Scheme and Syllabus of
MASTER OF ENGINEERING
M.E. (Biotechnology)
3rd to 4th semester

2020-2021

University Institute of Engineering and Technology,
Panjab University, Chandigarh
SCHEME AND SYLLABUS OF M.E. (BIOTECHNOLOGY) 1ST TO 4TH SEMESTER

SCHEME OF EXAMINATION OF M.E. BIOTECHNOLOGY

Second Year – Third Semester

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject Name</th>
<th>L-T-P</th>
<th>Credits</th>
<th>Contact hrs/week</th>
<th>Marks</th>
<th>Total Marks</th>
</tr>
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<tbody>
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<tr>
<td>1</td>
<td>ME BIO 301</td>
<td>Elective III</td>
<td>3-0-0</td>
<td>3</td>
<td>3</td>
<td>50</td>
<td>100</td>
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<td>2</td>
<td>ME BIO 302</td>
<td>Elective IV</td>
<td>3-0-0</td>
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<td>3</td>
<td>50</td>
<td>100</td>
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<td>3</td>
<td>ME BIO 303</td>
<td>Thesis Work I</td>
<td>20</td>
<td>10</td>
<td></td>
<td>100</td>
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<td>26</td>
<td>16</td>
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<td>200</td>
<td>300</td>
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Total Hrs/wk = 26     Total Credits = 16

ELECTIVE III

- ME BIO 301a: Nano Biotechnology and Nano Devices
- ME BIO 301b: Agriculture Biotechnology
- ME BIO 301c: Bioprocess Control & Instrumentation

ELECTIVE IV

- ME BIO 302a: Biological Waste Water Engineering
- ME BIO 302b: Biostatistics & Computer Applications
- ME BIO 302c: Polymer Science & Engineering
## SCHEME OF EXAMINATION OF M.E. BIOTECHNOLOGY

### Second Year – Fourth Semester

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject Name</th>
<th>L-T-P</th>
<th>Contact Hrs/week</th>
<th>Credits</th>
<th>Marks</th>
</tr>
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<tbody>
<tr>
<td>1.</td>
<td>ME BIO 401</td>
<td>Thesis Work I II</td>
<td>25</td>
<td>15</td>
<td>10</td>
<td>100</td>
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</tbody>
</table>

**Total Hrs/wk = 25**  
**Total Credits = 15**

*Instructions for Internal Assessment for marks/grades for Thesis*

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Grade</th>
<th>Requirement</th>
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<tbody>
<tr>
<td>1</td>
<td>A+</td>
<td>Publication from Thesis in SCI/SCIE indexed journal</td>
</tr>
<tr>
<td>2</td>
<td>A</td>
<td>Publication from Thesis in Scopus/ESCI indexed journal.</td>
</tr>
<tr>
<td>3</td>
<td>B+</td>
<td>Paper presented in International / National conference</td>
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**Total Marks: 1700**  
**Total Credits: 75**
SYLLABUS OF M.E. (BIOTECHNOLOGY) 3rd SEMESTER

Paper Title: ME BIO 301a: Nano Biotechnology and Nanodevices (Elective - III)

Paper Code: ME BIO 301a L T P 3 0 0 Credits: 3

Internal Assessment: 50 University Examination: 50

Course Duration: 45 Lectures of one hour each.

Note for the Paper setter: The semester question paper of a subject will be of 50 Marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each section.

SECTION A

INTRODUCTION TO NANOBIOTECHNOLOGY: Basic concept, recent advances and applications of nanobiotechnology

NANOFABRICATION TECHNIQUES FOR BIOLOGICAL APPLICATIONS: Top down techniques-electron beam lithography, nanoimprint lithography. Bottom up approaches-block copolymer micelle nanolithography, sol gel process.

HYBRID BIO NANODEVICES: Fabrication and applications

NANO FLUIDIC DEVICES: Basic theory, construction of nanofluidic devices, lab on a chip.

NANOSTRUCTURED SURFACE AND CELLULAR BEHAVIOUR: Creation of cell interactive surfaces by chemical and topographical nanopatteming, surface functionalization of nanoparticles, cellular response to the nanostructured surfaces.

SECTION B

DNA BASED NANOSTRUCTURES: DNA based nanowires and network fabric and their applications, self assembled DNA nanostructures and nanodevices, DNA programmed organization of nanostructures

PROTEIN NANOTECHNOLOGY: Protein based self-assembly nanostructures’ layers, nanopores. Protein nanoarrays- construction and application

NANOTECHNOLOGY AND DIAGNOSTICS: Quantum dots, Surface plasmon resonance based nanosensors, nanowires, SERS active nanoparticles, nanoparticles as contrast agents for MRI

NANOTECHNOLOGY AND THERAPEUTICS: Nanodiamonds, carbon nanotubes, virus based nanoparticles, dendrimers, gold nanoparticles

NANOTECHNOLOGY IN TISSUE ENGINEERING: Nanofabrication techniques to develop scaffolds for tissue engineering

Recommended Books

Note for the Paper setter: The Semester question paper of a subject will be of 50 Marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two Sections having three questions each and candidate is required to attempt at least two questions from each section.

SECTION-A

Introduction and History of Plant Biotechnology

General Concept and Methodology- Nutrition of cell and organ culture, PGRs and their use in micropropogation, totipotency, cloning (isolation and culture of single cells, propagation from non-meristematic tissues-non zygotic embryogenesis and organogenesis, transfer and establishment of whole plants in soil, shoot tip culture (clonal propagation and production of virus free plants), embryo rescue.,

Hybrid Plants- Protoplast isolation, culture and fusion, selection and regeneration of hybrid plants, symmetric and asymmetric hybrid, cybrid.

Production of Haploid/Double Haploid Plants- Andereogenesis and gynogenesis, homozygous lines.

In-vitro Pollination and Fertilization: Ovular, ovary and stigmatic pollination, techniques for in-vitro fertilization, chemical, physical and electoral fusion.

SECTION-B

Plant Transformation, Productivity And Performance- Basis of tumor formation, hairy root, features of Ti and Ri plasmids, mechanism of DNA transfer, role of virulence genes, use of Ti and Ri as vectors (binary and co-integrate), use of 35S and other promoters, selection markers, reporter genes, viral vectors and their application, transformation methods Ŧ biological, physical and chloroplast transformation. Herbicide resistance, insect resistance, virus resistance, thionins, PR proteins, nematode resistance, abiotic stress, post harvest losses, product shelf life improvement, male sterile lines, bar and barnase systems.

Plant Metabolic Engineering - control mechanisms, manipulation for Plant secondary metabolic pathways and their commercial relevance.

Recent Advances in Agricultural Biotechnology: Use of enzymes as biopesticides, nanopesticides, management of agro waste, phytoremediation of heavy metals, biodegradable plastics, therapeutic proteins, edible vaccines.

Recommended Books

Note for the Paper setter: The semester question paper of a subject will be of 50 Marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each section.

SECTION-A

Introduction, need for process control, design elements of a control system, Difference between feedback and feed forward control configuration, Hardware for a process control system. (5)  
Block Diagrams, Laplace transforms and transfer functions, difference between lumped and distributed parameter system. (4)  
Dynamic behavior of first and higher order systems, interacting and non-interacting systems, dead time. (8)  
Different modes of control actions and their basic characteristics, controllers and their characteristics, control valve. (6)  

SECTION-B

Stability Analysis of Feedback Systems-Notion of Stability, characteristic equation, Routh- stability criterion. (8)  
Root Locus Analysis  
Introduction to Advanced Control Systems- Cascade control, Over-ride Control, feed forward control, Ratio control, Inverse response, Control system design concepts. (7)  
Physical and Chemical Sensors, on line sensors for cell properties, off line analytical methods. (7)  

Recommended books:

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Measurement of Organic Pollutant: Parameters - BOD, COD & TOC, Factors affecting on BOD, BOD equations, methods of estimating BOD, Biological vs Physicochemical analysis. (5)

Microbial Growth Kinetics: Microbial Growth Kinetics terminology, rate of utilization of soluble substrates, other rate expression for the utilization of soluble substrate, rate of soluble substrate production from biodegradable particulate organic matter, rate of biomass growth with soluble substrate, rate of oxygen uptake, effects of temperature, total volatile suspended solids and active biomass, net biomass yield and observed yield. (7)

Biological Treatment: Overview of biological wastewater treatment, objectives of the treatment, role of Micro-organisms, Types of biological processes for wastewater treatment, suspended and attached growth systems, Municipal wastewater treatment, Unit operations of Pre and primary treatment. (10)

SECTION-B


Anaerobic Decomposition: Mechanism of anaerobic fermentation ï a multistep process, Microbiology and biochemistry of anaerobic processes, substrate inhibition, optimal anoxic environment, kinetic constants, stuck reactors, standard rate, high rate and multistage anoxic digesters. (10)

Recommended Books
Note for the Paper setter: The Semester question paper of a subject will be of 50 Marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two Sections having three questions each and candidate is required to attempt at least two questions from each section.

SECTION-A

Introduction to biostatistics: Basic definitions and applications, sampling representative sample size, sampling bias and sampling techniques. Data collection and presentation: types of data, methods of collection of primary and secondary data, methods of data collection, graphical representation by histogram, polygon, ogive curves and pie diagram.


Tests of significance: Tests of significance: small test (Chi-square t-test, F-test), large sample test (Z-test) and standard error. Introduction to probability theory and distribution (concept without deviation) binomial poison and normal (only definitions and problems) computer oriented statistical techniques. Frequency table of single discrete variable, bubble spot. Computation of mean, variable and standard deviations, t test, correlation coefficient.

SECTION-B

Computer: Introduction and application: Introduction to computers and computer applications: Introduction to computers, Computer applications in research, basics, organization, PC, mainframes and Super-computers, concept of hardware and software, concept of file, folders and directories, commonly used commands, flow charts and programming techniques. Introduction in MS Office software concerning Word processing, spreadsheets and presentation software.

Scientific writing in research: Research: Definition, importance and meaning of research, characteristics of research, types of research, steps in research, identification, selection and research problems, formulation of hypothesis. Scientific writing- characteristics. Logical format for writing thesis and papers. Essentials features of abstract, introduction, review of literature, materials, methods, and discussion. Effective illustration- table and figures. Reference styles- Harvard and Vancouver systems.

Recommended Books

1. Elements of Mathematical statistics by V.C.Kapoor and Gupta.
4. Biostatistical methods by Lachin
Paper Title: ME BIO 302c: Polymer Science and Engineering (Elective - IV)
Paper Code: ME BIO 302c
Internal Assessment: 50
University Examination: 50

Course Duration: 45 lectures of one hour each.

Note for the Paper setter: The semester question paper of a subject will be of 50 Marks having 7 questions of equal marks. Students are required to attempt 5 questions in all. First question, covering the whole syllabus and having questions of conceptual nature, will be compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each section.

SECTION-A
Introduction to polymers: Basic concept, classification of polymers, molecular weight and its distribution, preparation of polymeric materials and their characterization. Step growth and chain polymerization, copolymerization, kinetics and molecular weight distribution in polycondensation and free radical addition polymerization, control of molecular weight.

Dilute Solution viscometry, conformation and molecular dimensions of polymer chains, Thermodynamics of polymer solutions. Rubber elasticity, flow curve and its determination.

SECTION-B
Polymerization processes
Polymeric materials with discussion on electrical, optical, transport and mechanical properties.
Viscoelasticity, linear viscoelastic models.
Bio-polymer materials, applications in bio-technology and controlled drug delivery system.

Recommended Books

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<thead>
<tr>
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<th>PUBLISHER</th>
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<tbody>
<tr>
<td>1.</td>
<td>Polymer Science and Technology</td>
<td>J.R.fried</td>
<td>Prentice Hall</td>
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<tr>
<td>2.</td>
<td>Polymer Science and Engineering</td>
<td>D.J.Williams</td>
<td>Prentice Hall</td>
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Credits: 3
Paper Title: Thesis Work – I

Paper Code: ME BIO 303  
L T P 0 0 0  
Credits: 10

Internal Assessment: 100

SYLLABUS OF M.E. (BIOTECHNOLOGY) 4th SEMESTER

Paper Title: Thesis Work – II

Paper Code: ME BIO 401  
L T P 0 0 0  
Credits: 15

Internal Assessment: 100  
University Examination: 100