

**RATHNAVEL SUBRAMANIAM COLLEGE OF ARTS & SCIENCE (Autonomous)**  
**Sulur, Coimbatore – 641 402**

**SCHEME OF EXAMINATIONS – CBCS PATTERN**

**PROGRAMME: M.Sc (Biochemistry)**

**Syllabus effective for the students admitted during the academic Year 2019 Batch & onwards**

**(2019 – 2021)**



**HOD**

**PRINCIPAL**

**COE**

RATHNAVEL SUBRAMANIAM COLLEGE OF ARTS AND SCIENCE

DEPARTMENT OF BIOCHEMISTRY

PROGRAMME OUTCOMES (POs):

PO1	To provide outcome based education in the respective disciplines and to impart skills which will enable the students secure job in their core disciplines in this digitally transforming era.
PO2	To develop the art of critical thinking, creativity and to imbibe emerging trends thereby to excel in their interested domains of specializations.
PO3	To inculcate and develop research competence systematically besides the capacity to analyze the viability of new ideas, entrepreneurship and professionalism based on the students' choice and aptitude.
PO4	To instill a culture of life-long learning and the ability to understand the socio-economic issues.

PROGRAMME SPECIFIC OUTCOMES: (PSOs)

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

PSO1	To understand the fundamental concepts and master the pertinent experimental and theoretical techniques in Molecular Gene expression, Proteomics, Pathology, Clinical research and Nano-sciences so as to inflate the understanding of biology.
PSO2	To transform the way by using sophisticated technologies and thereby gaining insights from clinical data to make cognizant decisions, predictions and to reveal the proficiency in quantitative reasoning and analytical skill within a student.
PSO3	To understand the research oriented learning that develops methodical and integrative problem-solving approaches in the biochemical industries by enabling them to write effective project reports in multidisciplinary environment.
PSO4	To augment the students in pre-clinical studies and cancer biology enabling them to invent new ideas to develop their entrepreneurial skills, decisive thinking and self-governance.

**RATHNAVEL SUBRAMANIAM COLLEGE OF ARTS & SCIENCE**

**(Autonomous)**

**Sulur, Coimbatore – 641 402**

**SCHEME OF EXAMINATIONS**

**M.Sc (Biochemistry)**

**2017-2019 BATCH**

Semester	Course Opted	Course Name	D	L	CIA	SE E	Marks	Credits
I	CE -I	EMPLOYABILITY SKILLS I	3	2	25	75	100	-
	M -I	RESEARCH TECHNIQUES	3	4	25	75	100	4
	M -II	MOLECULAR BIOLOGY	3	4	25	75	100	4
	M -III	ENZYME TECHNOLOGY	3	4	25	75	100	4
	MP -I	LAB IN GENERAL BIOCHEMISTRY	6	5	-	-	-	-
	MP -II	LAB IN ENZYMOLOGY PLANT AND ANIMAL TISSUE CULTURE	6	5	-	-	-	-
	MP -III	COMPUTATIONAL BIOCHEMISTRY AND MOLECULAR STRUCTURE VISUALISATION.	3	4	40	60	100	4
	M -IV	STEM CELL AND CANCER BIOLOGY	3	4	25	75	100	-
		Total		3 2			600	28

Semester	Course Opted	Course Name	D	L	CIA	SE E	Marks	Credits
II	M - V	METABOLIC REGULATION	3	4	25	75	100	4
	M -VI	RECOMBINANT DNA TECHNOLOGY	3	4	25	75	100	4

	EL -I	ELECTIVE I – ADVANCED CLINICAL BIOCHEMISTRY	3	4	25	75	100	4
	M -VII	IMMUNOLOGY AND IMMUNO TECHNIQUES	3	4	25	75	100	4
	M -VIII	HUMAN PHYSIOLOGY, HORMONES AND SIGNAL TRANSDUCTION	3	4	25	75	100	4
	MP - I	LAB IN GENERAL BIOCHEMISTRY	6	6	40	60	0	4
	MP - II	LAB IN ENZYMOLOGY PLANT AND ANIMAL TISSUE CULTURE	6	6	40	60	100	4
	CE -II	EMPLOYABILITY SKILLS II	3	2	25	75	100	-
		Total		3 4			800	28

Semester	Course Opted	Course Name	D	L	CIA	SE E	Marks	Credits
III	CE -VI	EMPLOYABILITY SKILLS	3	2	25	25	50	-
	M -V	BIOINFORMATICS	3	4	25	75	100	4
	M -VI	DRUG BIOCHEMISTRY	3	4	25	75	100	4
	M -VII	CLINICAL RESEARCH	3	4	25	75	100	4
	MP -IV	LAB IN IMMUNOLOGY AND r DNA TECHNOLOGY	6	5	-	-	-	-
	MP -V	LAB IN RESEARCH TECHNIQUES IN BIOCHEMISTRY	6	5	-	-	-	-
	E - I	ELECTIVE – II MINI PROJECT AND VIVA VOCE	3		40	60	100	4
	M -IV	FORENSIC BIOCHEMISTRY	3	4	25	75	100	4
	EL - II	ELECTIVE III – EDC: HOSPITAL MANAGEMENT	3	4	25	75	100	4

		Total	3	2		600	28

Semester	Course Opted	Course Name	D	L	CIA	SEE	Marks	Credits
IV	M -IV	BIOSTATISTICS AND RESEARCH METHODOLOGY	3	5	25	75	100	4
	MP - III	LAB IN IMMUNOLOGY AND R-DNA TECHNOLOGY	6	5	40	60	100	4
	MP - IV	LAB IN RESEARCH TECHNIQUES IN BIOCHEMISTRY	6	5	40	60	100	4
	Pro - I	PROJECT REPORT AND VIVA VOCE	3	9	40	60	100	4
		Total		2	4		400	16

Course Title : RESEARCH TECHNIQUES	Course Code : 13A
Semester : I	Course Group : DSC I
Teaching Scheme in Hrs (L:T) : 3:1	Credits : 4
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	Explain the terms like pH, pOH, acidic, basic, neutral solutions and pH meter to acquire the practical skill.	PSOs	10	U
CO2	Outline the importance of suitable	PSOs	5	U

	chromatographic technique for actual analytical purposes.			
CO3	Apply the applications of centrifugation and chromatography in biological investigation.	PSOs	5	AP
CO4	Illustrating the use of electrophoresis techniques and its analysis of biomolecule separations.	PSOs	10	U
CO5	List out various spectroscopic techniques and its instrumentation methods.	PSOs	10	R
CO6	Explain the theoretical principles of radioactivity and appreciate the uses of radioisotopes.	PSOs	4	U
CO7	Motivating the students in handling the basic experimental techniques.	PSOs	4	AN

#### UNIT-I (LECTURE HOURS: 12)

Buffers -Introduction (Basics of acidity & basicity). pH ( Definition, determination of pH using indicators). Hendersons Hasselbach equation ( Relationship between pKa & pH). pH meter (Working, principle and instrumentation). Types of electrodes – ( Principle, working of calomel, silver/silver chloride, working, applications, hydrogen electrodes, working, diagram, applications).Centrifugation – (Introduction, Basic principles of centrifugation, Relative centrifugal force). Preparative and Analytical centrifugation – Preparative (Differential centrifugation, Principle, working, instrumentation with diagram, applications, Density gradient centrifugation (Principle, working, types, Isopynic, Rate – zonal centrifugation, Basic principles of sedimentation Applications). Analytical – (Ultracentrifuge, Rotors-types, principle, working, 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. – (Types- Ascending, descending, Circular, Principle, Technique& applications).Thin layer chromatography (Adsorbents, Mobile phase, stationary phase, solvents used, Principle, Technique& applications). Ion exchange chromatography –( Ion exchangers- anion & cation exchange resins, Mobile phase, stationary phase, Principle, Technique & applications). Molecular sieve chromatography – (Principle, Types of gels, Mobile phase, stationary phase, Molecular weight determination of proteins, technique& applications).

Affinity chromatography – (Principle, Mobile phase, stationary phase, Types of ligands used, Technique & applications). GLC – (Principle, Mobile phase, stationary phase, Carrier gas, columns, Technique & applications).HPLC- (Principle, Mobile phase, stationary phase, Pumping systems, column packing, 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- (Principle, Types (Horizontal, vertical)

Technique& applications).Gel electrophoresis – (Principle, - Types of gel electrophoresis- Agarose, SDS –PAGE, technique, applications). Pulse field Gel electrophoresis – (Principle, Technique& applications).

Immuno electrophoresis- (Principle, Antigen- antibody interaction, Single radial immunodiffusion , Ouchterlony double diffusion, Rocket immune electrophoresis,technique, applications). Isoelectric focusing – (Ampholytes Principle, technique& applications).

Blotting - Southern blot –( Principle, Techniques for DNA detection, applications)

Northern and western blot –( Principle, Techniques for RNA and protein detection, applications)

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 – (principle,Types, Emission flame & Atomic absorption spectrophotometry, techniques and applications).

Spectrofluorimetry – (Principle, types- Fluorescence, phosphorescence, Techniques, Instrumentation & applications). FTIR (Fourier Transform Infrared Spectroscopy – Principle, Instrumentation & applications).

Molecular characterization studies- ( NMR – Principle, Instrumentation & applications).

X-Ray diffraction – (Bragg's equation, Reciprocal lattice concept, Molecular structure of crystal).Mass spectrometry –(Principle, Types, GCMS & LCMS, Technique & applications).

SEM , TEM –( Principle, Technique & 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, Becquerel, specific activity). Measurement of radioactivity methods –(Gas ionization - GM counter, proportion counter, Principle, techniques and applications).Excitation - Scintillation counting (Principle, instrumentation working, applications).Photographic method – (Autoradiography, Principle, technique and applications).Clinical applications – (Tracer techniques, Diagnosis, Therapy).

Activity

- Article collection on environmental disasters of radioactive isotopes and methods of disposal of radioactive waste .
- Diagrammatic representation using different 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 7<sup>th</sup> - Keith Wilson and John Walker, 2016.

T3 - An introduction to Practical Biochemistry- Edition 3<sup>rd</sup> - David Plummer- 2017.

Reference Books:

R1 –Biophysical chemistry, Avinash Upadhyay and Kakoli Upadhyay,4<sup>th</sup> Edition 2019.

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

Course Title : MOLECULAR BIOLOGY	Course Code : 13B
Semester :I	Course Group : DSC II
Teaching Scheme in Hrs (L:T) : 3:1	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	Explain the basic concepts of replication in DNA.	PSOs	12	U
CO2	Explore the DNA repair mechanism and types of DNA damage.	PSOs	12	R
CO3	Describe the use of Prokaryotic transcription and its regulation.	PSOs	14	U



CO4	Explain about eukaryotic transcription and post transcriptional processing.	PSOs	14	R
CO5	Understand the concepts of both prokaryotic and eukaryotic translation.	PSOs	12	U
CO6	Explain about Genetic code and its clinical significance.	PSOs	10	R

#### UNIT-I (LECTURE HOURS: 12)

##### REPLICATION

DNA Replication -Types of replication (Semiconservative, Conservative, Dispersive) Meselson and Stahl experiment (E.coli, heavy isotope, N<sup>15</sup>, N<sup>14</sup>). Replications in circular chromosomes - Plasmid replication (Initiation, Elongation, Termination). Rolling circle model (Initiation, helicase enzyme, Topoisomerase Single strand binding proteins, Elongation, Eukaryotes, Prokaryotes, Termination, ligase enzyme, circular plasmid molecule). Theta model (unwinding replication, Lagging strand, Leading strand). Replication of mitochondrial DNA (Nuclear DNA, mitochondrial DNA, Replication of mt- DNA with diagram).

DNA replication in prokaryotes (Initiation, Enzymes and proteins involved in replication - helicase enzyme, Topoisomerase, Single strand DNA binding Proteins, DNA polymerase IV, V, Elongation, DNA polymerase I, II, III, Leading strand, Ladding strand, Okazaki fragment, Termination, Terminus sequence). Inhibitors of replication (Novobiocin, Nalidixic acid, Ciprofloxacin, Etoposide and Adriamycin).

Eukaryotic replication – ( Initiation, ORC, G1 phase, Pre – S phase, SPhase, Elongation, DNA polymerase alpha, epsilon, delta, Termination, Telomerase enzyme).

#### UNIT-II (LECTURE HOURS: 12)

##### DNA Repair and Recombination Mutations

DNA damage – (Dependent on various factors- cell type, age of the cell, extracellular environment, sources of damage). Types of DNA damage (Types- oxidative damage, Hydrolytic damage, DNA strand breaks). DNA repair mechanism – DNA repair (Definition, Mechanism - Nucleotide excision repair- distort the DNA double helix). Base excision repair- (changes to DNA bases, Glycosylases DNA polymerase, DNA ligase). Mismatch repair (Mut S, Mut L, Mut H, Enzymes). Recombination repair (Homologous, Site- specific and Transposition). Double stranded break repair (Homologous, non-homologous). SOS response- (Rec- A Protein, Lex- A repressor, error – prone repair system). Recombination – Homologous recombination (Holliday model). Site specific recombination (Lysogenic cycle, integrative mechanism) .

#### UNIT-III(LECTURE HOURS: 12)

Prokaryotic transcription and regulation – Transcription (Definition, Gene structure, Promoter region, RNA coding sequence, Terminator region, Initiation, Elongation, Termination).

Termination of transcription - Rho dependent (Definition, type 1 terminator, Hair pin loop). Rho independent termination (Definition, type 2 terminator, RNA polymerase).

Regulation of transcription in prokaryotes – lac operon( Definition, operon model, lac Z, lac Y, lac a, positive and negative regulation). Arabinose operon (Three structural genes, enzymes arabinose model, positive and negative regulation). Tryptophan operon (trp E, trp D, trpC, trp B and trp A, structure of trp operon, Negative control).

#### UNIT-IV (LECTURE HOURS: 12)

Eukaryotic transcription and regulation-(Eukaryotic gene control and RNA polymerases, regulatory sequence in eukaryotes, activators and repressors of transcription, transcriptional factors, Transcription initiation by RNA polymerase I, II and III, Elongation, RNA polymerase, Termination). Transcriptional regulation in eukaryotes –(Types- hormonal steroid hormone

receptors, phosphorylation - Stat proteins). Post transcriptional processing –(Definition, mRNA, rRNA and tRNA, Alternative splicing, RNA editing).

UNIT-V (LECTURE HOURS: 12)

Translation and Genetic code - Genetic code (salient features of genetic code, Wobble hypothesis).Components of protein synthesis –( mRNA, ribosomes and tRNA).

Protein synthesis in bacteria and eukaryotes –(initiation, elongation, termination).Post-translational modifications ( prokaryotes and eukaryotes). Inhibitors of protein synthesis-(Protein targeting - signal sequence hypothesis, targeting of proteins to different compartment of mitochondria, ER, plasma membrane, lysosomes, peroxisomes and chloroplast).Molecular basis of mutation- Types of mutation (missense, nonsense, silent, point and Frameshift mutation)

Text Books

1. Molecular biology of the Gene, James Watson, 7<sup>th</sup> Edition, 2017.
2. Principles of Molecular biology, VeeraBalaRastogi, 2<sup>nd</sup> Edition (Rev) 2016.
3. Freifelder's Essentials of Molecular biology, Malacinski, Jones and Bartlett, 4<sup>th</sup> Edition, 2015.
4. Molecular biology, W.H.Freeman and Co. Weaver, R.F. 2015.

Reference Books

1. Karp's Cell & Molecular biology , Gerald Karp, Janet Iwasa, Wallace Marshall, 9<sup>th</sup> Edition, 2019.
2. Molecular Cell Biology, Harvey Lodish, 8<sup>th</sup> Edition, 2018.
3. Molecular biology of the Gene, Watson, Steitz, Hopkins,Roberts, 4<sup>th</sup> Edition , 2016.

Course Title : ENZYMES AND ENZYME TECHNOLOGY	Course Code : 13C
Semester :I	Course Group : DSC III
Teaching Scheme in Hrs (L:T) : 3:1	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	Pos &PSOs	Cl.Ses	BLOOM'S TAXONOMY LEVEL
CO1	Explainthe classification of enzymes	PO1&	10	U

	according to IUB, isolation and purification of enzymes from different sources through various biochemical techniques.	PS01		
CO2	Summarize the structure of coenzymes and their role in various metabolic function.	PO1& PS01	5	U
CO3	Illustrate the mechanism of enzyme kinetics and enzyme inhibition in enzyme catalytic reaction	PO1& PS01	10	U
CO4	Describe the mechanisms involved in covalent modification of Glycogen Phosphorylase in animal and Glutamine synthetase in <i>E. coli</i> organism.	PO1& PS01	10	An
CO5	List out the mechanism of action of isoenzymes and proteolytic enzymes	PO1& PS01	10	An
CO6	Apply the methods of immobilizations and its applications in pharmaceutical and food industry.	PO1& PS01	10	Ap
CO7	Identify the role of enzyme in diagnosis and treatment of various diseases.	PO1& PS01	5	An

#### UNIT -I (LECTURE HOURS: 12)

##### ENZYME- INTRODUCTION ,NOMENCLATURE AND CLASSIFICATION

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 subcellular organelles (Mitochondria, Nucleus, Golgi apparatus, Lysosome). Isolation and purification of enzymes: Methods of homogenization– (Mammalian tissue, Plant, Fungal and Bacterial material homogenization) Methods of separation and purification of enzymes- Methods that depend on size or mass– Gel filtration. Centrifugation. - Ultra centrifugation and Dialysis - Membrane centrifugation of enzymes.-(principle and mechanism). Methods based on polarity- Ion exchange chromatography, Electrophoresis and Isoelectric focusing.(principle and mechanism)

Unit of enzyme activity: Turn over number of an enzyme -International Unit of enzyme, Katal (Definition and Reaction) Specificity of enzyme activity: Types of specificity- Absolute specificity, Stereo specificity, Optical Specificity, Group specificity or Relative specificity and Reaction specificity – (Definition. Reaction and 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)

##### COENZYMES

Introduction- Organic compounds - prosthetic groups - Integral part of active site. Nicotinamide coenzymes- NAD<sup>+</sup> and NADP<sup>+</sup>- (Structure and functions) Flavin nucleotides - FMN and FAD<sup>+</sup>- (Structure and functions) Coenzyme A- CoA.SH- (Structure and functions) Biotin- Free biotin, Protein bound biotin. -(Structure and functions) Folate coenzymes- THF-(Structure and functions) Lipoic acid- Coenzyme in decarboxylation of pyruvate.- (Structure and functions) TPP- Thiamine Pyrophosphate-(Structure and functions)

Pyridoxal phosphate-(Structure and functions) Active site- Binding sites and catalytic sites. (Introduction- and characteristic features of Active sites ). Mode of action- Lock and Key model and Induced fit theory- Mechanism with diagrammatic representation) Determination of active site residues- (Identification of substrate and inhibitors action in enzyme catalytic reaction)

Activity

1 - Model presentation for Lock and key and Induced fit theory

2 - Team work for making chart preparation for Coenzymes.

UNIT- III (LECTURE HOURS: 12)

### ENZYME KINETICS

Steady state theory – Definition and concept-(Rate of formation of ES, Rate of dissociation and Graph),  $K_m$  - Michaelis constant. and  $V_{max}$ – (Definition and Equation) Michaelis-Menten Derivation- Derive the equation and significance of M.M equation. (Definition and Derivation) LB Plot, Eadie-Hofstee and Hanes plot.-(Derivation, Graph and Significance) Mechanism of bisubstrate Reaction; Single displacement and Double displacement Reaction: Random - order mechanism- Ternary complex formation. (Introduction and Mechanism) Ping - pong mechanism– (Introduction and 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 - Introduction and mechanism-(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 Uric acid ). 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)).

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)

### REGULATION OF ENZYMES AND PROTEOLYTIC ENZYMES

Covalent modification of enzymes: Glycogen phosphorylase– Introduction and Mechanism (Phosphorylation and Dephosphorylation reaction in animal muscle cells.) Glutamine synthetase- Introduction and Mechanism– (Covalent modification mechanism in *E. coli* bacteria.) Isoenzyme- Introduction and features of Isoenzymes- Lactate Dehydrogenase - Introduction, Types - (LDH 1-5 and applications of LDH.) Multienzyme complex - Pyruvate Dehydrogenase – Introduction and mechanism of action of PDH – (Steps involved in PDH reaction).

Proteolytic enzyme:Chymotrypsin- Introduction -Mechanism of action of proteolytic enzyme- (Cleavage to specific amino acid residues)Carboxy peptidases-Introductionand mechanism (Action of cleavage of carboxy terminal end of protein compounds. Action of Zn in carboxy peptidase). Lysozyme –Introduction , Mechanism of action (-Digestion process of bacterial cell wall). Ribozyme ---Introduction and action (Non protein enzyme – Mechanism)Abzyme - Catalytic antibody – (Introduction and 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 AND INDUSTRIAL APPLICATION OF ENZYMES

Enzyme immobilization- (Introduction and mechanism) Methods of immobilization:(Types with suitable example)– Adsorption, Cross linking, Covalent Bonding, Entrapment and Encapsulation. Advantages and application of immobilized enzymes (Role of immobilized in– Food industry and pharmaceutical aspects) Industrial uses of enzymes-Textile and Foodindustries –(Baking of bread, brewing industries. Washing powders, immobilized glutamatedehydrogenase linked to alcohol dehydrogenase).

Role of enzyme in diagnosis and treatmentSerum Marker enzyme – ALT, AST, LDH, CPK,ACP, ALP, (Hepatic and other diagnostic application) Cancer marker enzymes-Prostatic acid phosphatase (PAP),Alkaline phosphatase Neuron-specific enolase, Aromatase. (Role of enzymes for cancer diagnosis) Covid-19 Viral disease- Angiotensin Converting Enzyme -2 receptor action- ACE-2 (Mechanism of action of enzyme in COVID-19) Therapeutic enzyme for various diseases. (Action of Asparaginase, Collagenase, Streptokinase, Urokinase, Penicillinase etc).Antioxidant enzymesMechanism of action of antioxidantenzymes-(Role in free radical scavenging activity.- SOD, Catalase, and Glutathione peroxidase)Role of enzyme in genetic engineering aspects-Enzymes in rDNA technology - Future prospects–(Restriction endo nucleases, 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, Lewis stevens 2010

T2 - Enzymes - Biochemistry, Biotechnology, Clinical chemistry. | Edition:3 | East west Press Pvt Ltd, New Delhi. | TREVOR PALMER. And PHILIP BONNER (2014)

Reference Books :

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

R2- Harper’s Illustrated Biochemistry, Victor Rodwell, David Bender, Kathleen Botham and Peter Kennelly, Thirty First Edition -May-2018.

R2- Enzyme Chemistry: Impact and Applications, 3<sup>rd</sup> Edition by Colin J Suckling and Gibson Colin .L -2010

Course Title : LAB IN GENERAL BIOCHEMISTRY	Course Code :
Semester :I	Course Group : MP I
Teaching Scheme in Hrs (P) : 5	Credits : 2
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

#### 1. QUANTITATIVE ANALYSIS

- a) Estimation of Starch - Anthrone method
- b) Isolation and Estimation of Glycogen - Colorimetry method
- c) Estimation of Protein - Lowry's method
- d) Estimation of DNA - Diphenyl amine method
- e) Estimation of RNA - Orcinol method
- f) Estimation of Phenol - Colorimetry method
- g) Estimation of Calcium - Titrimetry method
- h) Estimation of Chloride - Titrimetry method
- i) Estimation of Vitamin - C - Colorimetry method
- j) Estimation of Phosphorous - Fiske - Subbarow method
- k) Estimation of Total Protein, Albumin: Globulin ratio -

#### 2. DETERMINATION OF LIPID PROFILE

- a) Determination of Total Cholesterol
- b) Determination of Phospholipids
- c) Determination of Triglycerides
- d) Determination of HDL Cholesterol

e) Determination of LDL Cholesterol

Course Title : LAB IN ENZYMOLOGY PLANT AND ANIMAL TISSUE CULTURE	Course Code :
Semester :I	Course Group : MP II
Teaching Scheme in Hrs (P) : 4	Credits : 2
Map Code: H (PRACTICAL - EXPERIMENTS)	Total Contact Hours: 60
CIA: 40 Marks	SEE # : 60 Marks
Programme: MSC-BC	# - Semester End Exam

List of experiments

UNIT - I

1. DETERMINATION OF ACID PHOSPHATASE ACTIVITY
  - a) Effect of pH on Acid Phosphatase activity
  - b) Effect of Temperature on Acid Phosphatase activity
  - c) Effect of Substrate concentration on Acid Phosphatase activity -
2. ENZYMATIC ASSAYS IN LIVER AND SERUM
  - a) Assay of SGPT in Serum
  - b) Assay of SGPT in Liver
  - c) Assay of SGOT in Serum
  - d) Assay of SGOT in Liver
  - e) Determination of Serum Acid Phosphatase activity
  - f) Determination of Serum Alkaline Phosphatase activity
3. PLANT TISSUE CULTURE
  - a) Media preparation, Sterilization
  - b) Micropropagation
  - c) Callus induction & Embryo culture
  - d) Mitotic preparation from Onion root tip

Course Title : LAB IN COMPUTATIONAL BIOCHEMISTRY AND MOLECULAR STRUCTURE	Course Code : 13P
Semester :I	Course Group : MP III
Teaching Scheme in Hrs (P) : 3:1	Credits : 2
Map Code: H (PRACTICAL - EXPERIMENTS)	Total Contact Hours: 60
CIA: 40 Marks	SEE # : 60 Marks
Programme: MSC-BC	# - Semester End Exam

List of experiments

UNIT - I

IMAGE FILE MANIPULATIONS

Perform the basic image file manipulations using GIMP. (Cell Structure) - To create a new image file, To open an existing

image file, To save an image and to export an image file to .gif and other formats

TOOLBOX IN GIMP

Generate or develop an image file by exploring the basic tools in GIMP.(Cell Structure) - Use of Selection Tools : Rectangle , Ellipse ,Free , Fuzzy ,By Color , Scissors, Foreground. Use of Brush Tools: Bucket Fill - Blend- Pencil - Paintbrush - Eraser - Airbrush- Ink - Clone - Healing - Perspective Clone- Blur - Smudge- Dodge/Burn. Use of Transform Tools: Move - Align - Crop - Rotate - Scale - Shear - Perspective - Flip. Handling different types of Color Tools: Color -Hue- Saturation- Colorize -Brightness-Contrast -Threshold -Levels-Curves- Posterize

INSTALL GIMP SOFTWARE

Demonstrate on steps involved in installing GIMP software in your computer - Download the GIMP installer- Run the GIMP installer- Follow the prompts to install GIMP- Select what file formats you want to associate with GIMP- Finish the installation.

To detect the mutated cell for inherited Parkinson's disease using Animation. - Text effects- Color theory and animations

Identify the tumour in brain image using masking effects. - Use of layers - Masking effects.

USING FILTERS

Create Effects using variety of filters - Try different types of filters: Blur -Artistic-Distorts- Noise-Edge Detect- Light and Shadow-Generic-Decor-Render-Animation

How to create Layers in GIMP - Steps involved in creating and duplicating layers, adding colours to the layer



## TEXT EFFECTS

How to Create Text Effects in GIMP - Steps Followed: Open up a new document in GIMP-Place your basic text in the document-Add filters and adjust layers-Merge all layers into one.

## PROJECTS

ATP Energy Production process in Mitochondria using GEGL operations - Using Color Theory-GEGL operations.

Spot out the cancer cell from the normal cell using filters. - Use various filter operations.

## BIOLOGICAL DATABASES

PROTEIN DATABASES - PIR, ExPASy, TrEMBL

NUCLEIC ACID DATABASE - GENBANK, EMBL, DDBJ

STRUCTURAL DATABASE - MMDB, PDB

SPECIALIZED DATABASE - KEGG PATHWAY

SEQUENCE, SEARCH, COMPARISON & ALIGNMENT OF NUCLEOTIDE & PROTEIN

SIMILARITY SEARCHING - BLAST & FASTA

MULTIPLE SEQUENCE ALIGNMENT - Clustal W & Construction of phylogenetic tree

MULTIPLE SEQUENCE ALIGNMENT

PHYLOGENETIC ANALYSIS - Phylip, Phylodraw & Mega 4

3D STRUCTURE PREDICTION - Swiss model & RasMol

GENBANK - Using GenBank submit the sequence of Hemoglobin gene

## Text Books :

Multimedia: Making it Work | Edition:8 | TMGH | Tay Vaughan(2010)

Photoshop 6; The complete reference | Edition:5 | TMGH | Adele Droblas Greenberg AND Seth Greenberg(2001)

## Reference Books :

GIMP Pocket Reference: Image Creation and Manipulation | Edition: | | Sven Neumann( )

The Book of GIMP – A Complete Guide to Nearly Everything | Edition: | | Karine Delvare AND Olivier Lecarme ( )

Course Title : <b>STEM CELL AND CANCER BIOLOGY</b>	Course Code : <b>13D</b>
Semester : <b>I</b>	Course Group : <b>DSC IV</b>
Teaching Scheme in Hrs (L:T) : <b>3:1</b>	Credits : <b>4</b>
Map Code: <b>C(THEORY – CONCEPT)</b>	Total Contact Hours: <b>60</b>
CIA: <b>25 Marks</b>	SEE # : <b>75 Marks</b>
Programme: <b>MSC-BC</b>	# - <b>Semester End Exam</b>

#### UNIT-1 (LECTURE HOURS: 10)

##### 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 (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: 10)

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, Haematopoietc 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),Aging ( Introduction, Aging, Decline in stem cell function)

##### ACTIVITY

- 1.To download animations illustrating working of neural cells -
- 2.To label images on a worksheet in differentiating Stem Cells for Research -

#### UNIT-3 (LECTURE HOURS: 10)

##### 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), Issues related to stem cells (Ethical and legal issues ,Challenges in stem cell usage).

##### ACTIVITY

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

#### UNIT-4 (LECTURE HOURS: 9)

##### Cell cycle and cancer

Introduction of cell phases (Mitotic phase, Interphase, Centromere, Chromatids) ,Cancer (Tumor, Metastasis, Neoplasmas),Apoptosis (Introduction, Engulfment, Necrosis, Dendrites)

Cancer symptoms (Early symptoms, APC, tumor suppressor cells) leukemia (Introduction Definition, Reciprocal), translocationHistory and causes (Genetics, origin of cancer) Cancer stem cells (Introduction and its nature).

##### ACTIVITY

- 1.Debate on life after cancer -
- 2.To download animations illustrating Apoptosis -

#### UNIT-5 (LECTURE HOURS: 9)

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 (Transformation of normal cells, Apoptosis failure), Types (Biological therapy, Radiation therapy, Targeted cancer therapy , Immunotherapy)

##### ACTIVITY

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

##### Text Books :

Molecular Cell Biology | Edition:5 | Freeman and company  
| LODISH H ET AL(2004)Regenerative medicine |  
Edition:1 | NIH | Bethesda(2006)

##### Reference Books :

Understanding Stem cells | Edition:1 | National Academy Of Sciences | THOMAS P  
ZWAKA(2010)

Course Title : METABOLIC REGULATION	Course Code : 23A
Semester :II	Course Group : DSC V
Teaching Scheme in Hrs (L:T) : 3:1	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	Understand the structure of six metabolic pathway of carbohydrates and its regulations.	PSOs	10	U
CO2	Describe the structure of lipid metabolic pathway and its regulations.	PSOs	5	U
CO3	Understand the metabolic pathway of amino acids and Illustrate the catabolic pathway of protein metabolism such as urea cycle and its regulations.	PSOs	10	U
CO4	Describe the conversion of amino acids into some specialized products during various metabolic process such as the formation of neurotransmitters,	PSOs	10	AN

	polyamine, heme and various nucleotide synthesis.			
CO5	Distinguish the relationship between the biosynthesis of plant pigments chlorophyll and blood pigments haemoglobin and its functions in different scenario of plants and animals.	PSOs	10	AN
CO6	Describe the mechanism of absorption, metabolism and functions of essential mineral ions in our body.	PSOs	10	AP
CO7	Discuss the structure of the metabolic regulatory pathway of two different nucleotides such as purine and pyrimidine biosynthesis by denovo and salvage pathway and its catabol	PSOs	5	AN

#### 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

Anaplerotic reactions - Filling up Reactions

Gluconeogenesis - Regulation by allosteric and substrate level control mechanisms

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

Glycogen metabolism - Regulation of glycogen phosphorylase, glycogen synthase by effectors, covalent modification and hormones.

##### Activity

Carbohydrate metabolism - Preparing an activity based on Carbohydrate metabolism by using edible carbon source and vinegar .

#### UNIT-II (LECTURE HOURS: 12)

##### 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

Regulation & biosynthesis - Triacyl glycerols, cholesterol, phosphotidyl choline, phosphotidyl Ethanolamine.

Biosynthesis and regulation of prostaglandins - Eicosanoids, Thromboxanes, and Leukotrienes.

##### Activity

lipid metabolism - Demonstrating the lipid metabolism by using animal fat and a glass beaker in flame

#### UNIT - III (LECTURE HOURS: 12)

##### Amino acid metabolism

Gamma-Glutamyl cycle. - Gamma glutamyl transferase and reactions.

Metabolism of glutathione - Structure & reactions

SAM pathway - Methionine as methyl donor

Urea cycle - Pathway, reactions & regulation.

An overview of integrated metabolic pathways - Major metabolic pathways & control sites. Food intake and starvation induced metabolic change.

##### Activity

Amino acids - Preparing a chart model demonstrating the conversion of amino acids to its end product.

UNIT - IV (LECTURE HOURS: 12)

Porphyrin metabolism

Hemoglobin - Biosynthesis , degradation & regulation

Minerals

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

Manganese - 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 in diet

UNIT - V (LECTURE HOURS: 12)

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 - Preparing a chart model illustrating the nucleic acid metabolism

Text Books :

T1- Harpers illustrated Biochemistry | Edition:26 | McGraw Hill publication | ROBERT .K MURRAY,(2003

T2 - Text book of Biochemistry

EDITION:4 | Oxford and IBH publishing Co Pvt Ltd. | EDWARD STAUTON WEST & WILBERT R TODD(1974)

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

T4 - Plant physiology | Edition:2 | Prentice hall India Ltd | G.RAY NOGGLE GEORGE J FRITZ,(1992)

T5 - Plant Biochemistry & Molecular Biology | Edition:1 | John Wiley & Sons Publications | PETER J LEA (1995)

Reference Books :

R1-Biochemistry | Edition:3 | Tata Mc Graw Hill Education Private Ltd | S.C. Rastogi(2010)

R2-Plant Physiology | Edition:4 | CBS Publishers and Distributors | Robert .M. Devlin Francis H. Witham(1986)

Course Title : RECOMBINANT DNA TECHNOLOGY	Course Code : 23B
Semester :II	Course Group : DSC VI
Teaching Scheme in Hrs (L:T) : 3:1	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	Learn the basic techniques involved in recombinant DNA manipulations including DNA restriction, ligation, transformation and selection of recombinant plasmid.	PSOs	10	U
CO2	Understand the functions of several vectors used in cloning and Devise their own cloning strategies for DNA	PSOs	5	U
CO3	Illustrate creative use of modern tools and techniques for manipulation and analysis of genomic sequences.	PSOs	10	U
CO4	To describe the application of recombinant DNA technology in biotechnological research and Construct	PSOs	10	AN

	cDNA and genomic DNA libraries			
CO5	To understand the strategizing research techniques employing in rDNA technology	PSOs	10	AN
CO6	Learn the preparation of insert and vectors for the cloning	PSOs	10	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, Polynucleotide 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)

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 : IMMUNOLOGY AND IMMUNOTECHNIQUES	Course Code : 23C
Semester :II	Course Group : DSC VII
Teaching Scheme in Hrs (L:T) : 3:1	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	To understand the concept immune system for protection against diseases	PSOs	10	U
CO2	To remember the antigen and antibody structure, types, function and immunological reactions.	PSOs	5	U

CO3	To apply immune techniques to understand know the measurement of antigen and antibody interaction .	PSOs	10	U
CO4	To explain the different types of hypersensitivity and various immunological disorders .	PSOs	10	AN
CO5	To understand the significance of different vaccines .	PSOs	10	AN
CO6	To study the important organs transplantation and its impact of rejection	PSOs	10	AP

#### 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 function T 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) Organisation and structure of the lymphoid organs Primary lymphoid organs (Thymus and Bone Marrow) Secondary lymphoid organs –(Spleen, Lymph node, Peyer's Patches, CALT & MALT)

Activity Mechanism of action of vaccines Adverse effects of Vaccination Cells of the Immune System - 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 Fluorescence activated cell sorter (FACS) technique.

Activity Humoral and Cell mediated immunity, Secretory Ig and largest populated Ig in blood - 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)

Biology of the complement systems Complement system ( Classical, alternate pathway and lectin pathway Complement fixation test - Direct and Indirect) Immunogenetics (Major histocompatibility 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 Transplantation Immunology, MHC - 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 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).

Activity Hypersensitivity, Auto Immune disorders - 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- 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 Introduction (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)

Activity AIDS, Tumor Immunology - 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<sup>th</sup> – 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 Title : HUMAN PHYSIOLOGY,HORMONES AND SIGNAL TRANSDUCTION	Course Code : 23D
Semester :II	Course Group : DSC VIII
Teaching Scheme in Hrs (L:T) : 3:1	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	Recognize functions of blood and variety of terms specific to human body and health.	PSOs	10	U
CO2	Analyze and describe the structure and functions of human anatomy and physiology including respiratory system,	PSOs	5	U

	digestive system, circulatory system.			
CO3	To understand which elements in the various signaling pathways represent candidate drug targets for treatment of various diseases.	PSOs	10	U
CO4	To explain about activation, transport, metabolism and degradation along with importance of hormones.	PSOs	10	AN
CO5	Contribute to society by imparting physical understanding to health problems.	PSOs	10	AN
CO6	Aid to apply a wide knowledge about human mechanism in clinical level.	PSOs	10	AP

#### UNIT-I (LECTURE HOURS: 10)

##### 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 of digestion 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 and symptoms)

##### 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 -Mechanism (Transport of oxygen and carbon dioxide) 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) Excretory System - Kidney - Structure of nephron, composition .Urine formation - Mechanism of urine formation ( Glomerular filtration, 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: 9)

##### 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: 10)

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 Pituitary 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. Group discussion on
- 2.Hormones, biological clocks and daily and seasonal rhythms.

UNIT-V (LECTURE HOURS: 10)

RECEPTOR ACTION- NUCLEAR RECEPTOR , STERIOD RECEPTOR , RAS RECEPTOR AND TYROSINE RECEPTOR

Signaling by nuclear receptors: Ligands, nuclear and orphan receptors – (Structure and functions).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 : <b>ADVANCED CLINICAL BIOCHEMISTRY</b>	Course Code : <b>23E</b>
Semester : <b>II</b>	Course Group : <b>DSE I</b>
Teaching Scheme in Hrs (L:T) : <b>3:1</b>	Credits : <b>4 Credits</b>
Map Code: <b>C(THEORY – CONCEPT)</b>	Total Contact Hours: <b>60</b>
CIA: <b>25 Marks</b>	SEE # : <b>75 Marks</b>
Programme: <b>MSC-BC</b>	# - <b>Semester End Exam</b>

No	Course Outcome (Cos): After completion of this course, the students will be able to	PSOs	Cl.Ses	BLOOM'S TAXONOMY LEVEL
CO1	Remember the difference between plasma, Serum and the normal and abnormal constituents in various body fluids.	PSOs	12	U
CO2	Understand the aetiology, types, clinical manifestations and treatment of Diabetes mellitus and various disorders of carbohydrate metabolic pathways.	PSOs	12	U
CO3	Apply the etiology, types, clinical manifestations, diagnosis and treatment of various amino acid and the nucleic acid metabolism disorders.	PSOs	12	U
CO4	the clinical role of lipids including triglycerides, cholesterol and phospholipids in diseases.	PSOs	12	AN
CO5	Evaluate the diseases result from imbalance in certain enzymes and helps in diagnosis of liver, gastrointestinal, kidney diseases.	PSOs	12	AN

#### UNIT I (LECTURE HOURS: 12)

##### Laboratory Analytical Performance

Concepts - Concepts of Accuracy, precision, specificity, sensitivity & reproducibility

Quality Control - Automation in clinical biochemistry laboratory and factors in quality control.

##### Specimen collection and processing

Collection methods - 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.

#### UNIT II (LECTURE HOURS: 12)

##### Disorders of carbohydrate metabolism

Carbohydrate metabolism - - Introduction Hyperglycemia, Hypoglycemia, Glucose Tolerance Test (GTT), Glycosuria

##### Diabetes Mellitus(DM)

Types and metabolic abnormalities. - 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 Mucopolysaccharidases.

#### UNIT III (LECTURE HOURS: 12)

##### Disorders of amino acid and Nucleic acid metabolism- Introduction



Introduction - Inborn errors of aminoacid metabolism: Phenyl ketonuria, Alkaptonuria, Cystinuria, Maple syrup urine disease, and albinism

Disorders of Nucleic acid metabolism

Purine and Pyrimidine metabolism - Hyper uricemia-Gout and its types ,Hypo uricemia, Lesch Nyhan syndrome and hereditary Ortotic aciduria.

UNIT IV (LECTURE HOURS: 12)

Disorders of lipid metabolism

Clinical disorder of lipid metabolism - Hyperlipo proteinemia, Hypolipo proteinemia- Types

Lipid storage diseases - Taysach's and Niemann picks diseases, fatty liver, Hypercholestrolemia, Hypocholesterolemia..

Atherosclerosis - Clinical features and complications

UNIT V (LECTURE HOURS: 12)

Functional tests

Functional tests of liver - Liver disease - Jaundice, hepatitis, gall stones, cirrhosis and fatty liver. biochemical diagnosis of diseases by enzymatic assays-AST, ALT, ALP and GGT. Serum Bilirubin test: Van den berg reaction, Prothrombin time

Functional tests of kidney - 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 gastrica

Text Books :

Clinical Biochemistry | Edition:5 | Denis St. J. O'Reilly | Allan Gaw AND Michael J. Murphy AND Rajeev Srivastava AND Robert A. Cowan(2013)

Textbook of Clinical | Edition:5 | Tietz | Carl A. Burtis AND David E. Bruns AND Edward R. Ashwood (2012)

Reference Books :

Clinical Biochemistry | Edition:1 | Oxford University Press | Nessar Ahmed(2011)

Text Book of Medical Biochemistry | Edition:6 | Jaypee Publisher | M.N. Chatterjee AND Ranashinde(2006)

Course Title : LAB IN GENERAL BIOCHEMISTRY	Course Code : 13P
Semester :II	Course Group : MP I
Teaching Scheme in Hrs (P) : 5	Credits : 2

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

#### QUANTITATIVE ANALYSIS

Estimation of phenol by colorimetry method

Estimation of chloride by titrimetry method

Estimation of cholesterol by Zak's method

Separation of Lecithin from egg yolk

Extractions of lipids from egg

Estimation of Thiamine / Riboflavin from cereals by fluorimetry methods

#### CHROMATOGRAPHIC ANALYSIS

Paper chromatography (ascending)

Thin layer chromatography

column chromatography

#### ELECTROPHORESIS

Agarose gel electrophoresis

SDS gel electrophoresis

#### Text Books

Biochemical Methods | Edition:2 | New Age International Publishers |  
ManickamSadhasivam(2005)

Course Title : LAB IN ENZYMOLOGY PLANT AND ANIMAL TISSUE CULTURE	Course Code : 13Q
Semester :II	Course Group : MP II
Teaching Scheme in Hrs (P) : 5	Credits : 2
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

#### DETERMINATION OF ALPHA AMYLASE ACTIVITY

Effect of pH on the rate of alpha amylase activity -

Effect of Temperature on the rate of alpha amylase activity -

Effect of substrate concentration on the rate alpha amylase activity -

#### DETERMINATION OF CATALASE ACTIVITY

Effect of pH on the rate of catalase activity -

Effect of Temperature on the rate of catalase activity -

Effect of substrate concentration on catalase activity -

#### ENZYMATIC ASSAYS IN LIVER

Determination of Liver Acid phosphatase activity -

Determination of Liver Alkaline phosphatase activity -

#### ANIMAL TISSUE CULTURE

Sterilisation- Filter method -

Culture of lymphocytes from Blood sample- Monitoring microbial contamination -

Checking for viability of cells. -

#### INVITRO CYTOTOXICITY ASSAY

MTT assay -

Tryphan Blue experiment -

Text Books :

Biochemical methods | Edition:2 | New Age International Publishers |

ManickamSadhasivam(2005)

Principles and practice of Animal Tissue culture | Edition:2 | University press publishers |

SudhaGangal(2010)

Reference Books :

Principles and Techniques of Practical Biochemistry | Edition:5 | Cambridge University Press |

Keith Wilson John M. Walker(2001)

Course Title : FORENSIC BIOCHEMISTRY	Course Code : 33A
Semester :III	Course Group : DSC IX
Teaching Scheme in Hrs (L:T) : 3:1	Credits : 4 Credits
Map Code: C(THEORY – CONCEPT)	Total Contact Hours: 60
CIA: 25 Marks	SEE # : 75 Marks
Programme: MSC-BC	# - Semester End Exam

Course outcome: (Cos)

No.	Course Outcome (Cos): After completion of this course, the students will be able	POs & PSOs	Cl. Ses	CL
CO1	Understand the concepts of nanotechnology and applications of nonmaterial's in biosensor systems .	PSO 1	10	U
CO2	Apply the nano particles in pharmaceuticals in pharmaceutical aspects such as Nano wire, Nanotubes,Nanochips for clinical diagnosis and treatment.	PSO 2	10	U
CO3	Apply the Nanoparticles for cancer and skin diseases through combination of Nanoparticles with drug compounds by drug delivery mechanism	PSO 2	10	U & R
CO4	Applications of Nanoparticles for treatment for various diseases.	PSO 3	10	U &AN
CO5	Describes the role of nanotechnology as in agriculture field for making nutritional food products and smart packing materials.	PSO3	10	U &AN
CO6	Understand the concept of Nanobiophotechnics and its application.	PSO 3	5	U &AN
CO7	Identify and compare state of the art Nanofabrication methods and perform a critical analysis of there search literature.	PSO3	5	U &AN

## UNIT-I (LECTURE HOURS: 12)

IDENTIFICATION ( introduction, Definition and data to establish identity , race, religion, sex, age, stature, complexion and features, external peculiarities, anthropometry, dactylography, and poroscopy-superimposition technique)FORENSIC ODONTOLOGY

Odontology (Medico-legal importance of age and sex)

Activity

How will you give first aid for an accident victim - Demo -?

## UNIT-II (LECTURE HOURS: 12)

THANATOLOGY (introduction , Types of death,Modes of death and their patho-physiology-causes of death, classification and medico-legal aspects of natural death)Diagnosis of poisoning ( Live and dead) DUTIES OF THE MEDICAL PRACTITIONER (Duties of the medical practitioner , In suspected case of poisoning)

ACTIVITY

1. Giving first aid: Accident victim-
2. Giving first aid: In case of seizures.-

## UNIT-III (LECTURE HOURS: 12)

POST MORTEM CHANGES (Signs of death and changes following death and their medico-legal importance,Adipocere, mummification, embalming)Estimation of post mortem interval (time of death) (Presumption of death and survivorship)

MECHANICAL INJURIES (WOUNDS) (Classification and mechanism of wound production, Abrasions, Contusions, Incised wounds, Chop wounds, Stab wounds and Lacerated wounds and their medico-legal Importance) Firearms classification and cartridges (Firearm wounds by different firearms and their medico -legal importance -Bomb explosion Wounds.)

ACTIVITY

1. Case study : Collection of data from a murder site

## UNIT-IV(LECTUREHOURS:12)

VIOLENTASPHYXIALDEATHS (introduction, Classification, Hanging, Strangulation by ligature Throttling, Smothering, Gagging, Overlaying, Burking, Choking, Drowning) DEATH DUE TO COLD (Death Due to cold, heat, electricity and radiation) Anaesthetic and operative deaths.

ACTIVITY

Chart work on OT equipments.

## UNIT-V (LECTURE HOURS: 12)

MEDICO-LEGAL AUTOPSY (Protocol) ,Technique (Blotting & Finger printing) Postmortem report. EXAMINATION OF SET OF BONES(Ethical Consideration , Examining the set of bones)

ACTIVITY

How to collect Bone specimen for forensic examination.

Text Books :

Forensic science : an illustrated dictionary | Edition:1 | PBS publishers | John C. Brenner(2004)

Reference Books :

Encyclopedia of forensic sciences | Edition:1 | Editor-in- chief | Pekka J. Saukko, Geoffrey C. Knupfer( 200)

Forensic science : an encyclopedia of history, methods, and techniques | Edition:2 | PBS | William J. Tilstone, Kathleen A. Savage, and Leigh(2006)

Course Title : DRUG BIOLOGY AND DYNAMICS	Course Code : 33B
Semester :III	Course Group : DSC X
Teaching Scheme in Hrs (L:T) : 3:1	Credits : 4
Map Code: C(THEORY – CONCEPT)	Total Contact Hours: 60
CIA: 25 Marks	SEE # : 75 Marks
Programme: MSC-BC	# - Semester End Exam

Course outcome: (Cos)

No.	Course Outcome (Cos): After completion of this course, the students will be able to	PSOs	Cl. Ses	CL
CO1	To understand the time course of drugs and study the reaction by ADME	PSO 1	12	U
CO2	To explain the interaction between drug and receptor and to determine the impact of drugs in use and addiction on individuals	PSO 2	12	U
CO3	To analysis the safety of potential drugs and to analyze the impact of the drugs	PSO 1	12	R
CO4	To create an awareness on drug abuse	PSO 3	12	U &AN
CO5	To explain and understand the pharmacokinetics	PSO3	12	AN

UNIT-I (LECTURE HOURS: 12)

## PHARMACOLOGY

General Pharmacology - Introduction

Classification - Pharmacology, Pharmacodynamics, Pharmacokinetics, Toxicology, Therapeutics.

## DRUGS

Nature and sources of drugs - Animals, Plants, Microorganism, synthetic. Biosynthetic

Route of Administration - Oral, Injection, Transmucosal

Absorption - Passive Diffusion, Active transport, pinocytosis

Distribution - Plasma, Interstitial fluid compartment, trans cellular fluid compartment, cellular fluid compartment.

Metabolism - Phase I and Phase II

Elimination - Passive glomerular filtration, Active Tubular secretion, passive diffusion across the tubules.

#### ACTIVITY

1 - Discussion and pictorial presentation on different source of drugs

2 - Animation on ADME mechanism

#### UNIT-II (LECTURE HOURS: 12)

##### DRUG RECEPTORS

Cell surface receptors - Ion channels, G protein coupled receptors, Tyrosine kinases.

##### ADVERSE DRUG RESPONSE

Adverse drug reaction in man - Drug tolerance, Intolerance, Idiosyncrasy, allergy, tachyphylaxis, Drug dependence

##### ASSAY OF DRUG POTENCY

Assay - Chemical assay, Bioassay, Immunoassay.

##### DRUG EXTRACTION

Methods of drug extraction - Decoction and Pelleting

#### ACTIVITY

1 - Model/Chart work on different types of drug receptors.

#### UNIT-III (LECTURE HOURS: 12)

##### TOXICOLOGY

Introduction - Definition and scope of toxicology

Classification - Various Sub disciplines of toxicology

##### DOSE RESPONSE CONCEPT

Dose response relationship - Graded and Quantal Dose response relationship.

##### DRUGS IN DISEASE

Respiratory Disease - Cough, Asthma, TB

Gastrointestinal tract - Vomiting, Peptic ulcer, diarrhoea

Antimicrobial - Antibacterial, Antiviral, Antimalarial

Cancer chemotherapy - Introduction and Drugs used.

#### ACTIVITY

1 - Quiz on Toxicology

2- Making clay model of damaged organ

#### UNIT-IV (LECTURE HOURS: 12)

##### GENOME BASED MEDICINE

Cloning - Functional, Positional Cloning-for identifying diseased gene.

Analysis of human diseased gene - Huntington's disease and Cystic fibrosis.

##### GENE THERAPY

Introduction - Basic approach of genetherapy

Human somatic cell gene therapy - Exvivo and invivo



Vectors used in gene therapy - Viral and non-viral vectors

Antisense Therapy - Antisense oligonucleotides

#### ACTIVITY

1 - Slide presentation on Functional and Positional Cloning

2 - Discussion of Articles related to Gene therapy

UNIT V (LECTURE HOURS: 12)

#### DRUG DISCOVERY

Approaches - Introduction.

Target Identification and validation - Types of Targets, validation characters.

Identifying Lead compound - Qualities, Finding compounds.

Optimization of Lead compounds - Other outputs

#### PHARMACOKINETICS

Basic Concepts in Pharmacokinetics - Elimination - Metabolism + Excretion , Disposition - Distribution + Elimination

Important Pharmacokinetic Parameters - Primary pharmacokinetic parameters: Clearance and Volume of distribution. Secondary pharmacokinetic parameters: Half-life, Bioavailability

#### ACTIVITY

1 - Quiz on Drug discovery

2- Perform Docking of any ligand with its protein using AutoDock

Text Books :

RECOMBINANT DNA TECHNOLOGY | Edition:2 | W.H Freeman Company, Newyork |

JAMES D WATSON., MICHAEL GILMANMARK ZOLLER(2010)

BIOPHARMACEUTICAL BIOCHEMISTRY AND BIOTECHNOLOGY | Edition:2 | Wiley India Pvt Ltd, Ireland | Garywalsh(2013)

Reference Books :

Basic Bioinformatics | Edition:2 Nd | Narosa Publishing House, Chennai | Ignacimuthu S J(2013)

Pharmacology And Pharmacotherapeutics | Edition:25 | Popular Prakashan Pvt Ltd | Satoskar Rs Bhandarkarainapure(2017)

Textbook Of Toxicology | Edition:1 | I.K International Publishing House Pvt Ltd | BalaramPaniBalaramPani (2010)

Course Title : <b>BIOINFORMATICS</b>	Course Code : <b>33C</b>
Semester : <b>III</b>	Course Group : <b>DSC XI</b>
Teaching Scheme in Hrs (L:T) : <b>3:1</b>	Credits : <b>4</b>
Map Code: <b>C(THEORY – CONCEPT)</b>	Total Contact Hours: <b>60</b>
CIA: <b>25 Marks</b>	SEE # : <b>75 Marks</b>
Programme: <b>MSC-BC</b>	# - <b>Semester End Exam</b>

Course outcome: (Co's)

No.	Course Outcome (Cos): After completion of this course, the students will be able to	POs & PSOs	Cl. Ses	CL
CO1	To understand the retrieval of protein and genetic sequence	PSO 1	10	U
CO2	To know the transform raw data into meaningful information by applying computational techniques	PSO 2	10	U
CO3	To describe the principles and algorithms of pairwise and multiple alignments, and sequence database searching	PSO 2	10	U & R
CO4	To create the phylogenetic tree construction and application of phylogenetic analysis in evolutionary studies	PSO 3	10	U & An
CO5	To learn sequence analysis methods and tools used for gene prediction	PSO3	10	U & An
CO6	To apply the homology modeling for research	PSO 3	5	U & An
CO7	To evaluate the chemical structures and the uses of molecular modelling tools and their applications.	PSO3	5	U & An

UNIT-I (LECTURE HOURS: 12)

Bioinformatics

Introduction - Definition and objectives

Applications of bioinformatics - Applications related to information search, genetics, sequence comparison, phylogenetic analysis, pharmacogenomics, drug discovery etc.

## Biological databases

Introduction - Definition, types of databases

Protein databases - Tr EMBL,PIR,Expasy

Nucleicacid database - Genbank,EMBL,DDBJ

Structural database - MMDB,PDB

Specialized database - Metabolic pathway-KEGG

### Activity

1 - Visualisation of 3D structure of Keratin using Protein Data Bank (PDB)

2 - To retrieve the TCA cycle in Kyoto Encyclopedia of Genes and Genomes (KEGG)

## UNIT-II (LECTURE HOURS: 12)

### Genome sequencing approaches

Clone by clone and whole genome shot gun method - Introduction, generation of sub clones, automated sequencing methods - Metagenomics

Sequence alignment & comparison (DNA and Protein) - Dot plot global and local alignment

Scoring matrices- - PAM and BLOSUM

Tools for similarity searching . - FASTA and. BLAST

Multiple sequence alignment - Clustal W.

### Activity

1 - Group Discussion on Sequence alignment tools

2 - Perform Clustal W after downloading 5 different sequences of insulin mRNA from NCBI

## UNIT-III (LECTURE HOURS: 12)

### Phylogenetic analysis

Phylogenetic trees - Introduction,definition,types-rooted and unrooted trees.

### Phylogenetic softwares

Methods of phylogenetic analysis- Distance methods - Distance matrices and Neighbour joining methods.

Character-based methods - Maximum parsimony, minimum evolution and maximum likelihood

Phylip - Phylogeny inference package-methods

Phylodraw - Tree drawing system

### Visualisation tools

RASMOL and Swiss PDB viewer - Procedure and different options for viewing.

### Activity

1 - Construct a phylogenetic tree using PHYLIP for collagen sequence from 5 different species

2 - Exhibit 3D structure and Ramachandran plot of p53 protein using Swiss PDB viewer

## UNIT-IV (LECTURE HOURS: 12)

Genomics and genome projects

Human genome project (HGP) - Salient features and benefits of genomic research scope and applications

Proteomics

Secondary structure analysis - Choufasman,GOR

Prediction methods - Nearest Neighbour methods.

Sequence based protein prediction methods

Homology modeling - Comparative modeling (Threading)- Swiss model

Ab initio Approach. - Molecular dynamics, Lattice models etc.

Activity

1 - Quiz on Genomics and Genome projects

2 - Make a chart presentation on protein structure prediction methods

UNIT-V (LECTURE HOURS: 12)

Computer aided drug designing

Introduction - Drug discovery process,complementaryinteractions,drug related terms.

Drug design approaches

Ligand based - QSAR, Pharmacophore hypothesis model.

Computer aided drug designing

Computer –Aided Molecular design - Quantum CACHE & Project Leader

Target based drug designing - Docking, Docking programmes- Auto Dock and LUDI.

ADME properties.

Approaches towards ADMET prediction - Reduction of drug toxicity,improve drug safety & Computational approaches.

Activity

1 - Perform Docking of any ligand with its protein using AutoDock (e.g. Glucose with Hexokinase)

Text Books :

Basic Bioinformatics | Edition:2 | Narosa Publishing House Ltd, New Delhi. | S.Ignacimuthu(2013)

Bioinformatics with Fundamentals of Genomics &Proteomics | Edition:1 | Tata McGraw-Hill Education Private limited, New De | Shubha Gopal, Anne Haake(2014)

Bioinformatics-concepts, skills and applications | Edition:2 | CBS Publishers, Delhi | SC Rastogi, Namita MendirettaParag Rastogi(2013)

Reference Books :

Bioinformatics sequence and genome analysis, | Edition:1 | - | DavidW.Mount(2014)

Bioinformatics, a Practical Approach | Edition:1 | Aparnaa publication, Tamilnadu| K. Mani N. Vijayaraj(2004)

Course Title : <b>CLINICAL RESEARCH</b>	Course Code : 33D
Semester : <b>III</b>	Course Group : M - XII
Teaching Scheme in Hrs (L:T:P) : 4:0:0	Credits : 4
Map Code: <b>C(THEORY – CONCEPT)</b>	Total Contact Hours: 60
CIA: 25 Marks	SEE # : 75 Marks
Programme: <b>M.SC-BC</b>	# - <b>Semester End Exam</b>

No	Course Outcome (Cos): After completion of this course, the students will be able to	PSOs	Cl.Ses	BLOOM'S TAXONOMY LEVEL
CO1	Understand the origin of clinical research and clinical trials	PSOs	12	U
CO2	Develop a comprehensive knowledge of the history and evolution of clinical trials	PSOs	12	U
CO3	Critical understanding of the purpose and context of each of the phases of clinical research	PSOs	12	U
CO4	Understand the study of clinical trial protocol design.	PSOs	12	U
CO5	Understand the most important ethical issues in clinical research.	PSOs	12	U

#### UNIT- I : LECTURE HOURS: 12)

##### History & Background of Origin of Clinical Research

Thalidomide tragedy - Sulphanilamide disaster, Declaration of Helsinki, The Belmont Report.

Introduction of Clinical Research - Core research methodology

Types of clinical research - Treatment, Prevention, Diagnostic research

Principles of science - - Scientific method - Five basic components (Critical thinking, types of evidence, anecdotal, correlational, circumstantial evidence)

#### ROLE OF ORGANIZATIONS IN CONDUCTING CLINICAL RESEARCH

Government organization - UGC, BT, DST, ICMR

Commercial organization - non-profit organization

## ACTIVITY:

Group discussion on difference between Clinical Research and Clinical Trial.

## UNIT II (LECTURE HOURS: 12)

### BASIC CLINICAL TRIAL

History of Good Clinical Practices (GCP) - Introduction to ICH, The Nuremberg Code, and Principles of ICH-GCP

### GCP GUIDELINES AND TYPES

Guidelines - ICH Guidelines, Indian GCP guidelines, ICMR Guidelines

### TYPES OF TRIALS

Trials - Prevention Trials, diagnostic trial, Treatment trial, Case cohort study, Observational studies, Quality of life trials

### PHASES OF CLINICAL TRIALS

Phases of clinical trials - Phase I, Phase II, Phase III, Phase IV

## ACTIVITY

1- Group Discussion on Four Phases in Clinical Trials

2 - Make a chart on Good Clinical Practice

## UNIT III (LECTURE HOURS: 12)

### CLINICAL TRIAL PROTOCOL DESIGN

FUNDAMENTALS OF TRIAL DESIGN - Randomized clinical trial, uncontrolled trials, protocol development, end points, Patient selection, sources and control of bias, Randomization, sample size and power

PRINCIPLES OF CONTROLLED CLINICAL TRIALS - Clinical trial protocol, consent in clinical trials, placebo, bias and methods to prevent bias.

ETHICAL ASPECTS: - Ethical principles underlined research involving human subjects, respect for persons, beneficence, justice, legal authorities for Institutional Review Board (IRB).

## ACTIVITY

Group Discussion in Research problems faced by volunteers and investigators when testing new drugs

## UNIT IV (LECTURE HOURS: 12)

### CLINICAL DATA MANAGEMENT

Data Management - Overview, regulation, data management plan and CRF designing, database designing and implementation.

### CLINICAL TRIAL MANAGEMENT

Investigator site perspective - Safety monitoring and oversight

Co-ordinating a clinical trial at the site. - - Sample size calculation, inclusion/exclusion criteria, randomization, choice of centre

## DATA SAFETY MONITORING BOARD

### LAB IN RESEARCH TECHNIQUES IN BIOCHEMISTRY

Concepts and management. - Committee- Trial steering, trial management, data monitoring committee.

#### ACTIVITY:

Chart preparation for clinical trial management

#### UNIT V (LECTURE HOURS: 12)

### INTERNATIONAL REGULATORY BODIES AND GUIDELINES

US Food and Drug Administration (USFDA): - The FDA and Food Drug and Cosmetics Act, New drug development and approval.

India: - Regulatory laws, Schedule Y, registration of new drugs, requirements for registration, regulatory environment and practices

European Agency for Evaluation of medicinal Products (EMA): - National registration , the decentralized procedures, mutual recognition procedures

### INTELLECTUAL PROPERTY RIGHTS

Terminology - Patent Laws, TRIPS (Trade Related Intellectual Property Rights) Agreement, Trademarks, copyrights

### CLINICAL TRIAL APPLICATION REQUIREMENTS

New Drug Application(NDA): - Pre NDA meeting , NDA submission Check list , NDA review check list ICD9 and ICD10

#### ACTIVITY

1 - Group Discussion on safety Data Guidelines

2 - Quiz on IPR

Text Books :

Clinical trial of drugs and biopharmaceuticals | Edition:- | CRC Press | CHI-JEN LEELUCIA H LEE(2006)

Text Book of clinical trials | Edition:2 | Willey india Pvt ltd | DAVID MACHINSIMONDAY(2010)

Course Title : LAB IN IMMUNOLOGY AND R-DNA TECHNOLOGY	Course Code :
Semester :III	Course Group : MP IV
Teaching Scheme in Hrs (P) : 5	Credits : 2
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

#### IMMUNOLOGY

RA TEST

CRP TEST

WIDAL TEST

PREGNANCY TEST

IMMUNODIFFUSION - SINGLE, RADIAL

IMMUNODIFFUSION - DOUBLE

IMMUNOELECTROPHORESIS

ROCKET IMMUNO ELECTROPHORESIS

ELISA - HORMONE ASSAY

SEROLOGY

ASO TITRE

VDRL TITRE

DETERMINATION OF BLOOD GROUP

Text Books :

Biochemical Methods | Edition:1 | New Age International. | S. SadasivamA. Manickam(1996)

Reference Books :

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



Course Title : LAB IN RESEARCH TECHNIQUES	Course Code :
Semester :III	Course Group : MP V
Teaching Scheme in Hrs (P) : 5	Credits : 2
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	: <b>HOSPITAL MANAGEMENT</b>	Course Code	: 3EA
Semester	: III	Course Group	: EL3
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: <b>MSC-BC</b>			

Course outcome: (Cos)

No.	Course Outcome (Cos): After completion of this course, the students will be able to	POs & PSOs	Cl. Ses	CL
CO1	Understand the study of concept of hospital, classification and its functions.	PSO 1	12	U
CO2	Understand the study of operationthearte and its features	PSO 2	12	U
CO3	Illustrate the study of facilities and functions of Intensive care unit.	PSO 2	12	U & R
CO4	Understand the need and importance of cost effective sustainable health care through demand generation and enhanced quality care.	PSO 3	12	U
CO5	Remember the basic principles and methods for the assessment of health needs of a community and plan for health programs.	PSO3	8	R
CO6	Understand the handling and disposal requirements for hospital waste management.	PSO 3	4	U

UNIT-I (LECTURE HOURS: 12)

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

Service Organisation - Time Cycle, Recreation and environment, Adult education

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

#### UNIT-II (LECTURE HOURS: 12)

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 readiness, Care and disposal of tissues

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

Functions - Centralized area, Monitor the data, Patient care

#### UNIT-III (LECTURE HOURS: 12)

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

#### 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

Advantages - Immunization, Child and women benefits, Health benefits, Programme, Reporting, Effective maternal and health care

#### UNIT-V (LECTURE HOURS: 12)

##### 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)

##### 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 : <b>BIostatistics and Research Methodology</b>	Course Code : 43A
Semester : <b>IV</b>	Course Group : M - XII
Teaching Scheme in Hrs (L:T:P) : <b>4:0:0</b>	Credits :4
Map Code: <b>C(THEORY – CONCEPT)</b>	Total Contact Hours: 60
CIA: <b>25 Marks</b>	SEE # : <b>75 Marks</b>
Programme: <b>M.SC-BC</b>	# - <b>Semester End Exam</b>

No	Course Outcome (Cos): After completion of this course, the students will be able to	PSOs	Cl.Ses	BLOOM'S TAXONOMY LEVEL
CO1	Understand the basic concept of data analysis and statistical computing.	PSOs	12	U
CO2	Understand data collection method	PSOs	12	U
CO3	Collect data relating discrete and continuous random to variable which will be examined and calculate descriptive statistics from known database	PSOs	12	U
CO4	Differentiate the specificity and sensibility of each statistical technique.	PSOs	12	U
CO5	Apply hypothesis testing via some of the statistical distributions, define some concepts about hypothesis testing. Update the independent of random variables like t-Test, F-test, chi-square and ANOVA classification	PSOs	6	U
CO6	Understand the various research methods and report writing.	PSOs	6	U

#### UNIT-I (LECTURE HOURS: 12)

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

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 - preparation of chart work in pie diagram and bar diagram

2 - Quiz on different ways of data collection

UNIT-II (LECTURE HOURS: 12)

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.

Correlation

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 - Usage of regression analysis to draw derive line equation for colorimetric experiments.

2 - Group Discussion on relationship between mean, median and mode standard deviation.

UNIT-III (LECTURE HOURS: 12)

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

Chi square test(gene frequency analysis)Degrees of freedoms - assumption Continuity correlation - Related Problem

Calculation of chi square test - Related problems

Analysis of variance

One way ANOVA - Related problems

Two way ANOVA - Related problems

Null Hypothesis, MANOVA - Related problems

## 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 ways ANOVA, Distribution, Binomial, Poisson, Normal.

## UNIT-IV (LECTURE HOURS: 12)

### Research

Introduction - The design of any research project, Scientific and Systemic literature 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 - identifying in literature Formulating a Research Question, Formulating Hypothesis Aims and Objectives

### 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

## 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)

### 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

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

Formation of report - Informative Presentation of Tables, Graphs and Statistics

Text Books :

Statistical methods | Edition:30 | Sultan Chand & Sons Educational Publishers | Dr S.P.Gupta(2001)

Reference Books :

Research Methodology methods and Techniques | Edition:2 | New Age Publications | Kothari CR(2004)



Course Title : LAB IN IMMUNOLOGY AND R-DNA TECHNOLOGY	Course Code : 43P
Semester :IV	Course Group : MP IV
Teaching Scheme in Hrs (P) : 5	Credits : 2
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

#### r DNA Technology

Plasmid DNA isolation - Procedure, Principle, Reagent Preparation Result.

Genomic DNA isolation - Procedure, Principle, Reagent Preparation Result.

Estimation of RNA from Liver and Serum by Orcinol method - Procedure, Principle, Reagent Preparation Result.

Agarose gel electrophoresis of DNA /RNA and MW determination - Procedure, Principle, Reagent Preparation Result.

Estimation of DNA from Liver and Serum by Diphenyl amine method - Procedure, Principle, Reagent Preparation Result.

Restriction analysis of DNA - Procedure, Principle, Reagent Preparation Result.

Visit to animal cell culture lab. - Handling of animals, procedure.

Handling of animals. Immunization and raising anti sera - Demonstartion

#### Text Books :

Essentials Of Practical Biochemistry | Edition:1 | CBS Publishers and Distributors | Srivastava(- )

Principles and Techniques of Practical Biochemistry | Edition:4 | - | John Walker. AND Keith Wilson (- )

Course Title : LAB IN RESEARCH TECHNIQUES	Course Code : 43Q
Semester :III	Course Group : MP V
Teaching Scheme in Hrs (P) : 5	Credits : 2
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(- )