SYLLABUS

M. Sc., HUMAN GENETICS AND MOLECULAR BIOLOGY

(With effect from 2025-2026 - ONWARDS)

DEPARTMENT OF HUMAN GENETICS AND MOLECULAR BIOLOGY

Bharathiar University

(A State University, Accredited with "A++" Grade by NAAC

Coimbatore 641 046, INDIA

BHARATHIAR UNIVERSITY: COIMBATORE - 641 046
DEPARTMENT OF HUMAN GENETICS AND MOLECULAR BIOLOGY

MISSION

The mission is to empower the young talents to equip with knowledge and to solve practical problems in the field of Human Genetics. The programs aim to train students to be productive, knowledgeable scientists and molecular geneticist to pursue focused in genetics to work in national, international laboratories, academic, government and private sectors. Our process of education is to create the manpower with professional ethics and moral values.

PROGRAMME EDUCATIONAL OBJECTIVE (PEOs)

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The M.Sc., Human Genetics and Molecular Biology program describe accomplishments that graduates are expected to attain within five to seven years after graduation.	
PEO1	The students can be employed as geneticists in hospitals and Health care sector.
PEO2	The students can go for higher education in reputed National and International Institutions.
PEO3	The candidates would be able to establish a Genetic testing laboratory.
PEO4	Transform the knowledge into design the health care tools/methods for disease diagnosis.
PEO5	Delineate and evaluate the clinical data for the diagnosis of diseases of public health concern.
PEO6	The graduate can become a teacher in Human Genetics and Molecular Biology subjects in higher education institute in national and international level.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PROGRAMME SPECIFIC OUTCOMES (PSOs)	
After the successful completion of M.Sc., Human Genetics and Molecular Biology program, the students are expected to	
PSO1	Know the inheritance patterns of human.
PSO2	To explain the role of genetic changes in association with diseases and disorders.
PSO3	Capacity to design a device to identify the genetic changes.
PSO4	Capable to differentiate genetic and non-genetic disorders.
PSO5	Capacity to manipulating the mutated diseased genes.
PSO6	Capable to become a genetic counselor.
PSO7	The confidence to fill their talent gaps in the emerging field in Human Genetics.
PSO8	Practice the learned molecular methods in clinical center, hospitals and laboratories.

PROGRAMME OUTCOMES (POs)

PROGRAMME OUTCOMES (POs)	
On successful completion of the M.Sc., Human Genetics and Molecular Biology program	
PO1	Able to know the basics in genetic concepts and organization of genome on cellular and chromosomal level.
PO2	Able to explain the basic molecular genetics mechanisms in relation to the structure and function of the cells.
PO3	Candidates are able to describe the structure, function and replication of DNA as the genetic material and its manipulations.
PO4	Understand the impact genetic information in society.
PO5	Acquire the knowledge in the field of Medical, Cyto, Immuno, Molecular, Cancer, Developmental and Neuro genetics to diagnose diseases and disorders.
PO6	Capable to explain the various types of molecular biology methods that are used to study the regulation and function of biomolecules.
PO7	Acquire the ability to use their theoretical knowledge in solving practical issues.
PO8	Know the bioethics and safety measures to be followed in handling the biological samples.
PO9	Able to explain the applications and importance of biomarkers, DNA finger printing and stem cell therapy's in the field of Biomedical Genetics.
PO10	Can have hands on experience in various genetics techniques and familiar with practicing of genetic counseling.

BHARATHIAR UNIVERSITY: COIMBATORE - 641 046
M.Sc., HUMAN GENETICS AND MOLECULAR BIOLOGY
Curriculum (University Department)
(For the students admitted during the academic year 2025-2026 batch and onwards)

Course Code	Title of the Course	Credits	Hours		Maximum Marks		
			Theory	Practical	CIA	ESE	Total
FIRST SEMESTER							
13A	Core I - Medical Biochemistry	4	4	-	25	75	100
13B	Core II - Cell Biology and Cell Signaling	4	4	-	25	75	100
13C	Core III - Principles of Human Genetics	4	4	-	25	75	100
13D	Core IV - Molecular Genetics	4	4	-	25	75	100
13P	Core Practical - I (Medical Biochemistry, Cell Biology and Cell Signaling, Principles of Human Genetics, Molecular Genetics)	4	-	6	25	75	100
1EA / 1EB / 1EC	Elective I - Genomics and Proteomics / r-DNA Technology / Medical Physiology	4	4	-	25	75	100
GS09	Supportive I - Genetics and Society	2	2	-	12	38	50
	Total	**26**	**22**	**6**	**162**	**488**	**650**
SECOND SEMESTER							
23A	Core V - Human Cytogenetics	4	4	-	25	75	100
23B	Core VI - Medical Genetics & Genomics	4	4	-	25	75	100
23C	Core VII - Developmental and Behavioral Genetics	4	4	-	25	75	100
23D	Core VIII – Biostatistics	4	4	-	25	75	100
23P	Core Practical - II (Human Cytogenetics, Medical Genetics & Genomics, Developmental and Behavioral Genetics, Biostatistics)	4	-	6	25	75	100
2EC / 2ED / 2EE	Elective II - Bio Instrumentation / Nanobiomedicine/ Pharmacogenomics and Cheminformatics	4	4	-	25	75	100

GS89	Supportive II - Principles of Genetics	2	2	-	12	38	50
	Total	**26**	**22**	**6**	**162**	**488**	**650**
THIRD SEMESTER							
33A	Core IX - Immunogenetics	4	4	-	25	75	100
33B	Core X - Cancer Genetics	4	4	-	25	75	100
33C	Core XI - Neurogenetics and Epigenetics	4	4	-	25	75	100
33D	Core XII - Genetic Counselling	4	4	-	25	75	100
33P	Core Practical - III (Immunogenetics, Cancer Genetics, Neurogenetics and Epigenetics, Genetic Counselling)	4	-	6	25	75	100
3EC / 3ED / 3EE	Elective III - Stress and Biomarkers / Stem Cell Biology / Forensic Biology	4	4	-	25	75	100
GS106	Supportive III - Genetic toxicology	2	2	-	12	38	50
	Total	**26**	**22**	**6**	**162**	**488**	**650**
FOURTH SEMESTER							
43A	Core XIII - Bioethics and Biosafety (Self Study)	4	-	-	25	75	100
46A	Project and Viva	6	-	-	-	150	150
47B	Hospital Visits / Summer Internship*	2	-	-	-	20	20
	Research papers / Oral or Poster presentation as presenting author or Training / work shop attended more than 3 days in relevant to Genetics*****					20	20
	Industrial Visit*					10	10
	Total	**12**	**-**	**-**	**25**	**215**	**300**
	Grand Total	**90**	**66**	**18**	**511**	**1739**	**2250**
SWAYAM MOOCS#-1 or BU MOOCS#1-– 4 Weeks – 2 credits – Mandatory							
Job Oriented Course #-1							
Value Added #-1							

* Report to be submitted along with project work.

Additional credits

JOB ORIENTED COURSES OFFERED*

Year	Course Code	Subject	Hrs. per week	Hrs.	Max. Marks	Credits
First	---	Cytogenetic Techniques	2	30	50	2
	---	Molecular Diagnostics tools	2	30	50	2

VALUE ADDED COURSES OFFERED*

Year	Course Code	Subject	Hrs. per week	Hrs.	Max. Marks	Credits
Second	---	Cell Culture Techniques	2	30	50	2
	---	Drosophila Culture and Rearing	2	30	50	2
Job Oriented Course #-1						
Value Added #-1						

* Offered in the department; # Additional credits

HEALTH AN WELLNESS

Semester	Course Code	Subject	Hrs. Per week	University examination		Credits
				Duration in Hrs.	Max. Marks	
III	-	Health and Wellness	1	30	-	1

PRACTICAL COMPONENTS:

The M.Sc., HGMB Core Practical Examination having the following Marks:

INTERNAL MARKS: 25

Major Practical		10 Marks
Minor Practical		5 Marks
Spotters (A, B, C , D and E)	5x1 =	5 Marks
Observation and Viva		5 Marks
	Total =	25 Marks

EXTERNAL MARKS: 75

Major Practical		20 Marks
Minor Practical		10 Marks
Minor Practical		10 Marks
Spotters (A, B, C, D and E)	5x4 =	20 Marks
Record and Viva		10+5 Marks
	Total =	75 Marks

The M.Sc., HGMB Core and Elective Theory Examination having the following Marks.

CORE AND ELECTIVE PAPERS: MAXIMUM MARKS - 100

INTERNAL MARKS: 25

Test - 15 Marks
Assignment - 5Marks
Seminar - 5Marks

EXTERNAL MARKS: 75

SECTION - A: 10x1=10 Marks (Question No. 1 to 10)
Choose the best Answer type. Answer all questions. All questions carry equal marks.

SECTION - B: 5x5=25 Marks (Either or type- Question No. 11 to 15)
Answer all questions. All question carries equal marks. Each answer should not exceed 2 pages.

SECTION - C: 5x8=40 Marks (Either or type- Question No. 16 to 20)
Answer all the questions.

First Semester

Course code	13A	MEDICAL BIOCHEMISTRY	L	T	P	C
Core-I			4	-	-	3
Pre-requisite		Basic understanding about macromolecules	Syllabus Version			2025-26

Course Objectives:

The main objectives of this course are to:

1. Understand the basis of biochemical and physiological changes that are underlined invarious genetic defects.
2. Familiarize with topics such as synthesis, classification, structure and properties of carbohydrates, lipids, proteins and enzymes.
3. Introduce the learner with basics of the genes that are responsible in various biochemical pathways with the chemical nature and properties of biomolecules.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Get clear understanding about basic structure and function of biological macromolecules.	K2
2	Distinguish the various advanced molecular and physiological mechanisms in human being.	K2
3	Distinguish the different processing mechanism of macromolecules in our system and how energy generation and transformations occurs.	K2
4	Apply the knowledge of the acid-bases role, electrolyte balances, and osmolality regulation in our system and its associated diseases diagnosis.	K3
5	Distinguish different enzymes types its clinical significance and advancements.	K2

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**- Create

Unit: 1	STRUCTURE AND FUNCTION OF BIOMOLECULES	18 hours

Carbohydrates - Structure, Classification, Function and Their clinical significance; Amino acids – classification and biosynthesis; Proteins: Structure and classification, Role of proteins in various biological functions; Lipids - Structure and classification, Storage lipids and structural lipids in membranes, Lipids with specific biological activities.

Unit: 2	METABOLISM	12 hours

Bioenergetics, Glycolysis, TCA cycle, Oxidative phosphorylation Glycogen breakdown and synthesis, Gluconeogenesis, Biosynthesis of triglycerides and cholesterol. Oxidation of fatty acids, Fate of by-products of metabolism, Role of Tetrahydrobiopterin in metabolism. Role of NAD, FAD, NADPH in health and diseases.

Unit: 3	HORMONAL AND GENETIC REGULATIONS OF METABOLISM	10 hours

Hormones: Functions and classification, Hormonal regulation of fuel metabolism. Molecular mechanism of signal transduction. Role of vitamins in metabolic pathways in association with diseases, Nucleic acid metabolism, Conformation of nucleic acid

Unit: 4	HOMEOSTATIC MECHANISMS IN THE BODY	16 hours

Acid base balance: Hydrogen ion homeostasis and related disorders; Blood gas parameters and

clinical applications. Fluid and electrolyte balance; Regulation of osmolality and maintenance of fluids in the various body compartments and related disorders.		
Unit: 5	**CLINICAL ENZYMOLOGY**	**14 hours**
Enzymes: Introduction, Classification and regulation. Clinical enzymology: Clinical importance of serum enzymes - Aspartate transaminase, Alanine transaminase, Alkaline, phosphatase, Acid phosphatase, amylase, Lactate dehydrogenase, Creatine phosphokinase and Gamma-glutamyltransferase. Cardiac troponins and its clinical significance.		
Unit: 6	**CONTEMPORARY ISSUES**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**72 hours**

Text Book(s)	
1	Textbook of Medical Biochemistry Chatterjea M. N. Jaypee Brothers Medical Publishers. 2012.
Reference Books	
1	Principles of Biochemistry (4th edition) by Albert L. Lehninger, 2004. CBS Publishers and Distributors, New Delhi.
2	Biochemistry (8th edition) by Lubert Stryer, 2015. Co-written by Jeremy Berg, John L. Tymoczko and Gregory J. Gatto Jr and published by Palgrave Macmillan.
3	Biochemistry (4th edition) by D. Voet and J.G. Voet, 2010. John Wiley and Sons, USA Biochemistry, by R.H. Garrett and C.M. Grisham, Saunders College Publishers.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://swayam.gov.in/nd2_cec20_bt12/preview
2	https://swayam.gov.in/nd2_cec19_bt02/preview
3	https://nptel.ac.in/courses/102/105/102105034/
Course Designed By: **Dr. P. VINAYAGA MOORTHI**	

Mapping with Programme Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**M**	**M**	**M**	**L**	**S**	**S**	**M**	**L**	**S**	**M**
CO2	**S**	**S**	**S**	**M**	**S**	**S**	**M**	**L**	**S**	**M**
CO3	**M**	**M**	**S**	**M**	**S**	**S**	**M**	**M**	**S**	**M**
CO4	**L**	**M**	**L**	**L**	**S**	**S**	**S**	**L**	**S**	**S**
CO5	**L**	**M**	**M**	**L**	**S**	**M**	**L**	**L**	**L**	**L**

*S-Strong; M-Medium; L-Low

Course code	13B	CELL BIOLOGY AND CELL SIGNALLING	L	T	P	C
CORE-II			4	-	-	4
Pre-requisite		Basic understanding about cell and signaling mechanism	Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are to:

1. Cell Biology gives a detailed understanding of the fundamental processes of cellular function is critical to all specialties within biology.
2. This course detail property of cell-cell and cell-substrate interactions and elaborates on the fundamentals of intracellular signal transduction during these interactions.
3. Topics will include the function and regulation of signaling modules and membrane component in the context of cellular interactions with other cells and with the extracellular matrix.

Expected Course Outcomes:

On the successful completion of the course, students will be able to:

1	The students will be having a clear idea of the structural arrangements of the components of the cell, a functional unit of living system.	K1 & K2
2	Acquire knowledge basics of mechanism of membrane transport system.	K1 & K2
3	The students will be exposed to the basics of the nucleus.	K1 & K2
4	The cell communication is a crucial part of living systems and their functioning. Being a life science student, this must be learnt from themclearly. This course deals with the same.	K1 & K2
5	The molecular mechanisms of the cell and cell signaling pathways are basics of the cell research, this has also been dealt in this course.	K1, K2 & K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit: 1	CELLULAR ORGANIZATION	14 hours

Structure of cell: Cell membrane: Membrane constituents, receptors, phospholipid bilayer, fluid mosaic model. Subcellular organelles: Structure and functions - mitochondria, endoplasmic reticulum, Golgi apparatus, lysosomes, ribosomes.

Unit: 2	MEMBRANE TRANSPORT	14 hours

Membrane transport of small molecules and the ionic basis of membrane excitability. Principles of membrane transport, carrier proteins, passive movements of solutes and active membrane transport, and ion channels. Cell junctions and cell adhesion molecules, basement membrane, extracellular matrix.

Unit: 3	THE NUCLEUS	14 hours

Structure of nuclear envelope, the nuclear pore complex. Selective transport of proteins to and fro from nucleus. Regulation of nuclear protein import, transport of RNA's. Internal organization of nucleus. Chromosomes.

Unit: 4	CELLULAR COMMUNICATION	14 hours

General principles of cell signaling, types and mechanisms. Cell surface receptors, GPCR Molecular structure and functions, enzyme linked receptors, Activated tyrosine kinase and MAP kinase pathways. Cell Division: Overview of cell cycle, mitosis and meiosis. Cell cycle control in mammalian cells. Regulation of cell cycle and its mechanisms. Checkpoint in cell cycle regulation.

Unit: 5	AGING PROCESS	14 hours
Cell biology of cell aging process and its significance. Molecular mechanism of cell death: Cell necrosis and apoptosis. CASPASE types and molecular mechanisms, proapoptotic regulators, inhibitors of apoptosis. Molecular biology of Survivin and Bcl2 family members, Anti-agingprocess. Computational tools for modeling in cell biology. Computer aided tools for studying cell signaling.		
Unit: 6	**CONTEMPORARY ISSUES**	**2 hours**
Expert lectures, online seminars - webinars on the cell biology and cell signaling		
	Total Lecture hours	**72 hours**

Book(s) for study	
1	Cell Biology Orgnelle Structure and Function by Davide E. Sadava. Published by Panima India Edition. 2009.
2	Molecular Biology by Lodish, Berk, Kaiser, Krieper, Scot, Bretscher, Ploegh, Matsundan Aia. Published by WH Freeman and Company. 2016.
Book (s) for reference	
1	The Cell (7th edition) by Gerald Karp. Published by Wiley. 2013.
2	Molecular Cell Biology (6th edition) by Alberts. Published by Garland Science. 2014.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://swayam.gov.in/nd2_cec19_bt12/preview
2	http://ugcmoocs.inflibnet.ac.in/ugcmoocs/view_module_ug.php/152
3	http://ugcmoocs.inflibnet.ac.in/ugcmoocs/view_module_ug.php/41
Course Designed By: **Dr. A. VIJAYA ANAND**	

Mapping with Programme Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	S	S	M	M	L	M	M	L	L	L
CO2	S	S	M	M	L	M	M	L	L	L
CO3	S	S	S	S	S	S	M	M	L	S
CO4	S	S	S	S	S	M	M	M	L	M
CO5	S	S	S	S	S	M	M	M	L	M

*S-Strong; M-Medium; L-Low

Course code	13C	PRINCIPLES OF HUMAN GENETICS	L	T	P	C
CORE-III			4	-	-	4
Pre-requisite		Basic understanding about principles of human genetics and genetic disorder	Syllabus Version		2025-26	

Course Objectives

The main objectives of this course are to:

1. To provide the knowledge about the genetic influence and history of human genetics and Mendelian laws to the students for their curriculum development and knowledge enrichment.
2. To understand the principles and mechanisms of the inheritance from one generation to the next.
3. To understand the mechanism of inheritance by scientific experimentation.
4. To get updated with the knowledge on genetic diseases and its research approach.
5. To understand the genetic disorders and its complications

Expected Course Outcomes

On the successful completion of the course, student will be able to:

1	Gain knowledge on fundamentals of genetics and its impact.	K1 & K2
2	Identify the genetic disease and the pattern of inheritance.	K2 & K3
3	The course would be helpful for the students to obtain job opportunities in public and private sectors related to biology and medicine.	K3, K5 & K6
4	This aims to gain knowledge on futuristic aspects of genetic diseases and treatment and preventive options.	K4, K5, & K6
5	Helps the students to avail opportunities in research in different areas of genetics both Nationally and internationally.	K2, K4 & K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit: 1	THE CELLULAR AND MOLECULAR BASIS OF INHERITANCE	14 hours

Nucleus, Cell division, Types of DNA Sequence, **Role of non-coding RNAs,** Cell divisions: chromosomal segregation during mitosis and meiosis. Inheritance: Mendelian Laws (law of segregation, law of independent assortment, law of segregation and independent assortment), Non mendelian Inheritance, multiple allele, Codominance, Linkage, Crossing over.

Unit: 2	GENETICS OF HUMAN TRAITS	14 hours

Monogenic traits, autosomal inheritance (Dominant and Recessive), Sex-linked inheritance, Sex limited and influenced traits, Mosaicism, Chimerism, X-inactivation, mitochondrial inheritance. Complex traits.

Unit: 3	CHROMOSOMAL NOMENCLATURE	14 Hours

International system of Human Chromosome Nomenclature, Nomenclature of aberrant karyotypes, Chromosomal abnormalities: Common syndromes due to numerical chromosomal changes, Structural alterations (translocations, duplications, deletions, microdeletions, fragile sites and mutations).

Unit: 4	PEDIGREE AND ITS COMPLICATIONS	14 hours

Pedigree analysis: Family history, pedigree symbols, construction of pedigrees, presentation of molecular genetic data in pedigrees, Complications to the basic pedigree patterns.

Unit: 5	DISORDERS	14 hours
Disorders of Amino Acid and Peptide Metabolism, Disorders of Carbohydrate Metabolism, Disorders of Lipid and Lipoprotein Metabolism, Lysosomal Storage Disorders, Disorders in the Metabolism of Purines, Pyrimidines, and Nucleotides Peroxisomal Disorders.		
Unit: 6	**CONTEMPORARY ISSUES**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**72 hours**

Text Book(s)

1	Concepts of Genetics 10th Edition by Michael A Palladino and Michael K Cummings and William S Klug, Pearson. 2011.
2	Brooker, R. J. 2014. Genetics: Analysis and Principles. 5th edition. McGraw Hill.
3	Cummings, M. R. 2014. Human Heredity: Principles and Issues. West Publishing Company.
4	Principles Of Genetics 8th Edition by Gardner.

Reference Books

1	Alberts *et al.*, Molecular Biology of the Cell 2nd Edition, Garland 2007.
2	Snustad and Simmons, Principles of Genetics, 4th Edition, Wiley' 2005.
3	Lewin, Genes IX, 9th Edition Jons and Bartlett 2007.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://dmhuk8np1ucwy.cloudfront.net/wp-content/uploads/2015/08/CH25-lm.pdf
2	https://nptel.ac.in/courses/102/104/102104052/
3	https://www.coursera.org/learn/geneticsevolution?.ranMID=40328&ranEAID=7bhGe75fAQ8&ranSiteID=7bhGe75fAQ8-GHJVooGTS0D2rg9M08o2uA&siteID=7bhGe75fAQ8 GHJVooGTS0D2rg9M08o2uA&utm_content=15&utm_medium=partners&utm_source=linkshare&utm_campaign=7bhGe75fAQ8

Course Designed By: **Dr. P.VINAYAGA MOORTHI**

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	M	S	M	M	S
CO3	S	S	M	S	S	S	M	S	S	M
CO3	M	M	M	S	M	M	S	M	M	M
CO4	S	S	S	M	M	S	M	M	M	S
CO5	M	S	M	M	M	M	M	S	S	S

*S-Strong; M-Medium; L-Low

Course code	13D	MOLECULAR GENETICS	L	T	P	C
CORE-IV			4	-	-	4
Pre-requisite		Fundamentals in genetics	Syllabus Version			2025-26

Course Objectives:

The main objectives of this course are to:

1. To understand the fundamentals of genetic material in living system.
2. To enable them with better understanding about the defects in genetic material and to modify them for the proper functioning.
3. To have an overview of all kinds of diagnostic techniques for such molecular mechanisms.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understanding the fundamentals of hereditary materials and their role in functioning of human system.	K1 & K2
2	Able to identify the damage in hereditary material and malfunctioning of genes to help in eradicating the disease.	K3 & K4
3	Capable of understanding the Gene editing techniques.	K3
4	Able to understand the human Genome and features.	K2 & K4
5	With the wide technical knowledge, the students able to modify the genes and restore the functions of the hereditary material.	K5 & K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

UNIT: 1	CENTRAL DOGMA AND ADVANCEMENTS	14 hours

General concept of a gene, gene families, C-value paradox non-coding genes, flow of genetic information, Splice variants, repetitive DNA, replication, transcription ("rho" dependent and "rho" independent termination), splicing, translation and post translational changes in Prokaryotes and Eukaryotes. Regulation of Gene Expression at different levels Inducible operons - Galactose Repressible operon - Tryptophan.

UNIT: 2	MUTAGENESIS, DNA DAMAGE AND REPAIR	14 hours

Mutagens and mutagenesis and types of mutations. DNA damage and DNA repair: Types of DNA damage, Endogenous and Exogenous origins of DNA damage. DNA repair Mechanism: Error- prone, Mismatch, Photo activation, excision and SOS repair.

Unit: 3	RECOMBINATION	14 hours

Cell-based DNA cloning, vector-based cloning; nucleic acid hybridizations, PCR-based DNA cloning. Models and molecular mechanisms, Homologous and site-specific recombination: Molecular mechanism of Transposons and transposition. Gene editing techniques: using CRISPR-Cas9, ZFNs, and TALENs.

Unit: 4	FEATURES OF THE HUMAN GENOME	14 hours

Organization of the human genome, human multigene families, Mapping of the human genome: Physical mapping and Genetic mapping. Footprints of evolution, human DNA instability. Chromosome walking.

Unit: 5	APPLICATIONS OF MOLECULAR GENETICS	14 hours
Disease diagnosis, Epigenetic testing, Prognostic and diagnostic markers, Development of molecules in Biopharma, Therapeutic advancements, Disease diagnosis and Disease inheritability, Improving existing biological outcomes, Vaccine development and Gene therapy.		
Unit: 6	**CONTEMPORARY ISSUES**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**72 hours**

Text Book(s)	
1	Principles of Genetics Gardner, Simmons, Snustad8th Edition 2006.
Reference Books	
1	Tom Strachan and Andrew. P. Read, Human Molecular Genetics, Bios" Scientific Pub UK. (1996).
2	Watson, J.D., Hopkins, N.H., Roberts, J.W., Steitz, J. and Weinter, A.M., Molecular Biology of Genes (4th edition) 1987. The Benjamin/Cummings publishing Company Inc., Joky.
3	Lewin, B. Genes VI (1997). Oxford University Press, Oxford, New York, Tokyo.
4	Darvell, J.et.al., Molecular Cell Biology (7th edition) 2002. Garland Publishing Iwc., New York
5	Molecular Biology by Glick and Pasternack, 2003.
6	Lewin, Genes IX, 9th Edition Jones and Bartlett 2007
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://swayam.gov.in/nd1_noc20_bt06/preview
2	https://brighterion.com/artificial-intelligence-101-genetic-algorithms/
3	https://www.ncbi.nlm.nih.gov/books/NBK21571/
4	https://www.cell.com/trends/biotechnology/pdf/0167-7799(92)90173-S.pdf
5	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2628815/
Course Designed By: **Dr. R. SIVASAMY**	

Mapping with Programme Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**S**	**S**	**S**	**S**	**M**	**L**	**L**	**L**	**M**	**S**
CO2	**M**	**M**	**S**	**S**	**S**	**M**	**M**	**M**	**S**	**M**
CO3	**L**	**M**	**S**	**S**	**S**	**M**	**L**	**M**	**S**	**S**
CO4	**S**	**S**	**S**	**M**	**M**	**S**	**L**	**L**	**S**	**M**
CO5	**S**	**S**	**S**	**M**	**M**	**S**	**L**	**M**	**S**	**S**

*S-Strong; M-Medium; L-Low

Course code	13P	MEDICAL BIOCHEMISTRY, CELL BIOLOGY ANDCELL SIGNALING, PRINCIPLES OF HUMAN GENETICS, MOLECULAR GENETICS)	L	T	P	C
CORE PRACTICAL-I			-	-	6	4
Pre-requisite		Basic knowledge in macromolecules and genetic materials	Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are to:

1. Develop the knowledge in the area of disease diagnosis through various biochemical markers and its disease association.
2. Inculcate the cell culturing and visualization techniques for the distinguishing the normal and disease conditions.
3. Apply the principles of inheritance pattern and to study the structural alterations of chromosomes and DNA in diseased individuals. Practical and experimental knowledge will be gained from the hands-on experiments.
4. To understand the structural and functional aspect of Human Genomic DNA for studying the molecular mechanism behind genetic diseases and to perform various molecular techniques for understanding the genetic and epigenetic mechanism behind various human disease progression.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Measure and interpret the biochemical markers and its association in diseases.	K3
2	Visualize and culture the cells of cytology importance and interpret the diseases association with it.	K3
3	Students can able to learn and understand the genetic pattern of a disease and the significance of chromosomal change in evolution and illness. They can understand how mutations can affect gene dosage and function.	K5
4	Understand the properties and functions of every component present in the DNA and perform basic molecular genetic tests to identify structural alterations in DNA.	K3, K5 & K6
5	Employ the techniques for their services in disease diagnosis in hospitals and research institutes.	K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

MEDICAL BIOCHEMISTRY

1. Determination of blood glucose
2. Estimation of total cholesterol
3. Estimation of DNA by using Diphenylamine method
4. Estimation of RNA by Orcinol method
5. Determine the melting temperature and GC content by using melting curve.
6. Determination of protein in blood by Lowry *et al*. method
7. Paper chromatography
8. Demonstration of chromatographic techniques

CELL BIOLOGY AND CELL SIGNALING

1. Uses of Microscope and Micrometry
2. Preparation of blood smear
3. Counting of RBC and WBC using Haemocytometer
4. Preparation of slides for the process of Mitosis and Meiosis

5. PBMC isolation and differentiation
6. Cell signaling tools: SMART and Sig2GRN

PRINCIPLES OF HUMAN GENETICS

1. Pedigree analysis
2. Karyotyping
3. Buccal micronucleus
4. Banding techniques
5. Arrangement of 23 pairs of chromosomes

MOLECULAR GENETICS

1. Nucleic acid extraction
2. Estimation of DNA and RNA by UV Spectrophotometry
3. Restriction Digestion and Ligation
4. Primer designing
5. Polymerase chain reaction
6. Retrieval of sequences from nucleic acid databases

	Total Lecture hours	**108 hours**

Book(s) for study	
1	Concepts Of Genetics 10th Edition by Michael A Palladino and Michael K Cummings and William S Klug, Pearson.
2	Brooker, R. J. 2014. Genetics: Analysis and Principles. 5th edition. McGraw Hill.
3	Cummings, M. R. 2014. Human Heredity: Principles and Issues. West Publishing Company.
4	Principles Of Genetics 8th Edition by Gardner.
5	Analytical Biochemistry, 3rd Edition. Holme, D.J and Peck, H. 1998. Pearson Education Limited.1-501.
6	Tom Strachan and Andrew. P. Read, Human Molecular Genetics, Bios‟ Scientific Pub UK. (1996).
Books for references	
1	Alberts et al., Molecular Biology of the Cell 2nd Edition, Garland2007.
2	Snustad and Simmons, Principles of Genetics, 4th Edition, Wiley 2005.
3	Lewin, Genes IX, 9th Edition Jons and Bartlett 2007.
4	Modern experimental Biochemistry, 3rd Edition, Rodney Boyer. 2000. Benjamin Cummins. 1-480.
5	Amaldi, F., 1982. Practical Methods in Molecular Biology.: RF Schleif and PC Wensink. Springer-Verlag, New York, Heidelberg, Berlin, 1981, xiii+ 220 pp. DM69. 00, US $32.20.
6	Schleif, R.F. and Wensink, P.C., 2012. *Practical methods in molecular biology*. Springer Science & Business Media.
7	Davis, L., 2012. *Basic methods in molecular biology*. Elsevier.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://onlinecourses.swayam2.ac.in/cec20_bt17/preview
2	https://nptel.ac.in/courses/102/104/102104052/

3	https://www.futurelearn.com/courses/biochemistry
4	https://bio.libretexts.org/Bookshelves/Genetics/Book%3A_Online_Open_Genetics_(Nickle_and_Barrette-Ng)/08%3A_Techniques_of_Molecular_Genetics
5	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2592051/
6	https://www.ncbi.nlm.nih.gov/books/NBK21248/?term=molecular%20Genetics

Course Designed By: **Dr. A. VIJAYA ANAND, Dr. P. VINAYAGA MOORTH, AND Dr. R. SIVASAMY**

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**M**	**M**	**M**	**M**	**S**	**S**	**S**	**S**	**S**	**S**
CO2	**M**	**S**	**M**	**M**	**S**	**S**	**S**	**S**	**S**	**S**
CO3	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO4	**M**	**M**	**M**	**M**	**S**	**S**	**S**	**S**	**S**	**S**
CO5	**M**	**M**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**

*S-Strong; M-Medium; L-Low

Course code	1EA	GENOMICS AND PROTEOMICS	L	T	P	C
ELECTIVE-I			4	-	-	4
Pre-requisite		Understanding about the Genomics and Proteomics	Syllabus Version			2025-26

Course Objectives:

The main objectives of this course are to:

1 To understand the genome organization of various organisms.
2 To understand the corresponding protein and their functional role in various systems.
3 To know the principles and working mechanism of all the genomic and proteomic techniques.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Able to understand the Genome organization.	K1 & K2
2	Understanding the Genome of prokaryotic and Eukaryotic system.	K2
3	Capable of understanding the mechanism of protein product in every genes.	K2 & K3
4	Techniques used in genomics and proteomics study will be helpful in future research by exploring many aspects of defective genes and their products.	K4 & K5
5	Abe to understand the Biological Databases and their applications.	K3 & K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

UNIT: 1	BASICS IN GENOMICS	14 hours

Structure and organization of prokaryotic and eukaryotic genome, genetic and physical mapping. Assembly of a contiguous, DNA sequence, clone contig approach generation of genomic and cDNA libraries.

UNIT: 2	GENOME OF PROKARYOTIC AND EUKARYOTIC ORGANISM	14 hours

E. coli, *Arabidopsis thaliana* and *Musmusculus*. Evolution and structure of mitochondrial genomes, Chloroplast genome, mtDNA, and mitochondrial diseases. Architectures of genome and chromosomes, genes and gene families, the structure of chromatin and chromosomes, heterochromatin, euchromatin, transposons.

UNIT: 3	TRANSCRIPTOMICS	14 hours

Transcriptome, yeast transcriptome and the human transcriptome, link between the transcriptome and proteome. Transcripts analysis, Serial analysis of gene expression (SAGE), non- array based whole transcriptome analysis, Epitranscriptomic modifications, differential display, Yeast two hybrid systems.

UNIT: 4	PROTEOMICS	14 hours

Tools for proteome analysis,2D-PAGE, Mass spectrometry, MALDI, TOF, TANDOM, MS, LC- MS, protein microarray Affinity purification of proteins and TAP TAG. Protein-Protein interactions and uses of their databases. Peptide finger printing: Sample preparation for proteomic analysis and sequencing of proteins.

UNIT: 5	BIOLOGICAL DATABASES	14 hours

Overview, applications, gene and protein sequence databases, GenBank, EMBL, DDBJ, and PDB. Online databases InterPro, UniProt, Pride and Pfam Sequence alignment and sequence analysis**:** Concept of local and global sequence alignment, Pair- wise sequence alignment, BLAST, Multiple sequence alignment, homology, analogy. RNA Seq Data analysis, Metagenome analysis, Proteome data analysis (Mascot and Peaks)

UNIT: 6	CONTEMPORARY ISSUES	2 hours
Expert lectures, online seminars – webinars		
	Total Lecture hours	**72 hours**

Text Book(s)	
1	Brown, T.A., 2006, Genomes, John Wiley and Sons, Pvt. Ltd., Singapore.
Reference Books	
1	Campbell A, Heyer. 2004, Discovering Genomics, Proteomics and Bioinformatics, Pearson Education, New Jersey.
2	Liebler, Daniel, C.,2002, Introduction to proteomics tool for the new biology, Humana Press, New Jersey.
3	Lesk, A.M. 2007. Introduction to Bioinformatics, Oxford University Press, Oxford.
4	Old, R.W. and Primrose, S.B. 2006. Principles of Gene Manipulation, Blackwell Science Publication, Berlin.
5	Pennington, S.R , Dunn, M,J., 2002, Proteomics from Protein sequence to function, Viva Books Pvt., Ltd, New Delhi.
6	Introduction to Bioinformatics, Tramontano A, Chapman and Hall.
7	Understanding Bioinformatics, Zvelebil M and Baum JO, Taylor and Francis.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.frontiersin.org/articles/10.3389/fgene.2020.00309/full
2	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6325641/
3	https://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1005457
4	https://www.ncbi.nlm.nih.gov/books/NBK21121/
5	https://www.denbi.de/online-training-media-library/proteomics
6	https://www.sciencedirect.com/science/article/pii/S1874391912001479
7	http://www.bio.iitb.ac.in/~sanjeeva/e-learning-activities/
8	https://swayam.gov.in/nd1_noc19_bt26/preview
Course Designed By: **Dr. R. SIVASAMY**	

Mapping with Programme Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**S**	**S**	**S**	**M**	**M**	**M**	**M**	**M**	**S**	**S**
CO2	**S**	**S**	**S**	**S**	**M**	**S**	**M**	**M**	**S**	**S**
CO3	**M**	**M**	**S**	**M**	**L**	**S**	**M**	**M**	**L**	**S**
CO4	**S**	**M**	**S**	**L**	**M**	**S**	**S**	**M**	**S**	**S**
CO5	**M**	**M**	**M**	**L**	**L**	**S**	**S**	**M**	**S**	**S**

*S-Strong; M-Medium; L-Low

Course code	1EB	r-DNA TECHNOLOGY	L	T	P	C
ELECTIVE-I			4	-	-	4
Pre-requisite		Basic understanding about DNA and other prokaryotic and eukaryotic organisms	Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are to:

1. To understand the concepts of gene cloning and vectors used.
2. To study the techniques available to reveal the structural architecture of the genetic materials.
3. To study the methods used for extracting and eluting the genetic material from biological samples.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Describe the basics of genes, how it is being controlled by different biomolecules.	K1
2	Gain knowledge to classify the restriction and modification enzymes and apply it for genetic analysis and functioning.	K2
3	Understand the construction of gene library, role of different vectors and its biomedical application in larger scale.	K2
4	Learn profound understanding about techniques that dissect the DNA, RNA andProtein and use it for analyzing disease.	K4
5	Apply the recombinant techniques for production of health care materials.	K3

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**- Create

Unit: 1	GENES AND ITS MODIFICATION ENZYMES	14 hours

Genes within the cells, genetic elements that control gene expression, restriction and modification enzymes (Restriction enzymes, DNA ligases, Klenow fragment, T4 DNA polymerase, Polynucleotide kinase, Alkaline phosphatase). All different types of polymerases.

Unit: 2	GENE LIBRARY AND VECTORS	16 hours

Construction of genomic DNA Library, Design of linkers and adaptors. Characteristics of plasmid and phage vectors, prokaryotic and eukaryotic expression vectors, Insect, Yeast and Mammalian vectors. Gene isolation, gene cloning, screening and expression of cloned gene. Different types of Cloning.

Unit: 3	MOLECULAR BIOLOGY TECHNIQUES	18 hours

Isolation of DNA, mRNA and total RNA, polymerase chain reactions (PCR) and types of PCR. Southern and Northern and Western blotting. *In situ* hybridization, Site-directed mutagenesis, Transposons. Transduction – Transformation and its type - Competent cell preparation.

Unit: 4	SEQUENCING TECHNIQUES	12 hours

DNA sequencing (Maxam and Gilbert, Sangers, Pyrosequencing, Shotgun sequencing method), Short read and long read next gen sequencing, Protein sequencing, RNA sequencing, Metagenomics, Single cell multiomics analysis

Unit: 5	APPLICATIONS OF r-DNA TECHNIQUES	10 hours

Production of insulin, Human growth factor, Gene therapy (antisense, ribozyme technology, mRNA technology) Safety guidelines of recombinant DNA research, mRNA vaccine – Nobel Prize -2023, Molecular Kit.

Unit: 6	CONTEMPORARY ISSUES	2 hours

Expert lectures, online seminars – webinars		
	Total Lecture hours	**72 hours**
Text Book(s)		
1	H.K. Das, Text Book of Biotechnology, 1st Ed, 2004, Wiley Publishers.	
2	Winter P.C., Hicker G.I., H.L. Fletcher. Instant notes: Genetics. 2nd Edition 2003. Viva's Book (Pvt) Ltd.	
Reference Books		
1	Old and Primrose, Principles of Gene Manipulation, 3rd Ed, Blackwell Scientific Publishers.	
2	Brown TA, Genomes, 3rd ed. Garland Science 2006.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://swayam.gov.in/nd1_noc19_bt15/preview	
2	https://nptel.ac.in/courses/102/103/102103013/	
3	https://nptel.ac.in/courses/102/103/102103074/	
Course Designed By: **Dr. P. VINAYAGA MOORTHI**		

Mapping with Programme Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**S**	**S**	**S**	**M**	**S**	**S**	**M**	**M**	**S**	**M**
CO2	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**M**	**S**	**S**
CO3	**S**	**M**	**S**	**M**	**S**	**S**	**S**	**M**	**S**	**M**
CO4	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**M**	**S**	**S**
CO5	**M**	**M**	**M**	**M**	**S**	**M**	**S**	**M**	**S**	**M**

*S-Strong; M-Medium; L-Low

Course code	1EC	MEDICAL PHYSIOLOGY	L	T	P	C
ELECTIVE I			4	-	-	4
Pre-requisite		Basic understanding human physiology	Syllabus Version	2025-26		

Course Objectives:

The main objectives of this course are to:

1. Medical Physiology is a subject that mainly helps the learners to understand the morphology, function and so on.
2. To acquire a core scientific knowledge about humans as a physiological entity.
3. To apply basic physiology principles in the appropriate clinical context.

Expected Course Outcomes:

On the successful completion of the course, students will be able to:

1	Students will understand the organs and its specific parts and functions.	K1 & K2
2	It depicts them to understand the parameters of healthy and unhealthy nature of the organs.	K1 & K2
3	It helps the students to know the disease condition through various structures and physiological nature.	K1 & K2
4	It also helps the students to design the novel therapeutic approaches.	K1 & K2
5	It gives aware of physiological research to improve diagnoses and treatments of diseases.	K1 & K2

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit: 1	BLOOD	14 hours

Blood: Composition and functions of blood, Blood plasma, Formed elements, Hemostasis: Vascular spasms, Platelet plug, Coagulation, Clot retraction and repair. Fibrinolysis, Transfusion and Blood replacement, Diagnostic blood tests, Developmental aspects of blood.

Unit: 2	CARDIOVASCULAR SYSTEM	14 hours

Cardiovascular system: Heart, Blood supply to the heart, Heart physiology: Electrical events, Mechanical events - cardiac cycle, Heart sounds. ECG - its principle and significance. Cardiopulmonary resuscitation. Biochemical parameters to diagnose heart diseases.

Blood vessel: Arterial system, Capillaries, Venous system. Blood pressure, Measurement of blood pressure.

Unit: 3	RESPIRATORY AND EXCREATORY SYSTEM	14 hours

Functional anatomy of the respiratory system, Mechanism of breathing, Gas exchanges in the body, Transport of Respiratory gases by blood, Control of respiration.

Renal physiology: Mechanism of urine formation - Glomerular filtration, Tubular reabsorption, Tubular secretion. Renal clearance, Characteristics and Composition of urine. Renal function test.

Unit: 4	DIGESTIVE AND NERVOUS SYSTEM	14 hours

Functional anatomy of digestive system. Physiology of chemical digestion and absorption. Gut microbiome. Liver function test.

Organization of the nervous system: The central nervous system, Peripheral nervous system, Neurons. Neurophysiology: Resting membrane potential, Synapse, Neurotransmitters and their receptors. EEG. MRI.

Unit: 5	ENDOCRINE AND REPRODUCTIVE SYSTEM	14 hours
Endocrinology: Functions, hypo and hyper secretion of hormones of pituitary, thyroid, parathyroid, adrenal, pancreas, sex hormones. Basic mechanism of hormone action, neuroendocrine regulation. Assay of hormones.		
Unit: 6	**CONTEMPORARY ISSUES**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**72 hours**

Text Book(s)

1	Human Physiology: An integrated Approach by Dee Unglaub Silverthorn. Published by Pearson. 2014.
2	Gray's Anatomy by Roger Warwick and Peter Williams. Published by Longman Group Ltd. 1973.

Reference Books

1	Textbook of Medical Physiology by A.C. Guyton and J.E. Hall. Published by W.B. Saunders Company. 2011.
2	Physiology (3rd edition) by L.S. Costanzo. W.B. Saunders Company. 2006.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://swayam.gov.in/nd2_cec20_bt19/preview
2	https://www.classcentral.com/course/independent-anatomy-and-physiology-mooc-3757
3	https://swayam.gov.in/nd2_cec20_bt21/preview

Course Designed By: **Dr. A. VIJAYA ANAND**

Mapping with Programme Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**M**	**S**	**L**	**M**	**S**	**S**	**M**	**M**	**L**	**M**
CO2	**M**	**S**	**L**	**M**	**S**	**S**	**M**	**M**	**L**	**M**
CO3	**M**	**S**	**L**	**M**	**S**	**S**	**M**	**M**	**L**	**M**
CO4	**M**	**S**	**L**	**M**	**S**	**S**	**M**	**M**	**L**	**M**
CO5	**M**	**S**	**L**	**M**	**S**	**S**	**M**	**M**	**L**	**M**

*S-Strong; M-Medium; L-Low

Course code	GS09	GENETICS AND SOCIETY	L	T	P	C
SUPPORTIVE-I			2	-	-	2
Pre-requisite		Basics in genetics	Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are to:

1 To know the impact of genetic diseases on the society.
2 To make students aware about the ethical and legal issues behind genetic research.
3 To have a better understanding about the social impact on various kinds of researchassociated with genetics.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Able to understanding about the impact of genetics in medicine and society.	K2
2	Inculcate the knowledge to understanding about the genetic makeup of Human.	K2 & K3
3	Capable of understanding the human Genome project and applications.	K2
4.	Able to understand the ethical and legal issues involved in genetics.	K3 & K 4
5.	Able to understand the modern genetics tools and their uses.	K2 & K3

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

UNIT: 1	**HUMAN GENOME**	**6 hours**

The history and impact of Genetics in Medicine and Society, Medical Genetics, Early beginnings, Centre for Genetics and Society around the world, an overview.

UNIT: 2	**GENETIC ASSOCIATION OF DISEASES**	**6 hours**

Genes and Pedigrees in a Population. Creation of Awareness about Genetic diseases and disorders. Genetic Testing (Prenatal & Postnatal).

UNIT: 3	**HUMAN GENOME PROJECT**	**5 hours**

Human Genome Project, Beginning and Organization of the HGP, Sequencing of the Human Genome, Promises and Achievements., Diversity Project.

UNIT: 4	**ETHICAL AND LEGAL ISSUES**	**5 hours**

Ethical, Legal and Social issues of the HGP, Other Genome Projects initiated as a directcon sequence of HGP completion. Ethical and Legal Issues in Medical Genetics.

UNIT: 5	**ADVANCES IN MODERN GENETICS**	**10 hours**

Advances in Modern Genetics: Some of the areas of concern in Modern Genetics, GM crops, personal DNA data, Gene Therapy, Pharming, Molecular Cytogenetics. Population Genetics.

UNIT: 6	**CONTEMPORARY ISSUES**	**2 hours**

Expert lectures, online seminars – webinars

	Total Lecture hours	**36 hours**

Text Book(s)

1	Genetics, A Conceptual Approach, 4th ed., B.A. Pierce, Palgrave Macmillan, 2012.
2	Emery's Elements of Medical Genetics, 14th ed., P.D. Turnpenny and S. Ellard, Churchill Livingstone, 2012.

Reference Books	
1	Introduction to Genetics, A Molecular Approach, T. Brown, Garland Science, 2012
2	Genome Duplication, Concepts, Mechanism, Evolution and Disease, M.L. De Pamphilis and S.D. Bell, Garland Science, 2011.
3	Human Molecular Genetics, 4th ed., T. Strachan and A. Read, Garland Science, Taylor and Francis Group, 2011.
4	A Guide to Genetic Counseling,2nd ed., W.R. Uhlmann, J.L. Schuette and B.M. Yashar, Wiley, Blackwell, 2009.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://portal.e-lfh.org.uk/Component/Details/465515
2	https://www.e-lfh.org.uk/programmes/genomics-education-programme/
3	http://www.bionet.nsc.ru/ICIG/CHM/books/Hartl_Jones_Genetics.pdf
Course Designed By: **Dr. R. SIVASAMY**	

CYTOGENETIC TECHNIQUES		
The objectives of the Course are:		
The main objectives of this course are to:		
1	To provide a working knowledge of cytogenetics, the preparation of materials for study, and theimportance of chromosomal variations in structure and number in human diseases.	
2	Diagnose and interpret pathology of human chromosomes	
3	Demonstrate a professional knowledge of the cytogenetic disorders and clinical diagnosis.	
4	To understand the human karyotype in normal and diseased patients.	
5	To study the mechanism of disease progression and its genetic influence	
Course Content	Lecture / Practical / Project / Internship	
Module 1	**Classical Cytogenetics** Pedigree analysis, Peripheral blood leukocyte culture for chromosomal studies, G-banding, C-banding, R-banding, Karyotyping, Microscopy - operation and maintenance of bright-field microscopy, inverted and fluorescence microscopy. Each fellow is expected to conduct cytogenetic analysis for at least 2 cases per week and review/interpret the abnormal cases vs. control samples during this training module. The fellow should document his/her roles in every case that he/she is involved.	**6 hours**
Module 2	**Molecular Cytogenetics** FISH (Fluorescent In-situ Hybridization), CGH (Comparative genomic hybridization), aCGH (Array comparative genomic hybridization). Each fellow is expected to process and analyze at least 2 cases per week and review/interpret the results for abnormal vs. control samples using FISH, CGH and aCGH during this training module. The fellow should document his/her roles in every case that he/she is involved.	**6 hours**
Module 3	Sex chromatin analysis (buccal mucosa, hair bud), Buccal micronucleus, Blood Micronucleus test and COMET assay. Each fellow is expected to process and analyze at least 2 cases per week and review/interpret the results and should document his/her roles in every case that he/she is involved.	**6 hours**
Module 4	**Case study analysis:** Interacting with patients, learning family history and preparation of pedigree chart. The participating fellows will be involved in patient's direct contact to obtain information regarding family history and expected to preparepedigree chart for the participants involved and preparation of case reports.	**6 hours**
Module 5	Prenatal diagnosis: Chorionic villi sampling, foetoscopy, ultrascopy, amniocentesis. Postnatal: sister chromatid exchange, fragile site, Mitotic index and Genetic Counselling. Each fellow is expected to process and analyze at least 2 cases per week and review/interpret at least 20 cases (normal vs. abnormal) during this training module. The fellow should document his/her roles in every case	**6 hours**

	that he/she is involved. The fellow will be trained to conduct genetic counselling for the needed patients.	
		30 Hours

Book(s) for Study	
1	DP Snustad and MJ Simmons (2012) Principles of Genetics, John Willey & Sons Publication, 6th Edition
2	Human Genetics 5th Edition 2017 By Gangane
Book(s) for reference	
1	Alberts et al., Molecular Biology of the Cell 2nd Edition, Garland 2007.
2	Snustad and Simmons, Principles of Genetics, 4th Edition, Wiley' 2005.
Related Online Contents	
1	https://www.coursera.org/learn/genes
2	https://www.gfmer.ch/SRH-Course-2011/community-genetics/pdf/Cytogenetics-Dahoun-2011.pdf
3	https://arup.utah.edu/media/andersen-introCyto-2018/lecture-slides.pdf

Second Semester

Course code	23A	HUMAN CYTOGENETICS	L	T	P	C
CORE-V			4	-	-	4
Pre-requisite		Basic understanding about human classical and molecular cytogenetics	Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are to:

1. Demonstrate an advanced knowledge on human cytogenetics and human diseases.
2. Diagnose and interpret pathology of human chromosomes.
3. Demonstrate a professional knowledge of the cytogenetic disorders and clinical diagnosis.
4. To understand the human karyotype in normal and diseased patients.
5. To study the mechanism of cancer progression and its genetic influence.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	The course would help in acquainting with case studies and the practice of genetic counseling individually.	K1, K2 & K3
2	Basically cytogenetic studies are widely used for genetic testing of various diseases; hence the students will get trained in identifying different hereditary diseases and could analyze any chromosomalanomalies which will be helpful in medical practice.	K2, K3, K4 & K5
3	This course could help students to get placement in various hospitals and R&D laboratories as technicians or genetic counsellors.	K4, K5 & K6
4	The course outcome helps the students in availing opportunities in both technical as well in computational biology (Artificial Intelligence).	K1, K4 & K6
5	The course helps to understand the application of genetics in Medical Practice.	K4, K5 & K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit: 1	HISTORY OF HUMAN CYTOGENETICS	14 hours

History of Human Cytogenetics, Denver conference (1940), Denver Conference (1960), Chicago conference (1966), Paris conference (1971). Marker chromosome, Derivative chromosome, Ring chromosome, isochromosome, Pseudodicentric chromosome.

Unit: 2	CHROMOSOMAL ANALYSIS	14 hours

Peripheral blood cultures; banding techniques: G, Q, C and R band identification of 23 pairs of human chromosomes by band position. Molecular Cytogenetics: Fluorescent In-situ Hybridization –Types of FISH probes. Spectral Karyotyping, Multicolor FISH, Applications of FISH: Structural Abnormalities, Microdeletion Syndromes, Interphase FISH for Prenatal Diagnosis of Common Aneuploidies. Preimplantation FISH Diagnosis of Aneuploidies. Molecular Approaches for Delineating Marker Chromosomes.

Unit: 3	PRENATAL DIAGNOSIS	14 hours

Prenatal diagnosis: Chorionic villi sampling, foetoscopy, ultrascopy, amniocentesis. Postnatal diagnosis: Peripheral blood leucocyte culture, Sister chromatid exchange, Mitotic index, Genetic Counseling. PGD, Neonatal diagnostics.

Unit: 4	**CYTOGENETIC REPORTING AND DISORDERS**	**14 hours**
Standard cytogenetic reports: Components of standard cytogenetic report, Prenatal normal results, Neonatal normal results. ISCN rule and reporting of chromosome. Autosomal trisomies: 21, 13, 18; Trisomy Mosaic: 21, 8, 9, 20, 22. Translocations: Robertsonian translocation.		
Unit: 5	**CANCER CYTOGENETICS**	**14 hours**
Oncogenes and cancer. Cytogenetic abnormalities in myeloid and lymphoid disorder. Cytogenetic abnormalities in solid tumors. Chromosomal microarray for tumors.		
Unit: 6	**MEDICAL GENETICS AND GENOMICS**	**8 hours**
Expert lectures, video lectures, online seminars – webinars		
	Total Lecture hours	**60 hours**

Text Book(s)	
1	DP Snustad and MJ Simmons (2012) Principles of Genetics, John Willey & Sons Publication, 6th Edition.
2	Human Genetics 5th Edition 2017 By Gangane.
3	Principles Of Genetics 8th Edition by Gardner.
Reference Books	
1	Alberts *et al.*, Molecular Biology of the Cell 2nd Edition, Garland2007.
2	Snustad and Simmons, Principles of Genetics, 4th Edition, Wiley'2005.
3	Lewin, Genes IX, 9th Edition Jons and Bartlett2007.
4	Textbook of Human Genetics: The Yale journal of biology and medicine 45(5) · Sep1972
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.coursera.org/learn/genes
2	https://www.gfmer.ch/SRH-Course-2011/community-genetics/pdf/Cytogenetics-Dahoun-2011.pdf
3	https://arup.utah.edu/media/andersen-introCyto-2018/lecture-slides.pdf
Course Designed By: **Dr. P VINAYAGA MOORTHI**	

Mapping with Programme Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**S**	**S**	**M**	**M**	**S**	**M**	**M**	**M**	**M**	**M**
CO3	**S**	**S**	**S**	**S**	**S**	**S**	**M**	**S**	**M**	**S**
CO3	**M**	**M**	**S**	**S**	**M**	**S**	**S**	**M**	**S**	**S**
CO4	**S**	**S**	**S**	**M**	**M**	**S**	**M**	**M**	**M**	**M**
CO5	**S**	**M**	**M**	**M**	**M**	**M**	**M**	**M**	**M**	**S**

*S-Strong; M-Medium; L-Low

Course code	23B	MEDICAL GENETICS & GENOMICS	L	T	P	C
CORE-VI			4	-	-	4
Pre-requisite		Basic understanding in genetics	Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are to:

1. To have a thorough understanding about human genetic diseases, disorders and syndromes.
2. To know the risks associated with genetic diseases, disorders and syndromes.
3. To initiate the genetic counselling for the family members about the chances of inheriting the genetic disease to the following generations.
4. To prevent common people from genetically inherited diseases.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Able to understand uniqueness of disorders and syndromes at the molecular level.	K1 & K2
2	Capable of classifying genetic basis of Inborn errors of metabolism.	K2 & K3
3	Improve the knowledge the field of Neurogenetic disorders.	K3 & K4
4	Capable of understanding the hematopoietic and eye disorder.	K5 & K6
5	Able to differentiate various polygenic syndromes.	K3 & K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

UNIT: 1	GENETIC BASIS OF SYNDROMES AND DISORDERS	14 hours

An overview of the genetic basis of syndromes and disorders. Monogenic diseases with well- known molecular pathology: Cystic fibrosis, Tay Sach's syndrome, Marfan syndrome. Congenital and non-congenital diseases.

UNIT: 2	INBORN ERRORS OF METABOLISM	14 hours

Genetic bases and Classification, Phenylketonuria, Maple syrup urine syndrome, Mucopolysaccharidosis, Galactosemia. Genome imprinting Syndromes: Prader Willi and Angelman syndromes, Beckwith- Wiedemann Syndrome.

UNIT: 3	NEUROGENETIC DISORDERS	14 hours

Charcot Marie Tooth syndrome, Spinal muscular atrophy. Syndromes due to triplet nucleotide expansion: Alzheimer's disease, Autism spectrum disorder and Epilepsy and Seizures.Movement disorders Dystrophies (Becker Muscular Dystrophy) myotonias, myopathies.

UNIT: 4	HEMATOPOIETIC & EYE DISORDERS	14 hours

Overview of Blood cell types and haemoglobin, Sickle cell anemia, Thalassemia, Hemophilia. Genetic disorders of Eye: Colour Blindness, albinism Retinitis pigmentosa, Glaucoma, Cataracts, aniridia, Retinoblastoma, Diabetic Retinopathy.

UNIT: 5	MULTIFACTORIAL DISORDERS	14 hours

Polygenic syndromes: Hyperlipidemia, Atherosclerosis, Diabetes mellitus, Genetic disorders in the skeleton and skin, mitochondrial syndrome, Management of genetic disorder. Counseling for multifactorial disorders. Whole genome sequencing (WGS), and whole exome sequencing (WES) in the identification of complex polygenic diseases and disorders.

UNIT: 6	CONTEMPORARY ISSUES	2 hours

Expert lectures, online seminars – webinars

	Total Lecture hours	**72 hours**
Text Book(s)		
1	Clinical Genetics, A short course by Wilson, 2000.	
2	Principle and Practice of Medical Genetics, Rimoin et al., 2002.	
Reference Books		
1	Genes in Medicine, Rasko and Doumes, 1995.	
2	An introduction human molecular genetics, Pasternack, 2000.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.sciencedaily.com/releases/2019/06/190606133805.htm	
2	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6947640/	
3	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2845894/	
4	https://www.sciencedirect.com/topics/medicine-and-dentistry/inborn-error-of-metabolism	
5	https://swayam.gov.in/nd2_cec20_bt03/preview	
6	https://swayam.gov.in/nd2_cec20_bt17/preview	
7	https://swayam.gov.in/nd1_noc20_bt06/preview	
Course Designed By: **Dr. R. SIVASAMY**		

Mapping with Programme Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**M**	**S**	**M**	**S**	**S**	**M**	**M**	**M**	**S**	**S**
CO2	**M**	**S**	**S**	**S**	**S**	**M**	**M**	**S**	**S**	**S**
CO3	**M**	**S**	**M**	**S**	**S**	**M**	**M**	**L**	**S**	**S**
CO4	**M**	**M**	**S**	**S**	**S**	**L**	**L**	**L**	**S**	**S**
CO5	**M**	**M**	**M**	**S**	**S**	**M**	**M**	**M**	**S**	**M**

*S-Strong; M-Medium; L-Low

Course code	23C	DEVELOPMENTAL AND BEHAVIORAL GENETICS	L	T	P	C
CORE-VII			4	-	-	4
Pre-requisite		Basic understanding about organisms	Syllabus Version		2025-26	

Course Objective

The main objectives of this course are to:

1. Study the basic developmental stages of the animal development and its associated internal cellular changes.
2. Understand the developmental morphogenetic and gene expression pattern in Drosophila models.
3. Reveal the information on behavioral changes and its associated disorders in human being.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the basics developmental processes.	K2
2	Distinguish developmental events in Drosophila and humans.	K4
3	Identify how genes behave with respect to different developmental stages in different organisms and significance in maintenance of genetic architect.	K4
4	Describe the basic and advanced information's about behavioral changes and its associated disorders.	K2
5	Discuss the basic and essential knowledge about disorders of behaviors and itsgenetic basis.	K2

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**- Create

Unit: 1	EARLY DEVELOPMENT	18 hours

Early development: Structure of Sperm and egg, Fertilization in sea urchin and mammals, Types of cleavage, Gastrulation: Cell movement and formation of germ layers in Frog, Chick and Mammals. *Drosophila*: Maternal genes and formation of body axes and signaling pathways in development, Segmentation genes, Homeotic genes function, Imaginal disc development and Sex determinations.

Unit: 2	DEVELOPMENT IN VERTEBRATES	16 hours

Differentiation of germ cells and Gametogenesis, Fertilization and implantation, Development of vertebrate nervous system, formation of neural tube, Neural tube defect, Formation of brain regions, Axes formation, and HOX genes, Role of 3D genome architecture in Development, Genetic determination of sex in mammals, Stages of human embryonic development. Genetic basis of male and female infertility and Assisted Reproductive technology.

Unit: 3	GENETIC MANIPULATION DURING DEVELOPMENT	12 hours

Programmed rearrangements in genes: Chromatin diminution, Endoreplication cycles, Gene amplification, Congenital malformations and Teratogenesis, Epigenetic regulation. Regeneration, Senescence.

Unit: 4	BASICS OF BEHAVIOR AND DISORDERS	10 hours

Structure and function of brain, Nature and behavior, Identifying genes for behavior, Investigating the genetics of human behavior:Twin and adoption study design. Dementia, Schizophrenia, Mood disorders, Anxiety disorders.

Unit: 5	BEHVIORAL DISEASE AND DISORDERS	14 hours

Cognitive study designs: Disorders of childhood personality disorders, Antisocial personality disorder. Cognitive disabilities: Mental retardation. Learning disorders: Communication disorders. Artificial

Intelligence - Introduction - Neural networks - Application of Artificial Intelligence in Psychiatric disorder diagnosis.		
Unit: 6	**CONTEMPORARY ISSUES**	**2 hours**
Expert lectures, Online seminars – Webinars		
	Total Lecture hours	**72 hours**

Text Book(s)

1	A Textbook of Developmental Genetics. Sharma & Chakraborty. 2012. Wisdom Press.
2	Principles of Developmental Biology. Sally A. Moody. (Editor). 2007. Academic Press.

Reference Books

1	Scott F. Gilbert, Developmental Biology, VIII edition, Sinauer Associates Inc., Publishers, Sunderland, Massachusetts USA (2006).
2	Bruce Alberts, A. Johnson, J. Lewis, M. Raff, K. Roberts, P. Walter (2008). Molecular Biology of the cell, V edition, John Wiley and sons Inc., 2008.
3	Benjamin Lewin (2010), Genes X, Jones and Bartlett Publishers, England

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://swayam.gov.in/nd1_noc20_bt35/preview
2	https://nptel.ac.in/courses/102/106/102106084/
3	https://swayam.gov.in/nd2_cec20_ed13/preview

Course Designed By: **Dr. P. VINAYAGA MOORTHI**

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	S	M	M	S	M	S	M	S	M
CO2	M	S	M	M	S	S	M	M	S	S
CO3	S	S	M	M	S	M	S	M	M	S
CO4	M	M	M	M	S	S	M	M	M	M
CO5	S	S	M	M	S	S	M	S	S	S

*S-Strong; M-Medium; L-Low

Course code	23D	BIOSTATISTICS	L	T	P	C
CORE-VIII			4	-	-	4
Pre-requisite		Basic understanding research design, presentation and interpretation of the results	Syllabus Version	2025-26		

Course Objectives:

The main objectives of this course are to:

1. The role of Biostatistics is tremendous in all branches of life sciences.
2. It serves as the base to analyze and understand the sample outcomes with comparative and probability based studies.
3. This course will provide the basic knowledge on essential research works to learners.

Expected Course Outcomes:

On the successful completion of the course, students will be able to:

1	Biostatistics is the tool to analyze and interpret the results of the biological research. This course helps the students to understand the role of biostatistics.	K1, K2 & K3
2	The various methods of analysis have also been dealt in this course, which helps the students to get clear information's regarding the bio statistical analysis.	K1, K2, K3, K4 & K5
3	This course also deals with the computational tools of analysis for biological research.	K1, K2, K3, K4 & K5
4	Better way to present the research data.	K1, K2, K3, K4 & K5
5	To derive positive interpretation and better outcomes of the results.	K1, K2, K3, K4 & K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit: 1	STATISTICAL INVESTIGATION	14 hours

Statistical population and sample in biological studies, variables, qualitative and quantitative measures, discrete and continuous series. Sampling methods: probability and non-probability methods, classification of data, representation of data, frequency distribution, tables, diagram and graph. Applications of statistics in biology.

Unit: 2	MEASURES OF CENTRAL TENDENCY AND DISPERSION	14 hours

Measures of central tendency: mean, median and mode. Measures of dispersion: range, standard deviation, variance, standard error.

Unit: 3	CORRELATION, REGRESSION AND CHI-SQUARE	14 hours

Correlation: types, methods of correlation, graphic method, Karl Pearson's correlation, Spearman Rank correlation. Regression analysis, equation, estimation of unknown value from known value. Chi-square test, test of independence, test for goodness of fit and homogeneity.

Unit: 4	TESTING SIGNIFICANCE	14 hours

Testing of hypothesis: Null and alternate hypothesis, test for significance for large samples - based on mean, standard deviation, correlation coefficient and test for significance for small samples.

Unit: 5	ANOVA	14 hours

ANOVA: One way and two-way classification. Statistical analysis of Duncan's multiple range test. Basic statistical tools in research and data analysis. Software used in statistical analysis. Excel use for statistics and SPSS. Types of statistical tools: Stata, R programming, GraphPad Prism, Statistical techniques for genetic analysis - development and application of analytical methods to derive inferences from genetic data. Artificial intelligence and data science. Python.		
Unit: 6	**CONTEMPORARY ISSUES**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**72 hours**

Text Book(s)	
1	Biostatistics: A foundation for analysis in the Health Sciences by Wayne W. Daniel.Published by Wiley India. 2013.
2	Statistics in Human Genetics by Pak Sham. Published by Aronald Publishers. 1997.
Reference Books	
1	Statistical Methods (44th edition) by S.P. Gupta. Published by Sulton Chand and Sons Publishers. 2021.
2	Introductory Statistics (7thEdition) by Prem S. Mann. Published by John Wiley and Sons (ASIA) Pvt Ltd. 20100.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://swayam.gov.in/nd1_noc20_ma22/preview
2	https://swayam.gov.in/nd2_cec20_mg04/preview
3	https://www.classcentral.com/course/swayam-probability-and-statistics-5228
Course Designed By: **Dr. A. VIJAYA ANAND**	

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	L	L	L	M	M	L	S	S	M	M
CO2	L	L	L	M	M	L	S	S	M	M
CO3	L	L	L	M	M	L	S	S	M	M
CO4	L	L	L	M	M	L	S	S	M	M
CO5	L	L	L	M	M	L	S	S	M	M

*S-Strong; M-Medium; L-Low

Course code	23P	HUMAN CYTOGENETICS, MEDICAL GENETICS & GENOMICS, DEVELOPMENTAL AND BEHAVIORAL GENETICS AND BIOSTATISTICS	L	T	P	C
CORE PRACTICAL-II			-	-	6	4
Pre-requisite		Basic knowledge in chromosome, genetic materials and developmental biology	Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are to:

1. The students will gain the ability to analyze and assess the genetic defects through performing cytogenetic techniques in fundamental molecular genetics.
2. To motivate students in developing techniques and methods to identify mutations in genetic diseases.
3. Make awareness in use of model organism (Drosophila) for various developmental and behavioral analysis.
4. Import the significance of statistics in research through practical exposure in SPSS software.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Student can gain the practical knowledge on chromosomes and its related aberrations. They can be able to expand their knowledge on the chromosomal basis of inheritance and would be able to identify the type of chromosomal alterations using various cytogenetic techniques.	K5
2	Capable of performing tests that can identify the exact genetic modifications present in different diseases that are rare and complicated.	K4, K5, K6
3	Observe the change in the behavior by applying the various developmental study Techniques.	K6
4	Validate the quality of any data from the research for the precise identification of the research outcomes.	K3
5	Apply the cytogenetic, medical genetic and behavioral assays for diagnosis of diseases and disorders.	K3

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

HUMAN CYTOGENETICS

1. Blood Micronucleus test
2. COMET assay
3. Real-Time PCR
4. Case-report writing and analysis
5. Visualization of lymphoblastic cell
6. Fish (Video Demonstration)

MEDICAL GENETICS

1. DNA fragmentation Assay
2. Western blotting analysis
3. Identification of the sickle cell anemia
4. Case study on eye disorders
5. NGS data analysis
6. Identification of *in silico* analysis of disease variants

DEVELOPMENTAL AND BEHAVIORAL GENETICS

1. Live Observation of *Drosophilla melanogaster* embryo
2. Dissection and mounting of Imaginal disc of *Drosophila melanogaster*
3. Study of behavior in *Drosophila* model: 1. Climbing assay and 2. Flight assay
4. Dissection of brain of *Drosophila melanogaster*
5. Case studies, learning disorders, Mental retardation
6. Study the life stages of *Drosophila melanogaster*
7. Study on mitotic chromosomes of Drosophila melanogaster
8. Analysis of Drosophila eye pigments by paper and thin layer chromatography
9. Study of polytene chromosomes of *Drosophila melanogaster*

BIOSTATISTICS

1. Learning of SPSS software
   a) Mean b) Standard Deviation c) Student t test d) Chisquare test e) ANOVA
2. Graphad Prism software
3. Microsoft Excel
4. SYSTAT

	Total Lecture hours	**108 hours**

Book(s) for study	
1	DP Snustad and MJ Simmons (2012) Principles of Genetics, John Willey & Sons Publication, 6th Edition.
2	Human Genetics 5th Edition 2017 By Gangane.
3	Principles Of Genetics 8th Edition by Gardner.
4	Key experiments in Practical Developmental Biology. Maria-Beffa, M. and Knight, J. 2005. Cambridge University Press.
5	Molecular Cloning - A laboratory manual. 3rd Edition. Sambrook and Russel. Cold Spring harbor laboratory Press. 2001.1-2331.
6	Principle and Practice of Medical Genetics, Rimoin et al., 2002.
Books for Reference	
1	Alberts et al., Molecular Biology of the Cell 2nd Edition, Garland2007.
2	Snustad and Simmons, Principles of Genetics, 4th Edition, Wiley 2005.
3	Lewin, Genes IX, 9th Edition Jons and Bartlett 2007.
4	Methods in Molecular Biology-Genomics Protocol - Starkey, M.P. and Elaswarapu, R. 2001. Humana Press.1-538
5	Maria-Beffa, M. and Knight. J. Key experiments in Practical Developmental Biology. 2005. Cambridge University Press.
6	Sharga, B.M., Pylypiv, D.B. and Feketa, V.P., MEDICAL BIOLOGY PRACTICALS. GENETICS.
7	Gelehrter, T.D., Collins, F.S. and Ginsburg, D., 1998. Principles of Medical Genetics. Lippincott Williams & Wilkins.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1684083/
2	https://fypuxumoboz.hotellewin.com/human-cytogenetics-book-14960yw.php
3	https://www.sheffield.ac.uk/bms/undergrad/modules/bms6083
4	https://www.jove.com/v/5325/an-introduction-to-developmental-genetics
5	https://www.ncbi.nlm.nih.gov/books/NBK61999/?term=MEDICAL%20Genetics
6	https://www.ncbi.nlm.nih.gov/books/NBK21766/?term=RFLP
7	https://www.ncbi.nlm.nih.gov/books/NBK21248/?term=RFLP

Course Designed By: **Dr. R. SIVASAMY, Dr. P. VINAYAGA MOORTHI AND Dr. A. VIJAYA ANAND**

Mapping with Programme Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO2	**M**	**M**	**M**	**M**	**S**	**S**	**S**	**S**	**S**	**S**
CO3	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
CO4	**L**	**S**	**L**	**S**	**S**	**S**	**M**	**S**	**S**	**S**
CO5	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**

*S-Strong; M-Medium; L-Low

Course code	2EC	BIO INSTRUMENTATION	L	T	P	C
ELECTIVE-II			4	-	-	4
Pre-requisite		Basic understanding about instrumentation	Syllabus Version	2025-26		

Course Objectives:

The main objectives of this course are to:

1. To teach the principal, working mechanism and applications of instruments in biology.
2. To learn to operate the instruments in different fields of biology.
3. To understand the imaging techniques useful for field of sciences.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Learning of various types of centrifugation techniques.	K1 & K2
2	Able to understand the electrophoresis techniques and its applications.	K3 & K4
3	Inculcate the students with the knowledge of handling radioactive materials and use.	K4, K5 & K6
4	Able to Understand the principles of spectrophotometry and importance.	K4
5	It's mainly used for students to learn basic principles, working mechanism and applications of all microscopic techniques.	K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

UNIT: 1	CENTRIFUGATION AND GEL FILTERATION TECHNIQUES	14 hours

Principles of centrifugation, different types of instruments, rotors and its applications. Chromatography: Principles and application of adsorption, partition and ion, exchange chromatography, gel filtration, affinity, high performance liquid chromatography and gas liquid chromatography. Pipette multichannel, micro volume test, magnetic beads, genetic analysis, DNA RNA purification.

UNIT: 2	ELECTROPHORESIS	14 hours

Moving boundary and zonal electrophoresis, gel electrophoresis (Native PAGE, SDS PAGE,agarose gel electrophoresis, Real Time PCR), isoelectric focusing technique. Immunoelectrophoresis, ELISA and RIA. Sequencing: NGS and Sanger sequencing.

UNIT: 3	RADIOACTIVITY AND IT'S APPLICATION	14 hours

Autoradiography. Applications of radio isotopes in biological and medical sciences. Incorporation of radioisotopes in biological tissues and cells, molecular imaging of radioactive material, Detection and measurement of different types of radioisotopes normally used in biology, *In vitro* mutagenesis and deletion techniques, fluorography, and phosphor imaging.

UNIT: 4	SPECTROPHOTOMETRY	14 hours

Beer, Lamberts law, extinction coefficient and its importance, design of colorimeter and spectrophotometer. Flow Cytometry, Principles of atomic absorption spectrophotometry, circular dichroism spectroscopy and its application in Biology. Principles and applications of x-ray diffraction and NMR in structure determination.

UNIT: 5	MICROSCOPE	14 hours
Principles and Applications of Light, Phase Contrast, Fluorescence Microscopy, Scanning and Transmission Electron Microscopy, Confocal Microscopy, Cytophotometry and Flow Cytometry, advances of microscopy.		
UNIT: 6	**CONTEMPORARY ISSUES**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**72 hours**

Text Book(s)	
1	Instrumental methods of chemical analysis, P.K. Sharma.
2	Handbook of Biomedical Instrumentation, R.S. Khandpur, Tata McGraw Hill.
Reference Books	
1	Skoog, D.A. et al., "Principles of Instrumental Analysis", 5th Edition, Thomson / Brooks, Cole, 1998.
2	Braun, R.D. "Introduction to Instrumental Analysis", Pharma Book Syndicate, 1987.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/102/103/102103044/
2	https://www.google.com/search?q=Electrophoresis+(Part+1)%3ABasic+Concept+of+Electrophoresis%2C+performance+of+electrophoresis+and+its+applications&oq=
3	https://nptel.ac.in/courses/108/105/108105064/
Course Designed By: **Dr. R. SIVASAMY**	

Mapping with Programme Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**L**	**L**	**L**	**L**	**M**	**M**	**S**	**M**	**S**	**S**
CO2	**M**	**L**	**L**	**M**	**M**	**S**	**S**	**L**	**L**	**S**
CO3	**L**	**L**	**M**	**M**	**S**	**S**	**S**	**L**	**S**	**S**
CO4	**L**	**L**	**L**	**L**	**M**	**S**	**S**	**L**	**L**	**S**
CO5	**L**	**L**	**L**	**M**	**M**	**S**	**S**	**M**	**M**	**S**

*S-Strong; M-Medium; L-Low

Course code	2ED	NANOBIOMEDICINE	L	T	P	C
ELECTIVE-II			4	-	-	4
Pre-requisite		Basic understanding about nanoparticles and nanotechnology	Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are to:

1. Understand the origin, development and application of Nanotechnology.
2. Measure the level of development of Nanotechnology in healthcare sectors.
3. Estimate the dispersal and cause of nanoparticle in the environment and associated health hazards.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the foundation and advancement of nanotechnology.	K2
2	Apply the methods and instruments used for nanoparticle synthesis and characterization.	K3
3	Distinguish the nanoparticles and its application in healthcare industry such as treatment and therapies.	K4
4	Create the awareness about the route of entry of nanoparticle into our body.	K5
5	Distinguish merit and demerits of nanoparticles of clinical significance.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit: 1	INTRODUCTION TO NANOTECHNOLOGY	12 hours

Introduction and History of Nanotechnology, Emergence of Nanotechnology, carbon age, new form of carbon, Challenges in Nanotechnology, Occurrence of cells and systems in Nanoscale.

Unit: 2	SYNTHESIS AND ANALYSIS OF NANOPARTICLES	14 hours

Synthesis of metals (Au, Ag) and Metal oxides (TiO_2, CeO_2, ZnO), Bimetallic Nanoparticles. Characterization Techniques: Infra-red spectroscopy (IR), UV-visible, Absorption and Diffraction analyses X-ray diffraction. Scanning Electron Microscope (SEM) with Energy. Dispersive Spectroscopy, Transmission Electron Microscopy (TEM), Atomic Adsorption Spectroscopy.

Unit: 3	NANODIAGNOSTICS AND BIOSENSORS	14 hours

Nanomolecular diagnostics and Biosensor. Nanodiagnostics: Optamers, nanochips, Nanoparticles for molecular diagnostics, DNA nanomachines, CNT biosensor, application of nanodiagnostics, Nanodevices for health care industries.

Unit: 4	NANOPHARMACEUTICALS	16 hours

Nanobiotechnology for drug discovery, peptide drugs for cancer and diabetes, nanoparticle based drug delivery, Sustainable release, micelles, lipid nanoparticles, vaccination, nanocell therapy, and Gene therapy.

Unit: 5	HEALTH IMPACT OF NANOMATERIALS	14 hours

Bionanoparticles, Toxicity of nanomaterials in health care industries. Handling of Nanomaterials, entry routes into the human body: Lungs, inhalation, deposition and translocation, intestinal tract, skin and eye. Nanoparticle interaction with biological membrane, Neurotoxicology.

Unit: 6	**CONTEMPORARY ISSUES**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**72 hours**

Text Book(s)	
1	Textbook of Nanoscience and Nanotechnology. T. Pradeep. 2012. McGraw Hill Education (India) Private Limited.
Reference Books	
1	Kewal K. Jain, The Hand book of Nanomedicine, Humana Press, Springer 2008.
2	Dr. Parag Diwan and Ashish Bharadwaj (Eds), Nano Medicines, Pentagon Press, 2006
3	C.N.R. Rao, A. Muller, A.K. Cheetham (Eds), The chemistry of nanomaterials: Synthesis, properties and applications, Wiley VCH Verlag Gmbh and Co, Weinheim, 2004.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://swayam.gov.in/nd1_noc19_bt23/preview
2	https://nptel.ac.in/courses/102/107/102107058/
4	https://nptel.ac.in/courses/118/107/118107015/
Course Designed By: **Dr. P. VINAYAGA MOORTHI**	

Mapping with Programme Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**L**	**L**	**L**	**L**	**L**	**S**	**S**	**M**	**M**	**S**
CO2	**L**	**L**	**M**	**L**	**L**	**S**	**S**	**M**	**M**	**S**
CO3	**L**	**L**	**M**	**M**	**S**	**M**	**S**	**M**	**M**	**S**
CO4	**L**	**L**	**L**	**M**	**S**	**M**	**M**	**M**	**S**	**M**
CO5	**L**	**L**	**M**	**M**	**S**	**M**	**S**	**M**	**S**	**M**

*S-Strong; M-Medium; L-Low

Course code	2EE	PHARMACOGENOMICS AND CHEMINFORMATICS	L	T	P	C
ELECTIVE-II			4	-	-	4
Pre-requisite		Basic understanding about bioinformatics	Syllabus Version	2025-26		

Course Objectives:

The main objectives of this course are to:

1. This course gives an introduction to the application of genetic and genomic methods to explain about the drug response and the genetic basis for variation in that response.
2. It will give the students a wide viewpoint on the emergence Pharmacogenomics as a new field and also provides the approaches into the growing importance in the clinical therapeutics and future drug design.
3. It has been described as the application of informatics methods to solve chemical problems. It focuses primarily on chemical information related to derive from structural information.

Expected Course Outcomes:

On the successful completion of the course, students will be able to:

1	Understanding the basics of Pharmacogenomics will facilitate the students to better understand and manage the new genomics based tools for the best treatment.	K1, K2 &
2	The genetic basis of variability in the drug response can contribute to the drug efficacy and toxicity, adverse drug reactions as well as the drug-drug interactions.	K1, K2 & K3
3	To impart knowledge on chemical databases, various advanced techniques and tools, which employed in computational drug discovery.	K1 & K2
4	To impart knowledge about computation tools available in research.	K1 & K2
5	Make understanding about the database available and retrieving data.	K1 & K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit: 1	PHARMACOGENOMICS	14 hours

Pharmacogenomics: Introduction, basic concepts about genetic diseases. Personalized medicine: Introduction and importance. The genetics of therapeutic targets and gene based targets. Pharmacogenomics - necessity in drug designing. Pharmacogenomics databases.

Unit: 2	DRUG ANALYSIS	14 hours

Drug response to patients, structural influence in the drug response. Efficacy and metabolism of drugs. Drug metabolism pathways and adverse drug reactions. Lipinski's rule of five, drug likeness.

Unit: 3	TOOLS FOR PHARMACOGENOMIC ANALYSIS	14 hours

Tools for pharmacogenomics analysis. Pharmacokinetics, Pharmacodynamics. Process in structural pharmacogenomics - Target structure optimization, validation, lead identification, ADME prediction, synthesis, assays and clinical trials.

Unit: 4	CHEMINFORMATICS	14 hours

Cheminformatics: Introduction, origin and scope, applications in drug discovery and development, the old bottlenecks and HTS technologies, Combinatorial chemistry. Recent development and challenges in cheminformatics.		
Unit: 5	***IN SILICO* APPROACH**	**14 hours**
In silico chemistry: Data processing and data output problems. Molecular modeling, structure and substructure searches, PubChem, compound databases. Molecular drawer chemsketch, drug like liners, molecular properties and bioactivity prediction. Computer-assisted structure elucidation. Database mining for computer-assisted knowledge discovery.		
Unit: 6	**CONTEMPORARY ISSUES**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**72 hours**

Text Book(s)	
1	Genetics, Genomics, Proteomics & Bioinformatics, by Rajeev Tyagi and Yougesh Kumar. Published by Mangalam Publishers and Distributors. 2012.
2	Pharmacogenetics by Ian P. Hall and Munir Pir Mohamed. Taylor and Francis. 2013.
Reference Books	
1	Pharmacogenomics An Introduction and Clinical Perspective. BY Joseph S. Bertino, Angela Kashuba, Joseph D. Ma, Uwe Fuhr, C. Lindsay De Vane. Published by Mc-Grow Hill Publications. 2013.
2	Chemoinformatics: Basic Concepts and Methods by Thomas Engel, Johann Gasteiger. Published by John Willey and Sons. 2003.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://swayam.gov.in/nd1_noc20_bt10/preview
2	https://swayam.gov.in/nd2_cec20_bt03/preview
3	https://www.classcentral.com/course/swayam-bioinformatics-algorithms-and-applications-10031
Course Designed By: **Dr. A. VIJAYA ANAND**	

Mapping with Programme Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**S**	**S**	**S**	**S**	**S**	**M**	**S**	**M**	**L**	**M**
CO2	**S**	**S**	**S**	**S**	**S**	**M**	**S**	**M**	**L**	**M**
CO3	**S**	**S**	**S**	**S**	**S**	**M**	**S**	**M**	**L**	**M**
CO4	**S**	**S**	**S**	**S**	**S**	**M**	**S**	**M**	**L**	**M**
CO5	**S**	**S**	**S**	**S**	**S**	**M**	**S**	**M**	**L**	**M**

*S-Strong; M-Medium; L-Low

Course code	GS89	PRINCIPLES OF GENETICS	L	T	P	C
SUPPORTIVE-II			2	-	-	2
Pre-requisite		Basic understanding about Mendelian genetics and inheritance pattern of chromosomes.	Syllabus Version			2025-26

Course Objectives:

The main objectives of this course are to:

1. To provide the knowledge about the genetic influence and history of human genetics and Mendelian laws to the students for their curriculum development and knowledge enrichment.
2. To understand the principles and mechanisms of the inheritance from one generation to the next.
3. To understand the inheritance mechanism by scientific experimentation.
4. To get updated with the knowledge on genetic diseases and the research approaches.
5. To understand and apply the knowledge on human inherited disorders.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Gain knowledge on fundamentals of genetics and its impact.	K1, K2
2	Identify the genetic diseases and its inheritance pattern.	K3, K5
3	The course would be helpful for the students to get placed in government hospitals and private medical laboratories.	K3, K4 & K5
4	This course helps to obtain knowledge on the genetic diseases and its research approach towards treatment options.	K3, K4 & K6
5	The students can gain knowledge on the pattern of inheritance from learning the pedigree analysis	K3, K5& K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit: 1	MENDELIAN LAWS	6 hours

Mendelian Laws (law of segregation, law of independent assortment, law of segregation and independent assortment; test-cross; back cross.

Unit: 2	INHERITANCE	6 hours

Monogenic traits, autosomal inheritance, Sex-linked inheritance, mitochondrial inheritance.

Unit: 3	INTERNATIONAL SYSTEM OF HUMAN CHROMOSOME NOMENCLATURE	8 hours

International system of Human Chromosome Nomenclature; Structural and Numerical alterations. Chromosomal basis and non-chromosomal basis of sex determination.

Unit: 4	INHERITANCE PATTERN AND PEDIGREE ANALYSIS	6 hours

Pedigree analysis: family history, pedigree, construction of pedigrees; Complications to the basic pedigree patterns.

Unit: 5	AUTOSOMAL AND SEX-LINKED INHERITANCE	8 hours

Autosomal and Sex-linked inheritance; consanguinity and its effects; Mosaicism and chimerism,

male lethality, X-inactivation, Gene cards database		
Unit: 6	**CONTEMPORARY ISSUES**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**36 hours**

Text Book(s)	
1	Principles of Genetics, 6th ed. (Course Smart), D.P. Snustad and M.J. Simmons, John Wiley and Sons,2012.
2	Principles Of Genetics 8th Edition by Gardner
3	Human Molecular Genetics 4e (PB) by Strachan, Routledge Taylor and Francis group
Reference Books	
1	Human Genetics 5th Edition 2017 By Gangane
2	Genetics: A molecular perspective,1st edition W.S. Klug and M.R. Cummings, Benjamin Cummings,2002
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://dmhuk8np1ucwy.cloudfront.net/wp-content/uploads/2015/08/CH25-lm.pdf
2	https://nptel.ac.in/courses/102/104/102104052/
3	https://www.coursera.org/learn/genetics-evolution?ranMID=40328&ranEAID=7bhGe75fAQ8&ranSiteID=7bhGe75fAQ8-GHJVooGTS0D2rg9M08o2uA&siteID=7bhGe75fAQ8-GHJVooGTS0D2rg9M08o2uA&utm_content=15&utm_medium=partners&utm_source=linkshare&utm_campaign=7bhGe75fAQ8
	Course Designed By: **Dr. P. VINAYAGA MOORTHI**

MOLECULAR DIAGNOSTICS TOOLS		
Name of the Department	Human Genetics and Molecular Biology	
Name of the Faculty Member i/c With Complete Address with Phone and e-mail	**Dr. R. SIVASAMY** Assistant Professor Dept. of Human Genetics and Molecular BiologyBharathiar University, Coimbatore - 641 046 Email: rsivasamy@gmail.com Phone: (M): +91-94873-60779	
Inter / Intra Department Course	Intra Department	
Duration of the Course	30 Hours	
Eligibility	Any life Science Degree	
Number of Candidates to be Admitted	15	
Registration Procedure	Enroll through BU admission process	
Job Opportunities:		
1. Students will become independently carry out their research projects for Ph.D., 2. Students will be eligible to work in research companies and university laboratories.		
The objectives of the Course are:		
The main objectives of this course are to:		
1	Selection of an appropriate diagnostic method/tool for a particular disease condition and sample type.	
2	Adequate knowledge about recent advances and technological developments in the field of diagnostics.	
3	Practical knowledge of various diagnostic tools used in healthcare, industry and research.	
4	Expertise to perform any diagnostic test with an ability to in troubleshoot.	
Course Content	Lecture / Practical / Project / Internship	
Module 1	**Introduction to Molecular Diagnostics** History of diagnostics, Age of molecular diagnostics, Significance, Scope, Rise of diagnostic industry in Indian and global scenario.	**6 hours**
Module 2	**Biomarkers in disease diagnostics** FDA definition of disease markers, Role of markers in Disease diagnosis. Approaches and methods in the identification of disease markers, predictive value, diagnostic value, emerging bloodmarkers for sepsis, tumour & cancer markers, markers ininflammation and diagnosis of cytoskeletal disorders.	**6 hours**
Module 3	**Molecular Oncology Mitochondrial disorders** Cancer - Benign and Malignant neoplasms, multifactorial disposition,Cancer pathogenesis, positive and negative mediators of neoplastic development, Proto-oncogenes, Oncogenes and Tumor suppressors. Allele loss and loss of Heterozygosity. Mitochondrial inheritance, Mitochondrial myopathy, lactic acidosis, MELAS, LHONs, identity testing.	**6 hours**
Module 4	**Immunodiagnostic techniques** Introduction, Radioactive isotopes, DNA reporters, fluorogenic reporters, electro-chemiluminescent tags & label free immunoassays. Immunoassays - precipitation, agglutination,	**6 hours**

	hemagglutination, RIA, ELISA, RIA, MELISA and specific applications. Quantum dots. Immunohistochemistry - principle and techniques.	
Module 5	**Advance Molecular Diagnostics** Chromosomal techniques, DNA and RNA sequencing, In situ hybridization, Microarray analysis, Western blot analysis, Protein mass spectroscopy, Imaging based diagnosis, Biochemical testing, Histopathology, Flow cytometry and Blood cell screening.	**6 hours**
		30 Hours

Book(s) for Study	
1	DP Snustad and MJ Simmons (2012) Principles of Genetics, John Willey & Sons Publication, 6th Edition.
2	Human Genetics 5th Edition 2017 By Gangane.
3	Principles Of Genetics 8th Edition by Gardner.
Book(s) for reference	
1	An introduction to Human Molecular Genetics by Pasternak et al., John Wiley & Sons.
2	Human Chromosomes by Miller &Tharman, Springer Publishing Company.
3	Molecular Cell Biology: Darnell J, Lodish H and Baltimore D.
Related Online Contents	
1	https://dmhuk8np1ucwy.cloudfront.net/wp-content/uploads/2015/08/CH25-lm.pdf
2	https://nptel.ac.in/courses/102/104/102104052/
3	https://dmhuk8np1ucwy.cloudfront.net/wp-content/uploads/2015/08/CH25-lm.pdf

Third Semester

Course code	33A	IMMUNOGENETICS	L	T	P	C
CORE-IX			4	-	-	4
Pre-requisite		Basic understanding about blood cells and antigen	Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are to:

1. Understand the basics of immune cells, development and maturation.
2. Create ability to distinguish different types of Immunoglobulin and role of HLA in transplantation.
3. Teach the background information of vaccines, its development, uses and the techniques to measure the quantity in clinical diagnosis

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the basic architect of immunology such as Immunity, immune cells and organs.	K2
2	Write the role of immune response stimulating proteins.	K3
3	Differentiate the pathways involved in defending the antigen and other immune modulating members.	K4
4	Understand the background information about the vaccine preparation.	K3
5	Analyse the antigen and antibody interacts and how their interaction will be visualized in ELISA and immunoelectrophoresis.	K2

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit: 1	BASICS OF IMMUNOLOGY	18 hours

Historical perspective, lymphoid organs, lymphocytes. Cells of immune system, Cytokines, interleukins, T and B cell activation and maturation, Types of immunity and immune responses. Haematopoiesis. Immunoglobulins, Class switching, Antigens. The molecular basis of antigen and antibody interactions.

Unit: 2	PATHWAYS AND IMMUNOREGULATORS	10 hours

Complement system, the classical pathway, alternate pathway and the membrane attack pathway. MHC gene in man and mouse, Genomic map, gene expression, antigen presentation and processing by MHC class I and class II molecules. HLA, Immunostimulation, Immunopotentiation, adjuvants.

Unit: 3	MHC AND DISEASE IMMUNOLOGY	16 hours

Immunogenetics in anthropology, Immunoinformatics. Hypersensitivity. Autoimmune diseases and application of Artificial Intelligence in autoimmune disease, Transplantation Immunology, HLA assays, Tumour Immunology, Immunobiology of HIV infection. Immunobiology of SARS COVID, Immunology of infectious diseases.

Unit: 4	VACCINES	14 hours

Immunization, active and passive. Vaccines: whole organism vaccine, synthetic peptide vaccine, multivalent subunit-vaccine, anti idiotype vaccine, designer vaccine, edible vaccine, Nucleic acid vaccines, recombinant vector vaccine. Production and applications of monoclonal antibodies,

genetically engineered monoclonal antibodies, Abzymes, Vaccinomics and Adversomics.		
Unit: 5	**IMMUNOTECHNIQUES**	**12 hours**
Immunoprecipitation, Immunoelectrophoresis Radioimmuno Assay, ELISA, Immunofluoresence technique, Immune-histochemistry, Flow cytometry, EliSpot, Immunoelectron microscope, chimeric antigen receptor (CAR) T cell therapy, Immunotoxins.		
Unit: 6	**CONTEMPORARY ISSUES**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**72 hours**

Text Book(s)	
1	Essential Immunogenetics. A. R. Williamson and M.W. Turner. 1987. Blackwell Scientific Publication
Reference Books	
1	Kuby, J., 2008, Immunology, W.H. Freeman and Co., New York.
2	Roit, I.N., Brostaff, J.J. and Male, D.K., 2007, Immunology, C. Mosby, St. Louis.
3	Murphy, K., Travers, P., and M. Walport. 2008. 7th- Jane way's- Immunobiology-Garland Science (Taylor and Francis)
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://swayam.gov.in/nd2_cec20_bt05/preview
2	https://swayam.gov.in/nd1_noc20_bt43/preview
4	https://nptel.ac.in/courses/102/105/102105083/
Course Designed By: **Dr. P. VINAYAGA MOORTHI**	

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**M**	**S**	**S**	**M**	**S**	**S**	**S**	**L**	**M**	**S**
CO2	**M**	**M**	**L**	**L**	**S**	**S**	**S**	**M**	**M**	**S**
CO3	**S**	**S**	**M**	**L**	**S**	**S**	**S**	**M**	**S**	**M**
CO4	**M**	**M**	**M**	**L**	**S**	**S**	**S**	**M**	**S**	**S**
CO5	**M**	**S**	**M**	**L**	**S**	**S**	**S**	**M**	**S**	**S**

*S-Strong; M-Medium; L-Low

Course code	33B	CANCER GENETICS	L	T	P	C
CORE-X			4	-	-	4
Pre-requisite		Basic Understanding in cell biology and cancer genetics	Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are to:

1 To understand the various types of cancers and their prevalence
2 To understand the molecular basis and functional aspect of various genes involved in progression of cancer
3 To make them find out various pathways involved in various cancers and to equip the students with the existing and novel therapeutic approaches for controlling cancer growth

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Able to understand the status of Cancer worldwide and types.	K1 & K2
2	Capable of Understanding the transformation and progression cancer.	K2 & K4
3	Able to understand the role of genes in cancer developments.	K2
4	Inculcating the knowledge in the field of chromosome abnormalities in cancer progression.	K4 & K5
5	Able to understand familial association of cancer.	K5 & K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

UNIT: 1	CANCER HISTORY AND TYPES	14 hours

Cancer: Scope and current scenario of cancer research, types and their prevalence, Carcinoma, Lymphoma and Malignancy. Classification based on tissue types. Molecular biology of tumor invasion and metastasis. Somatic and germline mutation database.

UNIT: 2	CELL TRANSFORMATION AND TUMOURIGENESIS	14 hours

Oncogenes, tumour suppressor genes, DNA repair genes and genetic instability, epigenetic & Post translational modifications, telomerase activity, centrosome malfunction. Tumour progression: angiogenesis and metastasis.

UNIT: 3	ONCOGENES AND HUMAN CANCERS:	14 hours

Role of proto- oncogenes in regulating cell growth and survival, mechanisms of activation of oncogenes, retro viral activation, point mutations, fusion genes, gene amplification, chromosome rearrangements, promoter insertion, tumour suppressor genes. Cell cycle and Cancer, Knudson's two hit hypothesis. Role of miRNA in human cancers, circulating tumor RNA.

UNIT: 4	CHROMOSOME ABNORMALITIES	14 hours

Chronic myeloid leukemia, Chronic lymphocytic leukemia, Acute myeloid leukemia, Acute lymphoblastic leukemia, Myelodysplastic syndromes, Myeloproliferative disorders, Hodgkin's disease, non-Hodgkin's lymphoma, Burkitt's lymphoma.

UNIT: 5	FAMILIAL CANCERS, BIOMARKERS AND THERAPY	14 hours

Familial cancers, Biomarkers and Therapy: Retinoblastoma, Wilm's tumour, Li- Fraumeni syndrome, Colorectal cancer and Breast cancer. Cancer therapy: At cellular, gene and protein

level. Stages of cancer - TNM classification. Principles of cancer biomarker and their applications, chemotherapeutics for cancer, Phytotherapy for cancer. Advance therapies in cancer- Monoclonal Antibody therapies for cancer. Recent advancements in cancer - Gene Panels, Epigenetics Changes and Précised medicine.		
UNIT: 6	**CONTEMPORARY ISSUES**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**72 hours**

Text Book(s)	
1	The Biology of Cancer, R.A. Weinberg, Garland Science, Taylor and Francis Group, 2007.
Reference Books	
1	Cancer Biology,3rd ed., R.J.B. King and M.W. Robbins, Pearson Education Ltd., 2006.
2	Cancer cytogenetics, chromosomal and molecular genetic aberrations of tumor cells,3rd ed., S. Heim and F. Mitelman, Wiley, Blackwell Inc., 2009.
3	Human cytogenetics: malignancy and acquired abnormalities, a practical approach,3rd ed., D.E. Rooney, Oxford University Press, 2001.
4	ISCN 2013 An International System for Human Cytogenetic Nomenclature (2013),Recommendations of the International Standing Committee on Human Cytogenetic Nomenclature, L.G. Shaffer, J. Mc Gowan, Jordan and M. Schmid, S. Karger, 2013.
5	Introduction to the Cellular and Molecular Biology of Cancer,4th ed., M.A. Knowles and P.J. Selby, Oxford University Press, 2005.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://swayam.gov.in/nd2_cec20_ma14/preview
2	https://www.sciencedirect.com/science/article/pii/S0753332220304479
4	https://pubmed.ncbi.nlm.nih.gov/30671672/
5	https://www.ncbi.nlm.nih.gov/books/NBK9963/
6	https://oncologypro.esmo.org/education-library/esmo-e-learning-and-v-learning
Course Designed By: **Dr. R. SIVASAMY**	

Mapping with Programme Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**L**	**L**	**L**	**S**	**S**	**S**	**M**	**L**	**S**	**M**
CO2	**M**	**S**	**M**	**S**	**S**	**S**	**M**	**M**	**M**	**S**
CO3	**S**	**S**	**M**	**S**	**S**	**S**	**L**	**M**	**S**	**S**
CO4	**S**	**M**	**S**	**S**	**S**	**S**	**M**	**L**	**M**	**S**
CO5	**M**	**S**	**M**	**S**	**S**	**M**	**L**	**L**	**S**	**M**

*S-Strong; M-Medium; L-Low

Course code	33C	NEUROGENETICS AND EPIGENETICS	L	T	P	C
CORE-XI			4	-	-	4
Pre-requisite		Basic understanding about Neurological functions	Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are to:

1. Neuroscience is study of nervous system, whose ultimate goal is to understand higher brain function at a variety of levels.
2. This course provides the learners with current knowledge about common neuro diseases and disorders from both a basic research and a clinical perspective
3. Epigenetics explain the key concepts of what epigenetics is, types of epigenetic modifications, the importance of epigenetics and how it can be related to disease. It also discusses how diet can have an impact on health and disease through epigenetics.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Being a human genetics student, able learn about nervous systems and their functions.	K2 & K1
2	Understand the diseases associated with nervous systems.	K2 & K5
3	Inculcate the knowledge on degenerative brain diseases.	K3 & K4
4	The epigenetic basis of the nervous disorders is discussed along with theassociated risks that help the students to attain knowledge regarding the same.	K4
5	Capable of understanding the epigenetics disease and therapy.	K3 & K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit: 1	ORGANIZATION OF THE NERVOUS SYSTEM	14 hours

Organization of the nervous system. Histology of the nervous tissue: supporting cells and neurons. Neurophysiology: Resting membrane potential, Membrane potentials and signals. Synapse, postsynaptic potentials and synaptic integration. Neurotransmitters and receptors. Neuroendocrine system. Mimicking Nervous System Advance Artificial Intelligence.

Unit: 2	NEUROLOGICAL DISEASES	14 hours

Autosomal (recessive and dominant) and X-linked neurological diseases. Unstable mutation (repeat expansion) causing spinocerebellar ataxias, Huntington's disease, Myotonic dystrophy, Fragile-X syndrome. Metabolic defects causing neurological diseases (Tay-Sach's and Gaucher's diseases). Diagnostic procedures for assessing neurogenetic diseases and Mitochondrial Diseases.

Unit: 3	DEGENERATIVE BRAIN DISEASES	14 hours

Degenerative brain diseases: Cerebrovascular accidents, stroke, Parkinson disease and Alzheimer's disease: history, causes, signs, symptoms, pathophysiology, diagnosis, preventions and management. Therapeutics and novel therapeutics. miRNA.

Unit: 4	MECHANISMS OF EPIGENETIC MODIFICATION	14 hours

Epigenetics: Mechanisms of DNA methylation, histone modifications, chromosomal position effect and gene variegation, epigenetic control of gene activity, analysis of gene-specific DNA methylation, methods of assessing genome-wide DNA methylation. Model organism of epigenetics:

Drosophila.		
Unit: 5	**EPIGENETICS DISEASE AND THERAPY**	**14 hours**
Effects of diet and environmental agents on epigenetic processes. Role of epigenetic in immune diseases and disorders. Imprinting disorders in humans. Epigenetic therapy. epigenetic assays, DNA and Chromatin modifications		
Unit: 6	**CONTEMPORARY ISSUES**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**72 hours**

Text Book(s)	
1	Human Anatomy and Physiology by Elaine N. Marieb and Katja Hoehn, 2012.Published by Pearson Publisher.
2	Textbook of Medical Physiology (11th edition) by Arthur C Guyton and John E Hall, 2006. Published by Elsevier Publications.
Reference Books	
1	Handbook of Epigenetics by Tollefsbol T, 2011. Published by Elsevier Publications
2	Epigenetics by David C. Allis, Marie-Laure Caparros et al., 2015. Published by Cold Spring Harbor Laboratory Press.
3	Practical Guide to Neurogenetics by Thomas T. Warner and Simon R. Hammans, 2009. Published by Elsevier Ltd.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://swayam.gov.in/nd1_noc19_bt24/preview
2	https://www.nextbigfuture.com/2018/12/will-mimicking-the-nervous-system-advanceartificial-intelligence.html
3	https://link.springer.com/chapter/10.1007/978-3-642-22887-2_27
Course Designed By: **Dr. R. SIVASAMY**	

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**M**	**M**	**M**	**S**	**S**	**S**	**L**	**M**	**M**	**M**
CO2	**M**	**M**	**M**	**S**	**S**	**S**	**L**	**M**	**M**	**M**
CO3	**M**	**M**	**M**	**S**	**S**	**S**	**L**	**L**	**L**	**L**
CO4	**L**	**L**	**L**	**S**	**S**	**M**	**L**	**L**	**M**	**M**
CO5	**S**	**S**	**M**	**S**	**S**	**M**	**L**	**L**	**S**	**S**

*S-Strong; M-Medium; L-Low

Course code	33D	GENETIC COUNSELING	L	T	P	C
CORE-XII			4	-	-	4
Pre-requisite		Basic understanding about Genetic Counseling	Syllabus Version	2025-26		

Course Objectives:

The main objectives of this course are to:

1. Provides learners with the appropriate knowledge, experience and Skills to become motivated genetic counselors.
2. Provide exposure to coursework, including: clinical training, hospital visits, case studies and seminars, to develop their personalized skills towards understanding and handling of genetically inherited disorder subjects.
3. Promote graduates prepared to work in a variety of interdisciplinary clinics as well as in areas of research or commercial genetics laboratories relevant to genetic counseling and human genetics.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the Pedigree for Genetic counseling	K2
2	Analyze the basic pedigree patterns of humans for diagnosis	K4
3	Differentiate inheritance patterns of human	K3
4	Use genetic counseling public awareness	K2&K5
5	Able to understand the components of genetic counseling	K4&K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

UNIT: 1	HISTORY OF HUMAN GENETICS	14 hours

Pedigrees, gathering family history, Pedigree symbols, Construction of pedigrees, Presentation of molecular genetic data in pedigrees, Pedigree charts for different inheritance patterns..

UNIT: 2	COMPLICATIONS TO THE BASIC PEDIGREE PATTERNS	14 hours

Genomic imprinting and uniparentaldisomy, Spontaneous mutations, Male lethality, Consanguinity and its effects in the pedigree pattern.

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UNIT: 3	INHERITANCE	14 hours

Monozygotic and dizygotic twins and adoption studies, Polygenic inheritance of continuous (quantitative) traits, normal growth charts, Dysmorphology, Polygenic inheritance of discontinuous (dichotomous) traits, Genetic susceptibility in complex traits

UNIT: 4	GENETIC COUNSELING	14 hours

Historical overview and components of genetic counseling. Indication for and purpose, Information gathering and construction of pedigree Medical genetic evaluation (Basic components of medical history, past medical history, social and family history).

UNIT: 5	COMPONENTS OF GENETIC COUNSELING	14 hours

Physical examination, Patterns of inheritance, risk assessment and counseling in common Mendelian and multifactor syndromes. Prenatal and postnatal screening: noninvasive methods and invasive methods. Indications for chromosomal testing.

UNIT: 6	CONTEMPORARY ISSUES	2 hours

Expert lectures, online seminars – webinars

	Total Lecture hours	**72 Hours**
Text Book(s)		
1	1. Genetics, A Conceptual Approach, 4thed., B.A. Pierce, Palgrave Macmillan, 2012.	
Reference Books		
1	Emery's Elements of Medical Genetics, 14thed., P.D. Turnpenny and S. Ellard, 2012.	
2	6. Practical Genetic Counseling - 7 ed., P. S. Harper, CRC Press., 2010.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://kidshealth.org/en/parents/genetic-counseling.html	
2	https://www.ncbi.nlm.nih.gov/books/NBK115552/	
Course Designed by: **Dr. P. VINAYAGA MOORTHI**		

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**M**	**M**
CO2	**S**	**S**	**S**	**S**	**S**	**M**	**M**	**M**	**M**	**M**
CO3	**S**	**S**	**M**	**S**	**S**	**M**	**M**	**M**	**M**	**L**
CO4	**L**	**S**	**M**	**S**	**S**	**M**	**M**	**M**	**M**	**M**
CO5	**L**	**S**	**M**	**S**	**S**	**L**	**L**	**M**	**L**	**L**

*S-Strong; M-Medium; L-Low

Course code	33P	IMMUNOGENETICS, CANCER GENETICS, NEUROGENETICS AND EPIGENETICS, GENETIC COUNSELING	L	T	P	C
CORE PRACTICAL-III			-	-	6	4
Pre-requisite		Basic knowledge in immunology, cancer, genetics and bioethics	Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are to:

1. Equip the learners with immunotechniques for understanding the antigen antibody interaction and its use in disease diagnosis.
2. Understand the functional and genetic aspect of various types of cancers and their prevalence among various races and perform various techniques for understanding the cancer stages and genetics behind its progression.
3. Highlight and give hands on exposure in the epigenetic techniques for understanding mechanisms behind certain genetic changes.
4. To introduce basic concepts of ethics and safety that are essential for different disciplines of science and procedures involved and protection of intellectual property and related rights.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Distinguish the various immunological reactions for the diagnosis of diseases and disorders.	K4
2	Analyze the genetic defect behind the different cancer types and their corresponding molecular mechanism and apply and evaluate various assays and tests to develop testing kits for early diagnosis.	K3, K4, K5 & K6
3	Decipher the mode of epigenetic mechanisms creates the genetic changes.	K4
4	Follow the ethics and safety measures in all areas of research and realize the importance of IPR.	K3
5	Develop the self-sufficiency to be eligible for any medical or diagnostic works.	K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

IMMUNOGENETICS

1. Blood grouping test
2. Electrophoretic separation of serum proteins
3. Immunoelectrophoresis
4. Immunoelectrophoresis and Ouchterlony double diffusion assay
5. Isolation and determination of lymphocyte viability by Trypan blue dye exclusion test
6. Genotypic analysis of HLA genes (PCR based)
7. Amplification of cytokine/TLR genes

CANCER GENETICS

1. Preparation of Culture room and Media preparation.
2. Culturing of cancer cells & observation.
3. Cell Proliferation Assay (MTT)
4. Isolation of DNA from Tissues
5. Sequence similarity analysis for protein and nucleic acid using online bioinformatics tools
6. ROS Deduction assay

NEUROGENETICS AND EPIGENETICS

1. Amplification of gene sequences
2. Restriction digestion
3. CpG islands

GENETIC COUNSELING

1. Role of genetic counselor in hospitals
2. Hospital visit and report preparation
3. Case-report writing and analysis report

	Total Lecture hours	**108 hours**

Text Book(s)

1	Analytical Biochemistry, 3rd Edition. Holme, D.J and Peck, H. 1998. Pearson Education Limited.1-501.
2	Analytical Biochemistry, 3rd Edition. Holme, D.J and Peck, H. 1998. Pearson Education Limited.1-501.
3	Molecular Cloning - A laboratory manual. 3rd Edition. Sambrook and Russel. Cold Spring harbor laboratory Press. 2001.1-2331.
4	Cancer Biology, 3rd ed., R.J.B. King and M.W. Robbins, Pearson Education Ltd., 2006.
5	Bioethics, by Shaleesha A. Stanley (2008). Published by Wisdom Educational

Reference Books

1	Modern experimental Biochemistry, 3rd Edition, Rodney Boyer. 2000. BenjaminCummins. 1-480.
2	Methods in Molecular Biology-Genomics Protocol - Starkey, M.P. and Elaswarapu, R. 2001. Humana Press.1-538
3	Current Protocols in Immunology. John Donovan and Patricia Brown. 1995. John Wiley & Sons, Inc.
4	Bunz, F., 2008. Principles of cancer genetics (Vol. 1). New York, NY, USA:: Springer.
5	Haber, D.A. ed., 2010. Principles of clinical cancer genetics: a handbook from the Massachusetts General Hospital. Springer.
6	Matloff, E., 2013. Cancer principles and practice of oncology: handbook of clinical cancer genetics. Lippincott Williams & Wilkins.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://link.springer.com/chapter/10.1007/978-981-10-0875-7_24
2	https://books.google.co.in/books/about/Biosafety_and_Bioethics.html?id=IiqPrFYzRMMC&redir_esc=y
3	https://books.google.co.in/books/about/Bioethics_and_Biosafety.html?id=xP9dzbSBTZQC
4	https://www.nature.com/articles/35077207
5	https://www.thelancet.com/journals/lanonc/article/PIIS1470-2045(11)70092-4/fulltext
6	https://www.cancergeneticsjournal.org/

Course Designed By: **Dr. P. VINAYAGA MOORTHI, Dr. R. SIVASAMY, AND Dr. A. VIJAYA ANAND**

Mapping with Programme Outcomes										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**S**	**S**	**S**	**M**	**S**	**S**	**S**	**S**	**S**	**S**
CO2	**M**	**M**	**S**	**M**	**S**	**S**	**S**	**S**	**S**	**S**
CO3	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**M**
CO4	**L**	**L**	**L**	**S**	**M**	**M**	**L**	**S**	**M**	**M**
CO5	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**

*S-Strong; M-Medium; L-Low

Course code	3EC	STRESS AND BIOMARKERS	L	T	P	C
ELECTIVE-III			4	-	-	4
Pre-requisite		Basic understanding about stress physiology and toxicology	Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are to:

1. The topics are introductory in nature and build the ability to learn how human system works in stressed conditions under the influence of various internal and external stimuli.
2. The curriculum of pathology aims at preparing the learners in basic understanding of diseases and their pathogenesis with reference to stress by using biomarkers.
3. Toxicology is a vast, multidisciplinary subject encompassing various other basic fields of science. Not all toxicity effects are well understood, many of them unpin themselves into stress. Hence, it allows the learners to gain basic knowledge on toxicology effects.

Expected Course Outcomes:

On the successful completion of the course, students will be able to:

1	Next to neurology, it is necessary for the human genetics student to learn about the substances produced by the nervous system; this has been discussed in this course.	K1 & K2
2	The functions of the substances produced by the nervous system have also been discussed in this course which helps the students to obtain clear knowledge on the same.	K1 & K2
3	The biomarkers that indicates the malfunctioning of the body parts has to be known by the life science students, which has also been discussed by this course.	K1 & K2
4	Understanding about the neurological effects associated with stress.	K1 & K2
5	Learn basic research and toxicity test.	K1, K2, K3 & K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit: 1	STRESS PHYSIOLOGY	14 hours

Factors contributing to stress, physiological systems respond to stress and psychological response to stress. Principle pathways linked to steroidal hormones. Biomarkers: Introduction and types of biomarkers acting based on organ and tissue specific and non-specific. Biomarkers discovery and its applications.

Unit: 2	BIOMARKERS	14 hours

Methods for identifying biomarkers: Significance of biomarkers in oxidative stress, metabolic biomarkers, immunological biomarkers and physiological biomarkers. Blood chemistry and histopathology. Heat shock proteins.

Unit: 3	NEUROENDOCRINE BIOMARKERS	14 hours

Neuroendocrine biomarkers: The primary physiological factor that determine the neuroendocrine stress response, Stress relaxation and receptors, arterial pressure and regulation, functions of cortisol in stress and inflammation.

Unit: 4	STRESS AND NEUROLOGICAL EFFECTS	14 hours

Promising new vistas for chronic stress characterization, metabolomics, ultrastructure modifications in mitochondria. Neuroanatomy changes seen under stressed conditions. Neuropsychic disorders characteristic features, disease progression, treatment and control. Stress management using Artificial intelligence.

Unit: 5	TOXICOLOGY	14 hours

Chemical stress and Toxins: Introduction, definition, sub disciplines, environmental toxicants, routes of entry of xenobiotics. Toxicity tests: basic requirements, test organisms. Types of acute toxicity tests and chronic toxicity tests, terminologies used in toxicity tests and need for conducting toxicity tests.		
Unit: 6	**CONTEMPORARY ISSUES**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**72 hours**

Text Book(s)	
1	The Nervous System: The basic of neurosciences by Donald B. Tower and Roscoe O. Brady. Published by Raven Press Publishers. 1975.
2	Human Anatomy and Physiology by Elaine N. Marieb. Published by The Benjamin/Cummings Publishing Company, Inc. 1995.
Reference Books	
1	Text book of Medical Physiology (11th edition) by Arthur C Guyton and John E Hall. Published by Elsevier Publications. 2006.
2	Principles of Biochemical Toxicology (4th edition) by J.A. Timbrell. Taylor and Francis.Published by CRC Press. 2009.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://swayam.gov.in/nd1_noc19_ge26/preview
2	https://ciet.nic.in/swayam_psychology03_module08.php
3	http://ugcmoocs.inflibnet.ac.in/ugcmoocs/view_module_pg.php/697
Course Designed By: **Dr. A. VIJAYA ANAND**	

Mapping with Programme Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**M**	**S**	**M**	**M**	**S**	**S**	**S**	**S**	**S**	**L**
CO2	**S**	**S**	**M**	**M**	**S**	**S**	**S**	**S**	**S**	**L**
CO3	**S**	**S**	**M**	**M**	**S**	**S**	**S**	**S**	**S**	**L**
CO4	**M**	**S**	**M**	**S**	**S**	**M**	**S**	**S**	**S**	**L**
CO5	**M**	**M**	**L**	**M**	**S**	**S**	**S**	**S**	**S**	**L**

*S-Strong; M-Medium; L-Low

Course code	3ED	STEM CELL BIOLOGY	L	T	P	C
ELECTIVE-III			4	-	-	4
Pre-requisite		Basic understanding about Stem Cells, characterization and its applications	Syllabus Version	2025-26		

Course Objectives

The main objectives of this course are to:

1. Understanding key implications of stem cell research.
2. Relate the importance of stem cells to the development and maintenance of multicellular organisms.
3. To describe how stem cells can be used for medical purposes.
4. To understand how defects in stem cell behavior can lead to medical problems.
5. To understand complex molecular, cellular, and genetic techniques used to investigate stem cell biology.

Expected Course Outcomes

On the successful completion of the course, student will be able to:

1	Describe the characteristics of stem cells and the different types of stem cells.	K2
2	Understand the isolation process and culturing of stem cells.	K3
3	Understand basic biology/mechanisms and applications of stem cells.	K3
4	To obtain knowledge and understanding the behavior of stem cells in laboratory.	K2, K3 & K4
5	To gain knowledge and understand the mechanism of techniques involved in stem cell research.	K2, K3 & K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit: 1	INTRODUCTION TO STEM CELLS	14 hours

Introduction to stem cells and basis of stemness; Embryonic stem cells, adult stem cells, hematopoietic stem cells, mesenchymal stem cells, cancer stem cells, induced pluripotent stem cells. Biomarkers in stem cells.

Unit: 2	EMBRYONIC STEM CELLS	14 hours

Isolation, characterization and maintenance of embryonic stem cells. Serum and feeder free culture of human embryonic stem cells.

Unit: 3	MESENCHYMAL STEM CELLS	14 hours

Introduction to mesenchymal stem cells; isolation and characterization; Differentiation of mesenchymal stem cells into various lineages,

Unit: 4	INDUCED PLURIPOTENT STEM CELLS (iPSCs)	14 hours

Introduction to iPSC technology; Reprogramming iPSCs: integration and non-integration methods; Advantages and disadvantages of iPSCs.

Unit: 5	APPLICATIONS OF STEM CELLS	14 hours

Neurodegenerative diseases, spinal cord injury, eye diseases; Ethical and regulatory issues in the use of stem cells.

Unit: 6	CONTEMPORARY ISSUES	2 hours

Expert lectures, online seminars – webinars

	Total Lecture hours	72 hours

Text Book(s)

1	Handbook of Stem Cells, 2nd Edition, Atala A & Lanza R, Academic Press, 2012.
2	Essential of Stem Cell Biology, 3rd Edition, Lanza R, et al, Elsevier Academic Press, 2013.
3	Translational Approaches in Tissue Engineering & Regenerative Medicine, Mao JJ, et al, Artech House, 2007.
4	Stem Cell Repair and Regeneration, Volume-2, Habib NA, Levièar NY, Gordon M, Jiao L & Fisk N, Imperial College Press, 2007.

Reference Books	
1	Stem Cells Handbook, Edited by Stewart Sell, Human Press, 2010.
2	Human embryonic stem cells, Edited by Arlene Y. Chiu, Mahendra Rao, Human 5. Press, 2011.
3	Stem cell basics and application Ed. By K. D. Deb and S. M. Totey, Tata McGraw Hill Pvt. Ltd, 2011.
4	Stem cell Biology: Daniel R. Marshak, Richard Lavenham Gardner, David I. Gottlieb – 2001.
5	Essentials of Stem cell Biology: Robert Lanza, John Gearhart, Brigid Hogan – 2009.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.coursera.org/learn/stem-cells
2	https://online.stanford.edu/courses/xgen204-stem-cell-therapeutics
3	https://www.classcentral.com/course/advances-stem-cells-13105

Course Designed By: **Dr. A. VIJAYA ANAND**

Mapping with Programme Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**S**	**S**	**M**	**M**	**M**	**M**	**M**	**S**	**M**	**M**
CO3	**S**	**S**	**M**	**S**	**M**	**S**	**M**	**M**	**S**	**S**
CO3	**S**	**M**	**M**	**M**	**S**	**M**	**S**	**M**	**M**	**M**
CO4	**M**	**M**	**S**	**M**	**M**	**L**	**M**	**S**	**M**	**L**
CO5	**M**	**M**	**M**	**M**	**M**	**M**	**M**	**M**	**M**	**M**

*S-Strong; M-Medium; L-Low

Course code	3EE	FORENSIC BIOLOGY	L	T	P	C
ELECTIVE-III			4	-	-	4
Pre-requisite		Knowledge in genetics	Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are to:

1. To understand the forensic ethics, rules and regulations for investigation of crime.
2. To understand the techniques of investigation.
3. To analyse the biological evidences through DNA processing.
4. To know the legal standards of forensics.
5. To study the tools and applications of forensics.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Able to understand the forensic science disciplines and their functions.	K1
2	Understand about the crime and investigation techniques.	K3 & K4
3	Capable of knowing the different types of genetic markers that are used for forensic genetic analysis and interpretation.	K4 & K5
4	Able to understand the forensic profiling and their importance.	K5 & K6
5	Inculcate the knowledge on various tools and applications in Forensic Biology.	K6 & K3

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

UNIT: 1	INTRODUCTION TO FORENSICS	14 hours

Forensic science principles, forensic science disciplines and their functions. Basics, Rules, Ethics, Laws, Procedures, Cross Examinations, Investigating the Crime Scene- Crime scene and evidence collection and processing.

UNIT: 2	INVESTIGATION TECHNIQUES	14 hours

Crime Detection Devices, LA-ICP-MS, Alternative Light Photography, Forensic Carbon-14, Dating, High-Speed Ballistics Photography, 3D Forensic Facial Reconstruction, DNA, Sequencer, Magnetic Fingerprinting and Automated Fingerprint Identification (AFIS).

UNIT: 3	DNA DETECTION TECHNIQUES	14 hours

DNA Isolation, quantification and quality assessment from hard and soft tissues. RFLP, PCR amplifications, Amp-FLP, sequence polymorphism, Y-STR, Mitochondrial DNA. Evaluation of results, frequency estimate calculations and interpretation, Determining the allelic frequency.

UNIT: 4	FORENSIC PROFILING	14 hours

History of DNA profiling applications in disputed paternity cases, missing person's identity, child swapping, civil immigration, legal perspectives - legal standards for admissibility of DNA profiling - procedural & ethical concerns, status of development of DNA profiling in India & abroad. Overlapping genes and multiple gene families, VNTRs, STRs, Mini STRs , SNPs.

UNIT: 5	TOOLS AND APPLICATIONS	14 hours

Introduction Basics of gene prediction, pattern recognition, gene prediction tools, Tools for microarray analysis and application, Algorithm for identifications of homology. Combined DNA Index System (CODIS). Scope of analysis in forensic science laboratories/institutions. Legendries and their contributions in the field of forensic science.

Unit: 6	**CONTEMPORARY ISSUES**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**72 hours**

Text Book(s)	
1	Barnett P.D. (2001), Ethics in Forensic Science: Professional Standards for the Practice of Criminalistics, CRC press.

Reference Books	
1	B. A. J. Fisher, D. R. Fisher; "Techniques of Crime Scene Investigation, 8th Edition", CRC Press London, 2012.
2	Alan Gunn. Essential Forensic Biology, 2nd Edition, 2nd edition, Wiley-Blackwell 2009.
3	Henry C. Lee and R.E. Gaensslen; (1990), DNA and other Polymorphism in Forensic Science, Year book Medical Publishers, Inc.
4	F. Toroni, S. Bozza, A. Biedermann, P. Garbolino; "Data analysis in Forensic Science", Wiley, 2010.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.semanticscholar.org/paper/Artificial-Intelligence-in-Forensic-Sciencehinnikatti/
2	https://ieeexplore.ieee.org/document/8701416
4	https://www.sciencedirect.com/science/article/pii/S1877050920302672
5	https://swayam.gov.in/nd2_cec20_ge10/preview

Course Designed By: **Dr. R. SIVASAMY**

Mapping with Programme Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**L**	**L**	**L**	**S**	**M**	**L**	**M**	**M**	**S**	**S**
CO2	**L**	**M**	**M**	**S**	**S**	**L**	**M**	**M**	**S**	**S**
CO3	**M**	**M**	**M**	**S**	**S**	**L**	**M**	**L**	**S**	**S**
CO4	**M**	**M**	**M**	**S**	**S**	**L**	**M**	**M**	**S**	**S**
CO5	**M**	**M**	**M**	**S**	**S**	**L**	**M**	**M**	**S**	**S**

*S-Strong; M-Medium; L-Low

Course code	GS106	GENETIC TOXICOLOGY	L	T	P	C
SUPPORTIVE-III			2	-	-	2
Pre-requisite		Basic understanding about mutagens and mutations	Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are to:

1. Inculcate principles and guidelines in mutagenicity and genotoxic agents.
2. Cater various assays and procedures involved in mutagens evaluation.
3. Create the awareness about the effect of genotoxic agents and mutagens on health and nature.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Understand the basic principles and guidelines in mutagen monitoring and testing.	K2
2	Classify the genotoxic agents and relate the genetic defects with mutagens.	K4
3	Apply the assays and methods for measuring the toxic agents for its genetic effects.	K3
4	Gain the understanding on health effects of genotoxic agents/mutagens.	K2
5	Collect the genotoxic agents that can affect the developing embryo.	K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit: 1	PRINCIPLES ANG GUIDELINES	8 hours

General Principles of Mutagenicity, Testing and Regulatory Control of Environmental Chemicals. Monitoring of Chemical Mutagens in the environment.

Unit: 2	GENOTOXIC AGENTS	6 hours

Classification of Genotoxic agents. Genetic effects of environmental agents and Genotoxic agents in various occupations.

Unit: 3	ASSAYS AND METHODS	7 hours

Various assay procedures to determine genotoxicity, Methods of evaluation of mutagens, Microbial to mammals.

Unit: 4	HEALTH EFFECTS OF MUTAGENS	7 hours

Epidemiological approach to evaluate genetic hazards: Occupational Epidemiology and Reproduction.

Unit: 5	HEALTH EFFECTS IN NEW BORN	6 hours

Monitoring for genetic disease in the new born: Trans placental genotoxic agents.

Unit: 6	CONTEMPORARY ISSUES	2 hours

Expert lectures, online seminars – webinars

	Total Lecture hours	36 hours

Text Book(s)

1. Handbook of Mutagenicity Test Procedures. Kilbey, B.J., Lehgator, M., Nichols, W and Ramel, C (1984) Elsevier.

Reference Books	
1	Hsu, T.C (1982). Cytogenetic Assays of Environmental Agents.), Oxford and IBH, New Delhi.
2	Hollaender. A, and Serres F.J., Chemical Mutagens, Principles and Methods for their Detection. Volume 1- 10, Plenum Press.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://www.criver.com/products-services/safety-assessment/toxicology-services/genetic-toxicology?region=3701
2	https://www.atsdr.cdc.gov/training/toxmanual/modules/1/lecturenotes.html
3	https://ec.europa.eu/health/ph_projects/2003/action3/docs/2003_3_09_a21_en.pdf
Course Designed By: **Dr. P. VINAYAGA MOORTHI**	

CELL CULTURE TECHNIQUES	
Name of the Department	**HUMAN GENETICS AND MOLECULAR BIOLOGY**
Name of the Faculty Member i/c With Complete Address with Phone and e-mail	**Dr. R. SIVASAMY** Assistant Professor Dept. of Human Genetics and Molecular Biology Bharathiar University, Coimbatore - 641 046 Email: rsivasamy@gmail.com Phone: (M): +91-94873-60779
Inter / Intra Department Course	**Intra Department Course**
Duration of the Course	**30 Hours**
Eligibility	**Any life science Degree**
Number of Candidates to be Admitted	**15**
Registration Procedure	**Enroll through BU admission portal**

Job Opportunities:

The students who enroll in this value added course will learn how to culture the cell lines of different type's tissues which is essential for the any kind of morpho and molecular studies. It helps the students to get wide knowledge and it enhances cell interaction, cytotoxicity and cell signaling studies. It increases the opportunity to get to work in state and central institutions and various research projects.

The objectives of the Course are:

The main objectives of this course are to:

1	Understand the basic principles of Cell Culture techniques.
2	Provide theoretical and practical knowledge in relation to animal cell culture techniques.
3	Gain practical skills to subculture animal cells and quantify cell growth.

Course Content	Lecture / Practical / Project / Internship

Module 1	Cell culture III (cell differentiation, cell quantification, cytotoxicity and viability).	**6 hours**
Module 2	Cell culture techniques (types of tissue culture, primary cultures vs. finite vs. immortalized cell lines, finite cell lines, immortal cell lines, primary cultures).	**6 hours**
Module 3	Culture vessels & media development, Serum-free medium development & sterilization	**6 hours**
Module 4	Cell separation, characterization, differentiation & transformation Contamination, cryo-preservation & cyto-Toxicity	**6 hours**
Module 5	Introduction to tissue engineering, Biomaterials: natural materials, polymers, Biomaterials: hydrogels, ceramics, scaffold fabrication	**6 hours**
		30 Hours

Book(s) for Study

1	Molecular Cloning - A laboratory manual. 3rd Edition. Sambrook and Russel. Cold Spring harbor laboratory Press. 2001.1-2331.

Book(s) for reference

1	Modern experimental Biochemistry, 3rd Edition, Rodney Boyer. 2000. Benjamin Cummins. 1-480.
2	Methods in Molecular Biology-Genomics Protocol - Starkey, M.P. and Elaswarapu, R. 2001. Humana Press.1-538

Related Online Contents

1	https://onlinecourses.nptel.ac.in/noc20_me04/preview
2	https://nptel.ac.in/courses/102/104/102104059/

Fourth Semester

Course code	43A	BIOETHICS AND BIOSAFETY (Self-Study)	L	T	P	C
CORE-XIII			4	-	-	4
Pre-requisite		Basic understanding about Intellectual Property Rights, Biosafety regulation and bioethics	Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are:

1. To study the details about the equipment to acquire the basic knowledge of handling instruments.
2. To acquire the knowledge on biosafety levels.
3. To know the procedure of obtaining ethical clearance.
4. To obtain knowledge on Good Laboratory Practice.
5. To gain knowledge on IPR and patents in biological research.

Expected Course Outcomes:

On the successful completion of the course, students will be able to:

1	Understand the ethical guidelines and biosafety procedures when handling human samples and animal models.	K1, K2 & K5
2	The importance of bioethics will be acknowledged during the course.	K2, K3 & K4
3	Students will be well-trained in operating instruments and handling samples.	K3, K4, K5
4	The course aims in good practice for students to work in the laboratory.	K2, K3 & K5
5	Helps to obtain knowledge on Intellectual Property Right in research and development.	K2, K3 & K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit: 1	INTRODUCTION TO BIOETHICS	14 hours

Introduction and Development of bioethics in Genetics, ICMR Guidelines on Human Ethical Clearance (HEC), Board of members of HEC Committee, Consent forms, Questionnaire, Application form of HEC, Inclusion and Exclusion criteria, Helsinki regulations.

Unit: 2	BIOSAFETY REGULATIONS	14 hours

Bioethics and Biosafety regulatory bodies of National and International levels, Biosafety role and responsibilities. National and International Guidelines. Introduction, USA, European Union, Canada, Australia, South Africa, Asian Region including India.

Unit: 3	CPCSEA GUIDELINES FOR LABORATORY ANIMAL FACILITY	14 hours

Goal, Animal procurement, Quarantine, Sterilization, Surveillance, Animal care and technical personnel, Multiple surgical procedures on single animal, Duration of experiments, Physical facilities, Environment, Animal husbandry, Activity, Food, Bedding, Water, Sanitation and cleanliness, Assessing the effectiveness of sanitation, Waste disposal, Pest control, Emergency measures. Application form of Animal Ethical Committee Clearance, Animal transfer forms, Material transfer protocol. Board of members of animal ethical committee.

Unit: 4	GLP AND BIOETHICS	14 hours

Introduction, National Good Laboratory Practice (GLP) Programme, The GLP authority functions, quality standards for Clinical Trials. Biosafety cabinets and its provisions in India.

Unit: 5	INTELLECTUAL PROPERTY RIGHTS	14 hours
An Introduction, Origin of the Patent Regime, Early patterns Act and History of Indian Patent System. The Present Scenario, Basis of Patentability, Patent Application Procedure in India, Patent Granted Under Convention Agreement, Patent Procedure. Copyright.		
Unit: 6	**CONTEMPORARY ISSUES**	**2 hours**
Expert lectures, online seminars – webinars		
	Total Lecture hours	**72 hours**

Text Book(s)	
1	Bioethics, by Shaleesha A. Stanley (2008). Published by Wisdom Educational.

Reference Books	
1	IPR, Bioethics and Biosafety by Deepa Goel, Shomini Parashar. Pearson Education India.
2	Bioethics and Biosafety by M.K. Satheesh (2008). I. K. International Pvt Ltd.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://link.springer.com/chapter/10.1007/978-981-10-0875-7_24
2	https://books.google.co.in/books/about/Biosafety_and_Bioethics.html?id=IiqPrFYzRMMC&redir_esc=y
3	https://books.google.co.in/books/about/Bioethics_and_Biosafety.html?id=xP9dzbSBTZQC

Course Designed By: **Dr. P. VINAYAGA MOORTHI**

Mapping with Programme Outcomes										
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**
CO1	**M**	**M**	**S**	**M**	**M**	**M**	**M**	**S**	**M**	**S**
CO3	**M**	**S**	**S**	**M**	**S**	**M**	**S**	**M**	**M**	**M**
CO3	**S**	**M**	**M**	**M**	**M**	**M**	**M**	**M**	**S**	**S**
CO4	**S**	**M**	**S**	**S**	**M**	**M**	**M**	**M**	**M**	**M**
CO5	**M**	**M**	**M**	**M**	**M**	**S**	**S**	**M**	**M**	**M**

*S-Strong; M-Medium; L-Low

DROSOPHILA CULTURE AND REARING	
Name of the Department	**HUMAN GENETICS AND MOLECULAR BIOLOGY**
Name of the Faculty Member i/c With Complete Address with Phone and e-mail	**Dr. P. VINAYAGA MOORTHI** Assistant Professor Department of Human Genetics and Molecular Biology Bharathiar University Coimbatore - 641 046 Tamil Nadu, INDIA **MOBILE: 9994809189** **EMAIL:** vinayputhu@gmail.com**;** pvmhgmb@buc.edu.in
Inter / Intra Department Course	**Intra Department Course**
Duration of the Course	**30 Hours**
Eligibility	**Any life science Degree**
Number of Candidates to be Admitted	**15**
Registration Procedure	**Enroll through BU admission portal**

Job Opportunities:

The students who enroll in this value added course will learn how to rear the Drosophila and culture it for different generations. Drosophila is a model organism used by many researchers for studying the genetic disease through various behavioral assays due to sequence similarity with human genes. So learning the rearing skill and practical handling of behavioral assays give them self-sufficiency and give them courage to independently work for their doctoral thesis. It also gives the learners an eligibility work in various disease model projects as JRF, SRF and get opportunity work in central government institutions. Besides, if they start doing it with different types of species for different disease model flies, they can supply the flies for research works and they become entrepreneur in the field.

The objectives of the Course are:

The main objectives of this course are to:

1	learn the basic developmental stages of the *Drosophila melanogaster*
2	Understand the requirement for raising the colonies of *Drosophila melanogaster*
3	Use the *Drosophila melanogaster* for the behavioral assays

Course Content	Lecture / Practical / Project / Internship

Module 1	Identification of Male and Female - Egg - Embryo - Larval stages and Pupa - Life Cycle	**5 hours**
Module 2	Drosophila: Media preparation - Culture Conditions - Basic requirements - Safety Conditions	**5 hours**
Module 3	Drosophila: Maternal Genes, Segmentation Genes and its role in Development	**6 hours**
Module 4	Drosophila: Live observation of Embryo	**2 hours**
Module 5	Drosophila: Dissection of larval Brain	**2 hours**
Module 6	Drosophila: Dissection of adult brain	**2 hours**
Module 7	Drosophila: Behavioral assays - Flight assay	**2 hours**
Module 8	Drosophila: Behavioral assays - Climbing assay	**2 hours**

Module 9	Drosophila: Dissection of thorax for mitochondria - Theory	**2 hours**
Module 10	Drosophila: Dissection of thorax for mitochondria - Practical	**2 hours**
		30 Hours

Book(s) for Study	
1	Principles of Developmental Biology. Sally A. Moody. (Editor). 2007. Academic Press.
Book(s) for reference	
1	Scott F. Gilbert, Developmental Biology, VIII edition, Sinauer Associates Inc., Publishers, Sunderland, Massachusetts USA (2006).
2	Bruce Alberts, A. Johnson, J. Lewis, M. Raff, K. Roberts, P. Walter (2008). Molecular Biology of the cell, V edition, John Wiley and sons Inc., 2008.
Related Online Contents	
1	https://swayam.gov.in/nd1_noc20_bt35/preview
2	https://nptel.ac.in/courses/102/106/102106084/
4	https://swayam.gov.in/nd2_cec20_ed13/preview