MALLA REDDY VISHWAVIDYAPEETH

SCHOOL OF ALLIED AND PUBLIC HEALTH SCIENCES AND TECHNOLOGY

Centre of Excellence in Molecular Medicine and Stem Cell Technology

Suraram X Roads, Jeedimetla,
Hyderabad-500055
Web: https://mrvv.edu.in/

Program

Master of Science (M.Sc)

Molecular Medicine and Stem Cell Technology

2025

MALLA REDDY VISHWAVIDYAPEETH

SCHOOL OF ALLIED AND PUBLIC HEALTH SCIENCES AND TECHNOLOGY

Master of Science (M.Sc.)

Molecular Medicine and Stem Cell Technology

COURSE STRUCTURE

I Year I semester

S.NO	SUBJECT CODE	SUBJECT	L	T	P	C	Max. Marks		
							INT	EXT	TOTAL
1	MST23610101	Research Methodology, Biostatistics and Systematic Review	3	-	-	3	40	60	100
2	MST23610102	Medical Biochemistry	3	-	2	4	40	60	100
3	MST23610103	Cell Biology	4	-	-	4	40	60	100
4	MST23610104	Human Physiology	3	-	-	3	40	60	100
5	MST23610105	Fundamentals of Molecular Biology	2	-	-	2	40	60	100
6	MST23610106	Model systems for Biomedical Research	2	-	-	2	40	60	100
7	MST23610107	Mammalian Cell Culture Lab	-	-	2	1	40	60	100
8	MST23610108	Experimental Animal Lab	-	-	2	1	40	60	100
9	MST23610109V	Stress Management	1	-	-	1	100		100
TOTAL			18	-	6	21	420	480	900

I Year II semester

S.NO	SUBJECT CODE	SUBJECT	L	T	P	C	Max. Marks		
							INT	EXT	TOTAL
1	MST23610201	Pharmacokinetics, Pharmacodynamics and Pharmacogenomics	4	-	-	4	40	60	100
2	MST23610202	Cellular and Molecular Immunology	4	-	-	4	40	60	100
3	MST23610203	Computational Biology	3	-	2	4	40	60	100
4	MST23610204	Genetic Manipulation and Gene Therapy	4	-	-	4	40	60	100
5	MST23610205A MST23610205B	Elective -1 (a) Genomics and Proteomics (b) Laboratory Medicine	2	-	-	2	40	60	100
6	MST23610206	Molecular Biology Lab	-	-	4	2	40	60	100
7	MST23610207V	Art of Being a Better Person	1	-	-	1	100	-	100
TOTAL			18	-	6	21	340	360	700

II Year III semester

S.NO	SUBJECT CODE	SUBJECT	L	T	P	C	Max. Marks		
							INT	EXT	TOTAL
1	MST23610301	Microbial Pathogenesis, Diagnostics and Therapeutic Development	3	-	2	4	40	60	100
2	MST23610302	Molecular Pathophysiology and Therapeutics	3	-	-	3	40	60	100
3	MST23610303	Stem cell Biology and Regenerative Medicine	3	-	-	3	40	60	100
4	MST23610304	Adoptive Cell Therapies	2	-	-	2	40	60	100
5	MST23610305	Artificial Intelligence in Molecular Medicine	2	-	2	3	40	60	100
6	MST23610306	Mini Project	-	-	6	3	100		100
7	MST23610307A MST23610307B	Elective 2 (a) Forensic Pathology (b) Cancer Initiation & Metastasis	2	-	-	2	40	60	100
8	MST23610308V	Professionalism in the Workplace	1	-	-	1	100	-	100
TOTAL			**16**		**10**	**21**	**440**	**360**	**800**

II Year IV semester

S.NO	SUBJECT CODE	SUBJECT	L	T	P	C	Max. Marks		
							INT	EXT	TOTAL
1	MST23610401V	Communication skills, leadership qualities and Entrepreneurship	2	-	-	2	100	-	100
2	MST23610402	Dissertation /Research Project	-	-	36	18	40	60	100
TOTAL			**2**	**-**	**36**	**20**	**140**	**60**	**200**

Curriculum

1.1 Post Graduate Programme

Sl. No.	Course	Duration	Eligibility for admission
1	Molecular Medicine and Stem Cell Technology	2 years	MBBS.BDS/B.Sc. (Agri)/ BPT/ BAMS/BHMS/B.Pharm/B.Sc Allied Health Sciences/B.Sc Biotechnology/B.Sc Nursing/B.Sc in any Life Sciences or equivalent .

1.2. Medium of Instruction:

English shall be the medium of instruction for all subjects of study and for examinations.

1.3. Duration of the Course

Duration details are mentioned under clause no. 1.1 of this booklet.

1.4 Examination Regulations

1.4.1 Attendance: 75% of attendance (physical presence) is mandatory.
Medical leave or other types of sanctioned leaves will not be counted as physical presence. Attendance will be counted from the date of commencement of the session to the last day of the closing of attendance before the final examination.

1.4.2 Internal Assessments:

a) Regular periodic assessment shall be conducted throughout the course. In each semester there will be **two one hour internal assessments (15 marks each)** and a **continuous assessment** comprises of attendance, overall performance/behaviour and seminars/presentations, **(10 marks).** Thus a total of 40 marks for the internal exam. (i.e. weightage for internal assessment shall be 40% of the total marks in each subject).

b) **Exam pattern for internal assessment** in each semester will be

(a) one word/one liner/multiple choice questions 5 nos. each carrying 1 mark (i.e. 5 x 1 = 5 marks). Two concept map questions out of which the student should choose one question. Concept map question carries 10 marks (i.e. 1x 10 = 10 marks). Thus a total of 15 marks for one internal assessment.

b) Continuous assessment comprises of attendance, overall performance/behaviour and the performance in seminars/presentations (10 marks).

c) A candidate should secure a minimum of 40% marks in the internal assessment in each subject to be eligible to appear for the University examination.

d) For value added courses, only internal examination will be conducted. The assessment comprised of five assignments/presentations/case presentations each carrying 10 (i.e. 5 x 10 = 50 marks). Final examination will be for 50 marks with 5 concept maps each carrying 10 marks (5 x 10 = 50 marks). The minimum pass is 50% marks.

1.4.3 University Examinations:

a) University Examination shall be conducted at the end of every semester.

b) A candidate who satisfies the requirement of attendance and internal assessment marks, as stipulated by the University shall be eligible to appear for the University Examination.

c) Examination will be of 3 hours duration (for theory). The question pattern for those subjects without practical examination (60 marks) will be (a) one word/one liner/multiple choice questions 20 nos. each carrying 1 mark (i.e. 20 x 1 = 20 marks) (b) Out of five concept map questions, students should answer 4 concept map questions each carrying 10 marks (i.e 4 x 10 = 40 marks). Thus a total of 60 marks .

d) The question pattern for those subjects with practical examination (40 marks Theory and 20 marks practical) will be (a) one word/one liner/multiple choice questions 10 nos. each carrying 1 mark (i.e. 10 x 1 = 10 marks) (b) Four concept map questions out of which the student should answer 3 concept map questions each carrying 10 marks (i.e 3 x 10 = 30 marks).

Practical examination (20 marks) will be (a) Five Spotters each carrying 1 mark (i.e 5 x 1 = 5 marks), (b) practical record carries 5 marks (c) Practical/viva carries 10 marks.

The minimum pass for internal assessment is 40% and for the University Examination is 50%. i.e. a student should score a total of 50% (adding the internal and external examination) to pass in each subject.

Research Methodology, Biostatistics and Systematic Review 3-0-0-3

Course Contents:

Research Methodology: Introduction: Meaning, objectives and motivations in research, Characteristics and limitations of research, Components of research work - Criteria of good research, Research process – Types of Research, Fundamental, Pure or Theoretical Research –Applied Research –Descriptive Research – Evaluation Research - Experimental Research - Survey Research - Qualitative Research - Quantitative Research - Historical Research.

Research Design: Research Design – definition – essentials and types of research design – errors and types of errors in research design. Research problem: Selecting and analysing the research problem – problem statement formulation – formulation of hypothesis. Literature review: purpose, sources, and importance - literature review procedure. Objectives: Learning Objectives; Definitions; Formulation of the research objectives.

Biostatistics: Statistical methods in medicine, biology, molecular medicine. Design of experiments, Sampling and observational studies: sampling, random sampling, sampling in clinical and epidemiological studies, cross-sectional studies, cohort studies, case-control studies, questionnaire bias in observational studies. Summarizing data: types of data, frequency distribution, median and quantiles, mean, variance range and interquartile range, standard deviation. Presenting data. Probability: probability distribution and random variables, binomial distribution, mean and variance, poisson distribution. Normal distribution. Estimation. Significance tests: testing hypotheses, null and alternative hypotheses. Regression and correlation. Methods based on rank order: non-parametric, mann-whitney U test, wilcoxon matched pairs tests, spearman's rank correlation coefficient. Analysis of cross-tabulations: chi-square test, fisher exact test. Time to event data: Kaplan-Meier survival curves, logrank test, hazard ratio, cox regression.

Systematic Review: What is a systematic review, types of systematic review: scoping review, rapid review, narrative review, meta-analysis and mixed methods/mixed studies. Stages in a systematic review: formulating a research question, identifying studies and develop a protocol, searching database, describing and appraising studies, synthesis and systematic maps, software used in systematic review.
Meta analysis: Forest plots, getting pooled estimate, heterogeneity, measuring heterogeneity, investigating sources of heterogeneity, random effect models, continuous outcome variables, dichotomous outcome variables, time to event outcome variables, publication bias, network meta-analysis.

<u>Reference Textbook:</u>

1. Research Methodology: A Step-by-Step Guide for Beginners. 4th Edition, 2024. by Ranjit Kumar.
2. Fundamentals of Biostatistics. 8th Edition. 2015. by Bernard Rosner.
3. Cochrane Handbook for Systematic Reviews of Interventions. 2008. Edited by Julian PT Higgins and Sally Green

Medical Biochemistry 3-0-1-4

Electrolytes, blood gases, respiration and acid-base balance. Disorders of acid-base balance and their respiratory and renal mechanisms. **Evaluation of organ function tests:** Assessment and clinical manifestations of renal, hepatic, pancreatic, gastric and intestinal functions. Clinical importance of bilirubin. **Diagnostic enzymes:** Principles of diagnostic enzymology. Clinical significance of aspartate aminotransferase, alanine aminotransferase, creatine kinase, aldolase and lactate dehydrogenase. Enzyme tests in determination of myocardial infarction. Enzymes of pancreatic origin and biliary tract. **Biochemical aspects of haematology:** Disorders of erythrocyte metabolism, hemoglobinopathies, thalessemias thrombosis and anemias. Laboratory tests to measure coagulation and thrombolysis. **Detoxification in the body:** enzymes of detoxification, polymorphism in drug metabolizing enzymes. Mechanism of drug action and channels of its excretion.

Introduction to metabolism in humans. Energy metabolism, carbohydrate metabolism, fat metabolism, steroid metabolism, amino acid metabolism.

Disorders of carbohydrate metabolism: Diabetes mellitus, Galactosemia, glycohemoglobins, hypoglycemias, galactosemia and ketone bodies, mucopolysaccharidosis, hereditary fructose intolerance, lactose intolerance, glycogen storage disorders, Glucose 6 phosphate dehydrogenase deficiency. Glycogen storage diseases. Various types of glucose tolerance tests.

Physiology of lipids/lipoproteins. Lipidosis. Clinical inter-relationships of lipids (sphingo- lipidosis and multiple sclerosis), lipoproteins and apolipoproteins. Diagnostic tests for HDL-cholesterol, LDL-cholesterol and triglyceride disorders. **Disorders of lipid metabolism**: Hyper cholesterolemia, Hypo cholesterolemia, dyslipidemia, disorders of phospholipids and glycolipids, NAFLD, Disorders of fatty acid metabolism, obesity, fatty liver, atherosclerosis.

Disorders of Protein metabolism: Disorders of urea synthesis, inborn errors of amino acid metabolism: Phenylalanemia, homocystinuria, tyrosinemia, MSUD, phenylketonuria, alkaptonuria, albinism and animoacidurias. hyper ammonemia and hypo ammonemia.

Disorders of mineral, vitamins and trace elements metabolism: Hypercalcaemia, hypocalcaemia, normocalcaemia, hypophosphataemia, hyperphosphataemia, Hypothyroidism, dental caries.

Disorders of nucleic acid metabolism: Disorders in purine/ pyrimidine metabolism.

Biochemistry Lab

Course Contents:

This course will have practical: Hands-on experience on Qualitative analysis of monosaccharides, disaccharides, polysaccharides; Qualitative analysis of saturated and unsaturated lipids; Qualitative analysis of Albumin, Gelatin, Casein; Qualitative analysis of abnormal constituents of urine; Quantitative estimation of blood glucose, cholesterol, urea, creatinine, total protein, albumin, bilirubin; Electrophoretic separation of proteins; Estimation of lipid profile; Liver function tests; Renal function tests; Interpretation of case reports.

Reference Textbook:

1. David L. Nelson and Michael M. Cox. Lehninger Principles of Biochemistry 7th Edition. Freeman and Company. 2017
W.H
2. Ranjna Chawla. Practical Clinical Biochemistry Methods And Interpretations; 4th edition
Jaypee Brothers Medical Publishers. 2014

CellBiology 4-0-0-4

Coursecontents:

Cell theory, chemical composition of a cell: importance of carbon, water and selectively permeable membrane, importance of macromolecules in cell (proteins, nucleic acids, and polysaccharides) and the synthesis of biological macromolecules, importance of self-assembly. Bioenergetics: use of energy by cells. Macromolecules and human disease connection.

Cells and organelles: Basic properties of cells, prokaryotes and the eukaryotes.

Eukaryotic cell structure and functions: Plasma membrane, nucleus, mitochondria, chloroplast, endoplasmic reticulum, golgi apparatus, secretory vesicles, lysosome, peroxisome, vacuoles, ribosomes, and cytoplasm. Nucleus-nuclear envelope, nuclear matrix, DNA and other components of chromatin. Endosymbiont theory.

Cytoskeleton, structural elements of the cytoskeleton: microtubules, microfilaments, and intermediate Filaments. Microtubule based movements inside cells: kinesins and dyneins. Microtubule based cell motility: cilia and flagella. Microfilament based movement inside cells: myosins, microfilament based motility: in muscle cells and in nonmuscle cells,

Cell adhesions, cell junctions and extracellular structures.

Membrane transport of small molecules – molecular basis of membrane transport, transporters and channel proteins and their attributes to membrane properties, abnormalities involving membrane transport; Transport across intracellular compartments - the transport of molecules across the membranes of intracellular compartments; Intracellular vesicular traffic - molecular mechanisms of membrane transport and the maintenance of compartmental diversity.

Signal transduction: Neurons and membrane potential, electrical excitability and action potential, synaptic transmission and signal integration,

Cell signaling – chemical signals and cellular receptors, receptors and ligands, signal transduction, G protein-coupled receptors: structure, activation and inactivation of G proteins, Enzyme-coupled receptors, hormones and other long-range signals.

Cell division: Mitosis and meiosis, Cell cycle and regulation of cell cycle. Apoptosis,

<u>Reference Textbook:</u>

1. *Alberts B, Johnson A, Lewis J, Raff M, Roberts K and Walter P, " Molecular Biology of the Cell" Sixth Edition, Garland Publishing Inc. 2008.*
2. Gerald Karp, " Cell and Molecular Biology", Fifth Edition, John Wiley, 2008.

HumanPhysiology 3-0-0-3

Coursecontents:

Introduction to physiology, levels of organization in the human body, Homeostasis and feedback mechanisms, basic principles of cell physiology and membrane transport, membrane transport: active and passive transport, osmosis, diffusion; resting membrane potential and action potentials; Signal transduction and receptors; cell communication: gap junctions, synaptic transmission.

Blood and Circulatory System: Hemostasis and blood clotting, structure and function of the heart, cardiac cycle and heart sounds, blood pressure regulation, vascular system: arteries, veins, and capillaries; physiology of the lymphatic system.

Respiratory system: Anatomy of respiratory system, mechanism of breathing, gas exchange: oxygen and carbon dioxide transport

Digestive System: Anatomy and physiology of the digestive tract; process of digestion and absorption, role of enzymes in digestion, regulation of digestive processes, nutrient absorption and transport, function of liver and pancreas.

Excretory system: Anatomy of kidney and nephron, mechanism of filtration, reabsorption, and secretion, regulation of water and electrolyte balance, acid-base balance and urine formation, renal clearance and filtration rate.

Musculoskeletal System: Types of muscles and their functions (skeletal, smooth, cardiac); muscle fatigue and recovery.

Nervous System: Structure and function of the nervous system, neuron structure and function, action potential and synaptic transmission, sensory and motor pathways

Endocrine System: Classes of hormones and their mechanism of action eg: peptides, steroids, amines, hormonal regulation of metabolism (insulin, thyroid hormones), reproductive hormones,

<u>Reference Textbook:</u>

1. Arthur C. Guyton and John E. Hall (Eds.) Textbook of Medical Physiology 13th Edition . Saunders. 2015
2. Principles of Human Physiology" by Cindy L. Stanfield
3. Essentials of Human Physiology" by Stanley E. Gunstream

FundamentalsofMolecularBiology **2-0-0-2**

Coursecontents:

DNA structure and function, chromosomal DNA, nucleosome and structure of nucleosome, chromatin structure and function, RNA, Types of RNA, its structure and functions, central dogma and genetic code, DNA replication (prokaryotes vs eukaryotes), Initiators, polymerases and other accessory factors, control of DNA replication and inhibitors, DNA repair mechanism, homologous recombination, transcription, translation and its regulation (prokaryotes vs eukaryotes). Gene expression and its control, gene regulation in eukaryotes, role of transcription factors in gene expression, Epigenetics and its regulation.

Reference Textbook:

1. Molecular Biology: Principles and Practice by Michael M. Cox, Jennifer Doudna, and Michael O'Donnell.

2. Alberts B, Johnson A, Lewis J, Raff M, Roberts K and Walter P, " Molecular Biology of the Cell" Sixth Edition, Garland Publishing Inc. 2008.

ModelsystemsforBiomedicalResearch 2-0-0-2

Coursecontents:

This module covers how disease processes are modelled in appropriate systems. This is an example-led module that introduces some of the model systems that can be used to understand pathological processes and test potential therapeutic agents.

The advantages, disadvantages, capabilities, costs and ethics of each of the following systems:

Human *in vitro* cell systems : Use of cell/tissue culture for understanding various disease conditions and to check the efficacy of potential therapeutic agents with examples.

Non-mammalian models: Fruitfly, Zebrafish in biomedical research with examples

Mammalian models: mice, rat, rabbit, gerbils, hamsters, guinea pig, chinchilla, cattle, sheep, goats and pigs with appropriate examples

Non-human primates in biomedical research with examples.

Human organoids to study various diseases, genetic disorders and cancers. Advantages and disadvantages and challenges of human organoids.

Reference Textbook:

1. Animal Models in Medicine and Biology" by W. J. Stilling and M. A. Miller

2. Pamela M. Carroll & Kevin Fitzgerald. Model Organisms in Drug Discovery. John Wiley Sons, Ltd. 2003

3. Lesley A. Colby, Megan H. Nowland, Lucy H. Kennedy. Clinical Laboratory Animal Medicine: An Introduction. Wiley Blackwell, 2020

MammalianCellCultureLab 0-0-1-1

Coursecontents:

This practical course will provide students with a hands-on experience of the following: working in biosafety cabinets, counting cells using hemocytometer, culturing of an adherent cell line, culturing of a suspension cell line, maintenance of cell lines. cryopreservation of cells, thawing of cells. Cell viability tests: Trypan blue test, Alamar blue/MTT assay.

<u>Reference Textbook:</u>

1. Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications" by R. Ian Freshney

2. Mammalian Cell Culture: A Practical Approach" by Martin Clynes

ExperimentalAnimalLab **0-0-1-1**

Coursecontents:

This practical course will provide students with a hands-on experience of the following**:** Handling techniques of mice and rats and perform common procedures in these rodents including feeding, gavage, injection (tail vein, retro-orbital, intraperitoneal. intramuscular, subcutaneous), blood collection from mice (tail vein puncture, saphenous vein puncture, retro-orbital bleeding, and microsampling) and euthanasia.

<u>Reference Textbook:</u>

1. Animal Models in Medicine and Biology" by W. J. Stilling and M. A. Miller

2. Principles of Laboratory Animal Science" by Hedrich Hans J

3. An Introduction to Laboratory Animal Science and Technology" by A. W. B. Harkness and J. L. Wagner

Pharmacokinetics,PharmacodynamicsandPharmacogenomics 4-0-0-4

Coursecontents:

Basic concepts and introduction: Pharmacokinetics- Systemic exposure, specificity, active metabolites and prodrugs, anatomic and physiologic considerations, models for drug absorption and disposition. Definitions: absorption, distribution, metabolism, and excretion (ADME). Pharmacodynamics- agonists, antagonists, PK/PD modeling; classification of response: clinical response, surrogate end point, biomarker; assessment of drug response: endogenous compounds, baseline, placebo effect.; relating response to exposure: graded response, quantal response; dose-time-response relationship. **Exposure and response after a single dose**: Kinetics following an IV bolus dose, membranes and distribution, elimination, kinetics following an extravascular dose, absorption, response following a single dose. **Therapeutic Regimens:** Therapeutic window, constant-rate input, multiple-dose regimens.

Distribution kinetics, metabolites and drug response, protein drugs, prediction and refinement of human kinetics from in vitro, pre-clinical and early clinical data.

Overview of pharmacogenetics and pharmacogenomics, Study designs in pharmacogenetics and phenotype selection and identifying biological candidate genes; Linkage disequilibrium, HapMap, 1000 Genomes and ENCODE; TagSNPs, pfSNPs, and other web tools and databases; Genome-wide association studies (GWAS), GWAS and meta-analysis, Next-generation sequencing; Whole genome sequencing, Whole Exome sequencing; Molecular Genetics, Epigenetics and pharmacogenomics, DNA methylation analysis; Application of transcriptomics in Pharmacogenomics/RNAseq; Application of Metabolomics in Pharmacogenomics. Pharmacogenomics: Regulatory Issues; Pharmacogenomics: Translation to Practice.

Reference Textbook:

1. KatzungB.G., Masters S.B., Trevor A.J., " Basic and Clinical Pharmacology", 13th Edition, McGraw Hill, 2014

2. Malcolm Rowland, Thomas N. Tozer, " Clinical Pharmacokinetics and Pharmacodynamics,Concepts and Applications", 4th Edition, WoltersKluver, 2011

3. Principles of Pharmacogenetics and Pharmacogenomics" by Russ B. Altman, David F. L. L. and L. Peter P.

4. Basic and Clinical Pharmacogenomics" by Bert Vogelstein, Katalin Susanne (Eds.)

CellularandMolecularImmunology 4-0-0-4

Coursecontents:

Introduction to Immunology: History and overview of the immune system, Hallmarks of immunity, innate and adaptive immunity, components of the immune system: cells and organs.; Hematopoiesis and differentiation of immune cells; pattern recognition receptors (PRRs) and pathogen-associated molecular patterns (PAMPs); Complement system and pathways associated, complement targeted drugs, Structure, properties, classes and features of an antibody molecule, antibody based therapeutics, B cell receptors, T cell receptors, T cells in immune response, T cell recognition of antigen, MHC molecule, its cellular distribution, antigen processing and presentation (class I and Class II), Cytokines: cytokine families, key cytokines in innate and adaptive immune response, Chemokine and its classification, recombinant cytokines for therapeutics, Hypersensitivity reactions, type I, II, III and IV and diseases associated; autoimmunity, diseases associated with autoimmunity, therapies for autoimmunity, Transplantation, graft rejection and immune suppressive therapies associated. Immunodeficiency disorders;
Advances in immunology research: cutting-edge techniques employed in cellular immunology: Flow Cytometry, ELISA , CRISPR, single -cell RNA-seq; immunotherapy and current challenges in immunology: immunosenescence, immune evasion by pathogens; ethical issues in immunological research and therapies.

<u>Reference Textbook:</u>

1. 2. *Ken Murphy, Paul Travers, Mark Walport, Janeway's Immunobiology, 9th edition, Garland science publishing, 2007.*

2. Jenni Punt, Sharon A. Stranford, Patricia P. Jones, Judith A. Owen. Kuby Immunology. 8th Edition. W.H. Freeman and Company. 2019

ComputationalBiology 3-0-1-4

Coursecontents:

Introduction to computational biology, Biological data types: Genomic, Proteomic, Transcriptomic; Biological databases: NCBI, GenBank, UniProt;

Overview of algorithmic techniques in computational biology, Basic search algorithms, BLAST, scaling up: massive parallelization of BLAST, Protein bioinformatics, sequence alignment; Global & Local alignment, challenges in aligning sequences, issues in sequence alignment, multiple sequence alignment, patterns in data, sequence motifs,

DNA, RNA, and Protein structure basics; Sequence representation: Strings, Matrices, and Graphs; K-mer analysis; Data storage formats (FASTA, FASTQ, GFF, VCF); RNA structure prediction, phylogenetics, uses of phylogenetics, how to interpret phylogenetic trees, Bootstrap, probability, protein substitution matrices, substitution bias, PAM and BLOSUM, Hidden Markov models, bioinformatics programming.

Bioinformatics/computational biology and medical applications: Genome sequencing technologies NGS, Sanger; Genome assembly algorithms; Functional Genomics: Gene Expression, RNA-seq analysis; SNPs and Genomic Variation.

Protein structure (Primary, Secondary, Tertiary); Computational methods for protein structure prediction (Homology modeling, Ab initio); Molecular docking and simulation;

High-throughput technologies in genomics and proteomics eg: Microarrays, Next-Gen Sequencing; Data preprocessing, normalization, and quality control; Introduction to big data tools in computational biology;

Epidemiological models and simulations eg; SIR model, Agent-based models; Modelling genetic epidemiology; Infectious disease modelling with computational tools.

<u>Bioinformatics Lab</u>

Hands-on with BLAST and basic sequence alignment, Parsing sequence data (FASTA/FASTQ), Working with genomic data using Python, RNA-seq data analysis in R (DESeq2); Using PyMOL or Chimera for protein visualization, Structure prediction using I-TASSER; High-throughput data analysis using R/Bioconductor

<u>Reference Textbook:</u>

1. Andreas Dress, Michal Linial, Olga Troyanskaya and Martin Vingron. "Bioinformatics: An Introduction". Springer 3rd edition. 2015

2. Scott T. Kelley and Dennis Didulo. Computational Biology: A HypertextBook. ASM Press. 2018

Genetic Manipulation and Gene Therapy 4-0-0-4

Course contents:

Restriction enzymes and cloning vectors: Host controlled restriction modification, Restriction endonucleases - types and classification, Modifying enzymes used in molecular cloning - methylases, polymerases, ligases, kinases, phosphatases and nucleases, Vectors for cloning, expression vectors, Vectors for library preparation (lambda phage vectors, cosmids, BAC & YAC), Host organisms used in r-DNA technology: *E. coli*, Yeast. **Cloning, Construction of Genomic and cDNA libraries**: Introduction to cloning (conventional & recombination based), Gene transfer techniques: Transformation, transfection and transduction, Strategies for construction of genomic libraries, Strategies for construction of cDNA libraries. **Selection and characterization of recombinant clones:** Genetic Selection- insertional inactivation and alpha complementation, Labeling of nucleic acids, Immunological probes, Selection of recombinant clones-hybridization techniques, colony hybridization & library screening, hybrid arrest & hybrid release translation, DNA sequencing methods, DNA arrays.

Gene editing technologies: Genome editing tools- CRISPR-Cas system, TALENs & zinc finger, nucleases, Mechanisms of Genome Editing; Precision Medicine: Targeted Editing for Genetic Diseases; Ethical Considerations in Genome Editing;

Vectors for gene delivery: Viral Vectors: Adenoviruses, Retroviruses, Lentiviruses, AAV (Adeno-Associated Virus); Non-Viral Vectors: Liposomes, Electroporation, and Nanoparticles; Advantages and Challenges of Different Vectors; Immune Response and Safety Considerations

Gene therapy applications and regulations; Gene therapy for genetic disorders: Cystic Fibrosis, Hemophilia, Duchenne Muscular Dystrophy; gene therapy for cancers: case studies of gene therapy in oncology eg: leukemia, lymphoma; gene therapy for viral infections: HIV, Hepatitis;
In vivo gene therapy and ex vivo gene therapy: benefits and limitations of each approach; Immune response to gene therapy: Immune rejection and toxicity; ethical, social, and regulatory issues associated with gene therapy; personalized gene therapies and precision medicine

<u>Reference Textbook:</u>

1. Sandy B. Primrose, Richard Twyman, Bob Old. Principles of Gene Manipulation. Wiley, 08- Feb-2002

2. Jeremy W Dale and Malcom von Schantz. From Genes to Genomes: Concepts and Applications of DNA Technology. John Wiley & Sons, Ltd. 2002

3. Anthony Meager. Gene Therapy Technologies, Applications and Regulations: From Laboratory to Clini. John Wiley & Sons, Ltd. 1999

GenomicsandProteomics 2-0-0-2
(Elective1)

Course contents
Overview of genomics and proteomics; relationship between genes, proteins, and phenotypes; basic structure and function of DNA and RNA; DNA sequencing technologies: Sanger vs. Next-Generation Sequencing (NGS); RNA sequencing (RNA-Seq); single-cell genomics; high-throughput sequencing technologies; genome mapping and assembly: De novo genome assembly and annotation, applications in metagenomics; gene expression analysis: transcriptional profiling, microarray technologies; RNA-Seq data analysis and applications; gene regulatory networks;

Omics and importance, genome size, sequence complexity, Gene identification; gene prediction rules and softwares; Genome databases; Annotation of genome. Genome diversity: taxonomy and significance of genomes - Homo sapiens. Genome mapping.

Clinical Genomics: overview of technical aspects and chemistries of next-generation sequencing, Sanger sequencing, cyclic array sequencing, illumina sequencing, SOLiD sequencing, Ion Torrent sequencing, Third-generation sequencing platforms. RNA sequencing and Methylome analysis, Interpretation and reporting of clinical genomics
Role of genomics in personalized medicine

Proteomics: Introduction to proteomics, proteome and proteomics, difference between proteomics and genomics, Mass Spectrometry in Proteomics: Principles of mass spectrometry for proteomics, tandem mass spectrometry (MS/MS), protein identification and quantification by MS, Data analysis in proteomics: peptide mapping, protein quantification; Methodology for separation and identification of proteins and their interactions, electrophoresis, 2D Gel electrophoresis, capillary electrophoresis, Liquid chromatography: Gel filtration, affinity chromatography, Ion exchange chromatography, reverse phase and High Performance Liquid Chromatography (HPLC), multidimensional chromatography.
Determination of 3D structure of protein: X-Ray crystallography, neutron scattering, NMR spectroscopy, protein microarray. Application of proteomics in clinical practice.

<u>Reference Textbook:</u>

1. . Shashikant Kulkarni and John Pfeifer (Eds.). Clinical Genomics. Elsevier. 2015

2. Nawin C. Mishra. Introduction to proteomics: Principles and Applications. John Wiley & Sons. 2010

LaboratoryMedicine 2-0-0-2

(Elective1)

Course contents

Overview of Laboratory Medicine, role of the clinical laboratory in patient care; laboratory safety.
Clinical Diagnostic Techniques: Flow Cytometry, Medical Cytogenetics, Fluorescence *In Situ* Hybridization, Immunohistochemistry, Laser Capture Microdissection. Clinical application of flow Cytometry.
Quality Assurance in the Laboratory Medicine: Framework for Quality Assurance in Laboratory Medicine, Verification of Molecular Assays, Standards and Standardization of Molecular Diagnostics and Laboratory-Developed Tests.
Applications of Molecular Diagnostics for Genetic Diseases; Molecular diagnostics of Coagulation, cystic fibrosis, Prenatal Genotyping for Identification of Fetuses at risk for immune cytopenic Disorders.
Applications of Molecular Diagnostics for Human Cancers: hereditary neoplasms, acute and chronic leukemia.
Applications of Molecular Diagnostics in Infectious Diseases: eg: HPV.
Identity-Based Testing: HLA Typing, for Forensic Casework and Parentage Testing, for Bone Marrow Transplant Engraftment.
Issues in laboratory medicine: Genetic Counseling Considerations in Laboratory medicine, ethical, social, and legal issues related to laboratory medicine.

<u>Reference Textbook:</u>

1. *William B. Coleman (Editor), Gregory J. Tsongalis (Editor). Molecular Diagnostics: For the Clinical Laboratorian / Edition 2 Publisher: Springer-Verlag New York, LLC.*

2. *Buckingham and Flaw's,* " *Molecular Diagnostics: Fundamentals, Methods and Clinical Applications", F.A. Davis Company; First edition, 2007*

MolecularBiologyLab 2-0-0-2

Course contents

Introduction to Molecular Biology Techniques: safety protocols, overview of equipment and materials.

DNA isolation and purification; Gel Electrophoresis: DNA size separation by agarose gel electrophoresis; Polymerase Chain Reaction (PCR): Design PCR primers, Set up PCR reactions for amplification of a target gene; Restriction Enzyme Digestion: Digest DNA with restriction enzymes, analyze digestion patterns using gel electrophoresis.

RNA Isolation and Analysis: total RNA isolation and RNA integrity and purity assessment, use of spectrophotometry and agarose gel electrophoresis to assess RNA quality; Reverse Transcription and qPCR: Reverse transcription of mRNA into cDNA, Set up and run qPCR experiments.

<u>Reference Textbook:</u>

1. Molecular Biology Techniques: A Classroom Laboratory Manual by Heather Miller, D. Scott Witherow, and Sue Carson

2. Laboratory Manual in Molecular Biology" by D. Ray

3. Molecular Biology: A Laboratory Manual" by David S. Latchman

Microbial Pathogenesis, Diagnostics and Therapeutic Development 3-0-1-4

Course Contents:

Overview of infectious diseases and pathogens; Historical perspectives in microbial pathogenesis; Pathogenesis and host-microbe interactions; Epidemiology of infectious diseases
Identification of microbes, Nomenclature and classification of microbes, clinically important bacteria, fungus, viruses and parasites; Sterilization and disinfection,
Bacterial Pathogenesis: Bacterial adhesion and invasion, Toxin production eg: exotoxins vs. endotoxins, immune evasion strategies, host response to bacterial infections.
Viral Pathogenesis: Viral entry, replication, and spread, Viral evasion of host immune responses,
Fungal Pathogenesis: Fungal infection mechanisms, Dimorphic fungi and opportunistic pathogens, Immune responses to fungal infections,
Parasitic Pathogenesis: Protozoan pathogens and diseases, Helminths and arthropod-borne diseases, Mechanisms of parasitic immune evasion.
Biology of disease-causing bacteria (Staphylococcus, Streptococcus, Enterococcus, Pneumococcus; Neisseria, anerobes, mycobacteria, Enterobacteriaceae, Vibrio, Pseudomonas, Haemophilus, Bordetella, Brucella, Mycoplasma); General properties of viruses and viral diseases (Herpes virus, Myxoviruses, Picornaviruses, Arboviruses, Hepatitis virus, HIV); fungal diseases; parasitic diseases; Vector borne diseases (Chikungunya, Dengue, filariasis), infective syndromes.

Diagnostic Techniques: Microscopic and culture methods: limitations of culture-based methods; Molecular and immunological methods: PCR, RT-PCR, ELISA, Rapid diagnostic tests (RDTs) and Next-generation sequencing; Molecular diagnostic techniques for resistant pathogens;

Therapeutic Development: Development of Antimicrobials: Mechanisms of Action of antibiotics, antivirals, and antifungals; drug development pipeline: discovery to FDA approval; Antimicrobial Resistance (AMR) Challenges and Solutions; Vaccine development strategy, types of vaccines: inactivated, live attenuated, subunit, mRNA vaccines; role of vaccines in preventing infectious diseases.

Microbiology Lab

Course Contents:

Microbiology lab:

Overview of Lab Safety; introduction to microscopy, sterilization, inoculation, and subculturing, preparation of solid and liquid media; isolation streaks, Staining procedures: Gram staining and microscopic examination, measuring bacterial growth: CFU, turbidity; Bacterial Isolation and Purification: streak plate method, colony morphology; Antimicrobial Susceptibility Testing: Disk Diffusion Method (Kirby-Bauer Test)

Reference Textbook:

1. Molecular Medical Microbiology" (2nd Edition) by David H. Perkin and Michael R. W. Brown

2. Pathogenic Microorganisms: Diagnosis and Therapeutics by Richard H. E. Scuderi

3. Molecular Pathogenesis of Infectious Disease by Stephen B. Calderwood, M. S. G. Farrow, and M. J. Paget

4. Principles of Molecular Virology by Alan J. Cann

5. Essential Microbiology Laboratory: A Manual for Beginners by Ronald A. Day

MolecularPathophysiologyandTherapeutics 3-0-0-3

Course Contents:

Molecular disease mechanism, pathology, diagnosis and current treatments of the following diseases.

Complex disease - Genetics of Obesity and Appetite Regulation; Genetic causes of diabetes; Genetics of Cleft Lip or Palate, Dental Anomalies in Orthodontic Patients; **Auto-immune diseases**-coeliac disease, multiple sclerosis and Alopecia Areata; **Autosomal dominant genetic disorder -** Hereditary Haemorrhagic Telangiectasia (HHT); **Immune dysregulation**-Sepsis; I**nfectious bacterial disease-**Tuberculosis; **viral infections**- Influenza / COVID 19; Oncogenic Herpes Viruses - Epstein-Barr virus (EBV), Kaposi's sarcoma-associated herpesvirus (KSHV); **Coagulation Disorders**- Hemophilia and Von Willebrand disease; **Cancers-** Breast Cancer, Prostate Cancer. Lung Cancer and oral cancer; **inherited disease-** Muscular Dystrophy and its gene therapy.

<u>Reference Textbook:</u>

1. *Vinay Kumar, Abul Abbas, Jon Aster,* " *Robbins & Cotran Pathologic Basis of Disease" 9th Edition., Elsevier 2014*.

StemCellBiologyandRegenerativeMedicine 3-0-0-3

Course contents:

Introduction to stem cells: definition and types of stem cells: embryonic, adult stem cells, Induced pluripotent stem cells (iPSCs), cancer stem cells, origin of stem cells. Mechanism of stem cell self-renewal, cell cycle regulators in stem cells.

Adult stem cells: Haematopoietic stem cells, mesenchymal stem cells, cardiac stem cells.; Cord blood stem cells;

Stem cell niche and singling: characteristics of niches (Hepatic stem cell niche and hematopoietic stem cell niche),

Embryonic stem cells (mouse and human) and its derivation.

Cancer stem cells: background on the origins of cancer, discovery and origin of cancer stem cells, basic properties of cancer stem cells, Solid cancer stem cells (Breast, lung, liver, prostate, stomach, glioma). Stem cells in Haematological malignancies (Acute myeloid leukaemia).

Side-population cells in flow cytometry.

Induced pluripotent stem cells (iPSCs): reprogramming of somatic cells and deriving iPSCs, potential applications of iPSCs.

Regulatory and Ethical issues related to stem cells and research.

Basics of Regenerative Medicine: Stem cell therapies in regenerative medicine; therapeutic application of stem cells, stem cells in heart disease, neurological disorders, diabetes and orthopedic regeneration; Gene therapy and cell therapy in regenerative medicine; overview of clinical trials involving stem cells; Emerging cellular therapies such as mesenchymal stem cells (MSC) in cancer therapy and iPSC derived therapies.

<u>Reference Textbook:</u>

1. Stem Cell Biology and Regenerative Medicine" by Robert Lanza, Bob Lanza, and Anthony Atala

2. Essentials of Stem Cell Biology" by Robert Lanza and James A. Thomson

3. Regenerative Medicine and Stem Cell Therap by W. L. Gore

AdoptiveCellTherapies 2-0-0-2

Coursecontents:

Overview of immunotherapy, mechanisms of immune system activation in cancer therapy; overview of adoptive cell therapies (ACT): differences between ACT and other cancer therapies eg: chemotherapy, radiotherapy; Types of immune cells used in ACT eg: T cells, NK cells, macrophages; T cell-based therapies: TCR (T-cell receptor) and CAR-T (Chimeric Antigen Receptor-T) cells, Natural Killer (NK) cell therapies, Dendritic cell therapies.
CAR-T Cell Therapy Overview: Structure and function of CAR-T cells, engineering of CAR-T cells, current clinical applications, Challenges associated with CAR-T cell therapy eg: toxicity, tumour heterogenicty, antigen escape, limitations of CAR-T cell therapy
TCR Therapy: TCR engineering for targeted cancer antigens, current clinical applications and current trials.
NK cell therapies: Mechanisms and applications.
Macrophage-based therapies.
Tumour-infiltrating Lymphocyte (TIL): Generation of TIL, TIL therapy protocol, challenges and limitations of TIL therapy,
Current FDA approved adoptive cell therapies.

<u>Reference Textbook:</u>

1. Adoptive Cellular Therapy by Frank M. Marincola and Robert L. Ferris

2. T-Cell Therapy: A Comprehensive Guide to the Therapeutic Use of T-Cells by Anne M. O'Mara

3. Cancer Immunotherapy: Principles and Practice by Lisa H. Butterfield, et al.

ArtificialIntelligenceinMolecularMedicine 2-0-1-3

Coursecontents:

Basics of Artificial Intelligence (AI) and Machine Learning (ML): Definition and concepts of AI, ML, and deep learning; supervised vs unsupervised learning; tools and platforms for AI in healthcare;

AI in Drug Discovery and Development: Machine Learning in Drug Discovery, AI for drug target identification and validation, Drug repurposing and virtual screening, QSAR (Quantitative Structure-Activity Relationship) models and deep learning;

AI in toxicology and preclinical testing: Predicting drug toxicity and side effects, in silico models for preclinical drug testing, role of AI in reducing animal testing,

AI in Personalized Medicine : AI in tailoring treatment plans based on genetic and molecular profiles,

Predictive modeling for disease progression and treatment outcomes, AI-based tools for diagnostics e.g., radiology, pathology, decision support systems for personalized treatment strategies;

Ethical challenges in AI and medicine: Privacy and data security concerns in healthcare AI, Bias and fairness in AI models, regulatory challenges and policy considerations.

Reference Textbook:

1. *Artificial Intelligence in Healthcare by Parashar Shah, Bhavya B. Vora, and Nishant Kumar*

2. *Artificial Intelligence in Medicine by Adam Bohr and Kaveh V. V. Gohari*

3. *Deep Learning for the Life Sciences by Bharath Ramsundar, Peter Eastman, and Patrick Walters*

4. *AI for Drug Discovery, Biomarker Development, and Targeted Therapy by Sandeep R. Soni and Nadeem Z. Shaikh*

Mini Project 0-0-3-3

Course contents:

Students will start individual projects in lab. Review of literature need to be done and a review paper need to be submitted for publication.

ForensicPathology 2-0-0-2
(Elective2)

Coursecontents:
Overview of forensic pathology; Autopsy procedures and their significance; *Death scene investigation:* scene etiquette, natural death, accident, suicide, homicide, homicide suicide.

Forensic autopsy. Postmortem changes at molecular level: algor mortis, livor mortis, rigor mortis; Role of molecular testing in post-mortem investigations; genomic analysis in determining cause of death;

Molecular techniques in identifying death causes: Genetic disorders and their contribution to death e.g., inherited cardiac arrhythmias, metabolic disorders; use of transcriptomics in investigating causes of death.

DNA analysis and its applications in forensic science; DNA profiling in criminal investigations; Mitochondrial DNA and Y-chromosome analysis in missing person cases,

Forensic Toxicology: three prongs of toxicity (exposure, dose and mechanism), multiple drug effect, toxicokinetics, biotransformation, postmortem toxicology, organ system toxicity (neural, cardiac, hepatic, kidney and pulmonary), toxins drugs and drug classes, analysis of metabolites, drug interactions, and toxic substances; toxicogenomics.

Whole-genome sequencing and its future in forensic pathology

Reference Textbook:

1. *Molecular Pathology of Forensic Medicine edited by D. K. Ghosh, K. M. Haseeb, and others*

2. *Forensic DNA Typing: Biology, Technology, and Genetics of STR Markers by John M. Butler*

3. *Forensic Molecular Biology by Christopher R. G. McNally and Mark E. D. McNally*

4. *Molecular Forensics by W. H. Benson*

CancerInitiationandMetastasis 2-0-0-2

(Elective2)

Coursecontents:

Introduction to Cancer, cardinal manifestations of cancer, History of cancer research, Overview of the hallmarks of cancer, **Cell Proliferation and Differentiation:** Tumour growth and proliferation in vivo, cell cycle control, check points, DNA damage induced check points, Check point defects in tumour cells, differentiation, extracellular and intracellular factors of differentiation, Differentiation and cancer therapy. **Apoptosis and cancer:** Apoptosis, Apoptosis caused by caspases, caspase activation pathways, apoptosis dysregulation in cancer. **Growth factors and signal transduction in cancer:** Background, growth factors, classification of growth factors and its receptors, abnormalities associated with growth factors in cancer cells, signalling pathways in cancer. Signalling pathways and its implications for cancer therapy. **Oncogenes:** Mutagens, carcinogens and mutations, Tumor viruses and the discovery of oncogenes, Tumor cells and genetic abnormalities, mechanism of oncogene activation, oncogenes in the initiation and progression of neoplasia. **Invasion and Metastases:** Tumour-host and tumour-stroma interactions, adhesion, tumour cell migration, angiogenesis, genetic regulation of invasion and metastases, cancer stem cells, therapeutic intervention. Invasion-metastasis cascade, Epithelial-mesenchymal transition (EMT) and invasiveness, reversibility of EMT, transcription factors orchestrating EMT and tumour progression, extracellular proteases and invasiveness, small Ras-like GTPases and cellular processes such as adhesion, cell shape and cell motility, metastasis from primary tumour site, metastasis suppressor genes and regulation of metastatic phenotype, occult micrometastases, **Cancer Epidemiology:** Incidence of cancers in india and other parts of the world.

<u>Reference Textbook:</u>

1. Principles of Cancer Biology by Lewis J. Kleinsmith

2. Cancer Metastasis: Biologic Basis and Therapeutic Perspectives edited by Stephen B. Baylin, Fadlo R. Khuri, and Wendy W. Smith

3. Cancer Biology by Raymond W. Ruddon

Communication skills, leadership qualities and Entrepreneurship 2-0-0-2

Course contents:
Fundamentals of Communication: Verbal vs. Non-verbal Communication, barriers to effective communication; Professional Communication: writing effective emails and business correspondence, public speaking and presentation skills, communication in team settings, virtual communication etiquette.

Leadership Qualities: Defining leadership vs. management, Autocratic, Democratic, Laissez-Faire Leadership Styles, understanding your leadership style, situational leadership and adaptability,

Entrepreneurship: Entrepreneurial Mindset: Innovation, Risk-taking, and Problem-solving; Stages of starting a business: idea generation, market research, and feasibility analysis; business models and value proposition;

Starting Your Own Venture: Business planning and strategy, funding, budgeting, cash flow; legal aspects of entrepreneurship eg: Intellectual Property, Business Registration; Marketing strategies for startups; Operational efficiency and scaling; managing innovation and competitive advantage.

<u>Reference Textbook:</u>

1. The Art of Public Speaking" by Dale Carnegie

2. Leadership: Theory and Practice by Peter G. Northouse

3. Entrepreneurship: Theory, Process, Practice by Donald F. Kuratko

4. The Art of Public Speaking by Stephen E. Lucas

Dissertation /Research Project 0-0-18-18

Course contents:

Students will carry out individual projects in lab.

Value Added Course

Stress Management 1-0-0-1

Course Objectives:

By the end of the course, students will:
1. Understand what stress is and how it affects the body and mind.
2. Learn how to recognize personal stressors and individual responses to stress.
3. Explore various coping strategies to manage stress effectively.
4. Understand how lifestyle changes can reduce overall stress.
5. Learn how to manage stress in academic and professional settings.
6. Equip students with tools to build long-term resilience against stress.

Unit 1
Introduction to Stress and Its Effects

Definition of stress: Eustress vs. Distress
Types of stress: Acute vs. Chronic
The biology of stress (fight-or-flight response, hormones)
Short-term and long-term effects on physical and mental health
The role of perception and coping mechanisms

Unit 2
Identifying Stressors and Personal Stress Responses

Internal vs. external stressors (work, relationships, environment)
Identifying stress patterns (thoughts, behaviours, physical reactions)
Emotional regulation and its role in stress management
The Stress Process: How stress develops and escalates

Unit 3
Coping Strategies and Stress Relief Techniques

Problem-focused vs. emotion-focused coping

Cognitive Behavioral Therapy (CBT) techniques for stress
Relaxation techniques (deep breathing, progressive muscle relaxation)
Time management and organization as stress-relief tools
Developing a personal coping plan

Unit 4
Lifestyle Changes for Managing Stress
The role of physical activity and exercise
Sleep hygiene and its connection to stress
Nutrition and its impact on mental health
Social support and healthy relationships
Mindfulness and meditation practices

Unit 5
Stress Management at Work and School
Managing work and school stress: Time management, prioritization
Dealing with high-pressure environments and deadlines
Building resilience and avoiding burnout
The importance of taking breaks and practicing self-care

Unit 6
Building Long-Term Stress Resilience
Resilience theory and how to bounce back from adversity
Developing a growth mindset to handle challenges
Building emotional intelligence to cope with stress
Integrating stress management into daily life

Assessment & Evaluation
Participation: 20 (Engagement in group discussions and exercises)
Assignments: 30
Final Exam (Internal) : 50 marks

Art of Being a Better Person 1-0-0-1

Course Description:

This course explores what it means to live ethically, compassionately, and meaningfully as a human being. Students will engage in discussions about moral philosophy, empathy, self-awareness, and how to cultivate kindness, responsibility, and social engagement in everyday life.

Course Objectives:

By the end of the course, students will:

1. Understand foundational ethical principles that guide human behavior.
2. Cultivate emotional intelligence and empathy.

3. Learn practical strategies for self-improvement and kindness.
4. Understand their role in society and how to make a positive impact.
5. Reflect on personal actions, relationships, and contributions to the community.

Unit 1
Introduction to Being a Good Human
Defining "goodness" and ethical living
Overview of moral philosophies: Utilitarianism, Deontology, Virtue Ethics
The role of self-awareness in personal growth
Activity: Reflective journaling on what "being good" means to you.

Unit 2
The Power of Empathy
Understanding empathy vs. sympathy
The science behind empathy and its benefits for social connections
Techniques for cultivating empathy in everyday life
Activity: Empathy-building exercises and discussions.

Unit 3
Emotional Intelligence (EQ)
What is Emotional Intelligence? (Self-awareness, self-regulation, motivation, empathy, and social skills)
The role of EQ in personal and professional relationships
Strategies to improve emotional intelligence
Activity: Self-assessment of emotional intelligence and EQ development exercises.

Unit 4
Compassion and Kindness
The science of kindness: How kindness benefits us and others
Practicing kindness in small, everyday actions
Overcoming barriers to kindness (e.g., stress, biases, indifference)
Activity: "Random Acts of Kindness" challenge.

Unit 5
Personal Integrity and Honesty
The importance of integrity in personal and professional life
Consequences of dishonesty and lack of integrity
How to align actions with values
Activity: Case study discussion on ethical dilemmas and decision-making.

Unit 6
Building Positive Relationships
Communication skills for healthy relationships
Setting boundaries and respecting others' boundaries
Conflict resolution and forgiveness
Activity: Role-playing scenarios to practice healthy communication.

Unit 7
Responsibility and Accountability
The concept of personal responsibility in life
Accountability in both personal and community contexts
How to take ownership of mistakes and learn from them

Activity: Reflect on past mistakes and plan for growth.

Unit 8
Contributing to the Community and Society
The role of individuals in building strong communities
Volunteering, activism, and social responsibility
The impact of small, positive actions on a larger scale
Activity: Brainstorming session on potential ways to contribute to the local community.

Unit 9
Practicing Gratitude and Contentment
The psychological and emotional benefits of gratitude
Practicing contentment in a consumer-driven world
Techniques for cultivating a mindset of abundance
Activity: Gratitude journal and daily reflection.

Unit 10
Living with Purpose and Meaning
Discovering personal values and purpose
The intersection of passion, skills, and service
Creating a life plan that aligns with core values
Activity: Create a personal mission statement.

Week 11
Overcoming Negative Traits: Greed, Anger, and Envy
The psychology behind negative emotions and traits
How greed, anger, and envy affect our well-being
Strategies for managing and transforming negative emotions
Activity: Mindfulness meditation and reflection exercises.

Bringing It All Together: A Life of Goodness
Review of key learnings from the course
Creating a vision for continuous personal growth
How to maintain a positive and ethical life in a challenging world
Activity: Final reflection paper or presentation on how students will apply the course's principles to their life.

Assessment and Evaluation:
Class Participation :20
Assignments/ case study presentations: 30
Final: 50

Professionalism in the Workplace 1-0-0-1

Course Description:

This course is designed to provide students with the foundational knowledge and skills required to demonstrate professionalism in a variety of workplace settings. Topics will include communication, ethics, accountability, time management, problem-solving, conflict resolution, and maintaining a positive and effective work ethic. Students will engage in practical activities that promote personal and professional growth.

Course Objectives:

By the end of this course, students will:

1. Understand the key elements of professional behavior in the workplace.
2. Demonstrate effective communication, both verbal and non-verbal, in a professional environment.
3. Learn to manage time effectively and handle workplace challenges with a positive attitude.
4. Cultivate emotional intelligence and adaptability in professional settings.
5. Understand workplace ethics, integrity, and how to make ethical decisions.
6. Develop skills for conflict resolution and teamwork in diverse work environments.

Unit 1

Introduction to Professionalism

What is professionalism?

Characteristics of a professional: Appearance, behaviour, and attitude

The importance of professional ethics and integrity

Unit 2

Effective Communication in the Workplace

Verbal and non-verbal communication

Active listening and responding

Communicating across cultures

Unit 3

Workplace Etiquette and Networking

Social etiquette in the workplace

Networking best practices

Building relationships with colleagues, managers, and clients

Unit 4

Time Management and Organization

Prioritizing tasks and setting goals

Managing deadlines and avoiding procrastination

Tools and techniques for effective time management

Unit 5

Accountability and Reliability

Taking responsibility for your actions

Being reliable and dependable in the workplace

How accountability affects professional reputation

Unit 6

Problem Solving and Decision Making

Approaches to critical thinking and decision-making

Strategies for solving workplace problems effectively

The role of creativity and innovation in problem-solving

Unit 7

Teamwork and Collaboration

Working with diverse teams

Building trust and collaboration in teams

Managing team conflicts and maintaining harmony

Unit 8
Conflict Resolution and Handling Difficult Conversations
Understanding conflict dynamics
Techniques for resolving conflicts professionally
Role-playing difficult conversations in the workplace

Unit 9
Ethical Dilemmas in the Workplace
Recognizing ethical challenges
Making decisions based on ethical principles
The role of transparency and honesty

Unit 10
Building Emotional Intelligence and Adaptability
What is emotional intelligence and why does it matter?
Developing self-awareness and self-regulation
Adapting to changing work environments

Assessment and Evaluation:
Class Participation :20
Assignments/ case study presentations: 30
Final: 50