Jaypee Institute of Information Technology

Integrated M.Tech. Biotechnology

Semester VI

Course Descriptions
Detailed Syllabus
Lecture-wise Breakup

Course Code	15B11BT611	**Semester** Even	**Semester VI** **Session** 2023-24 **Month from** January- June
Course Name	Comparative & Functional Genomics		
Credits	4	**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	1. Prof Vibha Rani
	Teacher(s) (Alphabetically)	1. Dr. Chakresh Kumar Jain 2. Prof Vibha Rani

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Explain the fundamental concepts of functional genomics, transcriptomics and proteomics	Understand (C2)
CO2	Identify different bioinformatics tools related to genomics and proteomics	Apply (C3)
CO3	Relate the bioinformatics data obtained through genomics studies	Analyze (C4)
CO4	Examine advanced techniques for improved diagnostics and therapeutics	Analyze (C4)
CO5	Integrate and evaluate the molecular interactions using Omics technology	Evaluate (C5)

Pre-requisite
[10B11BT511]- Introduction to Bioinformatics

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**

1.	Genes and Genomes	Basics structure of gene and organization in prokaryotic to eukaryotic, features of genome structure and complexity, evolutionary conservation, type of model organism, their structure number of genes sequencing status, type of maps genetic linkage maps, physical maps, techniques used to map their significance relation with human genome	3
2.	Whole Genome Sequencing Technologies	Human genome project fact sheet, techniques used for sequencing (shot gun sequencing), mapping techniques (BAC, YAC), genome assembly problems	2
3.	Genome Annotation i.e. Mining Genomic Sequence Data	Sequential annotation, structural annotations, prediction of gene and their elements like ORF finder, promoter region, LDA method, functional genomics, Dijkstra's algorithm, application in functional correlation	3

4.	Haplotyping: Concepts and Applications	Basics of haplotyping and its application in disease	2
5.	Pharmacogenomics: Concepts and Applications in Healthcare	Basics of phylogenomic, methods used and application, Basics of pharmecogenomics and relation with disease, personalized medicine	4
6.	SNP Technologies: Platforms & Analysis	SNP structure, techniques, prevalence and application in population genetics	3
7.	Gene Silencing Mechanisms	RNAi, non coding RNAs, Structure and biogenesis difference between SiRNA, MiRNAs, protein involve in RISC, prediction rule set, CRISPER	3
8.	Gene Cloning and Expression Platforms	Introduction: Gateway technology; Microarrays; SAGE; GIS	3
9.	DNA Protein Interactions	General; CHIP assay, EMSA; Library screening; DNA foot-printing; south western analysis; one hybrid assay	5

10.	Phage display	introduction; peptide display; antibody display; phage and phagemid system	4
11.	Protein-protein Interactions	Ribosome display; tandem affinity purification; Yeast two hybrid system, GST pull Down	4
12.	Quantitative proteomics	MALDI-TOF; LC-MS-MS, ICAT method; 2-D technology; Biomarkers; protein arrays	6
		Total number of Lectures	**42**

Evaluation Criteria	
Components Maximum Marks	
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment-1&2, Home Assignment, Quiz and case studies)
Total	100

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	A. M. Lesk. *Introduction to Genomics*. United Kingdom (UK): Oxford University Press, 2007.
2.	T.A. Brown. Genomes-3. United Kingdom (UK): Oxford University Press, 2007.
3.	D. C. Liebler and J. R. Yates. *Introduction to Proteomics*. New York, USA: Humana Press, 2002.
4.	Protein-Protein Interactions, Methods and Applications, Editors: Meyerkord, Cheryl L., Fu, Haian (Eds.), 2015
5.	N. C. Jones and P. A. Pevzner. *Introduction to Bioinformatics Algorithms (Computational Molecular Biology)*. Massachusetts, USA: MIT Press, 2004.
6.	DNA-Protein Interactions, Principles and Protocols, Editors: Leblanc, Benoît P., Rodrigue, Sebastien (Eds.), 2015

Course Description

Course Code	15B17BT671	**Semester: EVEN**	**Semester Session 2023-24** **Month**: **Jan to June**
Course Name	**Comparative and Functional Genomics Lab**		
Credits	1	**Contact Hours**	3
Faculty (Names)	**Coordinator(s)**	Dr. Nidhi Batra	
	Teacher(s) (Alphabetically)	Dr. Ankisha Vijay Dr. Nidhi Batra Prof. Sujata Mohanty Prof. Vibha Rani	

COURSE OUTCOMES		**COGNITIVE LEVELS**
C374.1	Utilize different data bases to study genes and genome.	Apply Level (C3)
C374.2	Apply the acquired knowledge of gene expression technologies	Apply Level (C3)
C374.3	Analyze the data related to cloning and expression of gene of interest	Analyze Level (C4)
C374.4	Compare and analyze functional genomics and proteomic data using computational tools	Analyze Level (C4)

Module No.	**Title of the Module**	**List of Experiments**	**CO**
1-4	Basic skills of transcriptomics	RNAase free water preparation and DEPC treatment of labware	**CO2**
		RNA isolation from plant tissues	**CO2**
		Quality assessment of isolated RNA	**CO4**
		Primer designing for quantitative RT-PCR	**CO2**
5-9		Induction and expression of recombinant proteins	**CO2**

	Basic skills of proteomics	SDS-PAGE analysis of differential expression of recombinant proteins	**CO4**
		SDS-PAGE analysis of differential	**CO4**
		Gel densitometry using ImageJ	**CO4**
		Western blotting for expressed protein confirmation	**CO2**
10-13	Analysis of molecular interactions	To interpret the protein- protein interaction using STRING	**CO 3**
		a) Visualization of molecular interaction network and identification of crucial gene(s) using Cytoscape b)Identification of clusters/Modules in a network	**CO2**
		To utilize RINalyzer within cytoscape for in depth analysis and understand its applications.	**CO2**
		Integrating Biological Networks and microarray expression data	**CO3**

Evaluation Criteria

Components	**Maximum Marks**
Mid Term Exam	20
End Term Exam	20
Day to Day	60
Total	**100**

Project Based Learning: Students are given independent/group project based computational experiments on analysing protein-protein interactions, or identification of crucial genes, and hubs and nodes in networks of various diseases.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Keith Wilson, John Walker. ―Principles and Techniques of Practical Biochemistry‖. Cambridge University Press, 2000
2.	https://vlab.amrita.edu/?sub=3&brch=187&sim=1331&cnt=1 (Western blotting) https://vlab.amrita.edu/?sub=3&brch=186&sim=718&cnt=1 (RNA isolation) https://www.youtube.com/watch?v=OWcMYWaYYIU (RNA isolation)

3	http://vlab.amrita.edu/index.php?sub=3&brch=273&sim=1501&cnt=1 (Primer designing)
4	http://vlab.amrita.edu/?sub=3&brch=186&sim=319&cnt=1(Polyacrylamide gel electrophoresis) https://vlab.amrita.edu/index.php?sub=3&brch=276&sim=1483&cnt=1(nIntegrating Biological Networks and Microarray Expression data)
5	Design of experiments, principle and the expected outcome and related literature will be provided to the student

Detailed Syllabus

Minor Project -II

Course Code	**15B19BT691**	**Semester: EVEN**	**Semester: VI th** **Session 2023-2024** **Month from December - June**
Course Name	**Minor Project -II**		
Credits	**4**	**Contact Hours**	**4**

Faculty (Names)	**Coordinator(s)**	Prof Rachana
	Teacher(s) (Alphabetically)	Prof. Rachana

Sl. No.	**DESCRIPTION**	**COGNITIVE LEVEL (BLOOM's TAXONOMY)**
C351.1	Outline the specific biotechnological problem and understand the related scientific approaches.	Understanding level (C2)
C351.2	Utilize the literature related to the specified topic to address the problem	Applying level (C3)
C351.3	Demonstrate team effort in presentation and data analysis	Applying level (C3)
C351.4	Conclude the data and develop scientific report writing skills	Analyse level (C4)

Minor Project II (15B19BT691) - Prof. Rachana				
C351.1	Outline the specific biotechnological problem and	Understanding level (C2)	Viva I, (Literature Review, Rationale, Problem identification and	**Exit Survey**

	understand the related scientific approaches.		formulation, presentation) – 10 Supervisor's assessment of day to day work – 10	
C351.2	Utilize the literature related to the specified topic to address the problem	Applying level (C3)	Viva I, (Planning, Implementation, Presentation) -10 Supervisor's assessment of day to day work -10	**Exit Survey**
C351.3	Demonstrate team effort in presentation and data analysis	Applying level (C3)	Viva II (Planning, Methodology, Implementation) -10 Supervisor's assessment of day to day work -10	**Exit Survey**
C351. 4	Conclude the data and develop scientific report writing skills	Analyse level (C4)	Viva II (presentation) - 10 Report submission - 15 Supervisor's assessment of day to day work(attendance) - 15	**Exit Survey**

PBL Component: The students will learn to define a problem and discuss various approaches to find a solution to the defined problem using scientific interventions and approaches. The students will learn the skills of report writing and analysis of results using different tools

Detailed Syllabus

Course Code	16B1NBT631	**Semester** EVEN **(specify Odd/Even)**	**Semester** VI **Session: 2023-24** **Month from** JANUARY - MAY
Course Name	BIOECONOMICS		
Credits	4	**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	DR. ASHWANI MATHUR
	Teacher(s) (Alphabetically)	DR. ASHWANI MATHUR

COURSE OUTCOMES		**COGNITIVE LEVELS**
C330-2.1	Understanding the economics of biological resources	Understanding (Level 2)
C330-2.2	Identify economic challenges and externalities for market failure	Applying (Level 3)
C330-2.3	Apply the knowledge of bioeconomic principles in designing sustainable business model	Applying (Level 3)
C330-2.4	Analyze total economic value of biological resources using different valuation methods	Analyzing (Level 4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to bioeconomics	Bio-economics- Concept, Development of Economics and Bioscience (Concept of resource economics for scarcity of biological resources), Evolution and Development of Economics and Biology (Charles Darwin and the evolutionary paradigm)	4
2.	Bioeconomics and thermodynamics	Thermodynamic analysis and thermo economics, Exergy cost, Exergetic efficiency**,** 1st and 2nd Laws of Thermodynamics applied to economics, economic processes and elasticity, entropy and utility, Concept of excergy in waste – Waste to value	5
3.	Bioeconomics and sustainability	Development of resource efficient bioeconomy, Social and economic challenges for bioeconomy, Concept of Market and Market failures, Reasons for market failures, Externalities Concept and understanding of ecological and carbon footprint	5
4	Total Economic Value of Bioresources	Understanding of total economic value (TEV) of a resource, Application of the concept of TEV to renewable and non renewable resources, Understanding of the principles behind use and non-use value, Introduction to Option and Quasi-option value	5

5.	Market and Non-market valuation methods	Understanding of different Market and Non-market valuation methods, Revealed preference and stated preference methods for estimating use and non use value, Market cost method. Application of different methods to different conditions	6
6	Life Cycle Assessment and Impact Assessment	Life cycle assessment (LCA)– rationale and utility, Principles behind designing LCA, Understanding of Impact Assessment and its use in development of sustainability solutions	5
7.	SWOT analysis of Bioeconomy	Rationale and criteria for SWOT analysis of Bioeconomies and their suggested use in Bio-entrepreneurial planning	2
8	Generic bioeconomic mathematical models	Bioeconomic Models- Dynamic resource harvesting model, Dynamic optimization model, Demand-limited bionomic equilibrium, Growth and aging- The cohert model and multi cohort models	5
9	Ecological bioeconomics and bioeconomy for agriculture and fisheries	Forestry model, Inherent characteristic of fish stocks, The multi-cohort model for fisheries	3
10	Business plan writing using Bioeconomic analysis	Introduction to business plan, Role of Biotechnology entrepreneurship,	3
		Total number of Lectures	4 3

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment, Class Test-1 / MCQ / Business Plan writing)
Total	**100**

PBL component:

Students will learn the role of use and non-use value in estimating total cost and learn to estimate TEV using recent data from various Government portals. Students will learn the concept of Kuznet curve and use data of different states of India to plot the curve and analyze its importance. The course content will help student in understanding the bioeconomic factors in policy making

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Clark, C.W. Mathematical bioeconomics, John Wiley & Sons, USA, 2010
2.	Asafu-Adjaye, J. Environmental Economics for Non-Economists, World Scientific Publishing Co. Pvt. Ltd., London, 2000
3.	Viaggi, D. The bioeconomy : delivering sustainable green growth, CAB International publishers, U.K, 2018

4.	Tukker, A. Life cycle assessment as a tool in environmental impact assessment, Environmental Impact Assessment Review, 20 (2000), 435–456
5.	Satpute,M.S., Lamdande, A.G., Kadam, V.D. and Garud, S.R. Life cycle assessment of food. Internat. J. Agric. Engg., 6(2), (2013), 558-563.
6.	Glasson, J., Therivel R., Chadwick, A. Introduction to Environmental Impact Assessment, 3rd edition, Routledge, Taylor & Francis Group, 2013
7.	Muthu, S.S. The Handbook of Carbon Footprint, CRC Press, Taylor & Francis Group, 2016

Detailed Syllabus

Course Code	16B1NBT632	**Semester** Even	**Semester VI** **Session** 2023-24 **Month from** January- June
Course Name	Antimicrobial resistance		
Credits	4	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Vibha Gupta
	Teacher(s) (Alphabetically)	1. Vibha Gupta

Course Outcome:

Upon completion of the course students will be able to:

S. No.	Course Outcomes	Cognitive levels
C331-1.1	Explain the mechanisms of antimicrobials and emerging resistance	Understand Level (C2)
C331-1.2	Apply alternative therapies to solve microbial resistance – a global issue	Apply Level (C3)
C331-1.3	Examine different methods of antimicrobial susceptibility testing	Analyze Level (C4)
C331-1.4	Take part in antimicrobial stewardship	Analyze Level (C4)

Pre-requisite : NA

Module-wise breakup

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	Course overview	Basic overview of antibiotic resistance; Importance of optimizing antimicrobial usage for maintaining cost-effective therapies	2
2.	Antimicrobial Classes	Discovery and History of antibiotics, importance of antibiotics, Different classes of antimicrobials (bacterial, Viral & fungal) and their mode of action	6

3.	Mechanisms of Resistance	Molecular mechanisms of Resistance; Emergence and spread of resistance; Microbial resistance – a global issue	6
4.	Techniques for detection of resistance	Antimicrobial susceptibility tests; methods for detecting antimicrobial resistance; Obtaining good results; interpretation of antimicrobial susceptibility results; genomic analysis tools to detect resistance genes	10
5.	New antimicrobial approaches	Alternative therapies to antibiotics – phage therapy, probiotics, vaccines, etc.	7
6.	Antimicrobial Stewardship	Roles and responsibilities of different stakeholders in antimicrobial stewardship (including physician, pharmacist, microbiologist, hospital administrators); Case studies - Antimicrobial stewardship strategies by WHO, ICMR etc.	10
Total number of Contact hours			**41**

Evaluation Criteria

Components	**Maximum marks**
T1	20
T2	20
End term	35
TA	25
Total	**100**

Project based Learning: : Students in groups of 4 to 5 will be engaged in a project for improving public awareness for Antimicrobial Resistance phenomenon and critical thinking to tackle this global issue.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Kateryna Kon and Mahendra Rai "Antibiotic Resistance: Mechanisms and New Antimicrobial Approaches" Academic press 2016
2.	CARD - Comprehensive Antibiotic Resistance Database (https://card.mcmaster.ca/) site for information on publicly available resistance genes and related information.
3.	Research papers and Reports provided as per the course content.

Detailed Syllabus

Lecture-wise Breakup

Course Code	16B1NBT634 ELECTIVE	**Semester** EVEN	**Semester VI Semester Session** 2023 -2024 **Month from** January to June
Course Name	Genetic Disorder and Personalized Medicine		
Credits	4	**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	Dr. Sujata Mohanty
	Teacher(s) (Alphabetically)	Dr. Sujata Mohanty

COURSE OUTCOMES		COGNITIVE LEVELS
CO1	Explain and interpret genetic test results to understand disease etiology and mode of inheritance	Understand Level (C2)
CO2	Develop the concept of Personalized Medicine and integrate information from Human Genome Project databases	Apply Level (C3)
CO3	Analyze the role of population and quantitative genetics for genetic disorders	Analyze Level (C4)
CO4	Assess the genetic counseling process and its impact from a cultural, ethical and psychosocial perspective	Evaluate Level (C5)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction to Genetic Disorder and Principles of their Inheritance	Introduction to Medical Genetics, Genetic Disorder and Concern, Clinical Features, Genetic Principles to Understand Disease Etiology, and Mode of Inheritance, Pedigree analysis and carrier screening	08
2.	Genetic Screening and DNA Banking	Preventive Genetics; DNA Banking and Clinical DNA Testing, Cytogenetic, Molecular and Biochemical Common as well as Modern Technology based Genetic Tests and their Results Interpretation	08
3.	Population and Quantitative Genetics	Application of population genetics in genetic risk calculation within Family/Population, heritability factor estimation	06
4.	Case studies	Case studies; Epigenetics, Uniparental disomy, Mosaicism, Inborn errors of metabolism, cancer genetics etc.,	06
5.	Human Genome Projects	Human Genome Projects and Outcomes: Initial Reference Genome, 100,000, Encode, Gencode and the future prospects, Integration of genomic information in Biomedical Sciences, Related Databases	06
6.	Concept of Personalized Medicine	Personalized Medicine, Study of Genetic resources (OMIM, Gene tests, Gene clinics etc.)	04
7.	Genetic counseling	The Genetic Counseling Process and Its Impact from a Cultural, Ethical and Psychosocial Perspective	04
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment 1, Class Test, assignment 2)
Total	**100**

Project Based Learning:

Students after learning the modes of inheritance, will do small projects on various case studies with regards to appropriate genetics screening, carrier screening, % of transmission risk and also will make the family pedigree chart. In addition, students will do projects on comparative genomics using the available genomic information of biomarkers associated with genetic disorders and can understand the concept of Personalized Medicine.

Detailed Syllabus

Lecture-wise Breakup

Course Code	16B1NPH636	**Semester: Even**	**Semester: VI Session** 2023-24
Course Name	**Medical & Industrial Applications of Nuclear Radiation**		
Credits	4	**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	Dr Papia Chowdhury
	Teacher(s) (Alphabetically)	Dr Papia Chowdhury & Dr ManojTripathi

COURSE OUTCOMES		**COGNITIVE LEVELS**
C302-11.1	Define nuclear structure, properties and reactions; Nuclear magnetic resonance process.	Remembering (C1)
C302-11.2	Explain models of different nuclear imaging techniques; CNO cycle; principle of radioactive decays.	Understanding (C2)
C302-11.3	Apply knowledge of nuclear reaction mechanisms in atomic devices, dosimetry, radiotracers, medical imaging, SPECT, PET, tomography etc.	Applying (C3)
C302-11.4	Analyze different radiocarbon dating mechanisms and processes.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Nucleus, Radioactivity & Dating**	Structure of matter**;** Nucleus:Nuclear Size, Structure and forces; Binding energy and Nuclear stability, mass defect;Nuclear reaction: Fission, Fusion, chain reaction. Nuclear fusion in stars, Formation of basic elements: proton-proton chain, CNO cycle, Hydrostatic equilibrium; Applications: atom bomb, hydrogen bomb, nuclear power plants, Nuclear reactor problems, precautions. **ii)**Radioactive decay, kinetics of radioactive decay, Types of radioactive decay and their measurement, Half life, decay constant, Population of states, Production of radionuclides. Radioactive dating, Radiocarbon dating: Formation, mechanism of dating,	**17**

		carbon cycle, radiocarbon clock and applications, advantages, disadvantages, precautions; Other dating techniques, protein dating, accuracy in dating;	
2.	Radiation and matter interactions	Dosimetry and applications: Interaction of Radiation of matter: Biological effects of radiations; dosimetry, working principles, Tools and radiotherapy, Doses, Radioisotopes, Radiotracers;	09
3.	NMR and MRI	Nuclear Magnetic Resonance: General Introduction to Magnetic Resonance, Reference Frame; RF Pulses, Larmor precision, Basic principles of NMR & ESR Spectroscopy, Nuclear shielding, Chemical shifts; Couplings, Nuclear Imaging; 1D,2D, 3D Images, Application of NMR in medical industry as MRI, working MRI, Types of differen MRI, Applications of NMR in quantum computation;	09
4.	Nuclear Medicine and Nuclear Imaging	Nuclear Medicine and Nuclear imaging techniques, preclinical imaging, detector designing, photon counting, Medical imaging using β+γ coincidences, SPECT AND PET: Radiation tomography, applications;	05
		Total number of Lectures	**40**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 [2 Quiz (10 M), Attendance (10 M) and Cass performance (5 M)]
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Basic Sciences of Nuclear Medicine; Magdy M K halil, Springer
2.	Physics and Radibiology of Nuclear Medicine; Gopal B Saha, Springer
3.	A. Beiser, Concepts of Modern Physics, Mc Graw Hill International.
4.	Radionuclide Techniques in Medicine, JM McAlister (Cambridge University Press, 1979).
5.	Nuclear Physics; S.N.Ghosal

Detailed Syllabus

Lecture-wise Breakup

Course Code	19B13BT311	**Semester** Even	**Semester** VI **Session** 2023-24
Course Name	Nanoscience in Food Technology		
Credits	2	**Contact Hours**	2

Faculty (Names)	**Coordinator(s)**	Prof. Sudha Srivastava
	Teacher(s) (Alphabetically)	Prof. Sudha Srivastava

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Explain properties of nanoparticles and nanoemulsions	**Understand Level (C2)**
CO2	Outline food processing, packaging and preservation	**Understand Level (C2)**
CO3	Apply nanotechnology concepts to improve food quality, texture, and shelf life	**Apply Level (C3)**
CO4	Analyze food quality degradation and pathogens detection, using nanosensors	**Analyze Level (C4)**

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to Nanomaterials	Introduction to nanomaterials, nanoemulsions, method of synthesis and identification of nanoemulsions	5
2.	Food Packaging and Preservation	Introduction to food processing, packaging and preservation. Modified atmosphere packaging, active packaging and intelligent packaging.	6
3.	Application of nanotechnology in Food and agriculture	Microemulsions for delivery of nutraceuticals, edible films and coating for food, Polymer nanocomposites, effect of nanomaterials on mechanical, thermal and barrier properties	7

		of polymers. Application of nanotechnology for pesticide delivery, nutrient uptake etc. Nanomaterials in Food- Health and Safety Issues	
4.	Biosensors for monitoring food quality	Time temperature indicators, pathogen detection using biosensors, Pesticide detection using biosensor.	6
		Total number of Lectures	**24**

Evaluation Criteria

Components	**Maximum Marks**
Mid Term	30
End Term	40
TA	30 (Assignment, Presentations, Project based Evaluation)
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	VellaichamyChelladurai, Digvir S. Jayas, 2018 Nanoscience and Nanotechnology in Foods and Beverages CRC Press, ISBN 9781498760638
2.	Recent Research papers

Operations Research (18B12MA611)

LPP, graphical solutions, simplex method, Big-M method, two phase method, primal-dual relationship, dual simplex method, sensitivity analysis, north west corner rule, least cost method, Vogel's approximation method, resolution on degeneracy, Hungarian method, travelling salesmen problems, pure and mixed integer linear programming problems, cutting plane method, branch and bound method, convex functions, unconstraint problem, extreme points, quadratic programming, Wolfe's method, constrained problems, Lagrange method for equality constraints, Kuhn-Tucker conditions.

Course Description

Course Code	18B12MA611	**Semester Even**	**Semester VI** **Session** 2023-24 **Month from** Jan - Jun 2024	
Course Name	Operations Research			
Credits	3	**Contact Hours**	3-0-0	
Faculty (Names)	**Coordinator(s)**	Dr. Ram Surat Chauhan		
	Teacher(s) (Alphabetically)	Dr. Amita Bhagat		

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above-mentioned course, the students will be able to:		
C302-3.1	demonstrate understanding of mathematical models for optimization problems and interpret primal-dual relationship.	Understanding Level (C2)
C302-3.2	apply different methods for the solution of linear, non-linear and integer programming problems.	Applying Level (C3)
C302-3.3	solve various transportation and assignment models.	Applying Level (C3)
C302-3.4	examine optimality conditions and perform sensitivity analysis for linear and non-linear programming problems.	Analyzing Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Preliminaries	Introduction, Operations Research Models, Phases and Scope of O.R. Studies.	3
2.	Linear Programming Problems (LPP)	Convex Sets, Formulation of LPP, Graphical Solutions, Simplex Method, Big-M Method, Two Phase Method, Special Cases in Simplex Method.	8
3.	Duality and Sensitivity Analysis	Primal-Dual Relationship, Duality, Dual Simplex Method, Sensitivity Analysis.	8
4.	Transportation Problems	Introduction, Matrix Form, Applications, Basic Feasible Solution- North West Corner Rule, Least Cost Method, Vogel's Approximation Method. Degeneracy, Resolution on Degeneracy, Optimal Solution, Maximization TP Model.	5
5.	Assignment Problems	Definition, Hungarian Method, Traveling Salesmen Problems.	4
6.	Integer Linear Programming Problems	Pure and Mixed Integer Linear Programming Problems, Cutting Plane Method, Branch and Bound Method.	6
7.	Non-Linear Programming	Introduction to NLP, convex functions and graphical solution, Unconstrained Problem, Constrained Problems - Lagrange Method for equality constraints, Kuhn-Tucker Conditions for inequality constraints, Quadratic Programming -Wolfe's Method	8
Total number of Lectures			**42**

Evaluation Criteria	
Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, Tutorials)
Total	**100**

Project based learning: Each student in a group of 4-5 will collect literature on transportation, assignment and integer programming problem to solve some practical problems. To make the subject application based, the students analyze the optimized way to deal with afore mentioned topics.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Taha, H. A. - Operations Research - An Introduction, Pearson Education, 2011.
2.	Hadley, G. - Linear Programming, Massachusetts: Addison-Wesley, 1962.
3.	Hiller, F.S. and Lieberman, G. J. - Introduction to Operations Research, San Francisco, 1995.
4.	Wagner, H. M. - Principles of Operations Research with Applications to Managerial Decision, PHI, 1975.
5.	Vohra, N. D., Quantitative Techniques in Management, Second Edition, TMH, 2003.

Detailed Syllabus
Lecture-wise Breakup

Course Code	18B12HS611	**Semester EVEN** (specify Odd/Even)	**Semester VI Session** 2023-24
Course Name	Marketing Management		
Credits	**3**	**Contact Hours**	**(2-1-0)**

Faculty (Names)	**Coordinator(s)**	Dr Swati Sharma
	Teacher(s) (Alphabetically)	Dr Praveen Sharma, Dr Swati Sharma

COURSE OUTCOMES		**COGNITIVE LEVELS**
C304-7.1	To illustrate the fundamentals of marketing, marketing environment and market research	Understanding Level (C2)
C304-7.2	To model the dynamics of marketing mix	Applying Level (C3)
C304-7.3	To demonstrate the implications of current trends in social media marketing and emerging marketing trends.	Understanding Level (C2)
C304-7.4	To appraise the importance of marketing ethics and social responsibility	Evaluating(C5)
C-304-7.5	To conduct environmental analysis, design business portfolios and develop marketing strategies for businesses to gain competitive advantage.	Creating (C6)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**

1.	**Understanding New Age Marketing**	Defining Marketing For 21st Century The importance of marketing and marketing's role in business and society. Introduction to Digital Marketing. Online Communication Tools. The Social Media-Conversations, Community and Content. Affiliate Marketing and Mobile Engagement. The Digital Campaigns	5
2	**Marketing Environment and Market Research and insights**	Internal and external forces impacting marketers. Marketing and Customer Value. Gathering Information and Scanning the environment. Company's Micro and Macro Environment Responding to the Marketing Environment	3
3	**Strategic Planning and the marketing Process**	Explore the impact of social forces on marketing actions. Describe how technological change affects marketing. Designing the business Portfolio Discuss the Strategic Planning Process and Strategic Marketing Process.	5
4	**Consumer and Business Buyer Behaviour**	Consumer Markets and consumer buyer behaviour. The buying decision process. Business Markets and business buyer behaviour. Discuss the modern ethical standards.	5
5	**Branding**	Brand Image, Identity and Association. Product brands and Branding decisions. Product line and mix decisions. Consumer Brand Knowledge. New Product Development and Product life cycle strategies.	4
6	**Pricing products: Pricing considerations and strategies**	Factors to consider when setting prices. New product pricing strategies. Product mix pricing strategies. Price adjustments and changes.	4
7	**The New Age Social Marketing**	Ethics and social responsibility in marketing. Ethical behavior in business. Ethical decision making. Social forces affecting marketing. Impact of culture on marketing. Discuss modern ethical standards.	2

		Importance of marketing in CSR and business sustainability.	
		Total number of Lectures	**28**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Project, Viva, Oral Quiz)
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Kotler, Philip and Gary Armstrong, Principles of Marketing, 10th Edition, New Delhi, Pearson Education, 2004.
2.	Darymple, Douglas J., and Leonard J. Parsons, Marketing Management: Text and Cases, 7th Edition, John Wiley & Sons (Asia) Pte. Ltd., 2002.
3.	Kotler, Philip., and Kevin Lane Keller, Marketing Management, 12th Edition, New Delhi, Pearson Education, 2006.
4.	Winer, Russell S., Marketing Management, 2nd Edition, Prentice Hall,2003.
5.	Hollensen, S. (2019). Marketing management: A relationship approach. Pearson Education.

DETAILED SYLLABUS AND EVALUATION SCHEME

Course Code	21B12HS311	**Semester: EVEN (specify Odd/Even)**	**Semester: VI Session:2023-24**
Course Name	Development Issues and Rural Engineering		
Credits	03	Contact Hours	2-1-0

Faculty (Names)	**Coordinator(s)**	Dr. Amandeep Kaur
	Teacher(s) (Alphabetically)	Dr. Amandeep Kaur (amandeep.kaur@mail.jiit.ac.in)

COURSE OUTCOMES		**COGNITIVE LEVELS**
C304-10.1	Understand the concept, philosophy and determinants of rural development	Understanding Level- (C2)
C304-10.2	Assess public policies related to rural development	Analyze Level – (C4)
C304-10.3	Explain the role of local self-governance in planning and development of rural areas.	Understanding Level- (C2)
C304-10.4	Analyze the impact of recent policy changes and schemes on rural development.	Analyze Level – (C4)
C304-10.5	Evaluate the issue and challenges of through possible determinants of rural development.	Evaluation Level- (C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**

1.	Rural Development: An Introduction	Rural Development Philosophy, Concepts, Principles, Traditional and Modern Concept of Development, Trends and Pattern of micro as well as macro indicators of Rural Development.	4
2.	Public Policies and Rural Development	Policies related to Employment Generation, Poverty Reduction, Skill Development and, Infrastructure such as MGNGEGA, DDUGKY, Atam Nirbhar Bharat rojgar yojna and schemes related to MSMEs etc.	6
3.	Rural Development Administration and Panchayat Raj Institutions	Rural Development administration: Panchayat Raj System (73rd Amendment Act), functions of Panchayat Raj System, Financial Distribution of Resources in Rural India through Panchayat Raj System, merits and demerits of Panchayat system, Ways to strengthen the existing system by overcoming the flaws.	6
4.	Rural Development Issues and Challenges	Issues and challenges of Rural development: Employment in line with sectoral distribution (GDP and Employment), Poverty and Migration Issue, Rural and Urban Consumption and Production Linkages.	7
5.	Recent Advancements and changes	Recent packages and schemes implemented in Rural India, Budget Allocation for Rural Development -2019-20 and 2020-21: For Employment Generation, poverty reduction, infrastructure and MSMEs.	5
Total number of Lectures			**28**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment, Quiz, Project)
Total	**100**

Project-based Learning: Students are required to collect the data related to different indicators of rural development (related to agriculture, health and education infrastructure, literacy levels, population density,

poverty, employment etc.). They also need to check the compatibility of data (data mining and data refining process) and then analyse the contribution of these indicators in rural development of particular state/country as whole. Moreover, they are required to analyse the extent of progress and failure of programmes/schemes implemented in rural areas for poverty reduction, employment generation and MSMEs. Collecting information and analysing the data related to development indicators and policies will upgrade students' knowledge regarding the development issues and strengthen their skills to tackle multiple data handling and measuring issues.

Recommended Reading material:	
1.	**Singh, Katar.** Rural Development: Principles, Policies and Management *(3e).*2009
2.	**Coke, P., Marsden, T. and Mooney, P.** Handbook of Rural Studies. Sage Publications, 2006
3.	**Todaro, M.P**., **Stephen C. Smith,** Economic Development, Pearson Education, 2017
3.	**Ahuja, H. L.**, Development Economics, S Chand publishing, 2016
4.	**Musgrave, R. A., Musgrave, P. B.,** Public Finance in Theory and Practice, McGraw Hill Education,2017

Detailed Syllabus

Course Code	20B12HS311	**Semester** Even	**Semester VI** **Session** 2023-24 **Month January-July**
Course Name	Global Politics		
Credits	3(2-1-0)	**Contact Hours**	**3**

Faculty (Names)	**Coordinator(s)**	Dr. Chandrima Chaudhuri
	Teacher(s) (Alphabetically)	Dr. Chandrima Chaudhuri

CO Code	COURSE OUTCOMES	COGNITIVE LEVELS
C304-9.1	Demonstrate an understanding of the meaning and nature of globalization by addressing its political, economic, cultural and technological dimensions	Understanding (C2)
C304-9.2	Analyzing the significance of contemporary global issues	Analyze (C4)
C304-9.3	Analyze how the global politics shapes domestic politics	Analyze (C4)
C304-9.4	Demonstrate an understanding of the working of the global economy, its anchors and resistances offered by global social movements	Understanding (C2)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Globalization: Conceptions and Perspectives	Political Dimension of globalization Globalization and Culture Technological Dimensions Debates on territoriality and sovereignty	6
2.	Global Economy	Its Significance and Anchors of Global Political Economy: IMF- history and India's benefit from its membership of IMF WTO- History and India's experience with WTO and reform proposals World Bank- history and role of world Bank in India Rise of TNCs and role of TNCs in globalization	8

		Global resistances (Global Social Movement and NGOs)- their nature and characteristics , prominent movements and their impact	
3.	Contemporary Global Issues-I	Ecological Issues: historical overview of international environmental agreements-UNSCD, Paris agreement, climate change- Copenhagen summit to post Copenhagen summit policies of India, climate change and global initiatives global commons debate Proliferation of Nuclear Weapons-history of nuclear proliferation, threat of proliferation with increase in globalization	8
4.	Contemporary Global Issues-II	International Terrorism: globalization and global terrorism, impact of terrorism on globalization, role of non-state actors and state terrorism; the US and war on terrorism Migration and Human Security- globalization, violent extremism and migration; new global regime	6
		Total number of Lectures	**28**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Attendance, Quiz, Project)
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	C. Hay, Ed. *New Directions in Political Science: Responding to the Challenges of an Interdependent World.* New York, USA: Palgrave Macmillan Education, 2010
2.	D.Held & A. McGrew, *Globalization/Anti-globalization: Beyond the Great Divide*. Cambridge, UK: Polity Press, 2007
3.	F. Halliday, "Terrorism in Historical Perspective"., *Open Democracy*. 22 April, 2004 [Online] Available: http://www.opendemocracy.net/conflict/article_1865.jsp
4.	J. Baylis and S. Smith, Ed.*The Globalization of World Politics: An Introduction to International Relations*. Oxford, UK: Oxford University Press, 2017

5.	L.Gordon and S. Halperin, "Effective Resistance to Corporate Globalization" in *Contesting Global Governance,* R.O'Brien, A.M. Goetz, J.C. Scholte & M.Williams. Cambridge, UK: Cambridge University Press,2000

Detailed Syllabus
Lecture-wise Breakup

Course Code	**16B1NHS 531**	**Semester : Even (specify Odd/Even)**	**Semester : VI Session: 2023-24 Month: Jan-July**
Course Name	**Sociology of Youth**		
Credits	**3**	**Contact Hours**	**(2-1-0)**

Faculty (Names)	**Coordinator(s)**	**Ms Shikha Kumari**
	Teacher(s) (Alphabetically)	**Ms Shikha Kumari**

COURSE OUTCOMES		**COGNITIVE LEVELS**
C304-13.1	Demonstrate an understanding of Youth and youth culture in sociological perspectives	Understanding (C 2)
C304-13.2	Explain the ethical, cultural& social issues concerning Youth	Evaluating(C 5)
C304-13.3	Examine the relative importance of structure and agency in shaping young people's experiences and life opportunities	Analyzing(C 4)
C304-13.4	Evaluate youth experience in a context of social change	Evaluating(C 5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to Youth	Meaning and characteristics of youth, demographic profile of youth in India, Challenges faced by Youth, Youth's roles and responsibilities in society	2
2.	Youth Culture	Concept of Youth Culture, role of Popular culture in shaping youth culture,	2
3.	Perspectives on Youth Culture	Functionalist, Conflict, Interactionist and Feminist Perspective on Youth Culture, Youth and Gender	3
4.	Youth and Identity	Social divisions: sexuality, urban and rural youth, social identities: subcultural, digital, Experiences of youth to negotiate identities in contemporary societies	6

5.	Socialization of Youth	Concept and processs of socialization, Internalization of norms, types of socialization, conditions of learning, internalized objects, theories of socialization, stages of socialization, adult socialization, agents of socialization, role of culture in socialization, socialization and cultural differences, importance of socialization, Failure of the socialization process	7
6.	Problems of Youth	Role and Value conflicts, Generation Gap, Career decisions and Unemployment, Emotional adjustment, Coping with pressures of living, Unequal Gender norms, Crime (Social Strain theories),	6
7.	Changing perceptive of Youth and Youth Culture in 21st century	involvement of youth in major decision making institutions, Post-modernity and Youth, Youth Unrest	2
		Total number of Lectures	**28**

Evaluation Criteria

Components	**Maximum Marks**
T1	20 (Project based)
T2	20
End Semester Examination	35
TA	25 (Presentation, Assignment, attendance, Quiz and Participation in Tutorial)
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Tyyskä, V. *Youth and Society: The long and winding road*, 2nd Ed., Canadian Scholars' Press, Inc. (2008).
2.	White, Rob, Johanna Wyn and Patrizia Albanese. *Youth & Society: Exploring the Social Dynamics of Youth Experience.* Don Mills, ON: Oxford University Press, 2011.
3.	Bansal, P. *Youth in contemporary India: Images of identity and social change*. Springer Science & Business Media, 2012.
4.	Furlong, Andy. *Youth studies: An introduction*. Routledge, 2012.
5.	Blossfeld, Hans-Peter, et al., eds. *Globalization, uncertainty and youth in society: The losers in a globalizing world*. Routledge, 2006.
6.	Ruhela, Satya Pal, ed. Sociology of the teaching profession in India. National Council of Educational Research and Training, 1970.
7.	Frith, S. "The sociology of youth. Themes and perspectives in sociology." Ormskirk, Lancashire: Causeway Books , 1984.

Detailed syllabus
Lecture-wise Breakup

Subject Code	**16B1NHS632**	**Semester: EVEN**	**Semester: VI Session 2023-24** **Month: Jan-July**
Subject Name	**COGNITIVE PSYCHOLOGY**		
Credits	**3**	**Contact Hours**	**2-1-0**
Faculty (Names)	**Coordinator(s)**	**Dr. Badri Bajaj**	
	Teacher(s) (Alphabetically)	**Dr. Badri Bajaj**	

COURSE OUTCOMES		**COGNITIVE LEVELS**
C304-4.1	Understand and apply the concepts of cognitive psychology in everyday life	Applying Level (C3)
C304-4.2	Analyze the different models of various cognitive processes	Analyzing Level (C4)
C304-4.3	Evaluate cognitive psychology issues and recommend possible solutions	Evaluating Level (C5)
C304-4.4	Evaluate interventions/solutions for self-development through cognitive processes	Evaluating Level (C5)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Introduction to Cognitive Psychology	Historical Background: Emergence of modern cognitive Psychology; Approaches: Information Processing and PDP Model; Research Methods	**3**
3.	Perceptual Processes	Perceptual learning and development; perception of shape, space, and movement.	**4**

3.	Attention	Selective Attention and Divided Attention: Meaning, Definition, and Theories.	**4**
4.	Memory	Short Term Memory	**3**
5.	Imagery	Properties of mental images; Representation of images and cognitive maps.	**3**
6.	Language	Structure of language and its acquisition, speech perception, factors affecting comprehension.	**4**
7.	Thinking and Problem Solving	Types of thinking; Classification of problems; Problems solving approaches, Problems space theory by Newell and Simon, Creativity	**4**
8.	Decision Making	Logical reasoning types and errors in reasoning processes. Concept formation and categorization; Judgment and decision making	**3**
Total number of Hours			**28**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Project, Assignment, Oral Questions)
Total	**100**

Project based learning: Students in a group will choose a research topic from the syllabi of cognitive psychology. Students will cover the following points to prepare project reports: Understanding of concept, related theories and perspectives; Describe the relevance of the chosen concept for personal growth; Discuss the application of chosen topic for your professional life; Elaborate the relevance of the topic at group level and societal level. Discussions on these practical aspects will enhance students' understanding & application of concepts of cognitive psychology in everyday life.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Ronald T. Kellogg, Fundamentals of Cognitive Psychology, 2nd Ed., Sage Publishing, 2012
2.	Robert Solso, Otto Maclin, M. Kimberly Maclin, Cognitive Psychology, 8th Ed., Pearson Education, 2013
3.	Kathleen M. Galotti, Cognitive Psychology, 5th Ed., Sage Publishing, 2014
4.	Michael W. Eysenck, Mark T. Keane, Cognitive Psychology: A Student's Handbook , 7th Ed, Psychology Press, 2015
5.	Robert Sternberg, Karin Sternberg, Cognitive Psychology, 6th Ed, Wadsworth/Cengage Learning, 2011
6.	Edward E. Smith, Stephen M. Kosslyn, Cognitive Psychology: Mind and Brain, Ist Ed, Pearson Education India; 2015

Course Code	21B13BT311	**Semester** Even	**B.Tech Semester** VI **Session** 2023 -2024 **Month from January- June**
Course Name	Biorisk and Biosecurity		
Credits	**Value Added Course**	**Contact Hours (per week)**	2

Faculty (Names)	**Coordinator(s)**	Dr. Sonam Chawla
	Teacher(s) (Alphabetically)	Dr. Sonam Chawla

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Compare and classify the potential biorisk agents	Understand Level (C2)
CO2	Apply biosafety and biosecurity measures in laboratories and industries	Apply Level (C3)
CO3	Identify various hazards associated with biological agents	Apply Level (C3)
CO4	Examine Biosafety measures and Biosecurity surveillance	Analyze Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to Biorisk	Introduction to risk associated with biological materials, potential hazardous organisms and samples. Understand biological agent and associated biohazards	6
2.	Hazard identification	Human microbiota, pathogen and virulence factors, zoonotic agents of research animals, Hazards of plant pathogen, pathogens to human health, laboratory associated infections, nosocomial infections	6
3.	Risk assessment of biological Hazards	Assessment of the risks associated with hazardous agents- bacterial pathogens, viral, mycotic agents and biological toxins, molecular agents,	6
4.	Introduction to Biosafety and Biosecurity	Understanding biosafety, Safety in laboratories, biosafety in large scale production, Biosafety in pharmaceutical industry, biosafety guidelines for different containment level, Bioterrorism and Bioaccident, Introduction to biosecurity	6
	Elements of Biosecurity	Primary barriers and equipment for biosecurity, Biosecurity Surveillance strategies, Biosecurity surveillance in food and agriculture sector	6
		Total number of Lectures	**30**

Evaluation Criteria	
Components	**Maximum Marks**
Mid Term Examination	30
End Semester Examination	40
TA	30 (Assignments / Quiz / Reports/ Class Test/PBL)
Total	**100**

Project based Learning: The students will learn about potential bio risk associated with biological material, along with risk analysis approach. The knowledge of elements of security and safety measures associated with the risks, will help students being an intellectual resource for Institutions and organizations dealing with biological agents and organisms their working with them following good laboratory practices. The students will be submitting the assignment where potential risk situation (case studies) will be discussed with them and they will be advised to explore a solution in context to risk and plan a safety and security strategy.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Dawn P. Wooley, Karen B. Byers, Biological Safety: Principles and Practices- 3rd Edition, Wiley Publishers, **2020** [ISBN: 9781555819637]
2.	Recent review articles and research papers in the field

Detailed Syllabus

Course Code	**15B11BT414**	**Semester** Even **(specify Odd/Even)**	**Semester** VI **Session** 2023 -2024 **Month from** January to June
Course Name	Immunology		
Credits	4	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr Rachna
	Teacher(s) (Alphabetically)	Dr Shalini Mani, Dr. Rachna

COURSE OUTCOMES (New)		**COGNITIVE LEVELS**
C216.1	Outline the immune system and its diversity.	Understand Level (C2)
C216.2	Identify the antigen, antibody interactions and their regulation	Apply Level (C3)
C216.3	Classify deregulated immunological responses	Analyze Level (C4)
C216.4	Examine advanced immunological techniques and their applications in diagnostics and therapeutics.	Analyze Level (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Basic immunology	Historical perspectives, Cells and organs of the immune system	3
2.	Types of immunity	innate and acquired immunity	3
3.	Antigens	Immunogenicity, antigenicity, epitopes, haptens, mitogens	2
4.	Immunoglobins : structure and function	Basic structure and fine structure of Igs, immunoglobin classes	4
5.	B cell and T cell receptor	Organization and expression of immunoglobulin genes : Generation of antibody diversity, class switching, T cell receptor complex, TCR coupled signaling pathways, co-stimulatory signals	**5**
6.	Major histocpmatibility complex (MHC) and HLA	General organization and inheritance of MHC, structure of MHC class I and II molecules, peptide binding by MHC molecules, MHC and susceptibility to disease, Tissue and organ transplantation	**3**
7	Regulation of immune response and immunological tolerance	Cytosolic and endocytic pathway, Responses in humoral and cell mediated branch and immunological tolerance	2
8	Immune effector mechanisms	Complement system, Cytokines	3
9	Autoimmunity	Types of autoimmune diseases	2
10	Hypersensitivity reactions	Type I, II, II and IV, hypersensitivity reactions	2

11	Immune response to infectious diseases and tumor immunity	Viral, bacterial, protozoan diseases, parasitic infections	4
12	Immunodeficiency diseases	Primary and secondary immunodeficiency diseases, Acquired immunodeficiency syndrome (AIDS)	2
13	Antigen- antibody interactions	Theory, cross reactivity, precipitation reactions, agglutination reactions, RIA, ELISA, Western blotting, immunofluorescence,	4
14	Antigen antibody interaction in diagnostics and therapeutics	Active and passive immunization, vaccines, types of vaccines, adjutants, hybridoma technology, antibody engineering	3
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (class test, PBL)
Total	**100**

Project based learning: Students will be asked to search and identify relevant topics related to immunological techniques and/or Immunological disorders which will be further summarized by the student either in the form of a presentation or report. This activity will help students to gain more knowledge related to application of Immunological assays/significance of a healthy immune system.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	***Immunology (3rd edition),*** *Janus Kuby, W.H. Freeman and company*
2.	**Antibodies A laboratory Manual** Harlow and David Lane, Old spring Harbor Laboratory
3.	**Immunology – A Short Course**, Richard Coico, *et al*. 5th Ed., Wiley – Liss, 2003.
4.	**Immunology, 4th Ed** Richard Hyde. Lippincott Wilkins & Wilkins,.
5.	**Microbiology & Immunology Online.** Richard Hunt. Univ South Carolina, School of Medicine, http://pathmicro.med.sc.edu/book/immunol-sta.htm

Detailed Syllabus

Lab-wise Breakup

Course Code	15B17BT474	**Semester** Even	**Semester 6** **Session** 2023 -2024 **Month from** January to June
Course Name	Immunology Lab		
Credits	1	**Contact Hours**	2

Faculty (Names)	**Coordinator(s)**	Dr. Rachana
	Teacher(s) (Alphabetically)	Prof. Reema, Dr. Rachana, Dr. Shalini

COURSE OUTCOMES		**COGNITIVE LEVELS**
C374.1	Demonstrate basic immunological techniques.	Understand (Level C2)
C374.2	Select immunological techniques for quantifying antigen/ antibody in the given sample.	Apply Level (C3)
C374.3	Develop antibody/antigen affinity-based ELISA assay.	Apply Level (C3)
C374.4	Inspect innovative immunological techniques.	Analyse Level (C4)

Module No.	Title of the Module	List of Experiments in the module	CO
1.	Principles of Immunology	General Introduction and familiarization to Immune System and Immunology lab	CO1
2.	Detection and Quantification of antigen/ antibody concentration	Detection and quantification of antigen/antibody concentration, by Latex Agglutination Test.	CO1

3.	Detection and Quantification of antigen/ antibody concentration	Determination of Antigen concentration using precipitin assay.	CO2
4.	Quantification of antigen/ antibody concentration	Quantification of antibody concentration using Single Radial Immuno Assay (SRID)/Mancini's test and Affinity column chromatography.	CO2

5.	Demonstrate relationship between different antigens	Demonstrating relationship among the antigens using Ouchterlony Double Diffusion Assay (ODD).	CO2
6.	Demonstrate relationship between different antigens	Analysing antigens from their complex mixture (serum) using Immunoelectrophoresis.	CO4
7.	Principles of diagnostic assays	Detecting presence of antigen using DOT-BLOT ELISA, the basic principle behind pregnancy and other diagnostic kits.	CO3
8.	Principles of diagnostic assays	Demonstrating the principle and functioning of pregnancy kit.	CO4
9.	Principles of diagnostic assays	Estimation of antigen concentration using Indirect ELISA	CO3
10.	Advanced technology for diagnostics and research	Virtual lab - Demonstration of FACS analysis: Differential staining and isolation of different WBCs using FACS https://www.youtube.com/watch?v=e407J69aMvc	CO4
11.	Advanced technology for diagnostics and research	Virtual lab - Measurement of Phagocytosis by Phagocytes https://www.jove.com/v/3588/determining-the-phagocytic-activity-of-clinical-antibody-samples	CO4
PBL based learning: The experiments for this course are designed in a way that the students will learn from the scratch to purify the antibodies from crude serum and will learn to use them for different applications such as detecting and identifying antigens in unknown samples. Students also learn latest techniques like ELISA which are used diagnosing pregnancy and HIV etc.			

Evaluation Criteria	
Components	**Maximum Marks**
Lab Record	15
Performance based test	15
Mid term viva voce	20
End term viva voce	20
Day to day evaluation	20
Attendance	10
Total	**100**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	J.A Owen, J.Punt, S. A. Stanford, P. P Jones, Janus Kuby Immunology (7th edition), W.H. Freeman and company, 2009
2.	Harlow and D.Lane, Edward A. Greenfield Ed, Antibodies: A laboratory Manual, 2nd edition Old spring Harbor Laboratory, 2014

Detailed Syllabus

Lecture-wise Breakup

Course Code	**20B16CS326**	**Semester EVEN**	**Semester VI Session** 2023 -2024 **Month from JAN-JUN**
Course Name	Front End Programming		
Credits		**Contact Hours**	1-0-2

Faculty (Names)	**Coordinator(s)**	Dr. Amanpreet Kaur (J62), Dr. Shailesh Kumar(J128)
	Teacher(s) (Alphabetically)	Dr. Amanpreet Kaur, Dr. Bhawna Saxena, Dr. Lakshmi,Dr. Megha Rathi, Dr. Niyati Aggrawal, Dr.Shailesh Kumar

COURSE OUTCOMES		**COGNITIVE LEVELS**
C305-11.1	Demonstrate new technologies by applying foundation paradigms	Understanding [Level 2]
C305-11.2	Build strong foundations for basic front end tools & technologies thereby making them understand the application development lifecycle.	Apply [Level 3]
C305-11.3	Develop elegant and responsive Front-end by leveraging latest technologies	Apply [Level 3]
C305-11.4	Explain activity creation and Android UI designing	Understanding [Level 2]
C305-11.5	Develop an integrated mobile application to solve any complex real time problem	Create [Level 6]

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Object Oriented Programming Concepts	Objects, Classes, Abstraction, Encapsulation, Inheritance, Polymorphism	1
2.	Introduction to basic front end techniques	HTML 5, CSS 3, Javascript, jquery, bootstrap	3
3.	Java Fundamentals	Decision Making, Loop Control, Operators, Array, String, Overloading, Inheritance, Encapsulation, Polymorphism, Abstraction	2
4.	Advanced Front End Programming Concepts	Storing and retrieving data, Python Programming Concepts, Python for developing Android Application.	2
5.	Designing Android Application	Android development lifecycle, Learning UI and layout, controller, component, Directives, Services & views.	3
6.	Android with Database	Data base Application Development	2
7.	Privacy & Security Issues	Security Issues with Android Platform	1
		Total number of Lectures	**14**

Evaluation Criteria	
Components	**Maximum Marks**
Mid Semester Examination	30
End Semester Examination	40
TA	30 (**Attendance-10,Assignments/ Class Test/ Quiz/ LAB Record -05, Project-15**)
Total	**100**

Project based learning: In this subject students will learn the latest front end technology. After completing the subject, each student in a group of 3-4 will be able to create a mobile application.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
Reference Books:	
1.	Schildt, H. (2014). Java: The Complete Reference. McGraw-Hill Education Group.
2.	Mughal, K. A., & Rasmussen, R. W. (2016). A Programmer's Guide to Java SE 8 Oracle Certified Associate (OCA). Addison-Wesley Professional.
3.	Gaddis, T., Bhattacharjee, A. K., & Mukherjee, S. (2015). Starting out with Java: early objects. Pearson.
Text Books:	
4.	Duckett, J. (2014). Web Design with HTML, CSS, JavaScript and jQuery Set. Wiley Publishing.
5.	Shenoy, A., &Sossou, U. (2014). Learning Bootstrap. Packt Publishing Ltd.
6.	Lee, W. M. (2012). Beginning android for application Development. John Wiley & Sons.
7.	Hardy, B., & Phillips, B. (2013). Android Programming: The Big Nerd Ranch Guide. Addison-Wesley Professional.

Detailed Syllabus
Lecture-wise Breakup

Course Code	**24B12HS312**	**Semester** Even	**Semester: VI** **Session:** 2023-2024 **Month from Jan** 2023 to June2024
Course Name	**FILM STUDIES**		
Credits	**3**	**Contact Hours**	**2-1-0**

Faculty (Names)	**Coordinator(s)**	**Dr Mohammed Danish Siddiqui**
	Teacher(s) (Alphabetically)	**Dr Mohammed Danish Siddiqui**

CO Code	**COURSE OUTCOMES**	**COGNITIVE LEVELS**

CO1	Label with knowledge and reflect upon the articulation of a film's content, form and structure and genre	Remembering level(C1)
CO2	Demonstrate the formal and stylistic elements of film and extend an understanding of film language and terminology, and analyze the ways in which that this language constructs meaning and ideology	Understanding level(C2)
CO3	Applying Critical film theories to be able to identify significant movements and articulate key concepts.	Applying level (C3
C04	Discover the familiarity with diverse forms of the moving image, including, for example, the feature film, experimental and avant-garde cinema, video art and moving image installation, television, and digital media	Analyzing level(C4)
C05	Evaluate film forms and its historical and cultural contexts. Explain how a film offers a set of social, political, and cultural ideas and questions through form and content	Evaluating Level (C5)
CO6	Develop a competency in discussing the ways in which film is influenced and shaped by individuals, movements, institutions, and technologies with local, national, transnational, and global dimensions	Creating level(C6)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction of Film and Film Theorists	History of Film: role of Film in human culture, elements of film, Film Theories and Theorist, Language of Film, Camera, and its Language.	5
2.	Components of Cinema	Color meaning in Cinema, Film Genre, Editing, Intertextuality, History of Cinema: German Expressionism, Aesthetics of Neo -Realism, French new wave, Concept of Third Cinema, Film Noir, Indian cinema, OTT Platforms: NETFLIX, Amazon Prime Video, Disney Hot Star, EROS	5
3.	Critical Film Theory	An Introduction to Critical Film Theories, Apparatus theory, Screen theory, Queer Theory, Cognition, Auteur theory, Mise En Scene, Male Gaze	5
4.	Reception of Film	Film and reception theory, Spectatorship as bridge,	2
5.	Film Reading	Bride and Prejudice, Gone with the Wind, Avatar: The way of Water	6
6	Essays on Film	Andrea Bazin: The Evolution of the Language of Cinema Gilbert Harman: Semiotics and the cinema Laura Mulvey: Visual Pleasure and the Narrative Cinema Bill Nicholas: The Voice of the Documentary	5
		Total number of Lectures	**28**

PBL Component: The Project is to be done in a group of 3-4 Students. Students will be asked to write a Proposal with a well-researched technical report on the nature and critical appraisal of film by identifying the themes and purpose of film and its elements and its application in the real world**.**

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	Vallejo, Amy, Film Studies: The Basics, Routledge London, and New York 2005.
2.	Joret Blandine: Studying Film with Andre Bazin, Amsterdam university Press
3.	Nelmes, Jill: An Introduction to Film Studies, Routledge London 1998.
4.	Doughty Ruth and Deborah Shaw: FILM ---The Essential Study Guide, Routledge London and New York 2009.

Statistics (16B1NMA633)

Course Description

Course Code	16B1NMA633	**Semester:** Even	**Semester** VI **Session** 2023-24 **Month from** Jan 2023 - June 2024
Course Name	Statistics		
Credits	3	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**	Dr. Anuj Bhardwaj	
	Teacher(s) (Alphabetically)	Dr. Anuj Bhardwaj	

COURSE OUTCOMES		**COGNITIVE LEVELS**
After pursuing the above-mentioned course, the students will be able to:		
C302-1.1	recall measures of central tendency and dispersion for visualizing the data.	Remembering (C1)
C302-1.2	explain skewness, kurtosis, correlation, regression and sampling theory.	Understanding (C2)
C302-1.3	apply skewness, kurtosis, correlation, regression and estimation theory to find the confidence interval.	Applying (C3)
C302-1.4	analyze small and large sample data by using the test of hypothesis.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Descriptive Statistics	Graphical representation such as histogram, frequency polygon, AM, GM, HM, median, mode, measures of dispersion, skewness and kurtosis such as central and non-central moments, population variance, β, γ coefficient, Box and Whisker plot.	8
2.	Correlation and Regression Analysis	Scatter diagram. Karl Pearson's and Spearman's rank correlation coefficient, regression lines, regression coefficient and their properties.	5
3.	Sampling and Sampling Distributions	Populations and Sample, random sample, statistics, sample moments, law of large numbers, central limit theorem, distribution of sample mean and sample variance, MGF, Chi-square distribution, F-distribution, Student's *t* distribution.	7
4.	Parametric Point Estimation	General concept of point estimation, methods of moments and maximum likelihood for finding estimators, unbiasedness, consistency, efficiency, UMVUE, Cramer-Rao inequality, sufficiency, factorization theorem, completeness, Rao-Blackwell theorem.	10
5.	Parametric Interval Estimation	definition of confidence interval, pivotal quantity, confidence interval for mean, variance, difference of means and difference of variances for small and large samples.	5
6.	Hypothesis Testing	The basic idea of significance test. null and alternative hypothesis, type-I and type II errors, testing of small and large samples for mean, variance, difference in means, and difference in variances.	7
Total number of Lectures			**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Quiz, Assignments, Tutorials)

Total	**100**
Project based learning: Students in a group of 4 will collect sample data set and make simple regression models. They will validate the model by hypothesis testing. By this student will be able to make simple linear regression models and validate it.	
Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	**S. Biswas, G. L. Sriwastav**, Mathematical Statistics: A Textbook, Alpha Science International, 2011.
2.	**W. Feller**, An Introduction to Probability Theory and its Applications Vol. I, 3rd Edition, 2011.
3.	**V. K.Rohatgi**, An Introduction to Probability Theory and Mathematical Statistics Wiley Eastern, 1984
4.	**R. V. Hogg, A. T. Craig,** Introduction to Mathematical Statistics, McMillan, 1971
5	**AM. Mood**, **F. A. Graybill, and D. C. Boes**, Introduction to the Theory of Statistics McGraw Hill, 1974
6.	**Des Raj & Chandak**, Sampling Theory, Narosa Publishing House, 1998.
7.	**Sheldon Ross**, A First Course in Probability, 10th edition, Pearson Education Asia, 2018.
8.	**Meyer, P.L**, Introductory Probability and Statistical Applications Addison-Wesley Publishing Company, 1965.

Detailed Syllabus

Lecture-wise Breakup

Course Code	16B1NPH636	**Semester: Even**	**Semester: VI Session** 2023 -2024 **Month from:** January 2024 to June 2024
Course Name	**Medical & Industrial Applications of Nuclear Radiations**		
Credits	3	**Contact Hours**	3-0-0
Faculty (Names)	**Coordinator(s)**	Dr. Sandeep Mishra	
	Teacher(s) (Alphabetically)	Dr. Sandeep Mishra Dr. Vaibhav Subhash Rawoot	

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Define nuclear structure, properties and reactions; Nuclear magnetic resonance process.	Remembering (C1)
CO2	Explain models of different nuclear imaging techniques; CNO cycle; principle of radioactive decays.	Understanding (C2)
CO3	Apply knowledge of nuclear reaction mechanisms in atomic devices, dosimetry, radiotracers, medical imaging, SPECT, PET, tomography etc.	Applying (C3)
CO4	Analyze different radiocarbon dating mechanisms and processes.	Analyzing (C4)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Nucleus, Radioactivity & Dating	Structure of matter**;** Nucleus: Nuclear Size, Structure and forces; Binding energy and Nuclear stability, mass defect; Nuclear reaction: Fission, Fusion, chain reaction. Nuclear fusion in stars, Formation of basic elements: proton-proton chain, CNO cycle, Hydrostatic equilibrium; Applications: atom bomb, hydrogen bomb, nuclear power plants, Nuclear reactor problems, precautions. **ii)** Radioactive decay, kinetics of radioactive decay, Types of radioactive decay and their measurement, Half life, decay constant, Population of states, Production of radionuclides. Radioactive dating, Radiocarbon dating: Formation, mechanism of dating, carbon cycle, radiocarbon clock and applications, advantages, disadvantages, precautions; Other dating techniques, protein dating, accuracy in dating;	17
2.	Radiation and matter interactions	Dosimetry and applications: Interaction of Radiation of matter: Biological effects of radiations; dosimetry, working principles, Tools and radiotherapy, Doses, Radioisotopes, Radiotracers;	09
3.	NMR and MRI	Nuclear Magnetic Resonance: General Introduction to Magnetic Resonance, Reference Frame; RF Pulses, Larmor precision, Basic principles of NMR & ESR Spectroscopy, Nuclear shielding, Chemical shifts; Couplings, Nuclear	09

		Imaging; 1D,2D, 3D Images, Application of NMR in medical industry as MRI, working MRI, Types of different MRI, Applications of NMR in quantum computation;	
4.	Nuclear Medicine and Nuclear Imaging	Nuclear Medicine and Nuclear imaging techniques, preclinical imaging, detector designing, photon counting, Medical imaging using $\beta+\gamma$ coincidences, SPECT AND PET: Radiation tomography, applications;	05
		Total number of Lectures	**40**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25
Total	**100**

Project Bad Learning: Different groups of students with 5-6 students in each group may be formed and these groups may be given to complete a task like identifying common applications to nuclear science, recent developments in medical applications, etc. These problem domains (elemental and content analysis, materials modification, radiation gauging, solid/liquid Interface, and heart imaging) may be also chosen based on their potential interest to students. Students may be given a task of presenting the working of devices like MRI, PET scan, X-rays and other imaging techniques. Within each of these problem domains, the students will learn to work in a team. It will improve their analytical skills and the students will learn to achieve their common goal through mutual discussion and sharing of knowledge, information & understanding.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	Basic Sciences of Nuclear Medicine; Magdy M K halil, Springer
2.	Physics and Radibiology of Nuclear Medicine; Gopal B Saha, Springer
3.	A. Beiser, Concepts of Modern Physics, Mc Graw Hill International.
4.	Radionuclide Techniques in Medicine, JM McAlister (Cambridge University Press, 1979).
5.	Nuclear Physics; S.N.Ghosal

Employability: In this course, students learn about the principles and mechanism of working of various medical imaging instruments like MRI, SPECT, PET, PETCT. This course enhances the skill among the students to develop new theories, mechanisms for today's medical industry. By obtaining knowledge in this domain, students may get job opportunity in medical and biomedical industries like nuclear pharmacy, nuclear medicine radiology etc.

Detailed Syllabus

Lecture-wise Breakup

Course Code	16B1NBT634 ELECTIVE	**Semester** EVEN	**Semester VI Semester Session** 2022 - 2023 **Month from** January to June
Course Name	Genetic Disorder and Personalized Medicine		
Credits	4	**Contact Hours**	4

Faculty (Names)	**Coordinator(s)**	Dr. Sujata Mohanty
	Teacher(s) (Alphabetically)	Dr. Sujata Mohanty

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO1	Explain and interpret genetic test results to understand disease etiology and mode of inheritance	Understand Level (C2)
CO2	Develop the concept of Personalized Medicine and integrate information from Human Genome Project databases	Apply Level (C3)
CO3	Analyze the role of population and quantitative genetics for genetic disorders	Analyze Level (C4)
CO4	Assess the genetic counseling process and its impact from a cultural, ethical and psychosocial perspective	Evaluate Level (C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Introduction to Genetic Disorder and Principles of their Inheritance**	**Introduction to Medical Genetics, Genetic Disorder and Concern, Clinical Features, Genetic Principles to Understand Disease Etiology, and Mode of Inheritance, Pedigree analysis and carrier screening**	**08**

2.	Genetic Screening and DNA Banking	Preventive Genetics; DNA Banking and Clinical DNA Testing, Cytogenetic, Molecular and Biochemical Common as well as Modern Technology based Genetic Tests and their Results Interpretation	08
3.	Population and Quantitative Genetics	Application of population genetics in genetic risk calculation within Family/Population, heritability factor estimation	06
4.	Case studies	Case studies; Epigenetics, Uniparental disomy, Mosaicism, Inborn errors of metabolism, cancer genetics etc.,	06
5.	Human Genome Projects	Human Genome Projects and Outcomes: Initial Reference Genome, 100,000, Encode, Gencode and the future prospects, Integration of genomic information in Biomedical Sciences, Related Databases	06
6.	Concept of Personalized Medicine	Personalized Medicine, Study of Genetic resources (OMIM, Gene tests, Gene clinics etc.)	04
7.	Genetic counseling	The Genetic Counseling Process and Its Impact from a Cultural, Ethical and Psychosocial Perspective	04
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment 1, Class Test, assignment 2)
Total	**100**

Project Based Learning:

Students after learning the modes of inheritance, will do small projects on various case studies with regards to appropriate genetics screening, carrier screening, % of transmission risk and also will make the family pedigree chart. In addition, students will do projects on comparative genomics using the available genomic information of biomarkers associated with genetic disorders and can understand the concept of Personalized Medicine.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)	
1.	A.J.F. Griffiths, S.R. Wessler, R.C. Lewontin, S.B. Carroll, *Introduction to Genetic Analysis* ,12th Ed, WH Freeman, 2020
2.	**Peter D Turnpenny, Sian Ellard and Ruth Cleaver, *Elements of Medical Genetics and Genomics*, 16th Edition, Elsevier, 2021**
3.	M.R. Speicher, A.G. Motulsky, and S.E. Antonarakis (Eds) *Vogel and Motulsky's Human Genetics*. Berlin Heidelberg: Springer, 2010
4.	S. Gersen, M. B. Keagle (Eds), *The Principles of Clinical Cytogenetics*, Humana Press, 2015
5.	C. Szalai (Eds), *Genetics and Genomics*, 1st Edition, Tipotex, 2014
6.	E.S. Tobias, M. Connor, M.F. Smith, *Essential Medical Genetics*, 6th Ed, John Wiley & Sons, 2011
7.	***Genetic disorder and related databases*(e.g. *Indian Genetic Disease Database*(http://www.igdd.iicb.res.in/IGDD/home.aspx, *Rare Disorder by Ministry of health and family welfare*(*https://mohfw.gov.in/diseasealerts/rare-diseases*), *Clinical genomic databases*(*https://research.nhgri.nih.gov/CGD/*)**
8.	Current research articles relevant to this subject will be provided as study materials and discussed in the class.