Jaypee Institute of Information Technology

M.TECH Biotechnology

Semester II

Agriculture Biotechnology

Integrated M.Tech, M.Tech, MSc (Microbio), MSc (Environment)
(Elective Course)
Detailed Syllabus

Brief Outline: National Agriculture Policy, Food security, Agriculture and climate change, formulations for Plant Growth Promotion and Combating Phytopathogens, Formulation Technology of Biocontrol Agents, Laws & Regulations governing Bioformulations, Quality control in agriculture and agri-products

COURSE OUTCOMES: Upon completion of the course, students will be able to		**COGNITIVE LEVELS**
CO.1	Infer applications of agriculture biotechnology for improved quality and productivity.	Understand Level, C2
CO.2	Relate Physiological & Molecular mechanisms of plant, its genome and extra chromosomal genetic information.	Apply Level, C3
CO.3	Apply different agricultural & biotechnological methods to meet National food security goals.	Apply Level, C3
CO.4	Connect advances in agriculture biotechnology to quality control, transgenics, regulations & agriculture policies.	Analyze Level, C4

Detailed Syllabus

Lecture-Wise Breakup

Course Code	**22M12BT111**	**Semester:**	**Semester: II, IV, Session: Even 2024** Month from: Jan to June
Course Name	**Agriculture Biotechnology**		
Credits	3-0-3	**Contact Hours**	**3**

Faculty (Names)	**Coordinator(s)**		
	Teacher(s) (Alphabetically)	1. Prof. Krishna Sundari	
Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures for the module**
1.	Overview of agriculture biotechnology & NAP	Introduction and significance of biotechnology in agriculture, Climate change and its impact on agriculture, National agriculture Policy, food security, SDG & agriculture, quality control in agriculture & GAP	6

2.	Plant growth & Physiology	Fundamentals of Plant growth, Photosynthesis and genes involved, symbiotic and non-symbiotic nitrogen fixation, Role of lectins, nod genes, nif genes, Structure, function and regulation of nitrogenase, Leg-haemoglobin, Nodulins, Molecular aspects of regulation and enhancement of nitrogen fixation, Synthesis and metabolism of hormones and plant signaling	6
3.	Plant Genome & Plant Genetic resources	Genome size and sequence components, Nuclear, cytoplasmic/organelle genomes and significance, conservation of plant genetic resources, seedbanks, germplasm conservation and cryopreservation	4
4.	Agriculture Biotechnology & methods for improved production	Concept of plasticity in plant development, Tissue culture, hybridization, Marker Assisted Breeding, Molecular markers for plant genotyping and germplasm analysis commercial application of plant tissue culture	8
5.	Plant genetic engineering & applications	Agrobacterium-plant interaction; Virulence; Ti and Ri plasmids; Opines and their significance; T-DNA transfer; Disarming the Ti plasmid, Agrobacterium-mediated gene delivery, Cointegrate and binary vectors and their utility, Chloroplast transformation: advantages, vectors systems of plant genetic engineering, Enhancing crop yield and crop quality improvement through Genetic Engineering for quality improvement: Seed storage proteins; essential amino acids, Vitamins and minerals, heterologous protein production in transgenic plants for agriculture, industry and pharmaceuticals uses, biodegradable plastics	12
6.	Agriculture policies & Regulations for GM and non-GM crops	Provisions on crop genetic resources in Indian Biodiversity Act, CBD and Cartagena protocol, Agricultural biodiversity; International Treaty on Plant Genetic Resources for Food and Agriculture (PGRFA), Global efforts for management of crop genetic resources; Strategies on PVFR and Biodiversity Acts; Impact of GE crops on Biodiversity	6
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)	
1.	Genetics, Agriculture, and Biotechnology, Walter Suza, Iowa State University Donald Lee, Published by University of Nebraska-Lincoln, Copyright Year: 2021
2.	Textbook of Agriculture Biotechnology, Nag Ahindra, Second Edition, PHI publications, 2018
3	Plant Biotechnology and Agriculture-Prospects for the 21st Century, Eds. Arie Altman, Paul Hasegawa, Elsevier publications, 2nd Edition, 2020.
4.	Research articles from refereed journals.

Detailed Syllabus

Lecture-wise Breakup

Subject Code	18M12BT112	**Semester Even (specify Odd/Even)**	**Semester Integ MTech VIII/ MTech II Session 2023-24 Month from Jan to June**
Subject Name	Nanobiotechnology		
Credits	**3**	**Contact Hours**	**3**

Faculty (Names)	**Coordinator(s)**	1. Prof. Sudha Srivastava
	Teacher(s) (Alphabetically)	1. Prof. Sudha Srivastava 2. Prof. Shweta Dang
COs	**Cos description**	Level
CO111.1	Understand nanoparticles, their properties, characterization techniques and associated health hazards	Understand Level 2
CO111.2	Apply concepts of nanotechnology in healthcare, agriculture and environment	Apply level 3
CO111.3	Apply Nano-carrier based Drug Delivery to clinical pharmacokinetics	Apply level 3
CO111.4	Analyze role of nanotechnology in development of cutting edge technologies	Analyze Level 4

Module No.	**Subtitle of the Module**	**Topics in the module**	**# of Lectures**
1.	**Introduction to Nanotechnology**	Introduction to Nanomaterials; Properties of Nanomaterials; Methods of Nanomaterials Synthesis	6
2.	**Characterization Techniques**	X-ray Diffraction (XRD analysis) Transmission Electron Microscopy (TEM), Scanning Electron Microscopy(SEM)	4

3.	**Nanotechnology in Healthcare**	Applications of nanoparticles in Healthcare : Imaging, bone regeneration, tissue engineering, Medical and Environmental	9
4.	**Nanoparticles based Drug-Delivery Systems**	Formulations, characterization techniques, Pharmacokinetics and Pharmacodynamics of Nano-carriers for Drug delivery: Lipid-based nanoparticles, Polymer-based nanoparticles, nanoemulsions, Micelles, Lipoplexes and polyplexes, protein nanoparticles Commercial therapeutic products based upon nanocarriers	14
5.	**Novel bio-technologies employing nanoparticles**	DNA sequencing using nanopores; Nanoparticles in PCR; Magnetic nanoparticles in SNP detection.	4
6.	**Environmental and health hazards of nanotechnology**	Sources – Anthropogenic and Natural nanomaterials; Environmental Risks; Health Risks – Nanoparticles toxicity, Routes of exposure, translocation and elimination.	6
		Total number of Lectures	**42**
PBL: Students will make a report and present the nanotechnological solutions for healthcare/industrial biotechnology/environmental issues/problems			

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.	Nanostructures and Nanomaterials: Synthesis, Properties and Applications; G. Cao, Imperial College Press.
2.	Nanobiotechnology in Molecular Diagnostics: Current Techniques and Applications, K.K. Jain, Horizon Bioscience.
3.	Nanostructures for Drug Delivery: Ecaterina Andronescu, Alexandru Mihai Grumezescu, Elsevier, 2017
4.	Recent Research articles

BIOPROCESS AND INDUSTRIAL BIOTECHNOLOGY

Course Code	17M11BT113	Semester Even (Specify Odd/Even)	Semester VIII / M/Tech IInd Sem Session 2023-2024 Month from Jan-May
Course Name	BIOPROCESS & INDUSTRIAL BIOTECHNOLOGY		
Credits	3	Contact Hours	3

Faculty (Names)	Coordinator(s)	Dr. Anirudh Sharma
	Teacher(s) (Alphabetically)	Dr. Anirudh Sharma

COURSE OUTCOMES		COGNITIVE LEVELS
CO1	Relate role of economic principles in biomanufacturing processes	Understanding (C2)
CO2	Apply knowledge of engineering principles in designing of bioreactors for prokaryotic and eukaryotic systems	Applying (C3)
CO3	Analyze the role of bioprocess conditions in eukaryote cell culture	Analyzing (C4)
CO4	Analyze various strategies used for production of primary and secondary metabolites	Analyzing (C4)

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction to Industrial Bioprocesses	Concept of sustainability and sustainable manufacturing, Economic assessment and concept of cost and Lang factor; non-ideal systems of cultivating microorganism and economic process scale-up	3

2.	Microbial Process Development: Solid state fermentation	Cell growth kinetics of bacteria and fungi in non-ideal reactors; Concepts of solid-state fermentation; mechanism of cell growth and indirect methods of estimating cell growth kinetics, Comparison of solid *versus* submerged fermentation; water activity; bioprocess parameters regulating solid state fermentation	8
3.	Animal cell fermentation	Animal cell metabolism: Basic understanding of substrate and by-product stoichiometry, Concept of primary cells, cell lines and cancerous cells; growth characteristics and kinetics, methods and reactors for scalable production of animal cells and derived products; Biomaterial properties for anchorage dependent cell lines; Graf reactor; Concept of 2D and 3D culture, Bioreactors in Tissue Engineering, reactor design consideration	7
4.	Plant Cell Fermentation	Importance of plant cell cultivation, Plant cell / hairy root culture, callus and shoot propagation, kinetics of cell growth and product formation, Reactors for plant cell culture- type of reactors, comparison of reactor performance, immobilized plant cell reactor.	8
5.	Algal Fermentation	Basic classification of algae, Morphology and physiology; Algal derived metabolites, methods of studying growth kinetics of chemotropic and phototropic algae, type of reactors; Lab scale photo-bioreactors- Design and engineering principles, large scale pond reactors	6
6.	Production of primary & Secondary Metabolites	Isolation, preservation and propagation of microbial culture- An industrial perspective, Process technology for production of organics acids, amino acids, alcohols, antibiotics, vitamins, nucleotide and steroids, flavors; production of industrial enzymes: protease, cellulose, amylase, lipase; Enzyme inhibitors: inhibitors of cholesterol synthesis; biopesticides, biofertilizers, bio preservatives; biopolymers; plant derived therapeutically important metabolites	10
Total number of Lectures			**42**

Evaluation Criteria Components	Maximum Marks
T1	
T2	**20**
End Semester Examination	**20**
TA	**35**
Total	**25 (Class Test-1, Presentation / Report)**
	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.	P. M. Doran. *Bioprocess Engineering Principles*. Academic Press, USA, 2002
2.	S. J. Pirt. Principles of Microbe and Cell Cultivation. Blackwell Scientific Publications, Oxford Press, London, 1975
3.	P.F. Stanbury, A. Whittakar and S. J. Hall. *Principles of Fermentation Technology*. Butterworth-Heinemann, Oxford Press, London, 1994
4.	S. Aiba, A.E. Humphrey and N. F. Millis. *Biochemical Engineering.* University of Tokyo Press, Toyko, Japan, 1973
5.	A. H. Scragg. *Bioreactors in Biotechnology: A practical approach.* Ellis Horwood Publications, New York, USA, 1991
6.	Wulf Cruger and Anneliese Crueger. *Biotechnology: A Textbook of Industrial Microbiology.* Panima Publishing Corporation, New Delhi, India, 2003

Detailed Syllabus

1. **Lab-wise Breakup**

Course Code	**17M15BT112**	**Semester** Even **(specify Odd/Even)**	**Semester** II **Session** 2023 -2024 **Month from January to June**
Course Name	**Biotechniques Lab-II**		
Credits	3	**Contact Hours**	6
Faculty (Names)	**Coordinator(s)**	Prof. Sudha Srivastava	
	Teacher(s) (Alphabetically)	Dr. Shalini Mani, Prof. Sudha Srivastava, Dr. Vibha Gupta, Prof. Vibha Rani	
COURSE OUTCOMES		**COGNITIVE LEVELS**	
C170.1	Experiment with high-end analytical techniques in biotechnology	Apply Level (C3)	
C170.2	Develop basic and applied skills in cell culture	Apply Level (C3)	
C170.3	Examine and analyse disease-specific drug targets	Analyze (Level C4)	
C170.4	Analyse bioactive compounds from plant and microbial systems	Analyze (Level C4)	

Module No.	**Title of the Module**	**List of Experiments**
1.	Analytical techniques	To run High-performance liquid chromatography (HPLC); prepare and analyse curcumin extract by HPLC; purification of plant extract
2.	Cell culture techniques	Preparation and sterilization of media for cell culture; subculture of animal cell lines; analysis and counting of adherent cells; cell cytotoxicity determination
3.	Drug target analyses	SDS-PAGE analysis and fluorescent staining

4.	Natural product analyses	Extraction of antioxidant compound from *in vitro* grown plant and bacteria; purification of compound; antioxidant capacity analyses of extracts

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.	Biotechnology Procedures and Experiments Handbook http://site.iugaza.edu.ps/mwhindi/files/BIOTECHNOLOGY-PROCEDURES-AND-EXPERIMENTS-HANDBOOK.pdf
2.	Cornelia Kasper, Verena Charwat, Antonina Lavrentieva, "Cell Culture Technology" Springer, 2018
3.	ChukwuebukaEgbuna, Jonathan ChinenyeIfemeje, Jaya VikasKurhekar, Stanley ChidiUdedi, Shashank Kumar, "Phytochemistry Volume 2" Apple Academic Press, 2019
4.	Methods standardized in lab
5.	Lab manual on Biotechniques http://inpressco.com/lab-manual-on-biotechniques/

Detailed Syllabus
Lecture-wise Breakup

Course Code	**17M11BT114**	**Semester** Even	**Semester** VIII (Integrated) / II Sem (M.Tech) **Session** 2023 -2024 **Month from January -June**
Course Name	**Diseases and Healthcare**		
Credits	3	**Contact Hours**	3

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

COURSE OUTCOMES		**COGNITIVE LEVELS**
C115.1	Explain the etiology and pathogenesis of diseases	Understand Level (C2)
C115.2	Choose and apply the strategies of different diagnostic tests	Apply Level (C3)
C115.3	Analyze expression systems and mutagenesis techniques for biopharmaceutical production	Analyze Level (C4)
C115.4	Appraise biotechnology principles for the production of recombinant proteins and nucleic acids as therapeutic agents	Evaluate Level (C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	Introduction to diseases	Infectious diseases caused by bacteria, viruses, opportunistic fungi and parasites; pathology	3
2.	Genetic diseases	Medical genetics; Genetic mechanisms leading to diseases such as thalassemia, cancer	3
3.	Diagnosis of bacteria and virus	Challenges of pathogen detection; Pathogen Detection using Cytological, biochemical and molecular methods;	8

		Molecular cytogenetics, PCR variants	
4.	Immunodiagnostics	Immuno-diagnostics: immunofluorescence, Chemiluminescence, Microparticle Enzyme immunoassay, Fluorescence polarization immunoassay Applications in bacteriology, medicine, forensic sciences	4
5.	Cancer diagnostics	Cancer cytology analysis, genetic and epigenetic biomarkers	3
6.	Diagnosis in Forensic science	Forensic DNA typing and data analysis, Next generation sequencing technology and applications	3
7.	Engineering of Therapeuticals	Scientific and technological innovations in biopharmaceuticals production, Mutagenesis techniques	3
8.	Manipulating Host systems	Prokaryotes, yeast, baculo-virus and mammalian cells for production of recombinant proteins	5
9.	Therapeutic applications	Recombinant blood related products, hormones, interleukins, Vaccines, Monoclonal antibodies and Therapeutic enzymes	8
10.	Nucleic acid therapeutics	Antisense oligodeoxynucleotides, ribozyme, small interfering RNAs, aptamers as therapeuticals	2
		Total number of Lectures	**42**

Evaluation Criteria

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

PBL: Student will choose commercially available protein/ biotechnologically derived product and inspect the synthesis, purification, final product, and its market.

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

Yi-Wei Tang & Charles W Stratton, "Advanced techniques in Diagnostic microbiology", 2nd Ed. Springer

0	G. Walsh, " Biopharmaceuticals: Biochemistry and Biotechnology", 2nd Ed. John Wiley & Sons publication
0	Rodney J. Y. Ho Ph.D., FAAAS, FAAPS, Milo Gibaldi Ph.D. "Biotechnology and Biopharmaceuticals: Transforming Proteins and Genes into Drugs" John Wiley & Sons Inc.
0	Refereed papers from scientific journals for case studies

Detailed Syllabus
Lecture-wise Breakup

Subject Code	**19M13HS111**	**Semester: Even**	**Semester: M.Tech II & Dual degree VIIISession 2023-24** **Month from January to May 2024**
Subject Name	**English Language Skills for Research Paper Writing**		
Credits	**2**	**Contact Hours**	**2-0-0**
Faculty (Names)	**Coordinator(s)**	Dr. Ekta Singh	
	Teacher(s) (Alphabetically)	Dr. Ekta Singh	

Course Outcomes:

At the completion of the course, students will be able to,

COURSE OUTCOMES		**COGNITIVE LEVELS**
C204.1	Demonstrate an understanding of all the aspects of grammar and language needed to write a paper.	Understand Level (C2)
C204.2	Apply grammatical knowledge & concepts in writing and presentation.	Apply level (C3)
C204.3	Examine each section of a paper after careful analysis of Literature Review.	Analyze Level (C4)
C204.4	Determine the skills needed to write a title, abstract and introduction, methods, discussion, results and conclusion.	Evaluate Level (C5)
C204.5	Compile all the information into a refined research paper after editing and proofreading	Create Level (C6)

Module No.	**Subtitle of the Module**	**Topics in the module**	**No. of Lectures and Tutorials for the module**
1.	Grammar & Usage	Structure of English Language Voice, Aspect & Tense SVOCA Sense & Sense Relations in English Enhancing Vocabulary Connotation, Denotation & Collocation	**6**

2.	Elements of Paper Writing	Planning & Preparation Word Order Breaking Long Sentences Structuring Paragraphs Being Concise and Removing Redundancy Avoiding Ambiguity and Vagueness	**4**
3.	Paraphrasing & Writing	Highlighting Your Findings Hedging and Criticising Paraphrasing and Plagiarism Sections of a Paper Abstracts; Introduction	**6**
4.	Process of Writing	Review of Literature Methods Results Discussion Conclusion The Final Check	**4**
5.	Key Skills Needed	Key skills needed when writing a Title Key skills needed whenWriting an Abstract Key skills needed when writing an Introduction Key skills needed when writing a Review of the Literature Key skills needed when writing Methods & Results Key skills needed when writing Discussion & Conclusion	**4**
6.	Refining the Paper	Incorporating useful phrases Editing Proofreading References Annexures Ensuring good quality in submission	**4**
		Total number of Lectures and Tutorials	**28**

Evaluation Criteria	
Components	**MaximumMarks**
Mid Term	30

End Semester Examination 40 TA 30 (Project, Assignment/ Class Test/ Quiz, Class Participation) **Total** **100**	

PBL: The students in groups of 6-7 will identify a topic of their choice and write a self-edited research paper with all the essential components such as title, abstract and introduction, methods, discussion, results and conclusion in it.

Recommended Reading material:	
1.	Goldbort R. 'Writing for Science', Yale University Press (available on Google Books), 2006
2.	Day R. 'How to Write and Publish a Scientific Paper', Cambridge University Press, 2006
3.	Adrian Wallwork. 'English for Writing Research Papers', Springer, New York, Dordrecht Heidelberg, London, 2011
4.	Yadugari M.A. ' Making Sense of English: A Textbook of Sounds, Words & Grammar' Viva Books Private Limited, New Delhi, 2013, Revised Edition
5.	Strauss Jane. 'The Blue Book of Grammar and Punctuation, Josseybass, Wiley, San Francisco, 1999.
6.	Rizvi, A. R. 'Effective Technical Communication' 2nd edition, McGraw Hill Education Private Limited, Chennai, 2018
7.	Eckert, K. 'Writing Academic Paper in English:Graduate and Postgraduate Level', Moldy Rutabaga Books, 2017
8	Barros, L.O, 'The Only Academic Phrasebook You'll Ever Need: 600 Examples of Academic Language' Create Space Independent Publishing Platform; 1st edition,2016
9	Wallwork, A. 'English for Writing Research Papers (English for Academic Research)'.Springer; 2nd ed. 2016 edition.
10	Wallace,M&Wray,A. 'Critical Reading and Writing for Postgraduates (Student Success) SAGE Publications Ltd; Third edition, 2016
11	Butler, L. 'Longman Academic Writing Series 1: Sentences to Paragraphs, with Essential Online Resources', Pearson Education ESL; 2nd edition,2016
12	Saramäki, J. 'How to Write a Scientific Paper: An Academic Self-Help Guide for PhD Students Independently published, 2018

IPR IN BIOTECHNOLOGY

Detailed Syllabus
Lecture-wise Breakup

Course Code	**18M12BT116**	**Semester** Even **(specify Odd/Even)**	**Semester** 2023-24 Month from January to June
Course Name	**IPR in Biotechnology**		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. Shweta Dang
	Teacher(s) (Alphabetically)	Dr. Indira P. Sarethy, Dr. Shweta Dang

COURSE OUTCOMES		**COGNITIVE LEVELS**
CO 1	Explain and interpret the types of intellectual property rights, related laws and systems	**Understand (C2)**
CO 2	Apply specific IPR issues pertaining to medical biotechnology	**Apply (C3)**
CO 3	Evaluate plant and traditional knowledge protection	**Evaluate (C5)**
CO 4	Appraise commercialization of intellectual property, infringements and laws applicable	**Evaluate (C5)**

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Introduction**	Intellectual Property Rights - their Relevance, Importance and Business Interest to Industry, Academia, Protection of Intellectual Property, Relationship of IPRs with biotechnology	**2 [CO1]**
2.	**Types of Intellectual Property Rights**	Patents, Trademarks, Copyrights, Industrial Designs, Geographical Indications, Trade secrets, non-disclosure agreements	**2 [CO1]**

3.	**Patents**	General Introduction to Patents, Patent Terminology, Patent Claims, Patent Life and Geographical Boundaries, Utilization of Intellectual Patents, Licensing of patents	**4 [CO1, CO2]**
4.	**Elements of patentability**	Invention/Discovery, What constitutes Patentable subject matter, the Utility, novelty and non-obviousness of an invention, Patentability in Biotechnological Inventions: Case studies	**2 [CO2, CO3]**
5.	**Preparation and Process for Patenting**	Procedural steps to grant of a patent, Process of filing patents in India, PCT application, protocols of application, pre-grant & post-grant opposition	**3 [CO2, CO3]**
6.	**Patent Search**	Invention in context of "prior art", Patent Search methods, Patent Databases & Libraries, online tools, Country-wise patent searches (USPTO, EPO, India etc.), patent mapping	**2 [CO2, CO3]**
7.	**IPR laws**	Basic features of the Indian Patent Act, the Indian Copyright Act, and the Indian Plant Varieties Protection and Farmers' Rights Act, A brief overview of other Patent Acts & Latest Amendments of Indian, European & US patent systems	**2 [CO1, CO2, CO3]**
8.	**Patent issues in Drugs and Pharmaceuticals**	Generics, Compulsory Licensing, Exclusive Marketing Rights (EMR), Bolar provision, Bayh-Dole act, Second medical use	**2 [CO2, CO3]**
9.	**Worldwide Patent Protection, WTO & TRIPS Agreement**	Brief Background of different International conventions such as Paris convention, TRIPS, WTO, PCT and Patent Harmonisation including Sui-generis system, The relationship between IPRs and international trade, Overview of WTO & TRIPS Agreement, Enforcement and dispute settlement under the TRIPS Agreement, The implication of TRIPS for developing countries in the overall WTO system	**2 [CO1, CO2, CO3]**
10.	**Gene patents**	Introduction & overview, what constitutes gene patents, Bayh-Dole Act, ESTs, Cohen-Boyer technology, PCR patents, EPO case, BRCA gene, Types of IPR involved, Genetic Use Restriction Technologies, Patenting of biologics, Hatch Waxman Act	**9 [CO3, CO4]**
11.	**Protection of Plant Varieties /Seeds**	The interface between technology and IPRs in the context of plants, Key features of UPOV 1978, UPOV 1991 and TRIPS with respect to IPRs on plants, Indian Law on Protection of	**4 [CO3, CO4]**

		Plant Varieties, DUS criteria, patenting of genetically modified plants, The significance of IPRs in agricultural biotechnology, Biodiversity, Conventions & Treaties, plant patents, Plant Varieties Protection Act, Plant Breeders' Rights, UPOV, benefit sharing, *sui generis* systems Case studies	
12.	**Traditional Knowledge and Intellectual Property Rights**	The importance and relevance of Traditional Knowledge for developing nations, The various approaches to protecting TK, The local, national and global dimensions of the issues in TK and IPRs, Traditional Medicine & IP Protection, Folklore, Patenting of Health Foods: Case studies	**4 [CO3, CO4]**
13.	**Patent Infringement and Commercializing Intellectual Property Rights**	What all are considered as patent Infringement: Case studies, defenses to infringement including experimental use, patent misuse, legal considerations, Patent Valuations, Competition and Confidentiality issues, Assignment of Intellectual Property Rights, Technology Transfer Agreements	**4 [CO4]**
		Total number of Lectures	**4 2**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignments 1 (PBL based 5 Marks),Assignments 2. Presentation 1)
Total	**100**

PBL: students will be given keywords to do prior art search from free patent databases like google patents, UPTO and they can analyse the types of patents filed under various domains

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.	USPTO Web Patent Databases at: www.uspto.gov/patft
2.	Government of India's Patents Website: patinfo.nic.in

3.	Intellectual property India: www.ipindia.nic.in
4.	“Indian Patent Law : Legal and Business Implications” by Ajit Parulekar, Sarita D'Souza Macmillan India publication, 2006
5.	“Agriculture and Intellectual Property Rights”, edited by: Santaniello,V., Evenson, R.E., Zilberman, D. and Carlson, G.A. University Press publication, 2003
6.	Research papers and Reports provided from time to time

Detailed Syllabus

Course Code	**18M12BT113**	**Semester :** Even	**Semester:** II[nd] **Session:** 2022 - 2023 **Month from:** January
Course Name	Nutraceuticals		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. Smriti Gaur
	Teacher(s) (Alphabetically)	Dr. Smriti Gaur

COURSE OUTCOMES (New)		**COGNITIVE LEVELS**
CO1	Compare the traditional and modern trends in the nutraceutical Industry.	**(C2)**
CO2	Evaluate the mechanism of action of nutraceuticals in prevention of chronic diseases.	**(C3)**
CO3	Apply microbial and algal nutraceuticals for human health improvement	**(C3)**
CO4	Compare the Indian and international market for nutraceuticals and health food products.	**(C4)**

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1.	**Nutraceuticals and Functional Food: An Introduction**	Historical perspective, classification, scope & future prospects. Applied aspects of the Nutraceutical Science. Sources of Nutraceuticals, The link between nutrition and medicine.	**4**
2.	**Nutrient Components of Food**	Bioactive Carbohydrates: Polysaccharides, Soluble Fibers, Insoluble Fiber, Resistant Starch, Prebiotics, Slowly Digestible Starch.	**10**

		Bioactive Lipids: MUFA, PUFA, Omega 3 and 6 Fatty Acid, Conjugated Linoleic Acid(CLA). Bioactive Peptides: Sources, Isolation and Purification methods. Antihypertensive, Antioxidant, Antimicrobial, Anticancer and immunomodulating Peptides.	
3.	**Nutraceuticals of Plant Origin**	Plant secondary metabolites, classification and sub-classification – alkaloids, phenols, Terpenoids, uses and Preventive role in diseases.-	**5**
4.	**Nutraceuticals of Animal Origin**	Animal metabolites - Examples: Chitin, Chitosan, Glucosamine, Chondroitin Sulphate, uses and applications in preventive medicine and treatment.	**5**
5.	**Microbial and Algal Nutraceuticals**	Concept of probiotics - principle, mechanism, production and technology involved and health benefits of probiotics. Synbiotics for maintaining good health. Algae as source of omega - 3 fatty acids, proteins, fibers, antioxidants, vitamins and minerals – examples: Chlorella, Haematococcus, Spirulina, Dunaliella	**6**
6.	**Nutraceuticlas and Diseases (specific foods and food products)**	Tea, Garlic, Honey, Flaxseed, Mushroom, Barley, Grape seed extract and Lycopene and their preventive role in cardiovascular diseases, Metabolic disorders, Cancer, Bone health, skin diseases etc.	**8**
7.	**Nutraceutical Industry and Market Information**	Concept of cosmoceuticals and aquaceuticals, Nutraceutical industries in India and abroad (study of 5 reputed Indian and International industries involved in production and development of nutraceuticals and functional foods).	**4**
		Total number of Lectures	**42**
Evaluation Criteria			

Components	Maximum Marks
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment, report and viva)
Total	**100**

Project based learning: Each student will study, present and submit a report about 5 reputed Indian and International industries involved in production and development of nutraceuticals and functional foods. They will present and discuss in detail about the industries and their products. This will enhance the student's understanding about various application aspects of Nutraceuticals.

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.	Wildman, R.E.C. ed. Handbook of Nutraceuticals and Functional Foods, CRCPress, Boca Raton, 2000.
2.	R. E. Aluko, Functional foods and Nutraceuticals, Springer, 2012
3.	Yashwant V Pathak, Handbook of Nutraceuticals, CRC Press, 2010
4.	Shibamoto T. Functional food and health, Oxford University Press, 2008.
5.	Goldberg, I. Functional Foods: Designer Foods, Pharma foods, Nutraceuticals, Chapman & Hall, 1994.
6.	Robert E.C. Handbook of Nutraceuticals and Functional Foods. 2nd Ed. Wildman, 2006.

JAYPEE INSTITUTE OF INFORMATION TECHNOLOGY, NOIDA

DEPARTMENT OF BIOTECHNOLOGY

COURSE DESCRIPTION

Course: Project Based Learning - I

Course Code: 17M17BT111

Program: (M.Tech II Sem Student & M.Tech (Integrated) XI Sem)

Project based learning-1(17M17BT111) - Dr. Ashwani Mathur				
C216. 1	Describe the problem statement and its impacts on society and the environment	Understand Level II	**Viva I** (Problem statement) ; Day to Day (Problem statement) **Viva-I** (Rational of the study), **Day to Day** (Rational of the study)	Exit Survey
C216. 2	Summarize existing scientific data and literature-based information for designing the research strategy	Understand Level II	**Viva II** (Design of research strategy for identified problem / Elaboration of case studies / Literature reviewed); **Day to Day marks from supervisor** (Design of research strategy for identified problem / Elaboration of case studies / Literature reviewed)	Exit Survey
C216. 3	Apply literature-based information to execute appropriate methodologies and apply appropriate techniques for experimental outcomes	Apply Level III	**Viva-I** (Literature review); **Day to Day from Supervisor** (Literature Review) **Viva – II** (Analysis and interpretation of result / Analysis of results from literature / Survey outcomes); **Day to Day Marks from Supervisor** (Analysis and interpretation of result / Analysis of results from literature / Survey outcome)	Exit Survey

C216.4	Demonstrate the skill of data analysis and inference of experimental finding	Apply Level III	**Viva-II** (Conclusion / Learning Outcome)**; Day-to-Day marks from Supervisor** (Conclusion / Learning Outcome)	Exit Survey
C216.5	Demonstrate research concept, context clarity, and experimental findings, through presentation skills and report writing	Apply Level III	**Viva-II** (Presentation, Viva voce and Report); **Day to Day marks from Supervisor** (Presentation, Viva voce and Report)	Exit Survey

Marking Scheme: TOTAL: 100 MARKS

D2D MARKS: 48

END TERM VIVA MARKS: 52

Project based learning: The students perform lab based, in-silico, experimental and systematic analysis or survey-based analysis to define the problem statement and learn biotechnological and allied approaches to answer the problem statements. Such knowledge help student to develop independent thinking and inculcate the practice of following good laboratory, scientific and ethical practices in their career