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Program: Biotechnology		
Course Title: Biological Data Analysis		Course Code: 18EBTE402
L-T-P: 3-0-0	Credits: 3.0	Contact Hours: 03 Hours/Week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 40	Examination Duration: 03 Hours	

Unit I

1. Introduction to Basic statistics:

Strategy of Experimentation, History of the Design of Experiments, Basic Principles of DOE: Randomization, Replication, Blocking, Multi-factor Designs, Confounding; Steps for Planning, Conducting and Analyzing an Experiment, Typical applications of Experimental design, Basic Principles, Guidelines for Designing, Concepts of random variable, probability, density function, cumulative distribution function. Concept of confidence level. Statistical Distributions: Normal, Log Normal & Weibull distributions. Hypothesis testing, Probability plots.

04 Hours

2. Screening Design:

Introduction, Terminology: factors, levels, interactions, treatment combination, Orthogonal array, PB design, analysis of PD design, Numericals.

05 Hours

3. Full Factorial Design:

Basic Definitions and Principles, The Advantage of Factorials, The Two-Factor Factorial Design, Statistical Analysis of the Fixed Effects Model, Model Adequacy Checking, Estimating the Model Parameters, Concept of the General Factorial Design, 2^k Factorial Design, The 2^2 Design, The 2^3 Design, The General 2^k Design.

07 Hours

Unit II

4. Response surface methods:

Introduction, Central composite design, Box Behnken design, importance of counter and surface plots.

05 Hours

5. R Programming Basics:

Overview of R programming, Environment setup with R Studio, R Commands, Variables and Data Types, Control Structures, Vectors, Factors, Functions, Matrices, Arrays and Lists.


06 Hours

6. Interfacing:

Interfacing R to other languages, Parallel R, Basic Statistics: Linear Model, Generalized Linear models, Non-linear models, Time Series, Autocorrelation and Clustering.

05 Hours

Unit III

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7. Introduction to Bioconductor for Sequence Data:

Sequencing Resources, Ranges Infrastructure, DNA /amino acid sequence from FASTA files, Reads from FASTQ files, Aligned Reads from BAM files, Called Variants from VCF files, Genome Annotations from BED, WIG, GTF files. **04 Hours**

8. Biological Data Analysis:

Preparing count matrices, The DESeq, DataSet, sample information, and formula design, exploratory analysis and visualization, Differential expression analysis, Plotting results, Annotating and exporting results **04 Hours**

Text Books:


1. R for Everyone: Advanced Analytics and Graphics: by Jared P. Lander Addison Wesley Data & Analytics Series, 2013.
2. Design and analysis of experiments” by D.C. Montgomery, 7th edition John Wiley and sons, NewYork

Reference Books:


1. A Little Book of R for Bioinformatics: by Avril Coghlan, Release 0.1
2. Das. M.M. and Giri N.C. : - Design and Analysis of Experiments

Scheme for End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter numbers	Instructions
I	3 Questions to be set of 20 Marks Each	1, 2,3	Solve Any 2 out of 3
II	3 Questions to be set of 20 Marks Each	4,5,6	Solve Any 2 out of 3
III	2 Questions to be set of 20 Marks Each	7,8	Solve Any 1 out of 2

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Program: Biotechnology		
Course Title: Bioprocess Modeling and Simulation		Course Code: 18EBTE401
L-T-P: 3-0-0	Credits: 3.0	Contact Hours: 03 Hours/Week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 40	Examination Duration: 03 Hours	
Unit I		
1.Introduction to modeling: Introduction, Mathematical Modeling of Bioprocess Engineering System, General Aspects of the Modeling Approach, General Modeling Procedure: Fundamentals uses of mathematical model, scope of coverage, principles of formulation; Fundamental Laws of Modeling: continuity equation, energy equation with examples 05 Hours		
2.Fundamental Laws of Modeling: Equation of motion, transport equation, equation of state, phase and chemical equilibrium, chemical kinetics; Lumped and distributor parameters with examples 05 Hours		
3. Mathematical models of Biochemical Engineering Systems: Modeling of Batch reactors, modeling of CSTR, Numericals. Plug flow reactor, Fluidized bed reactor, Reactors used in effluent treatments, packed bed reactor. 05 Hours		
Unit II		
4. Use of MATLAB in Process Simulation: Basics-Data analysis-curve fittings, Numerical integration, Euler and fourth order RungeKutta method, Input and Output in MATLAB. Solving problems using MATLAB by numerical integration, Euler and fourth order Runge Kutta methods. Simulation of CSTR and Batch Reactor, Simulation of Plug flow reactor. 10 Hours		
4.Introduction to Process Design: Steps involved in process design, Process flow diagram structure and hierarchical approach, importance of Material and Energy balance, selection of unit operations, 05 Hours		
Unit III		
5.Introduction to process simulation software Bioprocess design with example: Process Description, Specifying Process Sections, Specifying Equipment Sharing, Initialization of Reaction Operations, Process Analysis, Cost Analysis and Economic Evaluation, Environmental Impact.		

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05 Hours

6. Use of Super Pro in Process Simulation:

Components and mixtures, Physical and Chemical properties of components, material and energy balance simulation, adding unit operation, scheduling the unit process, process cost estimation, sizing of the unit operation. Case study: Monoclonal antibody production, Enzyme production

05 Hours

Text Books:

1. Luyben W.L., Process Modeling Simulation and Control for Chemical Engineers., McGraw Hill, 1988.
2. Pauline M. Doran, "Bioprocess Engineering Calculation", Blackwell Scientific Publications.

Reference Books:

1. Kenneth J. Beers. "Numerical Methods for Chemical Engineering Applications in MATLAB®", Massachusetts Institute of Technology, Cambridge University press 2007 edition.
2. Bailey and Ollis, "Biochemical Engineering Fundamentals", 2 nd ed., McGraw Hill, 1986.

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UNIT	8 Questions to be set of 20 Marks Each	Chapter numbers	Instructions
I	3 Questions to be set of 20 Marks Each	1, 2	Solve Any 2 out of 3
II	3 Questions to be set of 20 Marks Each	3,4	Solve Any 2 out of 3
III	2 Questions to be set of 20 Marks Each	5,6	Solve Any 1 out of 2



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Program: Biotechnology		
Course Title: Quality Assurance & Regulations		Course Code: 18EBTE403
L-T-P: 3-0-0	Credits: 3.0	Contact Hours: 03 Hours/Week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 40	Examination Duration: 03 Hours	
Unit I		
1. Introduction		
Introduction to Quality and Quality Regulation, Validation and Regulatory Affairs in Bio (Pharmaceutical) Manufacturing: An Introduction to FDA Operations & Industry Compliance Regulations, The Fundamentals of Regulatory Compliance with respect to Good Clinical Practice (GCP), Good Manufacturing Practice (GMP) & Good Laboratory Practice (GLP).		
06 Hours		
2. Quality and Quality Management		
Terms Relating to Quality Management System, Quality Policy, Quality Objectives, Quality Planning, Quality Control, Quality Assurance, Quality Improvement, Continual Improvement, Effectiveness, Efficiency; Relating to Process and Product, Quality Characteristics; Terms Relating to Conformity, Non-Conformity, Defect, Preventive Action, Corrective Action, Rework, Repair, Scrap, Concession, Deviation Permit, Release; Terms Relating to Documentation.		
10 Hours		
Unit II		
3. Process Validation		
Definition and concept of validation, An introduction to process validation, Validation and Qualification, IQ, OQ and PQ. A Review of Prospective, Concurrent, Retrospective Validation Calibration and performance evaluation. Validation of Water & Thermal Systems, including HVAC Facilities & Cleaning Validation. Validation septic Processes, Computer software validation in pharmaceuticals (CSV).		
10 Hours		
4. Analytical Method Validation		
FDA and ICH guidelines. Analytical method validation, Specificity, Linearity, Accuracy, Precision, Limits of detection (LOD) and quantification (LOQ), Minimum detectable amount (MDA), Sample stability and method robustness, System suitability, Statistical process control for HPLC, Troubleshooting out-of-control systems, Case studies, Validation of Analytical Methods.		
06 Hours		
Unit III		
5. Quality Standards		
Introduction, ISO 9000 Series of Standards, Management Responsibility, Quality System, Contract Review, Design Control, Document and Data Control, Control of Quality Records,		

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Internal Quality Audits, Training, Servicing, Environmental Management System. <p style="text-align: right;">04 Hours</p>
6. Implementation and Regulation Role of QC and QA in Bio/Pharmaceutical organization, Quality System, Contract Review, Design Control, Document and Data Control, Product Identification and Traceability, Process Control, Control of Quality Records, Internal Quality Audits, Training. <p style="text-align: right;">04 Hours</p>
Text Books: <ol style="list-style-type: none"> 1. Pharmaceutical Process Validation by Robert Nash and Alfred Wachter, Marcel Dekker. Publisher: Marcel Dekker Inc. 2011. 2. Good Manufacturing Practices for Pharmaceuticals: A Plan for Total Quality Control From Manufacturer to Consumer, Sidney J. Willig, Publisher: Marcel Dekker Inc. 2005.
Reference Books: <ol style="list-style-type: none"> 1. Validation of Pharmaceutical Processes: Sterile Products, Frederick J. Carlton (Ed.) and James Agalloco (Ed.), Marcel Dekker, 2008. 2. Validation Standard Operating Procedures: A Step by Step Guide for Achieving Compliance in the Pharmaceutical, Medical Device, and Biotech Industries, Syed Imtiaz Haider, Saint Lucie Press, 2004.

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UNIT	8 Questions to be set of 20 Marks Each	Chapter numbers	Instructions
I	3 Questions to be set of 20 Marks Each	1, 2	Solve Any 2 out of 3
II	3 Questions to be set of 20 Marks Each	3,4	Solve Any 2 out of 3
III	2 Questions to be set of 20 Marks Each	5,6	Solve Any 1 out of 2

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Program: Biotechnology		
Course Title: Bioethics, Safety & IPR		Course Code:19EBTE401
L-T-P: 3-0-0	Credits: 3.0	Contact Hours: 03 Hours/Week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 40	Examination Duration: 03 Hours	
Unit I		
<p>1. Perceptions about Biotechnology: Biotechnology and social responsibility, Positive & negative perceptions of Biotechnology, Public acceptance issues, surveys, areas of public concern for Biotechnology. Socio, ethical, economic and legal aspects of Biotechnology. Public education & Biotechnology. 05Hours</p> <p>2. Bioethics: Legality, morality, and ethics, Principles of bioethics: autonomy, human rights, beneficence, justice, equity, etc. Expanding scope of ethics from Biomedical practice to Biotechnology, ethical conflicts in Biotechnology. 05 Hours</p> <p>3. Biosafety concept and issues : Rational vs. subjective perception of risks and benefits, Hazards of BT , relationship between risk and hazard, Ethical implications of biotechnology products and techniques, 05 Hours</p>		
Unit II		
<p>4. National and International Regulations: Cartagena protocol, OECD consensus documents and Codex Alimentarius; Indian regulations – EPA act and rules, guidance documents, regulatory framework – RCGM, GEAC, IBSC and other regulatory bodies; category of rDNA experiments; field trails – biosafety research trials – standard operating procedures - guidelines of state governments; GM labeling – Food Safety and Standards Authority of India (FSSAI) 10Hours</p> <p>5. Biosafety & Management: Laboratory associated Biosafety practices, assessment of biohazard, Biosafety levels,. Risk analysis and assessment, Containment levels-physical, biological containments,. Good manufacturing practice and Good lab practices (GMP and GLP). 05 Hours</p>		
Unit III		
<p>6. Intellectual Property rights: Introduction to history of GATT, WTO, WIPO and TRIPS; Introduction to IPR, Types of IP: Patents, Trademarks, Copyright, Design & Related Rights. Plant variety protection, Traditional knowledge, breeders rights, Geographical indications, Biodiversity and farmers rights. Patenting in biotechnology, case studies. 05 Hours</p> <p>7. Food, Agri and Pharma Sector: The GM-food debate and biosafety assessment procedures</p>		

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for biotech foods including transgenic food crops, case studies- Golden Rice and Flav Savr Tomatto. Biosafety assessment of pharmaceutical products such as drugs/vaccines etc. Biosafety issues in Clinical Trials.

05 Hours

Text Books


1. Bioethics & Biosafety- Sateesh MK, I.K. International Publishing House
2. Intellectual Property rights on Biotechnology – Singh K, BCIL, New Delhi.
3. Biotechnology: Expanding Horizons - B D Singh, Kalayani Publishers, 2010

Reference Books:

1. Bioethics & Biosafety – R. Rallapalli & Gita Bali, APH publication, 2007
2. Safety considerations for Biotechnology-Paris, OECD publications

Scheme for End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter numbers	Instructions
I	3 Questions to be set of 20 Marks Each	1,2,3	Solve Any 2 out of 3
II	3 Questions to be set of 20 Marks Each	4,5	Solve Any 2 out of 3
III	2 Questions to be set of 20 Marks Each	6,7	Solve Any 1 out of 2

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Program: Biotechnology		
Course Title: Industrial Waste Management		Course Code: 19EBTO401
L-T-P: 3-0-0	Credits: 3.0	Contact Hours: 03 Hours/Week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 40	Examination Duration: 03 Hours	

Unit I

1 Introduction

Introduction to waste management, general outline of waste management, Importance of waste management in industries. **04Hours**

2 Waste Water Treatment

Waste water characteristics: Physical, Chemical and Biological characteristics. Chemical Oxygen Demand (COD) and Biochemical Oxygen Demand (BOD). Introduction to physical and chemical waste water treatment methods. Biological wastewater treatment methods: Aerobic suspended growth treatment processes (Activated Sludge Process, aerated lagoons etc), Aerobic attached growth treatment processes (Trickling Filter). Anaerobic treatment. **11Hours**

Unit II

3. Solid Waste Management

Basic aspects, Generation of industrial solid wastes, general composition of Municipal solid waste, On site handling, storage and processing, Collection of solid wastes. Solid waste processing techniques and equipments. Recovery of biological conversion products from solid waste such as composting and anaerobic digestion. Disposal of solid wastes. **09Hours**

4. Control of Air Pollution


Sources and classification of air pollutants, Effects of air pollution on human health, animals and plants. Sampling procedures, Control of air pollution by equipments, odour combatment techniques, Air pollution Legislation and Regulation. **06Hours**

Unit III

5. Bioremediation

Introduction, Uses of bacteria for bioremediation, bioremediation of aromatic and aliphatic hydrocarbons, PCB dechlorination, immobilization techniques for bioremediation, biosorption & bioaccumulation, genetic engineering of microbes for bioremediation. Phytoremediation-plants capable of assimilating heavy metals. **05Hours**

6. EM Technology

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Introduction, Important organisms: Photosynthetic bacteria, Lactobacillus, yeast; their roles, Formulation of EM Mixture, Use of EM technology for treating industrial wastes – case studies.

05Hours

Text Books:


- Wastewater Engineering**-Metcalf and Eddy. McGraw-Hill International Edition.1991
- Solid Wastes**-George Tchobanoglous, Hilary Theisen and Rolf Eliassen. McGraw Hill Kogakusha,Ltd.

Reference Books:

- Basic Biotechnology** by Colin Ratledge, Cambridge Pub. 2001
- Air Pollution** – M.N.Rao and H.V.N Rao.Tata Mc Grew Hill.

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UNIT	8 Questions to be set of 20 Marks Each	Chapter numbers	Instructions
I	3 Questions to be set of 20 Marks Each	1,2	Solve Any 2 out of 3
II	3 Questions to be set of 20 Marks Each	3,4	Solve Any 2 out of 3
III	2 Questions to be set of 20 Marks Each	5,6	Solve Any 1 out of 2

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Program: Biotechnology		
Course Title: Bioprocess Plant Design and Economics		Course Code: 18EBTE301
L-T-P: 3-0-0	Credits: 3.0	Contact Hours: 03 Hours/Week
ISA Marks: 50	ESA Marks: 50	Total Marks: 100
Teaching Hours: 40	Examination Duration: 03 Hours	

Unit I

1. Introduction to Process Design Development

Design project procedure, design information from the literature and other sources of information, flow diagrams, preliminary design, and comparison of different processes, Equipment design and specialization, factors affecting the investment.

06Hours

2. General Design Considerations

Marketability of the product, availability of technology, Health and safety hazards, raw materials, human resources, loss prevention Environmental protection and utilities, site characteristics, plant location, plant layout, plant operation and control, utilities, structural design, storage, materials handling, materials and fabrication Selection, optimum design and design strategy. Waste disposal, physical treatment, chemical treatment and biological treatment, govt. regulations and other legal restrictions, community factors. Safety and hazard control measures.

10 Hours

Unit II

3. Cost Analysis and Manufacturing Cost

Cost Analysis: Factors involved in project cost estimation. Cash flow diagrams for the industrial operation, Cumulative cash position, factors affecting the Investment and production cost, Different methods employed for the estimation of the capital investment. Estimation of equipment cost by sixth tenth rule, Cost index. Marshall and swift installed – equipment indexes, Engineers News-Record construction index, Nelson –Farrar refinery construction index. and Chemical Engineering plant cost index Manufacturing Costs: Direct Production costs, indirect cost and fixed charges (including depreciation, taxes, insurance, rental costs etc.)


10 Hours

4. Bioprocess Economics:

Economic analysis for the production of following Products.(Historical Perspective, Fermentation Technology, Recovery of product and process economics of following products)

- High volume, low value products. (Citric acid, Ethanol and Amino acids etc)
- Medium volume, medium value products.(Antibiotics, Crude Enzymes and Vitamins etc)
- Low volume, high value products. (MAb, purified Enzymes and Therapeutic proteins etc)

06 Hours

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Unit III

5. Profitability Analysis and Optimization Technique

i) Importance of profitability analysis in investment decision making. Different Methods for calculating the profitability. Minimum Acceptable Rate of return. Methods that Do not consider Time value of money. **04 Hours**

ii) General procedure to find the optimum conditions, factors affecting the optimization, comparison of analytical and graphical methods. Linear programming, Simultaneous Equations and dynamic programming **04 Hours**

Text Books:

1. Peters and Timmerhaus, Plant Design and Economics for Chemical Engineers, McGraw Hill 5th edition, 2004.
2. Chemical Engineering plant design, Frank C Vilbrandt and Charles E Dryden , McGraw Hill 4th edition, 1959

Reference Books:

1. Rudd and Watson, Strategy of Process Engineering, Wiley, 1987.
2. Backhurst, J.R And Harker, J. H - Process Plant Design, Heieman Educational Books, (1973).
3. Biochemical Engineering Fundamentals, James E Baily David F Oillis. McGraw-Hill 2nd International Edition

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UNIT	8 Questions to be set of 20 Marks Each	Chapter numbers	Instructions
I	3 Questions to be set of 20 Marks Each	1, 2	Solve Any 2 out of 3
II	3 Questions to be set of 20 Marks Each	3,4	Solve Any 2 out of 3
III	2 Questions to be set of 20 Marks Each	5	Solve Any 1 out of 2



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Program: Biotechnology

Course Title: Environmental Biotechnology

Course Code: 18EBTE404

L-T-P: 3-0-0

Credits: 3.0

Contact Hours: 03 Hours/Week

ISA Marks: 50

ESA Marks: 50

Total Marks: 100

Teaching Hours: 40

Examination Duration: 03 Hours

Unit I

1. Introduction

Issues and scope of Environmental Biotechnology, Environment and Biotechnology, Areas of applications for Biotechnology. Microbes and Environment, Genetically modified organisms and Legislation. **03 Hours**

2. Waste Water Treatment

Sources of water pollution, Waste water characteristics: Physical, Chemical and Biological characteristics. Chemical Oxygen Demand (COD) and Biochemical Oxygen Demand (BOD). Introduction to physical and chemical waste water treatment methods. Biological wastewater treatment methods: Aerobic suspended growth treatment processes (Activated Sludge Process, aerated lagoons etc), Aerobic attached growth treatment processes (Trickling Filter, Rotating Biological contactors), Anaerobic suspended growth treatment processes- contact digestors, packed column reactors, UASB. **12 Hours**

Unit II

3. Solid waste Management

Basic aspects, Generation of solid wastes, general composition of Municipal solid waste, On site handling, storage and processing, Collection of solid wastes. Solid waste processing techniques and equipments. Recovery of biological conversion products from solid waste such as composting, sanitary landfilling, recycling, vermicomposting, incineration. Solid waste management for energy recovery-Biogas production, processing of lignocellulosic waste biomass for ethanol production **10 Hours**

4. Bioremediation

Uses of bacteria for bioremediation, bioremediation of aromatic and aliphatic hydrocarbons, PCB dechlorination, immobilization techniques for bioremediation, biosorption & bioaccumulation, genetic engineering of microbes for bioremediation. Phytoremediation-plants capable of assimilating heavy metals **05 Hours**


Unit III

5. Bioleaching

Bioleaching using microbes, role of Thiobacilli, direct & indirect bioleaching, copper extraction by leaching, dump leaching **05 Hours**

6. Environmental Impact Assessment

Introduction, Scope and history of EIA, Need of Environmental Impact assessment. Stakeholder

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and public involvement, Identification and quantification of environmental effects and Environmental Impact statement (EIS) **05 Hours**

Text Books:

1. Metcalf and Eddy, Wastewater Engineering, International Edition, McGraw-Hill, 1991
2. George Tchobanoglous, Hilary Theisen and Rolf Eliassen, Solid Wastes, McGraw Hill Kogakusha

Reference Books:

1. Colin Ratledge, Basic Biotechnology , Cambridge Pub, 2001
2. Indu Shekhar Thakur, Environmental Biotechnology, IK Pub, 2006
3. Pradipta Kumar Mohapatra, Environmental Biotechnology, IK Pub, 2006

Scheme for End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter numbers	Instructions
I	3 Questions to be set of 20 Marks Each	1,2	Solve Any 2 out of 3
II	3 Questions to be set of 20 Marks Each	3,4	Solve Any 2 out of 3
III	2 Questions to be set of 20 Marks Each	5,6	Solve Any 1 out of 2



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Year:

Program: Biotechnology		
Course Title: Bio-business & Entrepreneurship		Course Code: 20EBTE402
L-T-P: 3-0-0	Credits: 3.0	Contact Hours: 3 hours/week
ISA Marks:50	ESA Marks:50	Total Marks:100
Teaching Hours:40	Examination Duration:3 hrs	
Unit-I		
1. Entrepreneurship		
<p>Concept of Entrepreneurship - Development of Entrepreneurship; Stages in entrepreneurial process; Role of entrepreneurs in Economic Development; Characteristics of successful Entrepreneur, Classification of Entrepreneurs, Myths of Entrepreneurship, Entrepreneurial Development models, Entrepreneurial development cycle, Problems faced by Entrepreneurs. Entrepreneurship in India: Small scale industries: Definition; Characteristics; Need and rationale. Objectives; Scope; Introduction to bio-business, from the Indian context, SWOT analysis of bio-business.</p>		
10 hours		
2. Social Responsibilities of Business		
<p>Meaning of Social Responsibility, Social Responsibilities of Business towards Different Groups, Social Audit, Business Ethics and Corporate Governance Institutional Support for Business Enterprises: Introduction, Policies & Schemes of Central Level Institutions, State Level Institutions.</p>		
05 hours		
Unit-II		
3. Entrepreneurship opportunity in biotechnology		
<p>Business opportunity, Essential requirement, marketing strategies, schemes, challenges and scope-with case studies on entrepreneurship opportunities in different domains of Biotechnology (Agri biotechnology, industrial Biotechnology, food biotechnology, Biopharma, Nutraceuticals. etc).</p>		
05 hours		
4. Project management, technology management and startup schemes		
<p>Meaning of Project; Project Identification; Project Selection; Project Report; Need and Significance of Report; Contents; Formulation; Guidelines by Planning Commission for Project report; Network Analysis; Errors of Project Report; Project Appraisal. Identification of business opportunities: Market Feasibility Study; Technical Feasibility Study; Financial Feasibility Study & Social Feasibility Study.</p>		
10 hours		
Unit-III		
5. Startup Schemes		

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Building Biotech business challenges in Indian context-biotech partners (BIRAC, DBT, Incubation centers. Etc.), operational biotech parks in India. Indian Company act for Bio business-schemes and subsidies. Patent expiry and Entrepreneurship opportunity, Principles of Technology leasing, licensing and transfer, Business incubation support schemes, Successful startups-case study.

05 hours

6. Funding Opportunities

Startup schemes in Indian government Sources of Funding for startups. Crowd funding, Self-funding, Venture Capitalists, Angel Investment. Banking support for startup business. Types of companies: Sole proprietorship company, Partnership company, Private Limited, Limited company etc.

05 hours

Text Books:

1. Principles of Management – P. C.Tripathi, P.N. Reddy – Tata McGraw Hill,
2. Entrepreneurship Development - S.S.Khanka - S.Chand & Co.
3. Project Management by Sahni, Ane Books.

Reference books

1. Management Fundamentals - Concepts, Application, Skill Development - Robers Lusier - Thomson
2. Project Management for Business & Technology, Nicholas, PHI.

Scheme for End Semester Assessment (ESA)

UNIT	8 Questions to be set of 20 Marks Each	Chapter numbers	Instructions
I	3 Questions to be set of 20 Marks Each	1,2	Solve Any 2 out of 3
II	3 Questions to be set of 20 Marks Each	3,4	Solve Any 2 out of 3
III	2 Questions to be set of 20 Marks Each	5,6	Solve Any 1 out of 2