerance, Auto- immune disorders. Immuno-deficiencies- primary and secondary- complementary deficiency diseases), **Tumor immunology** (Tumor antigens, immune response to tumours, cancer cancer immunology: Monoclonal antibody, Interleukin 2, immune blockade therapies).**Pulmonary infection due to COVID-19**- Pneumonia (Mode of action)

Activity

1. Submission of Journals/ articles related to Hypersensitivity and a short report on the submitted article
2. CD with animations on Auto Immune disorders

UNIT V (LECTURE HOURS: 12)
VACCINES

Vaccines- (Definition Methods of vaccine preparation) (Synthetic vaccines & DNA vaccines) **Vaccine development** – (Identification of B and T epitopes for vaccine development, immuno screening of recombinant library) **Immunological abnormalities** (ntroduction (Types and Properties) AIDS (Diagnosis: Structure, Mechanism of infection, immunological abnormalities, diagnosis and prevention and vaccines) **Avian flu** (Diagnosis: Structure, Mechanism of infection, immunological abnormalities, diagnosis and prevention and vaccines) **Swine flu** (Diagnosis: Structure, Mechanism of infection, immunological abnormalities, diagnosis and prevention and vaccines) **COVID Vaccines**- Mode of action for Corona treatment).

Activity

1. Submission of reported status of AIDS currently in various countries and the research undertaken

2. CD with animations on synthetic vaccines

Text Books:

T1 - Immunology | Edition:3 | W.H.Freeman Publishers | Barbara A Osborne AND Richard A Goldsby AND Thomas J Kindt (2006)

T2 - Immunology - An Introduction | Edition:4 | Saunders College of publishing | Ian R. Tizard(1994)

T3 - Immunology | Edition:7 | .ELBS Publishers, UK | David Male AND David B Roth AND DONALD C.BIANDRI . AND Ivan Roitt AND Jonathan Brostoff (2001).

Reference Books :

R1- Immunology – Edition 6^{th} – Kuby, Kindt, Goldsby, Osborne (2007).

R2 - Immunology | Edition:1 | Mosby – Elsevier, London | Male & et al(2006)

R3 - Modern Pharmacology | Edition:5 | Lippincott Williams & Wilkins Publisher: | Craig CR AND Stitzel RE(2008)

R4 - Modern Pharmaceutics | Edition:1 | Marcel Dekker Inc. New York | Banker GS AND Rhodes M(2002)

Course Titl :**CLINICAL RESEARCH AND CLINICAL DATA ANALYTICS**	Course Code : 33D

Semester : **III**	Course Group : **M-XII**
Teaching Scheme in Hrs (L:T:P) : **4:0:0**	Credits : **4 Credits**
Map Code :**D(THEORY CONCEPTS)**	Total Contact Hours : **60**
CIA :**25 Marks**	SEE : **75 Marks**
Programme: **MSC-BC**	

S.No	Course Outcome	PSOs	Cl.Ses	BLOOM'S TAXONOMY LEVEL
CO1	Explain the core areas of Clinical research with guidelines and giving knowledge on clinical data information management	PSO1	12	U
CO2	Develop and prepare the clinical trial monitoring plans and applied with ethical standards promoting respect for all subject, health and rights.	PSO1	12	AP
CO3	Categorize clinical research regulations to promote new knowledge to make regulatory decisions in research.	PSO3	12	AN
CO4	Interpret data to inform business decisions, recognize trends, detect outliers, summarize data sets, craft sound survey questions and draw conclusions from population samples.	PSO2	12	AN
CO5	Analyze relationships between variables & develop, test hypotheses, implement regression analysis and other analytical techniques in Excel.	PSO2	12	AN

UNIT-I (LECTURE HOURS: 12)

INTRODUCTION TO CLINICAL RESEARCH:
(The declaration of Helsinki, Good Clinical Practice guidelines)
PHASES OF CLINICAL TRIALS- (Phase I, Phase II, Phase III, Phase IV)
PRINCIPLES OF CONTROLLED CLINICAL TRIALS- (Clinical trial design (observational and interventional) protocol, consent in clinical trials, placebo, bias and methods to prevent bias)
CLINICAL RESEARCH MANAGEMENT - (Clinical data management (CDM)- handling of data/ information, clinical trial management systems, Data safety monitoring board and Committees).
ACTIVITY

1. Model on phases of clinical trials
2. Pictorial chart on clinical management

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UNIT-II (LECTURE HOURS: 12)

CLINICAL TRIAL MONITORING
Clinical Trial Monitoring- (various types of monitoring plans and monitoring visits, Investigators, Study Coordinator, Sponsor, Monitor, Contract Research Organization)
Ethics in clinical research
(Health Insurance Portability and Accountability Act (HIPAA)- A new requirement to clinical study process).
Pharmacovigilance- (safety monitoring in clinical trials).
Clinical trial application requirements in India- IND, ANDA, AADA and NDA

ACTIVITY
1. Chart work on ethics in clinical research
2. Diagrammatic representation of clinical trial monitoring

UNIT III (LECTURE HOURS: 12)
USFDA REGULATIONS TO CONDUCT DRUG STUDIES

USFDA regulations to conduct drug studies
Clinical Research regulations in India – (CDSCO guidelines)
Clinical Research regulations in UK – (Medicines and Healthcare Products Regulatory Agency (MHRA))
Clinical Research regulations in Europe- (Clinical Research regulations in Europe (EMEA))
Describing and Summarizing Data
Introduction- (Analyzing Box office Revenues)
Visualizing Data- (Recognizing patterns, Histograms, Outliers)
Descriptive Statistics- (Central values for data, conditional means, percentiles, variability, Descriptive statistics in excel, coefficient of variation)
Relationships between Two Variables- (Scatter plots, correlation, hidden variables, time series)
ACTIVITY

1. Submit a model work based on the regulations to conduct drug studies
2. Chart work on visualizing data

UNIT IV (LECTURE HOURS: 12)

SAMPLING AND ESTIMATION

Sampling and Estimation
(Introduction- Sampling at Amazon)
Creating Representative and Unbiased Samples- (Samples Vs Population, Sample size, Avoiding Bias)
The Normal Distribution-(Rules of thumb, The Normal function NORM.DIST, The Normal function NORM.INV, The central limit theorem)
Confidence Intervals- (Estimating the population mean, Large samples, small samples, Choosing a sample size, Estimating the population proportion),
Amazon's Inventory Sampling- (Amazon's inventory sampling)
Hands on Practice- (Practice Problems)
Hypothesis Testing
Introduction- (Amazon's use of Hypothesis Testing)
Designing and Performing Hypothesis Tests – (Developing Hypothesis, Constructing a range of likely sample means, using p-values, Type I and Type II Errors, One sided testing, Comparing two populations)
Improving the Customer Experience- (The shopping cart A/B test, the arrow A/B test, the magazine A/B test)
Hands on Practice- (Practice Problems)
ACTIVITY
1. Create a sheet on Sampling and Estimation
2. Chart work on hypothesis testing

UNIT V (LECTURE HOURS: 12)
SINGLE VARIABLE LINEAR REGRESSION

Single Variable Linear Regression
Introduction- (Regression at Disney Studios)
Regression Line- (Visualizing the Relationship, The best fit line, the structure of the Regression line)
Forecasting- (Point Forecasts, Prediction intervals)
Interpreting the regression output- (Quantifying predictive power, testing for a significant relationship, R-square vs p-value, Residual analysis)
Performing Regression Analysis- (Regression Analysis in excel, Using dummy variables)
Forecasting Home Video Units- (The Disney Studio Model, Just a starting point)
Hands on Practice- (Practice Problems)
Multiple Regression
Introduction- (Multiple Regression at Caesars)
Multiple Regression equation- (Single Vs Multiple Regression, Interpreting the multiple regression equation, forecasting)

Adapting concepts from single regression- (Adjusted R-square, Residual Analysis, Testing for Significance of Variables)
Performing Multiple Regression Analysis- (Multiple Regression Analysis in Excel)
New Concepts in Multiple Regression- (MutiCollinearity, Dummy variables, lagged variables)
The Caesars Staffing Problem- (Developing the model, Analyzing the results, Improving the model)
(Hands on Practice- Practical Problems)

ACTIVITY

1. Chart work on Multiple Regression equation
2. Model work on Single Variable Linear Regression

REFERENCES

1.Handbook of clinical research. Julia Lloyd and Ann Raven Ed. Churchill Livingstone c.
2. Principles of Clinical Research edited by Giovanna di Ignazio, Di Giovanna and Haynes.
3. Textbook of Clinical Trials edited by David Machin, Simon Day and Sylvan Green, John Wiley and Sons.
4.Open Intro Statistics (Third Edition) by David M Diez , Christopher D Barr, Mine Cetinkaya - Rund | Edition:3 | Open Intro Statistics | Christopher D Barr AND David M Diez AND Mine Cetinkaya (2017)
5.An Introduction to Statistical Learning with Applications | Edition:1 | Springer | Daniela Witten AND Gareth James AND Robert Tibshirani AND Trevor Hastie(2013)
6.Business Analytics | Edition: | Harvard Business School | Janice Hammond(2017)

Course Title : LAB IN IMMUNOLOGY AND R-DNA TECHNOLOGY (P)	Course Code : 43P
Semester :III	Course Group : MP- IV
Teaching Scheme in Hrs (L:T:P) : 0:0:5	Credits : 4
Map Code: H (PRACTICAL - EXPERIMENTS)	Total Contact Hours: 75
CIA: 40 Marks	SEE # : 60 Marks
Programmer : MSC-BC	

List of Experiments

IMMUNOLOGY KIT

1) RA TEST
2) CRP TEST
3) WIDAL TEST
4) PREGNANCY TEST
5) IMMUNODIFFUSION - SINGLE, RADIAL
6) IMMUNODIFFUSION - DOUBLE
7) IMMUNOELECTROPHORESIS
8) ROCKET IMMUNO ELECTROPHORESIS
9) ELISA - HORMONE ASSAY

SEROLOGY

10) ASO TITRE
11) VDRL TITRE
12) DETERMINATION OF BLOOD GROUP

r DNA Technology

13) Plasmid DNA isolation - Procedure, Principle, Reagent Preparation and Result.
14) Genomic DNA isolation - Procedure, Principle, Reagent Preparation and Result.
15) Estimation of RNA from Liver and Serum by Orcinol method - Procedure, Principle, Reagent Preparation and Result.
16) Agarose gel electrophoresis of DNA /RNA and MW determination - Procedure, Principle, Reagent Preparation and Result.
17) Estimation of DNA from Liver and Serum by Diphenyl amine method - Procedure, Principle, Reagent Preparation and Result.
18) Restriction analysis of DNA - Procedure, Principle, Reagent Preparation and Result.
19) Visit to animal cell culture lab. - Handling of animals, procedure.
20) Handling of animals. Immunization and raising anti sera - Demonstartion

Text Books :

1.Essentials Of Practical Biochemistry | Edition:1 | CBS Publishers and Distributors | Srivastava
2.Biochemical Methods | Edition:1 | New Age International. | S.SadasivamA. Manickam(1996)
3. Principles and Techniques of Practical Biochemistry | Edition:4 | - | John Walker. AND Keith Wilson

Reference Books :

Principles and Techniques of Practical Biochemistry | Edition:5 | Cambridge University Press | Keith WilsonJohn M. Walker(2001)

Course Title : LAB IN RESEARCH TECHNIQUES IN BIOCHEMISTRY	Course Code : 43Q
Semester :III	Course Group : MP - V
Teaching Scheme in Hrs (L:T:P) : 0:0:5	Credits : 4
Map Code: H (PRACTICAL - EXPERIMENTS)	Total Contact Hours: 75
CIA: 40 Marks	SEE # : 60 Marks
Programme: MSC-BC	# - Semester End Exam

List of Experiments

UNIT - I

HAEMATOLOGY

Enumeration of RBC - Total RBC count, Haemocytometer

Enumeration of WBC - Total WBC count, Haemocytometer

Estimation of Haemoglobin - Collection of Blood sample, Haemoglobin estimation

Bleeding and clotting time - Blood sample collection, Time calculation

PHYTOCHEMICAL ANALYSIS

Preparation of plant extract (Soxhlet's Method) - Preparing different solvent extracts- Ethanol extract, Methanol extract, Aqueous extract, Petroleum ether extract and Chloroform extract.

Qualitative analysis of Secondary metabolites from different solvent extracts - Tannins, Alkaloids, Flavanoids, Steroids, Carbohydrates, Protein, Terpenoids and Phenol.

Comparison and estimation of Antioxidants in Ethanolic, Methanolic and Aqueous extract. - Vitamin-C, Catalase

Comparison and estimation of Metabolites in Ethanolic, Methanolic and Aqueous extract. - Tannins and Phenols

DEMONSTRATION: PCR, RAPD

Text Books :

Principles and Techniques of Practical Biochemistry | Edition:4 | - | WilsonJohn Walker

Course Title	:HOSPITAL MANAGEMENT	Course Code	: 3EA
Semester	: III	Course Group	: EL-3
Teaching Scheme in Hrs (L:T:P) : 4:0:0		Credits	: 4
Map Code	:C(THEORY CONCEPTS)	Total Contact Hours	: 60
CIA	:25 Marks	SEE	: 75 Marks
Programme: MSC-BC			

Course outcome: (Cos)

No.	Course Outcome (Cos)	PSOs	Cl.Ses	BLOOM'S TAXONOMY LEVEL
CO1	Outline the working, care, concept of hospitals, classification and its functions.	PSO 1	12	U
CO2	Describe the study of operation theatre and its features and functions of Intensive care unit.	PSO 2	12	U
CO3	Categorize the need and importance of hospital information system to achieve health care.	PSO 2	12	AN
CO4	Relate the basic principles and methods for the assessment of health needs of a community and plan for health programs	PSO 3	12	U
CO5	Explain the handling and disposal requirements for hospital waste management.	PSO3	12	R

UNIT-I (LECTURE HOURS: 12)

HOSPITAL AND ITS FUNCTION

Hospital and its Function-(Care of Sick and Injured - Care, Diagnosis, Treatment, Medical and Nursing care).

Education and Training for Nurses, Physicians – (Training and Experience, Lab technology, Workshop environment)

Promotion of Health – (Preventive Medicine, Medical staff, Health Department)
Concept of Hospital

(Definitions of Hospital - World health organization, Dorlands definition, Blackiston New Gold Definition)

Changing Concept of Hospital – (Trusteeship Period, Physician Period, Administration and Team Period)

Classification of Hospital

(Ownership - Public Hospital, Voluntary Hospital, Private Hospital
Directory of Hospital - General Hospital, Rural Hospital, Specialized Hospital, Teaching Hospital, Isolation Hospital)

System of Medicine – (Ayurveda, Siddha, Unani, Allopathy and Homeopathy)

ACTIVITY

1. Chart work on the Biochemical paramaters
2. Group Discussion on the history and classification of hospital management

UNIT-II (LECTURE HOURS: 12)

OPERATION THEATRE

Operation Theatre

(Location - Complex workshop, Preparation room, Exit area)

Zoning – (Protective zone, Inner zone, Innermost zone, Disposal zone)

Policies and Procedures – (Functions, Duties, Checking operating room readliness, Care and disposal of tissuses)

Features of Operation Theatre

(Size - Optimum size, Vinyl sheet, OT walls
Features - Lighting, Head lamps, Flooring
Facilities - Compressed air, Ventilator, Monitoring equipment)

Intensive Care Unit

(Location - Centralized place, Emergency department, Operating room)
(Facilities - Privacy, Medical gas outlets, Nurses station)
(Funtions - Centralized area, Monitor the data, Patient care)

ACTIVITY

1. Chart work on the management of the ICU ward
2. Model work and time management in Operation Theatre

UNIT-III (LECTURE HOURS: 12)

HOSPITAL INFORMATION SYSTEM

Hospital Information system

(Introduction - Dynamic department, Outpatient, Store information online)

Evolution of HIS – (Insurance centric health care delivery system, clean slate, HIS

Computerization - Integrated system, Online real time system, Patient oriented system)

Clinical Information system

(Introduction - Registration, Admission, Security and identity management)

Administrative information system – (Account title file, Financial management, Data entry)

(Human Resources - Payroll, Purchasing, E- Forms)

Health care delivery system

(Introduction - Hitherto health, Longer life span, Increased Public awareness Human rights - WHO, Integrated delivery system, Tele medicine)

Health care cost and Information Technology – (Two inflammatory factors, Problems, Principle role, Management)

ACTIVITY

1. Case study report of Diabetic patients

2. Flow chart on health care system

UNIT-IV (LECTURE HOURS: 12)

NATIONAL HEALTH PROGRAMME RELATED TO COMMUNICABLE DISEASES

(Introduction - National Health Programs, Policy and Implementation, Features, Advantages and Disadvantages)

Tuberculosis – (DOTS, Objectives)

AIDS – (Human immunodeficiency virus, Blood transfusions, Hypodermic needles, National Health Programs)

National Health Programme related to Non- Communicable diseases

Cancer – (Origin, Causes, Suggestions, Signs and Symptoms, Causes, National Health Programs)

Diabetes – (High blood sugar, Genesis, Objectives, Signs and Symptoms, Causes, National Health Programs, Treatment)

Alcoholism and habilitation – (Alcoholism effects, National Health Programs, Rehabilitation)

Reproductive and Child Health Programme

(Introduction - UIP, ORT, MCH

Health Programme - Family Planning, Maternal Health, Child Health, Adolescent health, Child Survival and Safe motherhood Programme, Highlights)

Health Programme Advantages - Immunization, Child and women benefits,

Health benefits, Programme, Reporting, Effective maternal and health care

ACTIVITY

1. Submit a report on health program

2. Create a awareness program on Non-communicable disease

UNIT-V (LECTURE HOURS: 12)

HOSPITAL WASTE MANAGEMENT

Hospital Waste Management

(Introduction - Definition, Biomedical waste)

Categorization of hospital waste – (Infectious waste, Hazardous waste, Radioactive waste, General waste)

Health impacts of biomedical waste – (Potential health hazards, Persons at risk Handling and safe disposal of biomedical waste - Segregation, Poly bags collection, Autoclaving, Incineration)

Occupational Health & safety Practices –(Usage of protective equipment, Emergency measures)

Laws and Policies regarding Biomedical waste management – (Rules and Guidelines of WHO, Central pollution control board (CPCB))

ACTIVITY

1. Poster presentation on Biomedical waste management

2. Oral presentation about Handling and safe disposal of biomedical waste

Text Books :

Hospital Information System | Edition:1 | Excel Book Private Ltd | S PORKODI(2008)

Reference Books :

Hospital Management | Edition:1 | APH Publishing Corporation | Mohammed Akbar Ali Khan(1999).

Course Title : **BIOSTATISTICS AND RESEARCH METHODOLOGY**	Course Code : 43A
Semester : **IV**	Course Group : **DSC XIII**
Teaching Scheme in Hrs (L:T:P) : **4:0:0**	Credits : **4 Credits**
Map Code: C (THEORY CONCEPTS)	Total Contact Hours: **60**
CIA: **25 Marks**	SEE # : **75 Marks**
Programme: **MSC-BC**	**# - Semester End Exam**

No.	Course Outcome	POs & PSOs	Cl. Ses	CL
CO1	Summarize the basics of Statistic terms.	PSO 1	12	AP
CO2	Explain the Measures of Central Tendency and Relationship of Mean Median and Mode -	PSO 1	12	AP
CO3	Apply hypothesis testing via some of the statistical distribution define some concepts about hypothesis testing . Update the independent of random variables like t-Test, F- test, chisquare and ANOVA classification	PSO 1	12	AP
CO	Experiment on Research, classification of research, Formulation of research paper	PSO 2	12	AP
CO5	Inspect Data collection techniques Data analysis and interpretation and Examine the various research method and report writing.	PSO 3	12	AN

UNIT-I (LECTURE HOURS: 12)

INTRODUCTION TO EPIDEMIOLOGY- Definition, agent, host and environment, mode of transmission, incubation period, spectrum of diseases, measure of mortality. Measure of morbidity, morbidity survey. Risk, cause and bias.

INTRODUCTION TO STATISTICS

Selected Statistical terms – (Variables, Constants, Data, Population)
Sample, Parameter, Notations used in Statistics – (Related problems)
Nature of Measurement and Types of variables Nature of Measurement and Types of variables –
Data Collection
(Collection of data – Related problems)
(Data collection and types -Related problems)
Classification and Tabulation of Data
(Bar diagram, Pie diagram, Frequency polygon and Cumulative polygon - Related Problems)
Difference between Histogram and Frequency polygon. – (graph)
Activity
1 - Visit nearby hospital and collect clinical data of 10 Diabetic patients which include Age, Blood Glucose and Bloodcholesterol. A.Draw Bar diagram relating to age and Blood sugar. B.Draw Pie diagram relating to age and Blood cholesterol
2 - Quiz on different ways of data collection

UNIT-II (LECTURE HOURS: 12)

MEASURES OF CENTRAL TENDENCY

Measures of Central Tendency Introduction – (Definition and objectives and types of averages)
Arithmetic Mean – (Calculation of arithmetic mean for discrete and continuous data).
Median – (Calculation of Median, merits & demerits)
Mode – (Calculation of Mode for discrete and continuous data series, Comparison of Mean, Median and mode – Relationship between mean, median & mode).
Measure of dispersion- dispersion, range, standard deviation.
Correlation (Karl person)
Calculation of correlation coefficient – (Introduction Significance for correlation coefficient and coefficient of variation)
Regression
Regression and calculation of Regression equation – (Introduction, Equation of X on Y and Y on X).

Activity
1 - Collect data related to market price of different brands of tea and coffee . Find the correlation coefficient between them.
2 - Group Discussion on relationship between mean, median and mode.

UNIT-III (LECTURE HOURS: 12)

NULL HYPOTHESIS, T-TEST AND F-TEST AND ANALYSIS OF VARIANCE

Null Hypothesis P.Value –(Related Problems)
Significant level – (related problems)
Confidence Interval – (Related Problems)
Type I and type II error – (Related problems)
T-test and F-test ('t' distribution , 't' test and F-test - Related problems)
Chi square Test
Degrees of freedoms - assumption Continuity correlation – (Related Problems)

Calculation of chi square test – (Related problems)
Analysis of variance
One way ANOVA – (Related problems)
Two way ANOVA – (Related problems)
Null Hypothesis, ANOVA – (Related problems)
INTRODUCTION TO PRACTICAL COMPONENT OF INDUSTRIAL AND CLINICAL TRIALS PROBLEMS (statistical analysis using excel and SPSS to industrial and clinical trial approach)

Activity
1 - Testing of Significance: A special type of fertilizer was used in 4 Agricultural fields A, B, C and D. Test whether the difference in mean yields of 4 Agricultural fields is significant or not?
2 - Group discussion on difference between one way and two way ANOVA.

UNIT-IV (LECTURE HOURS: 12)

RESEARCH
Introduction – (The design of any research project, Scientific and Systemic search, To discover answers)
Types & classification of research –(Diagnostic research, descriptive research, exploratory research)
Explanatory research ethics – (Explanatory or evaluative motive, Respect for persons, Beneficence, Justice)
Topology for literature search
Scientific methods –(Introduction, Methodology- the study of the methods, Minimize the influence of the researchers)
Components of scientific methods – (Formulate hypothesis Design experiment Test hypothesis / Collect data Interpret) (Analyze results Publish finding Research question / Problem Background / Observation)
Formulation of research paper – (Formulating a Research Question, Formulating Hypothesis Aims and Objectives, Abstract, Background, Methodology, Outcomes of the study)
Research design
Explanatory Types of research design – (Descriptive research research, Theory testing and theory construction)
Formation of hypothesis – (The linguistic expression, Prediction that will be tested by research)
Synopsis writing – (Start With a Hook, Introduction of Characters, Construct the Body of Your Synopsis)
Ethics in Research Deliverables- Plagiarism, Funding & Scholarship
Agencies funding research in biological sciences, types of scholarships in education.

Activity
1 - Powerpoint presentation on different components and writing of Dissertation /Thesis
2 - Group Discussion on formulation of research paper/ Journal

UNIT-V (LECTURE HOURS: 12)

CLINICAL TRAIL AND ITS MANAGEMENT (clinical trials, method of randomization, Ethical issues, crossover trails. Meta-analysis, trail and data management principles. Data safety monitoring board: concepts and management)

DATA COLLECTION TECHNIQUES SAMPLING

Data collection techniques Sampling – (Tool for converting data into information, Experiments, Surveys, Sample size and sample error)

Observation – (Gathering data by watching behavior, events Helps to watch for the results of behaviors or interaction)

Questionnaire and bibliometrics – (Standard bibliometrics methods, Applying Bibliometrics, Designing for Metrics)

Data analysis and interpretation

Geographical and graphical presentation of data – (Applied as tools, Automated graph, Animation, Diagrammatic methods)

Statistical analysis – (Quantitative approach., Descriptive Statistics, Inferential statistics)

Tools of argument – (Softwares, packages ,Installing packages, Loading packages)

Research reporting

Formation of report – (Informative Presentation of Tables, Graphs and Statistics)

Style and writing of report – (Reporting Descriptive (Summary) Statistics, Summarizing Statistical Test Outcomes in Figures)

References and bibliography – (Statistical Methodology, Retrospective Space-Time Scan Statistic, Year)

Activity

1 - Prepare a Questionnaire for collecting clinical Data of patient for Research purpose

2 - Demonstration on statistical tools in MS Excel and SPSS

Text Books :

1. Statistical methods | Edition:30 | Sultan Chand & Sons Educational Publishers | Dr S.P.Gupta(2001)
2. C.R. Kothari, 2004. "Research Methodology". 2 nd Ed. New Age International (p) Limited, Publishers.
3. Fundamentals of statistics – S.C.Gupta, Himalaya Publishing house, 7th Edition.2018.

Reference Books :

1. Research Methodology methods and Techniques | Edition:2 | New Age Publications | Kothari CR(2004)
2. Gordis Epidemiology, 7th Edition. Authors : David D Celentano & Moyses Szklo & Youssef Farag