M.Sc. Environmental Biotechnology

Semester IV

BIOENTREPRENEURSHIP

Subject Code	20M32BT213	Semester Odd	Semester 4
Subject Name	Bioentrepreneurship		
Credits	3	**Contact Hours**	3

Faculty (Names)	Coordinator(s)	1. Dr. Neeraj Wadhwa
	Teacher(s) (Alphabetically)	Dr. Neeraj Wadhwa

COURSE OUTCOMES		COGNITIVE LEVELS
C234-1	Explain bioenterpreneurship and describe its component and form	Understanding (Level 2)
C234-2	Understand business opportunities and aspects of finance and operation of business	Understanding (Level 2)
C234-3	Identify business feasibility , cost volume profit and break even analysis in bioventure	Apply (Level 3)
C234-4	Analyse underlying challenges apply creative techniques such as prototyping to cater to ever demanding societal needs in related environment.	Analyze (Level 4)

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
1.	Innovation and entrepreneurship in bio-business	Introduction and scope in Bio-entrepreneurship, Types of bio-industries and competitive dynamics between the sub-industries of the bio-sector (e.g. pharmaceuticals vs. Industrial biotech), Strategy and operations of bio-sector firms: Factors shaping opportunities for innovation and entrepreneurship in bio-sectors, and the business implications of those opportunities, Alternatives faced by emerging bio-firms and the relevant tools for strategic decision, Entrepreneurship development programs of public and private agencies (MSME, DBT, BIRAC, Make In India), strategic dimensions of patenting & commercialization	8

		strategies.	
2.	Bio markets: business strategy and marketing	Negotiating the road from lab to the market (strategies and processes of negotiation with financers, government and regulatory authorities), Pricing strategy, Challenges in marketing in bio business (market conditions & segments; developing distribution channels, the nature, analysis and management of customer needs), Basic contract principles, different types of agreement and contract terms typically found in joint venture and development agreements, Dispute resolution skills.	8
3.	Finance and accounting	Business plan preparation including statutory and legal requirements, Business feasibility study, financial management issues of procurement of capital and management of costs, Collaborations & partnership, Information technologytechniquessuch as enzyme detection, hybridization, PCR, Gene probe technology etc.	8
4.	Technology management	Technology – assessment, development & upgradation, Managing technology transfer, Quality control & transfer of foreign technologies, Knowledge centers and Technology transfer agencies, Understanding of regulatory compliances and procedures (CDSCO, NBA, GCP, GLA, GMP).	8
Total number of Lectures			**42**

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.	Adams, D. J., & Sparrow, J. C. (2008). Enterprise for Life Scientists: Developing Innovation and Entrepreneurship in the Biosciences. Bloxham: Scion.
2.	Shimasaki, C. D. (2014). Biotechnology Entrepreneurship: Starting, Managing, and Leading Biotech Companies. Amsterdam: Elsevier. Academic Press is an imprint of Elsevier. 3
3.	Onetti, A., &Zucchella, A. (n.d.). Business Modeling for Life Science and Biotech Companies: Creating Value and Competitive Advantage with the Milestone Bridge. Routledge.
4.	Jordan, J. F. (2014). Innovation, Commercialization, and Start-Ups in Life Sciences. London: CRC Press.
5.	Desai, V. (2009). The Dynamics of Entrepreneurial Development and Management. New Delhi: Himalaya Pub. House.

PBL: Students will apply creative techniques such as prototyping to cater to ever demanding

socital needs. By understanding the market research they will be able to strategically place their product in the market as well take care of their Cash flow, capital budgeting, pricing and Managing technology transfer.

MARKET RESEARCH AND DATA ANALYSIS

Course Code	22M22BT211	Semester Summer	Semester Summer Even Sem
			Session 2023-24
			Month from Jan - July
Course Name	Market Research and Data Analysis		
Credits	3	**Contact Hours**	42

Faculty (Names)	Coordinator(s)	Dr. Ashwani Mathur
	Teacher(s) (Alphabetically)	Dr. Ashwani Mathur

COURSE OUTCOMES		COGNITIVE LEVELS
CO1	Understand Market Research in context to its application in entrepreneurial and start-up initiatives	**Understand level (C2)**
CO2	Interpret Segmentation and market sizing and their role in Market Research design	**Apply Level (C3)**
CO3	Demonstrate knowledge / use software for data collection and analysis	**Apply Level (C3)**
CO4	Design market research reports on collected or available segmented data	**Analyze level (C4)**

Module No.	Title of the Module	Topics in the Module	No. of Lectures for the module
1.	Introduction	Introduction of Market Research, Market Research Industry size and potential, future prospects of Market Research sector	3
2.	Entrepreneurship in Market Research	Understand independent market research strategy, knowledge of market potential Entrepreneurship	3
3.	Market research – Categorization and strategic approach	Types of Market research based on problem statements (Ambiguous, somewhat defined and well defined problem), Market Research based on data source (Primary and Secondary data), Based on strategic approach (Exploratory and Descriptive Research) Employability	4

4.	Data collection strategy	Identifying and formulating the problem, Methods of Data collection, Nature of Data: primary data, secondary data, big data. Familiarize with data sources and approach to collect data for market sizing, company profiling	5 Employability
5.	Company profiling	Knowledge of competitor analysis based on Market Share, Understanding company revenue and market share, demographic analysis of competitor	5 Employability
6.	Product analysis	Categorization of products, analysis of market share of biological / therapeutic products based on available databases, data collection and analysis.	4 Employability
7.	Customer and Market segmentation	Diffusion of innovation theory, knowledge of Anstoff's matrix for exploring potential market, Knowledge of different attributes of market segmentation.	4 Employability
8.	Data collection and analysis	Familiarization with different databases used for collection of data for market research report, data collection through LinkedIn scouting, sample size estimation, Questionnaire designing and familiarizing with classification, open ended and close end questions	6 Employability
9.	Statistical tools and Data analysis softwares	Inferential statistical approaches for data analysis (hypothesis testing using student T-test, F- test) for data collected for the assigned PBL project, Use of MS Excel, SPSS and Tableau software. Understanding of ODK tool for primary survey (data collection).	4 Employability
10.	Preparation of Report	Report preparation template, components of Market Research report, Data presentation layout	4
		Total number of Lectures	42

Evaluation Criteria

Components	Maximum Marks
T1	20
T2	20

End Semester Examination	35
TA	25 (Market Research Report preparation)
Total	**100**

Project Based Learning: Students will understand the importance of Market Research in start-up ecosystem and entrepreneurial initiatives. They will learn different strategies of segmentation, data collection databases, primary data collection strategies and prepare a segmented market research report

	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 concise guide to market research by Marko Sarstedt and Erik Mooi, Springer Publication, 2020**
2.	**The market research tool box by Edward F McQuarrie, Sage Publication, 2015**
3.	**Entrepreneurship in Independent Market Research & Strategic Digital Marketing by Mirdul Amin Sarkar, Evincepub Publishing, 2020**
4.	**Recent Market Research reports (available online)**

DISSERTATION

Course Code	19M27BT211	Semester EVEN	Semester IV Session 2022-2023 Month from Feb - June
Course Name	Dissertation		
Credits	10	Contact Hours	20

Faculty (Names)	Coordinator(s)	Dr. Vibha Gupta
	Teacher(s) (Alphabetically)	Dr Vibha Gupta

Course Outcomes:

COURSE OUTCOMES: Upon completion of this course, student will be able to		COGNITIVE LEVELS
	Define a research problem relevant to health, environment, industry and society	Understanding Level Level II
C250.2	Interpret and organize the existing literature on the chosen topic to formulate hypothesis	Applying Level Level III
C250.3	Apply standard experimental methodologies to their chosen research problem	Applying Level Level III
C250.4	Analyze experimental findings	Analyze level Level IV
C250.5	Communicate research findings both orally and in written form	Create Level Level VI

PBL Component: The students will define a research problem relevant to health, environment, industry and society after literature mining. They will design a methodology for obtaining solution to the defined problem and execute it. The students will develop skills to analyze their findings and communicate them to scientific community both orally and in written form.

NANOBIOTECHNOLOGY FOR ENVIRONMENTAL ENGINEERING

Subject Code	22M32BT211	Semester Even (specify Odd/Even)	Semester MSc IV Session 2022-23 Month from Jan to June
Subject Name	Nanobiotechnology for Environmental Engineering		
Credits	3	Contact Hours	3

Faculty (Names)	Coordinator(s)	Prof. Sudha Srivastava
	Teacher(s) (Alphabetically)	Prof. Sudha Srivastava
COs	Cos description	Level
CO1	Explain nanomaterial, their synthesis and characterization techniques	C2
CO2	Apply nanotechnology for healthcare and agriculture	C3
CO3	Explain nanotechnological advancements for development of cutting edge technologies	C2
CO4	Apply nanotechnology concepts for environmental remediation	C3

Module No.	Subtitle of the Module	Topics in the module	No. of Lectures for the module
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)	5
3.	**Nanotechnology in Healthcare**	Applications of nanoparticles in Healthcare : Imaging, bone regeneration, tissue engineering, Nanoparticle based	4
4.	**Environmental**	Nanomaterial application for environmental	7

	Remediation	remediation - treatment of industrial waste, heavy metal remediation from soil, water etc.	
5.	**Biosensors and Its Applications**	Introduction to Biosensors; Biosensing devices, Implantable Biosensors; Microfluidics based biosensor; Applications of Biosensors- Medical, Environmental, Pharmaceutical, Industrial	10
6.	**Novel bio-technologies employing nanoparticles**	DNA sequencing using nanopores; Nanoparticles in PCR; Therapeutic Inorganic Nanoparticles; Magnetic nanoparticles in SNP detection.	6
7.	**Environmental and health hazards of nanotechnology**	Sources - Anthropogenic and Natural nanomaterials; Environmental Risks; Health Risks - Nanoparticles toxicity, Routes of exposure, translocation and elimination.	4
		Total number of Lectures	**42**

Evaluation Criteria

Components	**Maximum Marks**
Test 1	20
Test 2	20
End Term	35
TA	25 (assignment/test/presentation)
Total	**100**

PBL: Students will make a report and present the nanotechnological solutions for 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.	Recent Research articles