JAYPEEE INSTITUTE OF INFORMATION AND TECHNOLOGY

M.Tech Biotechnology

Semester I

PHYTOTHERAPEUTICS AND PHARMACOLOGY

Subject Code	**17M12BT119**	**Semester: ODD**	**Semester: I** **Session:** 2022-2023 **Month from:** July - Dec
Subject Name	**PHYTOTHERAPEUTICS AND PHARMACOLOGY**		
Credits	**3**	**Contact Hours**	**3+1**

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	25 (Class Test-1, Assignment-1&2, PBL, Case studies 1, 2& 3)
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)

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.

BIOSENSORS

Subject Code	**17M12BT111**	**Semester: Odd (specify Odd/Even)**	**Semester: I Session: 2022-23 July to Dec.**
Subject Name	Biosensors		
Credits	**3**	**Contact Hours**	**3**

Faculty (Names)	**Coordinator(s)**	1. Dr. Sudha Srivastava
	Teacher(s) (Alphabetically)	1. Dr. Sudha Srivastava

COs	**Cos description**	**Level**
CO111.1	Understand biosensor, its performance characteristics and types of biosensors and advancement thereof	Understand Level 2
CO111.2	Analyze different immobilization methods and their effect on biosensor performance	Analyze level 3
CO111.3	Evaluate performance of a given biosensor, for disease diagnosis, drug screening, pathogen and pollutant detection	Evaluate level 5
CO111.4	Design methods to improve sensitivity of the biosensor	Create Level 6

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures**
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**
PBL: Students form group or as individual and present a report on biosensor designing and performance for various applications like agriculture, environment and healthcare			

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

BIOMOLECULES AND CELL COMMUNICATION

Course Code	**17M11BT111**	**Semester** Odd	**Semester** MTech I **Session** 2021-2022 **Month from** July-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, juxtracrine 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 in receptor, JAK-STAT pathway, Signal	8

		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 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 : Notchsignalingg from Drosophila to humans, Wnt signaling, Hedgehog pathway; Epigenetic changes in cancer, Signalling pathways as therapeutic targets, Analysis of ssignalingevents 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 signaling molecule and its cascade to the associated disease and the development a of therapeutic molecule.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc. (Textbooks Reference Books, Journals, Reports, Websites in the IEEE format)	
1.	B. Gomperts, l. Kramer, P. Tatham "Signal transduction",2nd Ed. Academic Press
2.	V W Rodwell, D Bender, K M Botham, P J Kennelly, P A Weil, "Harper's Illustrated Biochemistry", 31st Ed. McGraw-Hill Lange 2018
3.	Alberts, Johnson, Lewis, Morgan, Raff, Roberts and Walter, "Molecular Biology of the Cell" Sixth Edition, Garland Science Publication,2014
4.	Refereed papers from scientific journals for case studies

MOLECULAR MODELING AND DRUG DESIGN

Course Code	17M11BT112	**Semester Odd (specify Odd/Even)**	**Semester** I **Session** 2022-2023 **Month from** June to Dec
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	

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 *in-silico* 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 Interactions. Electrostatic Interactions. Van der Waals Mechanics. Force Field Models for the Simulation of Liquid Water.	5
3.	Energy Minimizatio n 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 simulation	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 *ab-intio* 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, PBL)
Total	**100**

PBL: Students will choose any protein linked to a particular disease. How is it commercially used as a therapeutic molecule or as a target to manage the disease and its associated complications

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 Chemoinformatic" Springer model of publication, 2007
2.	Gasteiger Johann, "Chemoinformatic A text book" John Wiley, 2008
3.	Andrew R. Leach, "Molecular Modeling principles and applications" Pearson Education, Second edition, 2001

Course Code	**18M11GE111**	**Semester** Odd	**Semester** I **Session** 2022-23 **Month from** Aug - Dec 2022
Course Name	Research Methodology and Intellectual Property Rights		
Credits	2	**Contact Hours**	2-0-0
Faculty (Names)	**Coordinator(s)**	Dr. Shikha Pandey	
	Teacher(s) (Alphabetically)	Dr. Shikha Pandey	

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)	

Evaluation Criteria

Components	**Maximum Marks**
Mid Term Examination	30
End Semester Examination	40
Assignments	30 (Quiz, Assignments)
Total	**100**

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 testthe 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.

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

Stuart Melville and Wayne Goddard, Research Methodology: An Introduction for Science& Engineering Students, Kenwyn, South Africa: Juta & Co. Ltd., 1996.

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.

BIOTECHNIQUES LAB-I

Course Code	**17M15BT111**	**Semester Odd (Specify Odd/Even)**	**Semester I** **Session** 2022-2023 **Month from** July- December
Course Name	**Biotechniques Lab-I**		
Credits	3	**Contact Hours**	6

Faculty (Names)	**Coordinator(s)**	Dr. Reema Gabrani
	Teacher(s) (Alphabetically)	Dr. Chakresh K. Jain, Dr. Indira P. Sarethy, Dr. Neeraj Wadhwa, Dr. Pammi Gauba, Dr. Priyadarshini, Dr. Reema Gabrani, 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

REGULATORY AFFAIRS

Course Code	17M12BT116	**Semester Odd**	**Semester I** **Session** 2022-2023 **Month from July**19-Dec19
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**
C120.1	Explain regulatory markets and agencies; preclinical and clinical trials	Understanding (Level 2)
C120.2	Analyze the guidelines for approvals of new drugs/biologics	Analyzing (Level 4)
C120.3	Compare innovator and generic pharmaceutical industry with Patent and Non patent exclusivity	Evaluating (Level 5)
C120.4	Interpret ICH guidelines applicable to drugs and biotechnology based therapeutic products.	Understanding (Level 2)
C120.5	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 EMEA, European Union TGA, Australia	**2**
2.	Introduction To Pharmacopoeias and Monographs	Indian Pharmacopoeia (IP) British Pharmacopoeia (BP) United Sates 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/	FDA, CDER, CBER, IND, NDA, BLA, recalls, Phase IV, filing procedures	**7**

	biopharmaceutic als in USFDA		
5.	Approval pathways for Drugs/ biologic/ biopharmaceutic als in Europe	EMEA, market authorization application. Centralized, Decentralized, National, Mutual recognition procedure. CTD, eCTD, Nees Submissions, ICH M4	**4**
6.	Approval pathways for Drugs/ biologic/ biopharmaceutic als 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, EMEA 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 QSEM, ICH Q5, Q6, ICH E6, 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) PBL (5 Marks)
Total	**100**

PBL: Students will be given a project to search orange book database of USFDA and prepare a patent and non-patent exclusivity status of drugs

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.	Sandy Weinberg, GUIDEBOOK FOR DRUG REGULATORY SUBMISSIONS, 2009 (first edition), John Wiley & Sons, Inc.
2.	The Common Technical Document (CTD), Internet: http://www.ich.org/
3.	Guideline for submitting supporting documentation in drug applications for the manufacture of drug substances, February 1987, Internet: http://www.fda.gov/cder/guidance/drugsub.pdf
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.jser?@_ID=556&@_MODE=GLB