Panjab University

Scheme and Syllabus of
B.E. MBA integrated (Biotechnology)
3rd to 8th semester

2011-2012
# Scheme of Examination of B.E. MBA Integrated in Biotechnology

## Second Year - Third Semester

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## SCHEME OF EXAMINATION OF B.E. MBA INTEGRATED IN BIOTECHNOLOGY

**Second Year - Fourth Semester**

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## SCHEME OF EXAMINATION OF B.E. MBA INTEGRATED IN BIOTECHNOLOGY

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### Training of 8 weeks after 4th semester exams
### SCHEME OF EXAMINATION OF B.E. MBA INTEGRATED IN BIOTECHNOLOGY

#### Fourth Year - Seventh Semester

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### SCHEME OF EXAMINATION OF B.E. MBA INTEGRATED IN BIOTECHNOLOGY

#### Fourth Year - Eighth Semester

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**Grand Total: 1250**

**Options in Elective - I**
1. Nanobiotechnology
2. Microbial Biodiversity
SYLLABUS
B.E. MBA INTEGRATED IN BIOTECHNOLOGY
THIRD SEMESTER

Paper Title: Concepts in Biotechnology-I (Theory)
Paper Code: BIO 301                Max. Marks 50                 Credits: 4

Course Duration: 45 Lectures of one hour each.

Note for the Paper setter:  The question paper should be divided into Section A and Section B Total of 8 questions, 4 from section A and 4 from section B are to be set.. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A

1. Introduction to Biotechnology:  Historical perspectives, Emergence of modern biotechnology, Branches / scope of biotechnology

2. Biological systems in biotechnology: (a) Prokaryotic cell structure and systems: *E.coli, Bacillus*
   (b) Eukaryotic cell structure and systems: *Saccharomyces*, mammalian and non-mammalian cells in culture.


SECTION- B

2. Basic genetics : Mendelian inheritance, physical basis of inheritance, gene interactions., Bacterial and viral genetic systems., Genomic and mitochondrial DNA, C value paradox, cot curve, chromosome walking, Overview of DNA replication, genetic code, transcription, translation, Cytoplasmic inheritance, nucleo-cytoplasmic interactions.


6. Mutagenesis and protein engineering: Basic concepts only

BOOKS RECOMMENDED
c. Membrane Separation in Biotech by McGregor, C.W., 1986, Marcel Dekker Inc.,
New York.


Paper Title: Concepts in Biotechnology-I (Practical)
Paper Code: BIO 351                     Max. Marks 50   Credits: 1

Practicals:

1. Introduction to instrumentation: centrifuges, autoclaves, spectrophotometers, microscopes, laminar hoods, incubators, CO2 incubators, lyophilizer etc.
2. Polyacrylamide gel electrophoresis for proteins.
3. Use of microscopes: compound microscope, fluorescent microscope, inverted microscope and visit to E.M. lab.
4. Use of Geiger muller counter.

Paper Title: Microbiology (Theory)
Paper Code: BIO 302                     Max. Marks 50        Credits: 4
Course Duration: 45 Lectures of one hour each.

Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions, 4 from section A and 4 from section B are to be set.. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A

1. History of microbiology, Germ theory, Disciplines of microbiology,
2. Structure of microbes (bacteria, algae, fungi and viruses)
3. Microbial taxonomy including modern approaches of taxonomy such as DNA taxonomy and numerical taxonomy, different groups in bacteria.

SECTION-B

5. Microbial genetics, transformation, conjugation & transduction mutations.
7. Microbial ecology (with particular reference to C, N cycles)
8. Microbes as pathogens : Important microbial pathogens, toxins, mode of action of toxins
Books Recommended:

Paper Title: Microbiology (Practical)
Paper Code: BIO 352  Max. Marks -50  Credits: 2
Practicals:
1. Experiments on isolation-spread plate, enrichment culture; staining and measurement of microbes; effect of environment on microbial growth; lyophilisation.
2. Testing of microbiological qualities of milk and water; growth and production formation-batch culture, enzyme production, assay of enzymes.
3. Microbial assay of antibiotics.
4. Studies on auxotrophs
5. Detection of an enzyme production by a microbe
6. Determination of molecular weight of an enzyme.

Paper Title: Biochemistry (Theory)
Paper Code: BIO 303  Max. Marks 100  Credits: 4
Course Duration: 45 Lectures of one hour each.

Note for the Paper setter:  The question paper should be divided into Section A and Section B Total of 8 questions, 4 from section A and 4 from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A
1. Chemistry and properties of following Biomolecules:
   a) amino acids  b) proteins  c) carbohydrates  d) lipids  e) nucleic acids,  f) water soluble vitamins.

2. Chemical Bonds: Covalent bonds, co-ordinate bonds, hydrogen bonds, Vander waal's forces, hydrophobic interactions, ionic bonds, dipole interactions.
3. **Proteins:** Primary, secondary, tertiary and quaternary structures, methods for isolation and purification of proteins, protein analysis and amino acid sequence determination.

4. **Carbohydrate metabolism:** Glycolysis, glycogenolysis, glycogenesis and their regulation, citric acid cycle.

**SECTION-B**

5. **Fat metabolism:** Oxidation of fatty acids, synthesis of fatty acids (fatty acid synthase complex), ketone bodies.

6. **Amino acid metabolism:** General pathways of amino acid metabolism, transamination, decarboxylation, deamination, Urea cycle.

7. **Nucleic acid metabolism:** Biosynthesis of purines and pyrimidine nucleotides, biosynthesis of deoxyribonucleotides, their regulation, catabolism.

8. **Mitrochondria:** Structure of mitochondria, organization of respiratory chain, oxidative phosphorylation.

9. **Plant and microbial biochemistry:** Photosynthesis and Nitrogen fixation

**Books Recommended:**


**Paper Title: Biochemistry (Practical)**

**Paper Code:** BIO353  
**Max. Marks:** 50  
**Credits:** 2  

**Practicals:**

Qualitative tests of carbohydrates (monosaccharides, disaccharides, polysaccharides, reducing and non reducing sugars etc.), proteins and amino acids, paper chromatography of amino acids or sugars. Estimation of proteins (by Biuret method and Lowry method) carbohydrates, DNA, RNA, Cholesterol, lipids etc by spectrophotometry.
Note for the Paper setter: The question paper should be divided into Section A and Section B. Total of 8 questions, 4 from section A and 4 from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A

Membrane structure and function, cytoskeleton, ECM and its role in cell behavior regulation. (5)
Chromosomes and organization of DNA. (3)
DNA Replication in Prokaryotes and Eukaryotes: Basic process, enzymes involved in replication. (6)
DNA Recombination: A brief introduction to molecular mechanisms in Prokaryotes and Eukaryote. (4)
Insertion elements and Transposons: Background, types of IS elements and transposons. (4)

SECTION-B

Transcription in Prokaryotes and Eukaryotes: Mechanism, factors in prokaryotes and eukaryotes, regulatory mechanisms like substitution of sigma factor, Lac operon in prokaryotes, regulation of gene expression in eukaryotes, post-transcriptional changes in eukaryotes, RNA editing. (8)
Translation in Prokaryotic and Eukaryotic cells: stages, molecules involved differential translation. (6)
Cell Cycle and its Regulation: Phases of cell cycle, cell cycle check points, brief introduction to factors involved in cell cycle regulation. (4)
Signal Transduction: Signal transduction through receptor interacting with G-protein/receptor with tyrosine kinase activity, role of second messengers like c-AMP, Inositol-tri-phosphate, Diacyl glycerol, Ca^{2+} ions and mechanisms. (4)

Role of molecular Biology in Molecular Medicine. (1)

Books Recommended:


Paper Title: Cell and Molecular Biology (Practical)

Paper Code: BIO 354
Max. Marks: 50
Credits: 4

1. Isolation of plasmid DNA from *E.coli*. 

2. Isolation of Genomic DNA from *E.coli* cells.
3. Agarose Gel Electrophoresis.
4. Preparation of CaCl\(_2\) competent cells.
5. Preparation of electrocompetant cells.
6. Transformation of *E.coli* cells with the plasmid DNA by using CaCl\(_2\).
7. Transformation of *E.coli* cells with the plasmid DNA by using electroporator.

**Paper Title: Organization Behavior (Theory)**

**Paper Code: IBM 301**  Max. Marks 50  **Credits: 4**

**Course Duration:** 45 Lectures of one hour each.

**Note:** Examiner shall set eight questions, four from Part-A and four from Part-B of the syllabus. Candidate will be required to attempt any five questions selecting at least two questions from Part-A and two from Part-B.

**Part A**

**Introduction to Organization Behavior**  [10]

Definition and meaning of OB, impact of other sciences (Anthropology, Sociology, Psychology) on OB, perception, self esteem, attitude & personality, meaning of culture, impact of technology on OB.

**Motivation, Learning & Leadership**  [13]

Meaning of Motivation, Content theories of motivation (Maslows Hierarchy of needs, Herzberg’s two factor theory), Process theories (Vroom’s Expectancy theory, Porter-Lawler Model), Motivation applied (Job design, job rotation, goal setting, MBO), various methods of motivating employees, Behavioral & Cognitive theories of learning, Leadership theories (Trait theory, Fiedler’s Contingency theory, Path–Goal leadership theory), Leadership styles (Blake & Mouton managerial grid, Hersey & Blanchard’s life cycle approach)

**Part B**

**Group behavior:**  [10]

Group Dynamics, conflict, power & politics, Group behavior, types of groups, group decision making, conflict in organizations and reason, interpersonal conflict, inter group conflict, meaning of power, classification of power, politics in organizations

**Organization environment & Communication**  [12]

Authority & responsibility, delegation and division of work, quality of work life, communication process, modes of communication in organization and barriers to communication, formal & informal communication.

**Recommended Books:**


**Paper Title: Engineering Mathematics – III**

**Paper Code: BIO/AS -306**  Maximum Marks: 100  **Credits: 4**

**Course Duration:** 45 lectures of one hour each.
Note for the Paper setter: The question paper should be divided into Section A and Section B. Total of 8 questions, 4 from section A and 4 from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION- A


(8 Lectures)


(7 Lectures)

Eigen values, eigen vectors, Cayley – Hamilton theorem (statement only). Similarity of matrices, Basis of eigenvectors, diagonalization (Scope as in Chapter 7, Sections 7.1, 7.5 of Reference 1).

(7 Lectures)

SECTION- B

Complex Functions: Definition of a Complex Function, Concept of continuity and differentiability of a complex function, Cauchy – Riemann equations, necessary and sufficient conditions for differentiability (Statement only). Study of complex functions: Exponential function, Trigonometric functions, Hyperbolic functions, real and imaginary part of trigonometric and hyperbolic functions, Logarithmic functions of a complex variable, complex exponents (Scope as in Chapter 12, Sections 12.3 – 12.4, 12.6 – 12.8 of Reference 1).

(8 Lectures)

Laurent Series of function of complex variable, Singularities and Zeros, Residues at simple poles and Residue at a pole of any order, Residue Theorem (Statement only) and its simple applications (Scope as in Chapter 15, Sections 15.1 – 15.3 of Reference 1)

(7 Lectures)

Conformal Mappings, Linear Fractional Transformations (Scope as in Chapter 12, Sections 12.5, 12.9 of Reference 1).

(8 Lectures)

References:

SYLLABUS
B.E. MBA INTEGRATED IN BIOTECHNOLOGY
FOURTH SEMESTER

Paper Title: Concepts in Bio-Technology-II (Theory)
Paper Code: BIO 401     Max. Marks:100     Credits: 4
Course Duration: 45 Lectures of one hour each.

Note for the Paper setter:  The question paper should be divided into Section A and Section B Total of 8 questions, 4 from section A and 4 from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A
1. Applications of Bio-Technology
   a) Molecular diagnostics and therapeutics
   b) Immunological diagnostic procedures
   c) DNA diagnostics systems
   d) Pharmaceutical diagnostics
   e) Vaccines
2. Genetic Engineering of plants and animals

SECTION-B
3. Bioremediation and Biosensors
   a) Clean up of oil spills
   b) Clean up of soil contaminated with pesticides etc.
   c) Heavy metal biosorption
   d) Biodegradation of organic compounds
   e) Biosensors in the field of biology
4) Regulations and Patenting in Bio-Technology
   a) Biosafety levels of laboratories
   b) State level regulations to be followed in Bio-Technology laboratories
   c) Patents and biological products/processes

Books Recommended:
Paper Title:  Concepts in Bio-Technology-II (Practical)  
Paper Code:  BIO 451          Max. Marks:50          Credits: 4
Practicals:
1. Isolation of DNA and its visualization through electrophoresis.
2. Southern blot hybridization
3. Collection and cultures of microbes from some polluted spot and see their degradable activity.
4. Practice for filling up patent application.

Paper Title: Management of Information Technology (Theory)  
Paper Code: IBM 401          Max. Marks 100          Credits: 4
Course Duration: 45 Lectures of one hour each.
Note: Examiner shall set eight questions, four from Part-A and four from Part-B of the syllabus. Candidate will be required to attempt any five questions selecting at least two questions from Part-A and two from Part-B.

Part A
Information Technology (IT) [8]
IT and society, IT infrastructure in India vis-à-vis developed nations (Telecommunication, Internet reach, PC, Broadband, Mobile Phones), IT applications in Healthcare & Education, meaning of E-Readiness and E-participation index as defined by United Nations, areas where growth is expected in future.

System Investigation & Analysis, Networking [8]
System Analysis & Design, Symbols used in modeling a business process, Networking concepts, Ethernet, IP addressing, Functioning of Routers, Bridges, hubs and switches in a network, Telecommunication (GSM, CDMA, Wireless and other new technologies)

Internet & Intranet [7]
Functioning of Internet, Encryption & Digital signatures, Firewalls, Fraud on the Internet, Virus, Hacking & Denial of Service attacks, Intellectual Property Protection on the Internet, Intranet & security

Part B
E-Commerce & E-Governance [12]
E-Commerce models, Intermediaries in E-Commerce, E-Governance in India, study of successful E-Governance models like E-Choupal, E-Payments (E-Cash, E-Wallets) and major players in the area, Online Shopping, Revenue models for Online Shopping Portals, Web Auctions like eBay, dealing with E-Waste.

Knowledge Management & Business Intelligence [10]
Meaning of Knowledge Management, Designing a Knowledge Management System, Nature & Scope of Business Intelligence, Software for Business Intelligence, Data Warehousing and Data Mining techniques.

Recommended Books:


**Paper Title: Chemical Reaction Engineering (Theory)**
**Paper Code:** BIO403  **Max. Marks:** 100  **Credits:** 4
**Course Duration:** 45 Lectures of one hour each

**Note for the Paper setter:** The question paper should be divided into Section A and Section B. Total of 8 questions, 4 from section A and 4 from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

**SECTION-A**
Introduction and brief review of the Kinetics of Homogeneous reactions  (04)
Interpretation of rate data from Constant volume and Constant pressure systems. (08)
Single ideal reactors (04)
Design for single reactions (04)
Biochemical Kinetics: Interpretation of batch kinetic data; kinetics of enzymes catalyzed reactions in free and immobilized states; Michaelis-Menten equation and its various modifications; (04)

**SECTION – B**
Design for multiple reactions (08)
Biochemical Kinetics: Monod growth model and its various modifications; transport phenomena in bioprocess systems; Effects of external mass transfer in immobilized enzymes systems; analysis of intraparticle diffusion and reaction; kinetics of substrate utilization, product formation and biomass production. (06)
Thermal Characteristics of Reactors: Temperature and pressure effects. (07)

**Books Recommended:**

**Paper Title: Chemical Reaction Engineering (Practical)**
**Paper Code:** BIO 453  **Max. Marks:** 50  **Credits:** 1
1. Kinetic studies in a batch reactor.
2. Kinetic studies in a plug flow reactor.
3. Kinetic studies in a CSTR.
5. RTD studies in CSTR.
6. Dispersion number for packed bed reactor.
7. Adiabatic batch reactor.

**Paper Title: Industrial Microbiology (Theory)**

*Paper Code: BIO 404*  
*Max. Marks : 100*  
*Credits: 4*

*Course Duration: 45 Lectures of one hour each.*

**Note for the Paper setter:** The question paper should be divided into Section A and Section B Total of 8 questions, 4 from section A and 4 from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

**SECTION-A**

1. Industrially important microbes (E. coli, Bacillus, Actinomyces, Saccharomyces).
2. Preparation of an ideal growth medium for production of biomass and a microbial product.
3. Strain improvement by genetic means.
4. Culture preservation.
5. Classifications of microbial products.
6. Microbial fermentations, Introduction to design of fermentors.

**SECTION-B**

8. Equipments and accessories for industrial processes.
9. Microbial enzymes, their stability, Enzyme stabilization by selection and genetical engineering; protein engineering, reaction environment rebuilding, chemical modification, intra-molecular cross linking and "immobilization, role of enzymes" in bio-conversions of industrially important compounds.

**Books Recommended:**

Paper Title: Industrial Microbiology (Practical)  
**Paper Code:** BIO 454  
**Max. Marks:** 50  
**Credits:** 1  

**Practicals:**  
1. Microbial cell growth kinetics.  
2. Determination of size and density of the microbial cells; determination of thermal death rate constant.  
4. Production of ethanol, acids, solvents in microbial systems.  

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Paper Title: Immunology and Immunotechnology (Theory)  
**Paper code:** BIO 405  
**Max. Marks:** 100  
**Credits:** 4  

**Course Duration:** 45 Lectures of one hour each.  

**Note for the Paper setter:** The question paper should be divided into Section A and Section B. Total of 8 questions, 4 from section A and 4 from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.  

**SECTION-A**  
1. Introduction and historical perspectives of immune system. (2)  
2. Cell and tissues of immune system: Lymphoid cell, mononuclear cell, granulocytes, mast cells, dendritic cells, primary lymphoid organs, lymphatic system, secondary lymphoid organs. (4)  
3. Antigens and Haptens: Immunogenecity, chemical composition, susceptibility to antigen processing, immunogen dosage and route of administration, haptens, adjuvants. (4)  
4. Antibody Structure, Function and Antibody Diversity: Basic structure, Immunoglobulin domains, classes. (6)  
5. Major Histocompatibility Complex: MHC molecules, cellular distribution, general importance. (3)  
6. Antigen processing and Presentation to T cell: Antigen presenting cells and their role, pathway. (4)  

**SECTION-B**  
7. Antigen recognition and activation of immune response. (4)  
8. Autoimmunity: Organ specific and systematic autoimmune diseases. (3)  
9. Hypersensitive Reactions: Types, mechanisms of hypersensitivity. (3)  
10. Complement System: Components, Complement activation, consequences. (4)
11. Antigen-antibody reactions, interaction, cross reactions, precipitation and agglutination.

12. Immunoassays, radioimmunoassay, Enzyme linked immunosorbent assay, Western blotting. (4)

13. Active and Passive immunization, polyclonal and monoclonal antibodies and various types of vaccines. (4)

Books Recommended:

Paper Title: Immunology and Immunotechnology (Practical)

**Paper Code: BIO 455**  **Max. Marks: 50**  **Credits: 1**

**Practicals:**
1. TLC and DLC for blood samples.
2. Determination of cell number (viable/non-viable).
3. Ficoll density gradient, separation of cell types.
5. Determination of blood group antigens by hemeagglutination assay
7. Ouchterlony Double Diffusion Assay.
8. Characterization of immunobiologials by ELISA.

Paper Title: Legal Laws & IPR

**Paper Code: BIO 406**  **Max Marks: 100**  **Credits: 4**

**Course Duration:** 45 Lectures of one hour each.

**Note for the Paper setter:** The question paper should be divided into Section A and Section B Total of 8 questions, 4 from section A and 4 from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

**SECTION- A**

**Basics of Computer & Internet Technology:**
Internet, ISP & domain name; Network Security; Encryption Techniques and Algorithms; Digital Signatures.

**Introduction to Cyber World:**
Introduction to Cyberspace and CyberLaw; Different Components of Cyber Laws; Cyber
Law and citizens.

**E-Commerce :**
Introduction to E-Commerce; Different E-Commerce Models; E-Commerce. Trends and Prospects; E-Commerce and Taxation; Legal Aspects of E-Commerce.

**SECTION-B**

**Intellectual Property Rights:**
IPR Regime in the Digital Society; Copyright and Patents; International Treaties and Conventions; Business Software Patents; Domain Name Dispute and Resolution.

**IT Act, 2001 :**
Aims and Objectives; Overview of the Act; Jurisdiction; Role of Certifying Authority; Regulators under IT Act; Cyber Crime-offences and Contraventions; Grey Areas on IT Act.

**Project Work:**
Candidates will be required to work on a project. At the end of the course students will make a presentation and submit the project report.

**Books Recommended:**

2. Keith Merill & Deepti Chopra Cyber Cops, Cyber Criminals & Internet (IK Inter), 2002.
SYLLABUS
B.E. MBA INTEGRATED IN BIOTECHNOLOGY
FIFTH SEMESTER

Paper Title: Enzyme Engineering & Technology (Theory)

Paper Code: BIO501    M. Marks: 100    Time: 3 hrs

Course Duration: 45 Lectures of one hour each.

Note for the Paper-setter: Total of 8 questions, 4 from section A and 4 from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

Section - A
Introduction & Scope; General distinctive features and industrial applications; enzyme kinetics; single, substrate steady state kinetics; King-Altman’s method; inhibitors and activators; effect of pH and temperature; multi-substrate systems allosteric enzymes. (23)

Section - B
Immobilization of enzymes; advantages; carriers; adsorption; covalent coupling; cross linking and entrapment methods; micro-environmental effect; enzyme reactors; reactors for batch/continuous enzymatic processing, choice of reactor type; idealized enzyme reactor systems; mass transfer in enzyme reactors; steady state analysis of mass transfer and biochemical reaction in enzyme reactors bio-process design; physical parameters, reactor operational stability; operational strategies; a few case studies. (22)

Paper Title: Enzyme Engineering & Technology (Practical)

Paper Code: BIO551    M. Marks: 50    Time: 2 hrs

Assay of enzymes; substrate specificity and efficiency of enzymatic catalysis;
Kinetics of enzyme catalyzed reactions,
Immobilization of enzymes,
Microenvironmental effects in immobilized enzymes.

Books Recommended
Paper Title: Bio-Process Engineering (Theory)

Paper Code: BIO 502       Max. Marks: 100       Time: 3 Hrs.

Course Duration: 45 lectures of one hour each.

Note for the Paper-setter: Total of 8 questions, 4 from section A and 4 from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

Section - A

Kinetics of Microbial growth, substrate utilization and product formation in Batch, Fed-batch and continuous processes. (10)
Rheology of fermentation fluids and Scale-up concepts. (05)
Introduction to modeling of growth kinetics: General structure for kinetic models, overview of structure and unstructured models. (08)

Section - B

Sterilization of media: design of heat sterilization processes; kinetics; Sterilization in place and Cleaning in place concepts. (06)
Sterilization of air: Filter sterilization and kinetics. (04)
Design of fermentation media and optimization. (06)
Aeration and agitation: various correlations and mass-transfer aspects, \( k_l a \) determination. (06)

Paper Title: Bio-Process Engineering (Practical)

Paper Code: BIO 552       Max. Marks: 50       Time: 2 Hrs.

Study of different phases of microbial growth; Estimation of cell mass; Growth rate; mass and energy balance in a typical bioconversion process;
Concept of limiting nutrient and effect of its concentration on cell growth;
Study of growth inhibition kinetics;
Comparison between aerobic and anaerobic bioconversion processes;
Power consumption in a fermentation process and its correlation with rheology of the fermentation fluid; effect of speed on the mixing time in a bioreactor;
Estimation of \( k_l a \) in a fermentation process.

Books Recommended:

4. A.L. Demain; J.E. Davis : Manual of Industrial Microbiology and
Biotechnology, 1999 ASM Press, Washington DC, recented. 2010


Paper Title: Animal Cell Culture & Bio-Technology (Theory)

Paper Code: BIO503 M. Marks : 100 Time: 3 hrs

Course Duration: 45 Lectures of one hour each.

Note for the Paper-setter: Total of 8 questions, 4 from section A and 4 from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

Section-A

Animal Cell metabolism, regulation and nutritional requirement; Animal cell growth characteristics and kinetics; nutrients, substrate and product transport through mammalian cell; primary & secondary culture; cell culture in continuous, perfusion and hollow-fiber reactor; mass transfer in mammalian cell culture; scale-up of cell culture processes; case studies.

Section-B

Gene transfer in animal cells and its applications; contamination & cyno presentation; Transgenese and transgenic animals including live stock; Transgenics as bioreactors; Biotechnology or aquaculture, silkmoth, past control; Biodiversity, characterization, conservation; In vitro fertilization, embryotransfer technology; Stem cell Biology & Cloning.

Paper Title: Animal Cell Culture & Bio-Technology (Practical)

Paper Code: BIO553 M. Marks: 50 Time: 2 hrs

i. Preparation of cell culture medium.
ii. Establishment of Primary Culture;
iii. Establishment of culture of adherent cell line.
iv. Subculturing of non-adherent cell line
v. Cryopreservation of cultured cells.
vi. Revival of cryopreserved cell lines into culture.
Books Recommended:

Paper Title: Transport Phenomena (Theory)

Paper Code BIO 504 Max marks 100 Time 3 hours

Course Duration: 45 Lectures of one hour each.

Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions, 4 from section A and 4 from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A


Transport properties-Viscosity, Thermal Conductivity and mass diffusivity.

Development of mathematical models of transfer processes through shell momentum balance for solving specific problems of transport of momentum in laminar flow or in solids in one dimension.

Development of general differential equations of fluid flow and their applications in solving one-dimensional steady state and unsteady state problems of momentum transfer.

Emphasis on the analogy between momentum heat and mass transfer with respect to transport mechanism and governing equations.

SECTION -B

Development of mathematical models of transfer processes through shell energy balance and shell mass balance for solving specific problems of transport of heat and mass in one dimension.

Development of general differential equations for heat transfer and mass transfer and their applications in solving one-dimensional steady state and unsteady state problems of heat and mass transfer.

Dimensional Analysis.


Heat and mass transfer


Transport Phenomena (Practical)

Paper Code: BIO 554 Max Marks 50 Time: 2 hrs

1. Thermal Conductivity of solids
2. Measurement of viscosity of liquids
3. Measurement of diffusivity of a binary system
5. Heat transfer in natural convection.
7. Wetted wall column: to find the mass transfer coefficient as a function of gas mass velocity in a wetted wall column.

Marketing Management

Paper Code: IBM 501 Max. Marks 100 Time: 3 Hours

Course Duration: 45 Lectures of one hour each.

Note: Examiner shall set eight questions, four from Part-A and four from Part-B of the syllabus. Candidate will be required to attempt any five questions selecting at least two questions from Part-A and two from Part-B.

Objectives: (i) To understand the nature, tasks and the environment under which marketing operates. (ii) To study the theory, principles and practical aspects of various marketing functions. (iii) To learn to take marketing decisions.

Part A

Introduction to Marketing: Definition; Scope and Importance of Marketing; Key Customer Markets; Concepts/Philosophies of Marketing; Holistic Marketing Concept; Marketing Tasks; Marketing Mix
Marketing Environment:  
Marketing Environment; New Marketing Realities; New Consumer Capabilities; Demographic Environment; Social-Cultural Environment; Natural Environment; Technological Environment and Political-Legal Environment; SWOT analysis.

Analyzing Markets:  
Marketing Research Process; Sources of data collection; factors influencing consumer behavior; buying decision process; post-purchase behavior; Organizational Buying; Stages in the Buying Process.

Market Segmentation:  
Levels of market segmentation; segmenting consumer markets; Niche Marketing; segmenting business markets; Michael Porter’s five forces model; Analyzing competitors; strategies for market leaders; Targeting and Positioning.

Part B

Product Decisions:  
Product characteristics; classifications; differentiation; packaging and labeling; Product Life Cycle.

Pricing Strategies:  
Understanding Pricing; Setting the Price; Initiating and Responding to Price Changes; Reactions to Competitor’s Price Changes.

Marketing Channels:  
Marketing Channels; Role of Marketing Channels; Identifying Major Channel Alternatives; Types of Intermediaries; Channel-Management Decisions, Retailing, Wholesaling.

Marketing Communication:  
The Role of Marketing Communications; Communications Mix-Advertising, Sales Promotion, Public Relations and Publicity, Events and Experiences, Direct and Interactive Marketing, Personal Selling.

References:
2. Ramaswamy, V.S. & Namakumari, S: Marketing management, planning, implementation and control, 3rd, Mechnillan.
3. Hepner H.W.: Modern Marketing- Dynamics and Management.11th, UBS.
4. Britt and Boyd (ed): Marketing Management and Administration, 2nd, PHI.
Paper Title: Human Resource Management
Paper Code: IBM 502
Max. Marks 100
Time: 3 Hours

Course Duration: 45 Lectures of one hour each.

Note: Examiner shall set eight questions, four from Part-A and four from Part-B of the syllabus. Candidate will be required to attempt any five questions selecting at least two questions from Part-A and two from Part-B.

Objectives: The objective of the paper is to make student aware of the various functions and importance of the HR department in any organization. It is basically concerned with managing the human resources, whereby the underlying objective is to attract retain and motivate the human resources in any organization, which is the most challenging and daunting look for any organization today.

Part A

Introduction: [5]
Meaning, scope, objectives and functions of HRM; Importance of Human Resource Management; HRM & HRD a comparative analysis;

Environment of HRM: [5]
Role of government, internal and external forces; Human Resource Management practices in India.

Definition, objectives, process and importance; Job analysis, description, specification & job evaluation; Recruitment, selection, placement and induction process;

Human Resource Development: [6]
Concept, Employee training & development; Career Planning & development; Promotions, demotions, transfers, separation, absenteeism & turnover;

Part B

Job Compensation: [6]
Wage & salary administration, incentive plans & fringe benefits.

Performance Management: [6]
Concept & process, performance appraisal, Potential appraisal;
Quality of work life (QWL):
Meaning, techniques for improving QWL.

Industrial Relations:
Concept and theories, trade unions; Health, Safety & Employee welfare measures; Employee grievances and discipline, participation & empowerment; Introduction to collective bargaining.

References:

Paper Title: Bioinstrumentation (Theory)

Paper Code: BIO506  M. Marks : 100  Time: 3 hrs

Course Duration: 45 Lectures of one hour each.

Note for the Paper-setter: Total of 8 questions, 4 from section A and 4 from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

Section - A
Introduction: Problems unique to bioinstrumentation; Lab View: A graphical programming language for virtual instrumentation; Basic Principles: Review of system concepts input/output characteristics, the black box signals linear, time-invariant systems static characteristics dynamic characteristics time versus frequency domain analysis Fourier Analysis; Fourier transforms of common and important signals windowing Discrete Fourier Transforms The Fast Fourier Transform Spectrum Analyzers windows Frequency Analysis transfer functions, frequency response magnitude and phase functions signals through systems 'ideal' and 'best' systems time vs frequency domain filters how to measure frequency response in the laboratory; Sample systems in the time and frequency domains; 0th, 1st, and 2nd order systems; Non-ideal systems noise and signal-to-noise ratio; nonlinearities and distortion products, wave-analyzer synchronous [lock-in] detection modulator, demodulator digital techniques analog to digital conversion signal averaging V. Transducers and associated electronics displacement transducers resistive strain gages bridge circuits capacitive displacement transducers piezoelectric transducers optical transducers temperature transducers;

Hemodynamic Measurements
Blood pressure, pressure transducers (manometers) extra-vascular techniques
blood sounds stethoscopes intra-vascular techniques catheter-manometers
Blood Volume and Flow indicator-dilution methods electromagnetic flow meters
ultrasonic methods.

Section - B
Bioelectric Potentials-Electrophysiology
Origins of biopotentials dipoles remote versus local potentials muscle and nerve cells,
intracellular potentials resting potential action potential stimulators discriminators
histograms remote potentials evoked potentials; example: evoked potential audiometry
Electrodes electrode interfaces fluid-fluid salt-fluid metal-fluid surface (skin) electrodes
metal micro-electrodes glass micro-electrodes microelectrode preamplifiers
Recording and Stimulating Systems, Putting it all together interference minimization and
rejection stimulus isolation shielding grounding ground-loops; Sample recording system:
electrocardiogram; ECG instrumentation
Other cardiac devices; Pacemakers power and pulse sources electrodes; Defibrillators
Introduction to medical imaging

Books Recommended:
1. James Diefenderfer : Principles of electronics Instrumentation,
2. L.A. Geddes and Baker, L.E. : Principles of applied Biomedical Instrumentation,
3. Khandpur, R.S. : Handbook of Biomedical Instrumentation, Tata
4. G. John : Medical Instrumentation application & Designs,
5. J.R. Cameron : Homodynamic Measurements, Medical Physics.
Technology, Fourth Edition Pearson Education
Asia.
7. Cromwell et al. : Additional Reading: Biomedical Instrumentation

BIO507 Training of 4 weeks after 4th semester exams: 50 Marks
SYLLABUS
B.E. MBA INTEGRATED IN BIOTECHNOLOGY
SIXTH SEMESTER

Paper Title: Recombinant DNA Technology (Theory)

*Paper code:* BIO601                      *Max. Marks:* 100                        *Time:* 3 Hours

*Course Duration:* 45 Lectures.
*Note for the Paper setter:* Total of 8 questions may be set covering the whole syllabus. Candidate will be required to attempt any 5 questions.

**SECTION-A**

1. Gene cloning and need to clone a gene; Isolation and purification of plasmid, chromosomal and genomic DNA from bacterial, plant and animal cells. (10)

2. Different cloning vectors like plasmids, cosmids, phagemids, shuttle vectors, and other vectors for plant and animals; enzymes used in recombinant DNA technology like restriction endonucleases, ligases, polymerases, kinases and phosphatases. (10)

**SECTION-B**

3. Cloning of a specific gene; studying gene location and structure; studying gene expression; expression of foreign genes in research and biotechnology; maximization of recombinant proteins; brief introduction to sequencing and site directed mutagenesis, different types of PCR and applications; safety measures and regulations for recombinant DNA work (15)

4. A brief introduction to the followings: phage display system, Yeast two hybrid system, and RNAi technology. (5)

5. Applications of recombinant DNA technology in the fields of Medicine, Agriculture, Forensic and Environment. (5)

**Paper Title: Recombinant DNA Technology (Practical)**

*Paper code:* BIO651                      *Max. Marks:* 50                        *Time:* 2 Hours

Digestion of plasmid DNA by restriction endonuclease; Ligation assay; Amplification of DNA using PCR; RAPD PCR; Induction and expression of a gene cloned in an expression vector in *E.coli*.
Books Recommended:


SIXTH SEMESTER B.E. (BIO-TECHNOLOGY) SYLLABUS

**Paper Title:** Operations Research

**Paper Code:** BIO602  
**Maximum Marks:** 100  
**Time of examination:** 3hrs.

**Course Duration:** 45 lectures of one hour each.

**Note for the paper setter:** Total of 8 questions may be set covering the whole syllabus. Candidate will be required to attempt any 5 questions selecting at least two from each part.

**Syllabus:**

**PART A**

**Optimization Problems. Linear Programming:** Graphical Method (Scope as in Chapter 1 of Reference 1).  
Solution of simultaneous linear equations: An overview (Scope as in Chapter 2, Sections 2.15 – 2.16 of Reference 1).  
Basic solutions, lines and hyperplanes, convex sets, extreme points, convex sets and hyperplanes (Scope as in Chapter 2, Sections 2.19 – 2.21 of Reference 1).  
Reduction of any feasible solution to a system of equations to a basic feasible solution. Simplex Method: The simplex algorithm (Scope as in Chapter 3, 4 of Reference 1).  
Tableau format for simplex computations, Charne’s M-method, Two phase method (Scope as in Chapter 5 of Reference 1).  
The revised simplex method (Scope as in Chapter 7 of Reference 1).  

(12 Lectures)
Duality theory: Formulation of the dual problem, Theorems on duality: Weak Duality Theorem, Strong Duality Theorem, Complementary Slackness Theorem, Dual Simplex Algorithm (Scope as in Chapter 8, Sections 8.1 – 8.12 of Reference 1). (6 Lectures)

Integer Linear Programming: Branch and Bound Algorithm, Cutting Plane Algorithm (Scope as in Chapter 9, Section 9.1 – 9.2 of Reference 2). (4 Lectures)

PART B

Transportation Problem: Initial solution by North-West corner rule, Row minima method, Column minima method, Matrix minima method, Vogel’s method. Tableau of transportation problem, u-v algorithm for solving transportation problem. Degeneracy in transportation problem. (Scope as in Chapter 9 of Reference 1). (6 Lectures)

The Assignment Problem: Hungarian Method (Scope as in Chapter 5, Section 5.4 of Reference 2). (2 Lectures)

Traveling Salesman Problem (Scope as in Chapter 9, Section 9.3 of Reference 2). (2 Lectures)


CPM and PERT: Network representation, Critical path computations, Construction of time schedule, Linear programming formulation of CPM, PERT networks (Scope as in Chapter 6, Section 6.6 of Reference 2). (2 Lectures)

Basic Queuing Systems: Elements of a queuing model, Pure birth and pure death model, Generalized Poisson queuing model (Scope as in Chapter 17, Section 17.1 to 17.5 of Reference 2). (5 Lectures)

References:


Paper Title: Operation Research (Practical)

Paper Code: BIO652 Max. Marks 50 Time: 2 Hours

Practicals based on theory paper code BIO602
Paper Title: Introduction to Bioinformatics (Theory)

Paper Code: BIO 603          M. Marks : 100          Time: 3 hrs

Course Duration: 45 Lectures of one hour each.

Note for the Paper-setter: Total of 8 questions, 4 from section A and 4 from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

Section –A

Introduction to Bioinformatics:
History of Bioinformatics; Objectives and areas of Bioinformatics; Genome sequencing projects; Human Genome Project - history, techniques and insights.

Introduction to databases:
Basic concept of database, Type of databases;
Literature Databases-PUBMED, MEDLINE;
Nucleic acid and protein databases- GenBank, EMBL, DDBJ, SWISS PROT, UNIPROT;
Human, animal and plant databases- Ensembl, Genome project TIGR database, Maize
GDB etc. Structural databases- PDB, PDBsum, NDB etc; Motifs and Pattern Databases-
PROSITE, Pfam, BLOCKS, PRINTS etc; Database Retrieval and deposition systems-
SRS, Entrez, Bankit, Seqin, Webin, AutoDep.

Basic Sequence Analysis:
Protein Sequence Analysis- composition, hydropathy, flexibility, pattern, motif etc;
Nucleic acid Sequence Analysis- Composition, motif, restriction site, primer design etc.

Sequence Homology:
Scoring matrices, Local and global alignment concepts, Dot matrix sequence comparison,
Dynamic programming; Statistics of alignment score;
Database searches for homologous sequences- FASTA, BLAST, PSI-BLAST and PHI-
BLAST;
Multiple sequence alignment: CLUSTALW, PILEUP;
Evolutionary analysis- Concept of phylogeny and trees, Relationship of phylogenetic
analysis to sequence alignment.

Gene prediction:
Gene prediction in prokaryotic and eukaryotes genomes; evaluation of gene prediction
methods.
**Section - B**

**Protein structure prediction:**
Prediction of protein secondary structure from the amino acid sequence- Chou-Fasman/GOR method, JPRED, PSIPRED, PHD;
Prediction of three-dimensional protein structure-Homology-based structure prediction, Fold recognition and \textit{ab initio} methods for structure prediction;
Evaluating the success of structure predictions-CASP and CAFASP.

**Introduction to the concepts of molecular modeling:**
Molecular structure and internal energy; Molecular Mechanics; Energy Minimization and related methods for exploring the energy surface; Molecular Dynamics, Conformational analysis;
Use of molecular graphics packages- Rasmol, MOLMOL, Chimera, Pymol, spdbviewer.

**Computer Aided drug design:**
Drug discovery process; Role of molecular recognition in drug design; Concepts in Quantitative structure activity relationships (QSAR); Docking problem, Concepts of docking; Structure based Drug design.

**Applications of Bioinformatics:**
Comparative Genomics; Proteomics; Gene expression informatics; Metabolomics; Computer aided vaccine design.

**Text / Reference Books:**

7. Jiawei Han, Micheline Kamber, Data Mining Concepts and Techniques- Morgan Kaufmann publisher, 2001.
13. P. Clate & R. Backofen (1998), Computational Molecular Biology, Willy Publication,

**Paper Title:** Introduction to Bioinformatics (Practical)
**Paper Code:** BIO 653  **Max Marks** 50  **Time:** 2 hrs

a) To Study & analyse various biological databases at NCBI, EBI, Expasy, NBRF-PIR Nucleic acid sequence databases like Gene Bank, EMBL etc.
Protein sequence databases SWISSPROT, UNIPROT etc.
Structural databases- PDB, NBD

b) To retrieve sequences from NCBI/EBI/ExPasy using ENTRZ, SRS

c) Similarity searches using various tools like
BLAST/ FASTA, BLAST N, BLAST P, BLAST X

d) CLUSTALW / Phylogenetic analysis tools

e) To predict gene/ORF for genomic DNA sequences of prokaryotic and eukaryotic origin.

f) To analyze protein sequence using Secondary Structure prediction Methods:
Chou-Fasman/GOR method, JPRED, PSIPRED, PHD etc.

g) Energy minimization using SPDBV.

h) To download structures of proteins in software like RASMOL, SPDBV and analysis of structures in these software

i) Fold recognition

j) Homology modeling using SPDBV.

**Paper Title:** Managerial Economics
**Paper Code:** IBM 601  **Max. Marks** 100  **Time:** 3 Hours

Course Duration: 45 Lectures of one hour each.

**Note:** Examiner shall set eight questions, four from Part-A and four from Part-B of the syllabus. Candidate will be required to attempt any five questions selecting at least two questions from Part-A and two from Part-B.

**Objectives:** To provide students with an understanding of basic economic principles of production & exchange-essential tools in making business decisions in today’s global economy. The object presents the foundation to understanding how the economy works,
covering microeconomic description of business applications, including pricing for profit maximization, price elasticity, market structures and modeling of business in varying economic climates. The focus is on market economics, the organization that operation there and their business strategies.

Part A
Introduction to Managerial Economics: Nature Scope and Importance of Managerial Economics, opportunity costs, incremental principle, time perspective, discounts and equi marginal principles.

Demand Concepts and Analysis: Individual Demand, Market Demand, Kinds of Demand, Determinants of Demand, Demand Functions, Functions, Demand Schedule and Law of Demand.

Theory of Consumer Behavior: Cardinal Utility Approach and Ordinal Utility (Indifference Curves) Approach;

Elasticity of Demand: Concept, Types, Measurement and importance.

Demand Forecasting: Sources of Data-Expert Opinions, Surveys and Market Experiments; Time Series Analysis-Trend Projection; Barometric Forecasting-Leading Indicators, Composite and diffusion Indices.

Part B
Production Function: Concept and types, Returns to Factor and Returns to Scale, Law of Variable Proportions.

Cost concepts and Analysis: Concept of Cost, Short run and Long-run Cost Curves, Relationships among various costs, Break-even Analysis.

Revenue Curves: Concept and Types.

Perfect Competition: Characteristics, Equilibrium Price, Profit Maximizing output in Short Run and Long Run;

Monopoly: Characteristics, Equilibrium Price, Profit Maximizing output in Short Run and Lung Run; Price Discrimination;
Imperfect Competition:

Monopolistic Competition, oligopoly and Barriers to Entry.

References:
8. Mote, Paul Gupta: Managerial Economics, Vikas Publisher, New Delhi, 1st ed.

Paper Title: Corporate Legal Environment

Paper Code: IBM 602 Max. Marks 100 Time: 3 Hours

Course Duration: 45 Lectures of one hour each.

Note: Examiner shall set eight questions, four from Part-A and four from Part-B of the syllabus. Candidate will be required to attempt any five questions selecting at least two questions from Part-A and two from Part-B.

Objective: Corporate legal environment represents that external environment in which the organization has to work. The course covers the basic laws which a student must be aware of.

Part A

Information Technology Act-2000:
Objective of the act, documents excluded from the scope of the act, digital signatures, types of digital signatures in India, certifying authorities in India, regulation of certifying authorities, duties of subscribers, offences, appellate tribunal, penalties and adjudication

Company Law:
Definition and nature of a company, kinds of companies, formation of a company, memorandum of association, articles of association, prospectus, membership in a company, shares, transfer and transmission of shares, meetings and proceedings.

Part B

Patents Law:

Consumer Protection Act 1986:
Definitions under the act: complaint, consumer, defect, deficiency, unfair trade practice, consumer protection councils, redressal machinery under the act, district forum, state commission, national commission

References:

Paper Title: Downstream Processing

Paper Code: BIO605  M. Marks 100  Time: 3 Hours

Course Duration: 45 Lectures of one hour each.

Note for the Paper-setter: Total of 8 questions, 4 from section A and 4 from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

Section – A
Introduction; An overview of Bioseparation, Separation of cells and other insolubles from fermented broth; Filtration and microfiltration; Centrifugation (batch, continuous). Designing of centrifuges for desired product of desired capacity; Cell disruption: Physical methods – osmotic shock, grinding with abrasives solid shear, liquid shear, Chemical methods- alkali reagents, enzymatic methods; Product isolation: Extraction and adsorption method, solid-liquid separation, liquid-liquid separation, distillation, precipitation method using ammonium sulfate, organic solvents, high molecular weight polymers, reverse osmosis;

Section – B
Electrophoresis and chromatography principles for product purification. Different electrophoresis techniques viz. isoelectric focusing, chromatographic techniques viz. paper, gel filtration, column, ion exchange, affinity, GLC, HPLC. Dialysis, ultrafiltration; Product polishing: crystallization and drying.

Paper Title: Down Stream Processing (Practical)

Paper Code: BIO655  Max. Marks 50  Time: 2 Hours
Cell lysis and release of cell contents; Use of centrifugation, ultra centrifugation Ultra filtration, lypophilization, crystallization, HPLC for biosparation.

**Books Recommended:**


**Paper Title : Biomaterials**

Paper Code: BIO606 M. Marks 100 Time: 3 Hours

Course Duration: 45 Lectures of one hour each.

Note for the Paper-setter: Total of 8 questions, 4 from section A and 4 from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

**Section - A**

Introduction to biomaterials, Characterization of materials; mechanical properties; thermal properties; surface properties and adhesion; Various classes and forms of biomaterials;

**Metals** : Stainless steel, Cobalt- Chromium Alloys, Titanium based alloys other metals, metallic corrosion and urological tolerance.

**Cermics** : Carbons alumina, recoverable ceramics, composites, ceramic surface analysis

**Synthetic polymers** : Polymers in luomedial use, polyethylene, polypropylene, perfluorinated polymers. Acrylic polymers, hydrogels, polyurethanes, polyamide, silicone rubbers, polymer sterilization.

**Biopolymers** : Collagen, Elastin, Mucopolysarrharides, Proteoglycans Cellulose and derivatives and other.

**Tissue grafts** : Blood, Tissue grafts and rejection processes, shim and grafts

**Soft tissue speciation** : Space filters maxillofacial and fluid transfer implants, biomaterials in urological practice.

**Section - B**

**Biomaterials in ophthalmology** : Anatomy of eye, Viscoelastic Solution Contact Lens and Optical implants, Skeletal looking material for retinal detachment Vitreous implants artificial tears.

**Orthopedic implants** : Bone composition and materials, fixation devices, Fracline healing by clinical and dedromagnetic stimulation hip joint replacement, Knee joint repair, bone regeneration with restorable materials.

**Dental Materials** : Tooth composition and mechanical properties impression materials, filling and restorative materials, metal in dentist, oral implants use of collagen in dentist

**Books Recommended**:
2. Finman : Biomaterials
B.E. MBA(Biotechnology) Fourth Year-Seventh Semester (Syllabus)

BIO701 Environmental Biotechnology

Total Number of lectures: 45  M. marks: 100  Time: 3 hrs

Note for the Paper setter: The question paper should be divided into Section A and Section B. Total of 8 questions, 4 from section A and 4 from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A

Introduction: Environmental Pollution, Sources and effects. Biodegradation and Bioremediation—definitions and examples. (5)


SECTION-B


Microbial Leaching and Mining: Recovery of metals from solutions, microbes in petroleum extraction, microbial desulphurization of coal. (7)

Environmental Genetics: Degradative plasmids, release of genetically engineered microbes in environment. (5)

Practical:

To determine BOD & COD levels of the sample. Application of microbial approaches in the remediation of contaminated soils. Analysis of contaminated and bioremediated samples.

Reference Books

Paper Code: BIO 702  Food Biotechnology

Course duration: 45 Lectures of one hour each. M.Marks: 100  Time: 3 hrs

Note: The question paper should be divided into Section A and Section B Total of 8 questions, 4 from section A and 4 from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section

SECTION-A

History of Microorganisms in foods (2)
Primary sources of Microorganisms in foods (3)
Synopsis of common food borne bacteria, fungi and yeasts (6)
Incidence & Behavior of Microorganisms in foods (3)
Extrinsic & Intrinsic parameters of foods (4)
Role and Significance of Microorganisms as Single cell proteins, Food value of Mushrooms, Yeasts, Production of Fermented foods (3)

SECTION-B

Food types and their physical & chemical properties (4)
Food Spoilage (3)
Food Borne diseases (6)
Food Preservation (5)
Diagnosis of microbial contents of food: Classical & Molecular approach (4)
Food Biosensors (2)

Practical:

Microbiological Examination of food/s. Enumeration and detection of food borne organisms. Estimation of quality of milk-by dye reduction, direct microscopic count, Determination of diacetyl, titrable acidity in the milk sample.

Reference books


BIO703 Plant Tissue Culture

Total Number of lectures: 45  M. Marks: 100  Time: 3hrs

Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions, 4 from section A and 4 from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

Section A

Introduction, requirements and Techniques. (4)
Tissue Culture Media and Cell Culturing. (5)
Cellular Totipotency, Somatic Embryogenesis, Synthetic seeds. (6)

Haploid Production: Zygotic Embryo Culture: Morphogenesis in the culture of seeds with partially differentiated embryos. (5)

Section B

Microsurgical experiments, Morphogenetic potential of the embryo callus, practical applications. (5)
In-Vitro Pollination and Fertilization: Introduction, Terminology, In-Vitro Pollination, Applications. (5)
Genetic engineering and production of pathogen free plants: Gene expression, genetic stability, and field performance. (5)
Introduction, Strategies used to optimize product yield, commercial aspects, Germplasm storage: Introduction, long term Storage, Short or Medium term storage. (10)

Reference Books:


BIO 704 Bioanalytical Techniques

Max. Marks: 100
Time: 3 Hours

Course Duration: 45 lectures of one hour each.
Note for the paper setter: The question paper should be divided into section A and section B. Total of 8 questions, 4 from section A and 4 from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

Section-A

Spectrophotometry (UV and Visible): Principle, single beam and double beam spectrophotometer, factors influencing the absorption spectra, overview of empirical rules, solvent perturbation method and difference spectroscopy; various applications of absorption spectroscopy w.r.t. biotechnology. (05)

Spectrofluorimetry: Principle, significance and various details related to instrumentation. (03)

Atomic absorption Spectrophotometry: Principle, instrumentation details, various interferences in atomic absorption spectroscopy and applications. (04)

Infrared and Raman Spectroscopy: Principle, factors deciding the spectra, instrumentation, overview of different class of compounds and their IR spectra. Introduction to Raman scattering. (04)

Nuclear Magnetic resonance: phenomena of resonance, instrumentation, diamagnetic shielding, anisotropy, chemical shift, free induction decay (FID), population distribution of nuclei, and prediction of NMR spectra on the basis of (n+ 1) rule for basic class of compounds. Overview of electron spin resonance spectroscopy (ESR) and magnetic resonance imaging (MRI). (08)

Section-B

Electron Microscopy: Transmission and scanning electron microscopy, significance of vacuum, basic instrumentation for TEM and SEM, sample preparation for electron microscopy. Overview of Atomic force microscopy and tunneling microscopy w.r.t. their working principle and comparison with other scanning techniques. (05)

Crystallography and X-ray diffraction: Introduction to x-ray and general theory and instrumentation, Bragg’s law, various techniques to determine crystal structure. (05)

Radioisotope techniques: radiotracers, units of radioactivity measurement, proportional and scintillation counters, introduction to autoradiography and nuclear medicine. (06)

Mass Spectroscopic techniques: Introduction to mass-spectroscopy, significance, instrumentation details of a mass-spectrometer, ionization techniques, single and double focusing, alternate mass separation techniques- time of flight and quadruple. Interface of mass-spectra with liquid and gas chromatography (LC-MS and GC-MS). (05)
Practical:
Different experiments to confirm spectroscopic laws, practical demonstration of the above mentioned techniques.

Suggested Books:

IBM 701  Entrepreneurship and Project Management  L T P 3 1 0

Paper Code: IBM 701   Max. Marks: 100 (External)   Time: 3 Hrs
Course Duration: 45 Lectures of one hour each

Note: Examiner shall set eight questions, four from Part – A and four from Part – B of the syllabus. Candidate will be required to attempt any five questions selecting at least two from each part.

Objectives: To understand the concept and importance of entrepreneurship and its role in business life for individual, corporate growth and development.

Part – A

Introduction: Definition, Need, Classification, Process, Scope and Nature of Entrepreneurship, Difference between entrepreneur, entrepreneurship, enterprise and entrepreneurial. (6 hrs)

Concepts of Entrepreneurship: Factors affecting entrepreneurship, Functions of entrepreneurship, Culture of modern entrepreneurship, Competencies and traits of entrepreneurship, Entrepreneurial ventures in India. (6 hrs)

Types of entrepreneurship: Role of mitigation in entrepreneurship, Myths of entrepreneurship, Role of family structure in entrepreneurship. Women entrepreneurs, Internet Entrepreneurship, Case Study. (8 hrs)

Part – B
**Project Management**: Meaning, Concept, Characteristics, Types, Importance, and Steps in Project Identification, Concept of Project Management, Forms of Project Organization.  
(11 hrs)

**Project system**: Life cycle of system; Project Manager: Attributes;  
(7 hrs)

(7 hrs)

**Internal Assesment**:  
Sessionals 15+15 marks  
Quiz/Project/Assignment: 20 marks

**Text Books**:  

**Reference Books**:  

**IBM 702 Industrial Relations**

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Paper code: IBM 702  
Max marks: 100(External)  
Time:3hrs.

Course duration: 45 lectures of 1hour each

**Note**: Examiner shall set eight questions, four from Part – A and four from Part – B of the syllabus. Candidate will be required to attempt any five questions selecting at least two from each part  

**Objective**: The objective of this course is to make the students familiar with various industrial relations approaches and procedure to resolve industrial dispute and with various industrial relations legislations

**Part A**

**Industrial Relations**: Concepts & Definitions - Impact of Industrial Revolution on Industrial Relations - Indian Industrial Workers- Work Culture - wages and industrial relations - Objectives of Industrial Relations.  
6hrs

**Four Actors in Industrial Relations** – The Workers – management – Government – Society & their Importance in maintaining Industrial Relations.  
4hrs


Strikes – Types of strikes 2hrs

Part B

Trade Union – Definition structure – features – Functions of trade Union – Trade Union Security – Types of Trade Unions – Reformist trade union 4hrs


Industrial Democracy and Workers’ participation in Management – Role of workers and management in the industry. 3hrs

Employees’ grievance – Meaning – Causes – Grievance redressal procedures. 2hrs

Industrial Relations Legislations:
   a) Trade Union Act,1926
   b) Industrial Disputed Act, 1947
      (Tripartite and Bipartite bodies : Resolution of Industrial Disputes by conciliation , Arbitration, Ad-judication, Prohibition of strikes – Lockout – Layoff – Retrenchment – Closure etc.)
   c) Industrial Employment (Standing Orders) Act, 1946
      (Terms and Conditions of employment and disciplinary procedure) 6hrs

Other Legislations
Payments of Wages Act,1936
Minimum Wages Act,1948
The Factories Act,1948 6hrs

Suggested Readings:
1. Industrial Law –P.L.Malik,Eastern Book Co.Lucknow

BIO 705: Minor Project

BIO706 TRAINING OF 4 WEEKS AFTER 6th SEMESTER EXAMS.
SYLLABUS FOR B.E. MBA (BIO- TECHNOLOGY)
EIGHTH SEMESTER

BIO 801 Major Project

BIO 802 Enzyme Catalyzed Organic Synthesis

Total Number of lectures: 45  
Maximum marks: 100

Note for the Paper setter:  
The question paper should be divided into Section A and Section B Total of 8 questions, 4 from section A and 4 from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION-A

Biocatalysis: Definition of Biocatalysis, advantages and disadvantages of Biocatalysis over chemical catalysis. Different types of Biocatalysis; microbial, enzymatic and immobilized system of Biocatalysis; current industrial biocatalysis with different enzymes.

Immobilized enzymes for Biocatalysis.  
Industrial processes: Comparing different approaches.  

(15)  
(8)

SECTION-B

Stereo selective biocatalysts for the synthesis of chiral pharmaceutical intermediate such as synthesis of ACE inhibitors, definition, mode of action of inhibitors, recent developments synthesis of anticholesterol drug by biocatalysis routes, calcium channel blocking drugs, potassium channel openers, antiviral.

Practical:

Optimization of enzymatic catalysis reaction conditions.
Enzymatic catalysis reaction with activators and inhibitors.
Product identification using different analytical technique.

Reference Books


Research Methodology

Paper Code: IBM-801 Max. Marks: 100(External) Time: 3 Hrs
Course Duration: 45 Lectures of one hour each

Note: Examiner shall set eight questions, four from Part – A and four from Part – B of the syllabus. Candidate will be required to attempt any five questions selecting at least two from each part

Objectives: The main objective of this subject is to help the students to understand the nature, scope, complexities and process of defining a business research question. The learning focus is on developing business research skills to underpin the approach taken to a work integrated project.

PART-A

Introduction: Meaning, Features, Objectives/Motives, Steps & Types of Research; Attributes of good Research, Research Methods and Research Methodology; Research Process, Significance of Research in Managerial decision making. (8 hrs)
Research Design: Meaning, Characteristics and various concepts relating to research design and classification of research design, Importance, Design for different types of research. (5 hrs)
Concepts: Concept, Constructs, case study and Variables. (3 hrs)
Formulation of Hypothesis: Meaning, Characteristics and Concepts relating to testing of Hypothesis, Types of Hypothesis, Procedure of testing Hypothesis. Chi – Square test. (5 hrs)

PART-B

Data Collection: Sources of Data-Primary/Secondary Methods of collecting data; direct personal interview, indirect oral interview, information through local agencies, mailed questionnaire method, schedule sent through enumerators; questionnaire and its designing and characteristics of a good questionnaire. (8 hrs)
Sampling Design: Meaning, Need, Purpose and Principles of Sampling, Types of Sampling. (5 hrs)
Data Analysis & Interpretation: Introduction to Multivariate analysis- Multiple and partial correlation, multiple regression analysis (with two independent variables), specification of regression models and estimation of parameters, interpretation of results.
Analysis of Variance (ANOVA)-One way and Two way ANOVA. (Numerical not to be asked) (6 hrs)

**Report writing:** Style/format, contents and essential steps for report writing. (5 hrs)

**Internal Assessment:**
- Sessionals: 15+15 marks
- Quiz/Project/Assignment: 20 marks

**Text Books:**

**Reference Books:**
2. Ranjit Kumar: Research Methodology, Pearson Education.

**Financial Management**

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**Paper code:** IBM-802

Max marks: 100(External) Time: 3hrs.

Course duration: 45 lectures of 1 hour each

**Note:** Examiner shall set eight questions, four from Part – A and four from Part – B of the syllabus. Candidate will be required to attempt any five questions selecting at least two from each part.

**Objective:** The objective of this course is to create basic understanding of corporate finance, Capital Budgeting decisions, working capital management, project management etc in the Engineering profession.

**PART-A**

**Corporate Finance**


**Working Capital Management**

Concept, Need and Types of Working Capital Management of Cash, Inventory, Accounts Receivable and Accounts Payable, Over and Under Trading. 6hrs
Ratio Analysis

Techniques of capital Budgeting: Various types of Capital Budgeting, Payback method, NPV, IRR, ARR, Capital Rationing. 6hrs
Cost of Capital: Cost of Enquiry, Cost of Debt, Cost of Retained Earnings, Weighted Average cost of Capital. 3hrs

PART-B
Portfolio Management
Securities, Markets, Stock Exchanges, Risk Return, Relationship, Portfolio Structures. 6hrs

Dividends, Bonus and Rights
Dividends Policy, Legal Requirements for issue of Bonus Shares, Right Shares and Share Premium. 6hrs

Financial Management in Public Enterprises.
Concept & its applications 4hrs.
Concept of Leverages
Operating, Financial and Combined 3 hrs.
Optimum Capital Structure
EBIT-EPS Relationship, Tax shield Analysis 3 hrs.

Suggested Readings:

BIO 804 Modeling and Simulation of Bioprocesses

Total Number of lectures: 45 Maximum marks: 100

Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions, 4 from section A and 4 from section B are to be set.. The students will be required to attempt 5 questions selecting at least 2 from each section.
SECTION-A
Types of kinetic models. Data smoothing and analysis. (8)
Mathematical representation of bioprocess; parameter estimation; numerical integration techniques; parameter sensitivity analysis; statistical validity. (10)
Discrimination between two models. Physiological state markers and its use in the formulation of a structured model. (5)

SECTION-B
Development of compartment and metabolic pathway models for intracellular state estimation. (10)
Dynamic simulation of batch, fed-batch steady and transient culture metabolism; Numerical optimization of Bioprocesses using Mathematical models. (12)

Practical:
To design mathematical models from the provided data.

Reference Books

ELECTIVE - 1
BIO805 Nanobiotechnology
Total number of lectures: 45 Maximum Marks: 100
The question paper should be divided into section A and section B. Total of 8 questions, 4 from section A and 4 from section B are to be set. The students will be required to attempt 5 questions selecting at least 2 from each section
SECTION A

Cell nanostructure interactions: Surface patterning to control the adhesion of cells using nanoscale topography and chemical modifications

Magnetosomes: Magnetotactic bacteria, Magnetite crystals, Magneto-aerotaxis, Applications

Nanotherapeutics: Nanoshells, Dendrimers, Nanoparticles

Tissue engineering: Significance, Methodology, Tissue engineering scaffolds- composition, properties, fabrication, cell seeding and proliferation

Nanomembranes: Freely suspended nanomembranes

SECTION B

Bionanodevices: Nanosensors and Actuators

Nanopumps: Fabrication using SOI wafers

Nonorobots: Developing nanorobots for biomedical application

Molecular motors: Surface patterning and the control of motility of the actin/myosin motor system

Engineered nanopores: Classes of nanopores, engineering techniques, potential applications of nanopores

Reference Books


ELECTIVE – 2

BIO 805 Microbial Biodiversity

Total Number of lectures: 45 Maximum marks: 100

Note for the Paper setter: The question paper should be divided into Section A and Section B Total of 8 questions, 4 from section A and 4 from section B are to be set.. The students will be required to attempt 5 questions selecting at least 2 from each section.

SECTION A
Microbial biodiversity: definition and introduction, evolution and diversity of microorganisms. (7)
Physiological and metabolic diversity of microorganisms. (7)
Microbial diversity of major ecosystems. (8)

SECTION B

Biodiversity & role of microorganisms in plants and animal symbiosis. (8)
Microbial diversity in extreme environments. (9)
Microbial biodiversity, biotechnology and future biodiversity. (6)

Reference Books