

**Jaypee Institute of Information
Technology**

M.TECH Biotechnology

SEMESTER I

Detailed Syllabus
Lecture-wise Breakup

Course Code	17M11BT111	Semester Odd	Semester VII Integrated/ M.Tech I Session 2023 -2024 Month from August -December
Course Name	Biomolecules and cell communication		
Credits	3	Contact Hours	3

Faculty (Names)	Coordinator(s)	Dr. Reema Gabrani
	Teacher(s) (Alphabetically)	Dr. Reema Gabrani

COURSE OUTCOMES		COGNITIVE LEVELS
C110.1	Explain the signal molecules and major cell signaling pathways	Understand Level (C2)
C110.2	Analyze cell signaling pathways in normal and diseased conditions	Analyze Level (C4)
C110.3	Interpret the mechanisms and regulation of cell cycle and cell death	Understand Level (C2)
C110.4	Analyze the therapeutic drug targets for cancer	Analyze Level (C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Signal molecules	Cytokines and Hormones, Growth factors, neurotransmitters, extracellular matrix components as signaling molecules; autocrine, paracrine, juxtacrine and endocrine signaling	3
2.	G-protein linked signaling pathways	G Protein-Coupled Receptors, Heterotrimeric G Proteins, Second messengers, Effector enzymes, Mechanism of transduction, Switching Off and Desensitization of Receptors, Visual transduction pathway	8
3.	Signaling mediated by enzyme linked cell surface receptor	Photoreceptor development in Drosophila, Ras to MAP kinase, Phosphoinositide-3-kinase and signaling through insulin	8

		receptor, JAK-STAT pathway, Signal Transduction via Integrins	
4.	Nuclear receptor based signaling	Classification and Structure of Nuclear Receptors, Signaling by steroid hormones, Retinoids, Vitamin D3, and the T3-Hormone, Mechanisms of Transcriptional Regulation by Nuclear Receptors	4
5.	Bacterial Chemotaxis	Two-component signaling pathway, histidine kinase associated receptor, Adaptation, Chemotaxis in pathogenicity, symbiotic associations and biofilm	3
6.	Cell cycle regulation and cell death	Cyclin-CDK variation, Checkpoint signaling, Ubiquitin proteasome proteolytic system, Intrinsic and Extrinsic apoptotic pathways	8
7.	Malfunction of Signaling Pathways and Tumorigenesis	Hallmarks of cancer, Developmental pathways and cancer: Notch signalling from Drosophila to humans, Wnt signalling, Hedgehog pathway; Epigenetic changes in cancer, Signalling pathways as therapeutic targets, Analysis of signalling events via case studies	8
Total number of Lectures			42
Evaluation Criteria			
Components		Maximum Marks	
T1		20	
T2		20	
End Semester Examination		35	
TA		25 (Presentation, Assignments) PBL	
Total		100	

PBL: Students will be given project in groups on “Bench to bedside case study in cell signaling”. The project will link the signalling molecule and its cascade to the associated disease and development of therapeutic molecule.

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.	B. Gomperts, I. Kramer, P. Tatham “Signal transduction”, 2 nd Ed. Academic Press
2.	VW Rodwell, D Bender, K M Botham, P J Kennelly, P A Weil, “Harper’s Illustrated Biochemistry”, 31st Ed. McGraw-Hill Lange

3.	Alberts, Johnson, Lewis, Morgan, Raff, Roberts and Walter, “Molecular Biology of the Cell” Sixth Edition, Garland Science Publication
4.	Refereed papers from scientific journals for case studies

Detailed Syllabus

Course Code	17M11BT112	Semester Odd (specify Odd/Even)	Semester M.Tech I Session 2023-24 Month from August-December
Course Name	Molecular Modeling and Drug design		
Credits	3	Contact Hours	LTP 3 0 0

Faculty (Names)	Coordinator(s)	Dr Chakresh jain
	Teacher(s) (Alphabetically)	Dr Chakresh Jain, DrNidhi Batra

COURSE OUTCOMES		COGNITIVE LEVELS
C112.1	Explain macromolecular structures, their Mathematical representation and visualization	Understanding (C2)
C112.2	Explain structural modeling, simulation and dynamics	Understanding (C2)
C112.3	Apply computational drug designing and simulation approaches for drug discovery	Applying(C3)
C112.4	Compare <i>in-silico</i> ligand-target interaction methods	Analyzing (C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction to Molecular Modeling	Introduction to structure of DNA, protein and RNA. Structure representation and visualization, Coordinate Systems, Potential Energy Surfaces, Software and Hardware for molecular modeling, Tools such as Swiss pdb viewer, Pymol, VMD etc.	5
2.	Quantum Mechanics and Force Fields	Electron methods and molecular orbital calculations, General Features of Molecular mechanics force field , Bond Stretching. Angle Bending. Introduction to Non-bonded	5

		Interactions. Electrostatic Interactions. Van der Waals	
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		Interactions. Hydrogen Bonding in Molecular Mechanics. Force Field Models for the Simulation of Liquid Water.	
3.	Energy Minimization and computer simulations	Minimization and Related Methods for exploring the Energy Surface. Non-Derivative method, Minimization methods. Computer Simulation Methods. Simple Thermodynamic Properties and Phase Space. Boundaries. Analyzing the Results of a Simulation and Estimating Errors.	5
4.	Molecular Dynamics and simulations	Molecular Dynamics Simulation Methods. Molecular Dynamics Using Simple Models. Metropolis Method. Monte Carlo methods, Web Based Resources, Databases and tools such as GROMACS, AMBER, & CHARMM.	6
5.	Structure Prediction	Principles of structure prediction, comparative modeling and protein folding, Comparative and <i>ab-initio</i> modeling, CASP, validations, Projects such as ROSETTA, protein folding at home.	6
6.	Drug designing	Introduction to drug discovery and drug development, Rational approach to drug design, Approaches to lead optimization such as conformation restriction, pharmacophore etc. Designing drugs against enzymes and receptors, Computer Aided Drug Design methods. ADMET, QSAR Tools and databases such as AUTODOCK, MOLEGRO, Drug Bank etc.	16
Total number of Lectures			43

Evaluation Criteria

Components Maximum Marks

T1 20

T2 20

End Semester Examination 35

TA 25 (Assignment-1, MCQ, Project, Presentation)

Total 100

PBL: Students will be assigned the topic under PBL to explore for molecular visualization, modeling and docking techniques and its applications in drug designing through computational resources (databases/tools) towards drug-disease interaction.

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. Andrew R leach, V.J Gillet, "An introduction to Chemoinformatics" Springer
pumodel of publication, 2007

2. Gasteiger Johann, "Chemoinformatics A text book "John Wiley, 2008

3. Andrew R. Leach, "Molecular Modeling principles and applications" Pearson
Education, Second edition, 2001

4. Refereed papers from scientific journals

Detailed Syllabus
Lecture-wise Breakup

Course Code	17M12BT11 6	Semester Odd	Semester X Session 2023 -2024
Course Name	Regulatory affairs		
Credits	3	Contact Hours	3

Faculty (Names)	Coordinator(s)	Dr Shweta Dang
	Teacher(s) (Alphabetically)	Dr Shweta Dang

COURSE OUTCOMES		COGNITIVE LEVELS
CO120.1	Explain regulatory markets and agencies; preclinical and clinical trials	Understanding (Level 2)
CO120.2	Analyze the guidelines for approvals of new drugs/biologics	Analyzing (Level 4)
CO120.3	Compare innovator and generic pharmaceutical industry with Patent and Non patent exclusivity	Evaluating (Level 5)
CO120.4	Interpret ICH guidelines applicable to drugs and biotechnology based therapeutic products.	Understanding (Level 2)
CO120.5	Assess regulatory approvals via related case studies	Evaluating (Level 5)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction To Regulatory agencies	CDSCO, India USFDA, USA EMA, European Union TGA, Australia	2
2.	Introduction To Pharmacopoeias and Monographs	Indian Pharmacopoeia (IP) British Pharmacopoeia (BP) United States Pharmacopoeia (USP) International Pharmacopoeia (Int. Ph.) European Pharmacopoeia (Eur. Ph.)	2
3.	Safety and efficacy of drugs/biologics, preclinical studies, Clinical phases	Case studies of safety issues in history, Preclinical requirements, acute and chronic toxicity, dose determination, NOAEL, phases of clinical trials (I,II III)	4

4.	Approval pathways for Drugs/ biologic/ biopharmaceuticals in USFDA	FDA,CDER, CBER, IND, NDA, BLA, recalls, Phase IV, filing procedures	7
5.	Approval pathways for Drugs/ biologic/ biopharmaceuticals in europe	EMA, market authorization application. Centralized, Decentralized, National, Mutual recognition procedure. CTD, eCTD, NCTD Submissions, ICH M4	4
6.	Approval pathways for Drugs/ biologic/ biopharmaceuticals in India and Japan	Central Drug Standard Control Organization, INDIA, Pharmaceutical and Medical Devices Agency of Japan	3
7.	Generics and Biosimilars	Hatch Wax man Act (Para I,II,III and IV filings), BPCI act USA, CDSCO guidelines, EMA guidelines, Status of guidelines	6
8.	Non Patent Exclusivities	Orphan Drug law, Market exclusivity, Pediatrics exclusivity, First to file exclusivity	5
9.	ICH Guidelines for Biologics and Good Clinical Practices	Overview of ICH guidelines, ICH Q5E, ICH Q5C, ICH Q6E, ICH Q7A, ICH Q7B, ICH Q8,9,10	5
11.	Case Studies	Relevant Case studies	4
Total number of Lectures			42
Evaluation Criteria			
Components		Maximum Marks	
T1		20	
T2		20	
End Semester Examination		35	
TA		25 (Class Test, Assignment I and II)	
Total		100	
PBL: To find approved drug molecule and find its patent and non patent exclusivity from Regulatory websites			

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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.	FDA Regulatory Affairs, David Mantos, Taylor and Francis; 2014 (3 rd edition)
2.	Biosimilars Regulatory, Clinical, and Biopharmaceutical Development Editors: Gutka, Hiten J., Yang, Harry, Kakar, Shefali , Springer 2018

3.	The Common Technical Document (CTD), Internet: http://www.ich.org/
4.	ICH Guideline: The Common Technical Document for the Registration of Pharmaceuticals for Human Use: Quality - M4Q; Quality Overall Summary of Module 2, Module 3: Quality, Internet: http://www.ich.org/MediaServer.jserv?@ ID=556&@ MODE=GLB

Biosensors (17M12BT111)
Course Description

Course Code	17M12BT111	Semester Odd	Semester MSc/Integ. Mtech III/VII Session 2023-2024 Month from: July-December
Course Name	Biosensors		
Credits	3	Contact Hours	3

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

COURSE OUTCOMES		COGNITIVE LEVELS
CO1	Explain principle and working of biosensors and characterization techniques	Understand Level(C2)
CO2	Evaluate different methods of immobilization and their effect on biosensor performance	Evaluate Level (C5)
CO3	Analyze performance of a biosensor for disease diagnosis, environmental pollution, pathogen quantification	Analyze Level (C4)
CO4	Design strategy for fabrication of a given biosensor with high sensitivity and wide detection range	Create Level (C6)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction:	Sensors and biosensors, definitions, types of sensors, markets, target analytes, glucose and other medical sensors	2
2.	Biosensor Advancements and nanotechnology	First-, second-, third generation biosensors, Nanotechnology and present day biosensors	3
3.	Basic Design Considerations	Calibration, dynamic Range, signal to noise, sensitivity, selectivity, interference.	3
4.	The biological component	Whole cell sensors, enzymes – sensing substrates or inhibitors, antibodies (Mab, Fab). And other binding proteins, oligonucleotides and aptamers.	3

5.	Types of biosensors	Optical biosensors, Electrochemical biosensors, Piezoelectric biosensor, Calorimetric biosensors	8
6.	Immobilization method	Non-covalent immobilization - entrapment and multipoint electrostatic attachment. Covalent attachment via thiol, amino and hydroxyl groups. Affinity interactions - avidin/biotin, , complementary oligonucleotides.	4
7.	Techniques for sensing : Physical and chemical	Absorbance, fluorescence, chemi/bioluminescence and phosphorescence, Surface Plasmon Resonance (SPR), quartz crystal microbalance, cyclic voltammetry	8
8.	Sensor stabilization	Storage and operational stability. Polyols, polymers and low Mw compounds as stabilizing agents for drying and long term storage. Stabilization mechanisms.	3
9.	Applications	Pharmaceutical, agricultural, food safety, biomedical applications, food processing: state of the field, market potential, unique design criteria and needs, current sensors in use.	8
Total number of Lectures			42

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Class Test, Presentation)
Total	100

PBL: Students would be presenting and/or submit report in a group of 3-4, about biosensors for various application , their fabrication, performance characterization.

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.	Ligler, F.S. and Rowe Taitt, C.A. 2002. Optical Biosensors: Present & Future. Elsevier, The Netherlands. ISBN: 0-444-50974-7.
2.	Yang, V.C. and T.T. Ngo. 2000. Biosensors and Their Applications. Kluwer Academic/Plenum Publishers, New York, NY. ISBN: 0-306-46087-4.
3.	Recent research articles

Elective for B.tech /M.Tech Dual degree / Specialization course
Detailed Syllabus
Lecture-wise Breakup

Course Code	19M12BT113	Semester: Odd	Semester: DD-IX & M.Tech-I Session 2023 Month: July – December, 2023
Course Name	Sustainable Agriculture		
Credits	3	Contact Hours	3

Faculty (Names)	Coordinator(s)	Prof. S Krishna Sundari
	Teacher(s) (Alphabetically)	Prof. S Krishna Sundari

COURSE OUTCOMES		COGNITIVE LEVELS
CO.1	Interpret various practices in Indian agriculture, risks, challenges and status of Indian agriculture	Understand Level Level II
CO.2	Outline appropriate certification guidelines and Economic Rules that apply for organic farming and biotechnological farm inputs	Understand Level Level II
CO.3	Relate plant nutrition requirements to soil quality and agriculture yield impacts	Apply Level
CO.4	Examine methods to promote soil health, minimize water use, and decrease pollution in farm soils	Analyze Level Level IV
CO.5	Recommend strategies to avoid degradation of soils on a farm through implementation of sustainable management practices in agriculture	Evaluate Level Level V

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Soil health	Major types of soil, Soil structure and composition, problems in soils & Soil life	2
2.	Soil degradation	Soil structural decline, factors contributing to soil degradation, mechanisms of soil degradation	4
3.	Plant nutrition	Essential requirements for plant growth, micro and macro nutrients, principles of fertilization	4

4.	Synthetic crop chemicals	Types of chemical inputs in modern agriculture, fertilizers, pesticides, insecticides, weedicides, role and mechanism	2
5.	Phytotoxicity	Factors contributing to phyto toxicity, chemical toxicity, soil pollutants, soil antagonists	4
6.	Pest and diseases in Plants	Major categories of plant diseases and associated crop issues, Pest control & Preventative measures, integrated pest management	4
7.	Sustainable ways of farming	Different methods for Sustainable ways of farming, processes involved, advantages, strategy for implementation, Introduction to Land Management programs	6
8.	Organic farming	Natural farming, Safe Cultivation techniques, Cover crops, biofertilizers, biopesticides, bioinoculants, zero chemical input agriculture	5
9.	Tools for Sustainable farming	Irrigation systems & sustainability, Weed Management, cropping seasonal variations, plantation times, crop rotation, energy farming, restoring marginal lands and brown field	3
10	Agriculture economics	Economic principles of agriculture, Financial sustainability & planning, Integrated farmer community dynamics	3
11	Agriculture regulatory matters	Certification & guidelines for crop inputs (organic, biological inputs, hormones and others), IPR in agriculture, Role of Regulatory bodies	3
Total number of Lectures			42

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (...)
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)

- Organic Agriculture - A Global Perspective, Editors: Paul Kristiansen, Acram Taji and John Reganold, CSIRO PUBLISHING, Australia

2.	Sustainable Agriculture– Beyond Organic Farming, editor: Sean Clark, MDPI, Basel, Switzerland,
3.	Sustainable Agriculture, From Common Principles to Common Practice, Edited by Fritz J. Häni, László Pintér and Hans R. Herren, Published by the International Institute for Sustainable Development, ISBN 978-1-894784-05-4
4.	Technical reports of USDA, UNDP, ICAR
5.	Articles from Journals such as: Journal of Sustainable Agriculture; Agriculture, ecosystem & Environment; Agroecology and Sustainable Food Systems

Detailed Syllabus
Lecture-wise Breakup

Course Code	17M12BT118	Semester Odd (MSc Microbiology 111)	Semester . III. Session 2022-2023 Month from July – Dec 2023
Course Name	Product Development in Biotechnology		
Credits	3	Contact Hours	3

Faculty (Names)	Coordinator(s)	Prof. Neeraj Wadhwa
	Teacher(s) (Alphabetically)	Prof. Neeraj Wadhwa

COURSE OUTCOMES		COGNITIVE LEVELS
CO1	Outline various processes relevant for Biobusiness	Understand Level (C2)
CO2	Compare marketing techniques and related ethics	Apply Level (C2)
CO3	Select appropriate technology for the production of Biological products	Understand Level (C3)
CO4	Explain financial, regulatory, health policy aspects for biobased industries	Understand Level (C2)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Biotechnology Industries overview	Biotechnology as a function of science and business , Functional units Company structure and functions Emerging technology and technical convergences issues	5
2.	Business in the context of biotechnology Entrepreneurship-	Science/development, the idea and its development , Plant tissue culture lab-equipment- glasswares chemical requiremen--construction,techniquesin culturing and export abroad, Vermitechnology, Mushroom cultivation, single cell protein, Biofertilizer technology-production, Textile processing, leather treatment, leather industry set up Detergent industry, bakery, Unit processes in food industry	14
3.	Product development	a. Production of commercially important primary metabolites like organic acids, amino acids and alcohol & Production processes for various	12

		classes of secondary metabolites: Antibiotics, Vitamins and Steroids. b.Production of Industrial Enzymes, Biopesticides, Biofertilizers, Biopreservatives, Biopolymers, Pulp and Paper , SINGLE CELL PROTEIN & Mushroom culture, Bioremediation. Bioprocess strategies in Plant Cell organ culture and Animal Cell culture.	
4.	Biobusiness plans	Concerns and oppurtunities, Environmental clearances requirement from government, Quality checks and validation certificates, Packaging concerns, Policy and regulatory concerns,	6
5.	Bioremediation Bioethics and legal issues	Product development, Sustainability, Environmental concerns of product and their waste.	5
Total number of Lectures			42
Evaluation Criteria			
Components		Maximum Marks	
T1		20	
T2		20	
End Semester Examination		35	
TA		25 (Assignment)	
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.	Jordan, J. F. (2014). Innovation, Commercialization, and Start-Ups in Life Sciences. London: CRC Press.
2.	Desai, V. (2009). The Dynamics of Entrepreneurial Development and Management. New Delhi: Himalaya Pub. House.
3.	Cruger,Wulf and Anneliese Crueger, “Biotechnology: A Textbook of Industrial Microbiology”, 2 nd Edition, Panima Publishing, 2000
4	Karthikeyan,S and Arthur Ruf.” Biobusiness”MJP Publication Chennai India 2009

PHYTOTHERAPEUTICS AND PHARMACOLOGY

Subject Code	17M12BT119	Semester: ODD	Semester: I Session: 2023-2024 Month from: July - Dec
Subject Name	PHYTOTHERAPEUTICS AND PHARMACOLOGY		
Credits	3	Contact Hours	3

Faculty (Names)	Coordinator(s)	1. Professor. Vibha Rani
	Teacher(s) (Alphabetically)	1. Professor. Vibha Rani

COURSE OUTCOMES		COGNITIVE LEVELS
CO130.1	Analyze the existing biotechnological techniques to develop plant-based therapeutics	Analyzing (C4)
CO130.2	Evaluate the classes, synthesis and structure functional relationship of Phyto molecules	Evaluating (C5)
CO130.3	Explain the therapeutic applications of phytochemicals	Understanding (C2)
CO130.4	Identify the current aspects of phytomedicines on toxicity and clinical trials	Applying (C3)
CO130.5	Case studies to analyze Ayurpharmaco-epidemiology	Analyzing (C4)
CO130.6	Use of bioinformatics tools and approaches to predict the molecular function of novel bioactive molecules	Creating (C6)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1	Introduction	Concepts of Phototherapeutics, Trend and market analysis, Global herbal medicine market, Herbal Sector in India	3
2	Medicinal Plants Metabolites	Introduction to metabolites, Secondary metabolites, properties and beneficial aspects.	3
3	Isolation technique extraction procedure	Pharmacology Approaches in Phototherapeutics, Bioactive guided discovery process Isolation from medicinal plants. Isolation from aromatic plants. Recants advancements in extraction	4

4	Characterization technique	Qualitative and quantitative Analysis Gas Chromatography High Performance Liquid Chromatography: (HPLC) High Performance Thin Layer Chromatography: (HPTLC)	4
5	Structure functional relationship	Bioinformatics approach in predicting structure functional relationship Mechanism of Action Unidentified Therapeutic Intakes Factors that Affect Metabolism	4
6	Therapeutic Application	Free radicals and antioxidants Plants used in Metabolic disorder Plants used in respiratory system Plants used in COVID Pandemic Plants used with antimicrobial activity. Plants used with neurodegenerative disorders Plants used in cardiovascular system.	8
7	Toxicity Issue and Clinical Trials	Current aspects of phytomedicine on toxicity and clinical trials	6
8	Case studies	Success stories, research-based case studies related to phototherapeutics	8
9	Potential risks associated and future aspects	Discussion	2
Total number of Lectures			42

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA 1, 2& 3)	25 (Class Test-1, Assignment-1&2, PBL, Case studies
Total	100

Project based learning: Each student will opt a human health issues and diseases. To make subject application based, the students will analyze uncharacterized Indian medicinal herbs and will explore their therapeutic potential and also perform market research. Various phototherapeutics concepts will be discussed by students. Students would explain the critical disease targets and mechanism of actions of selected herbs by *in silico* methods. Understanding the concepts would enhances the student's knowledge and motivation for herbal drug discovery and its continuously growing market which will help their employability into various biotechnology and health sector.

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

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|----|---|
| 1. | Plant Bioactive and Drug Discovery: Principles, Practice, and Perspectives. Valdir Cechinel-Filho (Ed.). 2012 John Wiley & Sons, Inc. |
| 2. | Phototherapeutics (Recent Progress in Medicinal Plants). S. K. Sharma, J. N. Govil, V. K. Sing. 2005. Studium Press. |
| 3. | Phytotherapies: Efficacy, Safety, and Regulation. Iqbal Ramzan (Ed.) 2015 John Wiley & Sons, Inc. |
| 4. | Recent research articles and reviews related to each module. |

BIOTECHNIQUES LAB-I

Course Code	17M15BT111	Semester Odd (Specify Odd/Even)	Semester I Session 2023-2024 Month from July- December
Course Name	Biotechniques Lab-I		
Credits	3	Contact Hours	6

Faculty (Names)	Coordinator(s)	Dr. Vibha Rani
	Teacher(s) (Alphabetically)	Dr. Priyanka Tyagi, Dr. Sujata Mohanty, Dr. Vibha Rani

COURSE OUTCOMES		COGNITIVE LEVELS
C111.1	Apply basic analytical techniques in biotechnology	Apply Level (C3)
C111.2	Develop skills in molecular biology techniques	Apply Level (C3)
C111.3	Examine and analyse gene expression	Analyze (Level C4)
C111.4	Make use of purification techniques for natural products	Apply Level (C3)

Module No.	Title of the Module	List of Experiments	CO
1.	Analytical techniques	To explore drug-protein interactions	2
2.	Molecular biology techniques	Cloning strategy: Screening of recombinants: isolate recombinant plasmid DNA from bacterial cells; Restriction enzyme digestion, separate and visualize DNA bands by agarose gel electrophoresis	4
3.	Gene expression techniques	Designing primers for amplification of gene of interest by PCR, PCR amplification, analyze PCR products; Analysis of a recombinant protein by polyacrylamide gel electrophoresis	3
4.	Purification techniques	To obtain antimicrobial compound from bacterial culture; to purify the antimicrobial compound by column chromatography; use of bioactivity-guided fractionation to analyze and quantify the compounds	3
		Total	12

Evaluation Criteria

Components	Maximum Marks
Mid-Term Viva	20
Day-to-Day (Lab record, attendance, performance)	60
Final Viva	20
Total	100
Project Based Learning: The students learn column chromatography, molecular biology, and analytical techniques and analyze gene expression which is required for the Biotech industry.	

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication, etc. Textbooks, Reference Books, Journals, Reports, Websites, etc. in the IEEE format)	
1	Introduction to Biotechnology, Laboratory Manual: http://www.austincc.edu/awheeler/Files/BIOL%201414%20Fall%202011/BIOL1414_Lab%20Manual_Fall%202011.pdf
2	Frederick M. Ausubo, Roger Brent, Robert E. Kingston, David D. Moore, J.G. Seidman, John A. Smith, Kevin Struhl (eds.) Current Protocols in Molecular Biology. John Wiley & Sons Inc; ringbou edition (December 4, 2003)
3	Molecular Biology web book- http://www.web-books.com/MoBio/
4	S. V. S. Rana, Biotechniques Theory and Practice. Rastogi Publications 2008.
5	Methods standardized in lab

Course Code	18M11G E111	Semester Odd	Semester I Session 2023-2024
Course Name	Research Methodology & Intellectual Property Rights		
Credits	2	Contact Hours	2-0-0

Faculty (Names)	Coordinator(s)	
	Teacher(s) (Alphabetically)	

COURSE OUTCOMES:		COGNITIVE LEVELS
After pursuing the above-mentioned course, the students will be able to:		
C101.1	explain the basic concepts and types of research	Understanding Level (C2)
C101.2	define a research problem, its formulation, methodologies and analyze research related information	Analyzing Level (C4)
C101.3	explain research ethics, understand IPR, patents and their filing related to their innovative works.	Understanding Level (C2)
C101.4	explain and analyze the statistical data and apply the relevant test of hypothesis in their research problems	Analyzing Level (C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Research	What is research? Types of research. What is not research? How to read a Journal paper?	3

2.	Report writing	How to write report? Use of Mendeley in report writing. How to write a research paper? Problem identification and solving.	4
3.	Ethics, IPR and Research methodologies	Research ethics, patents, intellectual property rights, plagiarism regulation 2018. Steps in research process and common methodologies to attempt solution to research paper.	8
4.	Basics of statistics and probability distributions	Basic statistical concepts. Handling of raw data, Some common probability distributions.	7
5.	Test of hypothesis and regression analysis	Hypothesis testing. Parametric and non-parametric data, Introduction to regression analysis.	8
Total number of Lectures			30
(Course delivery method: open ended discussion, guided self-study, lectures)			
<p>Evaluation Criteria</p> <p>Components Maximum Marks</p> <p>Mid Term Examination 30</p> <p>End Semester Examination 40</p> <p>Assignments 30 (Quiz, Assignments)</p> <p>Total 100</p>			
<p>Project-based learning: Students divided in small groups will be assigned topics related to patents, intellectual property rights, plagiarism, and statistics. Students can write a report/review paper and find its similarity through plagiarism software available online. Students may collect data and test the relevant hypothesis. They may study some data set and do its regression analysis. The main purpose is to expose students to a wider arena of applicable knowledge of the subject.</p>			

<p>Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)</p>
<p>Stuart Melville and Wayne Goddard, Research Methodology: An Introduction for Science & Engineering Students, Kenwyn, South Africa: Juta & Co. Ltd., 1996.</p>

Kothari, C.R., Research Methodology: Methods and Techniques, New Age International, New Delhi, 2009.

Kumar, Ranjit, Research Methodology: A Step-by-Step Guide for Beginners, 2nd Edition, Sage Publications Ltd., 2005.

Ramappa, T., Intellectual Property Rights Under WTO, S. Chand, New Delhi, 2008.

Wayne Goddard and Stuart Melville, Research Methodology: An Introduction, Kenwyn, South Africa: Juta & Co, 2001.