

॥ अंतरी घेठू ज्ञानज्योत ॥
उत्तर गडाराष्ट्र विभागीय, जळगांव

जा. क्र. उमवि/६/२६/अ/ ६०२/९७

दिनांक :- २०.१.१९९७

प्रति,

१] मा. परीक्षा निदेशक, उमवि, जळगांव.

२] मा. उपकुलसचिव, परीक्षा-पूर्वार्ध/उत्तरार्ध, उमवि, जळगांव.

३] मा. सहा. कुलसचिव, परीक्षा-पूर्वार्ध/उत्तरार्ध, उमवि, जळगांव.

४] मा. तंगण्ण विभागप्रमुख, उमवि, जळगांव.

तिषय :- एम. एस्ती. मायक्रोबायोलॉजी व बायोटेक्नॉलॉजी
विषयाचा नविन सुधारित अभ्यासक्रम पाठजिणेबाबत.

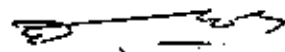
महोदय,

उपरोक्त विषयाच्या अनुषंगाने विहित कल्पनात येते की,
एम. एस्ती. लेमिटर-१ ते ४ वर्गातील मायक्रोबायोलॉजी व बायोटेक्नॉलॉजी
विषयासाठी नविन सुधारित अभ्यासक्रमाच्या प्रत्येकी एक-एक प्रती सोबत
आपल्या माहितीसाठी पाठविलेल्या आहेत. कृपया पोंच घ्यावी ही विनंती.

ठळावे,

सौ इत :- वरीलप्रमाणे.

आपला विश्वासू,



उपकुलसचिव.

अभ्यासक्रमाबाबत

Rs. 10/-

**NORTH MAHARASHTRA UNIVERSITY
JALGAON - 425 001**

SYLLABUS

FOR

**M.Sc. [BIOTECHNOLOGY]
(From JUNE - 1996)**

SEMESTER I TO IV

**DEPARTMENT OF BIOTECHNOLOGY
SCHOOL OF LIFE SCIENCES**

COURSE STRUCTURE
M.Sc. BIOTECHNOLOGY SYLLABUS
Semester-I

THEORY

SEMESTER-I	COURSE TITLE	TOTAL LECTURE
BT-101A	: BIOCHEMISTRY UNIT-I	25
BT-101B	: BASIC MICROBIOLOGY	25
BT-102A	: BIOPHYSICAL CHEMISTRY	25
BT-102B	: STATISTICS	25
BT-103	: CELL AND DEVELOPMENTAL BIOLOGY	50
PRACTICALS		
BT-104	: PRACTICAL COURSE-I (BIOCHEMISTRY & MICROBIOLOGY)	
BT-105	: PRACTICAL COURSE-II CELL AND DEVELOPMENTAL BIOLOGY & STATISTICS	

THEORY

SEMESTER-II	COURSE TITLE	TOTAL LECTURE
BT-201	: BIOPHYSICAL AND BIOCHEMICAL TECHNIQUE	50
BT-202	: MOLECULAR BIOLOGY AND GENETICS	50
BT-203A	: BIO-CHEMISTRY UNIT-II	25
BT-203B	: COMPUTER PROGRAMMING	25
PRACTICAL		
BT-204	: PRACTICAL COURSE-I (MOLECULAR BIOLOGY & GENETICS)	
BT-205	: PRACTICAL COURSE-I BIO-CHEMICAL TECHNIQUE AND COMPUTER PROGRAMMING	

THEORY

SEMESTER-III	COURSE TITLE	TOTAL LECTURE
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BT-301	: FUNDAMENTALS OF TISSUE CULTURE A) PLANT TISSUE CULTURE TECHNIQUES B) PRINCIPALS ANIMAL CELL AND TISSUE CULTURE	50
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BT-302A	: RECOMBINANT DNA TECHNOLOGY	25
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BT-302B	: RECENT ADVANCES IN MOLECULAR BIOLOGY	25
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BT-303	: IMMUNOLOGY	50
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PRACTICALS

BT-304	: PRACTICAL COURSE-I (RECOMBINANT & DNA TECHNOLOGY)	
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BT-305	: PRACTICAL COURSE-II (PLANT CELL TISSUE CULTURE AND IMMUNOLOGY)	
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THEORY

SEMESTER-IV	COURSE TITLE	TOTAL LECTURE
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BT-401	: MICROBIAL BIOTECHNOLOGY	50
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BT-402A	: PLANT PHYSIOLOGY AND PHYTOCHEMISTRY	25
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BT-402B	: APPLICATIONS OF TISSUE CULTURE IN AGRICULTURE AND BIOTECHNOLOGY	25
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BT-403	: BIOCHEMICAL PROCESSES & BIOTECHNOLOGY	50
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PRACTICALS

BT-404	: PRACTICAL COURSE-I (DISSERTATION)	
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BT-405	: PRACTICAL COURSE-II	
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BIOTECHNOLOGY SYLLABUS

SEMESTER-I

BT-101A: BIOCHEMISTRY UNIT-I

Biomolecules : Chemistry and properties of aminoacids, Carbohydrate, lipids, Vitamins.

Proteins : Primary, Secondary tertiary and quaternary structure, Methods for isolation and characterization.

Nucleic acid : Chemistry and structure.

Fat metabolisms : β oxidation of fatty acids, synthesis of fatty acids (fatty acid synthesis complex system) Ketone bodies.

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

Amino acid metabolism: Oxidative degradation and synthesis of amino acids

Books :

- 1) A.L. Leninger, Biochemistry (3rd Edition) Kalyani Publishers, Ludhiana.
- 2) Biochemistry, Groffrey Zubay Addison-Wesley Publishing Company, 1983.
- 3) Biochemistry, Lubert Stryer, W.H. Freeman & Co., Sanfrancisco, 1981.

BT-101B BASIC MICROBIOLOGY

1. Characterization and classification of microorganisms.
2. Cell wall structure of peptidoglycan and other cell wall components.
3. Cultivation of Bacteria, nutrition, physiology and growth of microbial cells.
4. Reproduction and growth, synchronous growth, continuous culture of microorganisms.
5. Pure cultures and cultural characteristics
6. Fundamentals of control of microbial growth, control by physical agents, control by chemical agents.
7. Production of mutants by chemical and physical agents and their characterizations.
8. Host Microbe Interactions, endotoxins, exotoxins, capsular materials. Enzymatic and other factors, tissue affinity, resistance and immunity.
9. Viruses, bacterial, plant and animal cells, structure classification, life cycle Mycoplasma and virioids.

REFERENCES BOOKS

1. Microbiology, M.S. Pelezar, H.D. Reid, E.C.S. Chan McGraw Hill (1986) New York.
2. General Microbiology (Fifth edition). R.Y. Stanier et.al. Prentice Hall. (1986).

3. Biochemical Engineering, S. Abia : A.E. Humphrey, Nancy F. Mills, University of Tokyo Press. (1978).
4. Introductory Microbiology, F.C. Ross. Charles Merrill Publication (1983).

BT-102A : BIOPHYSICAL CHEMISTRY

1. Macromolecular interactions - hydrogen bond, hydrophobic interactions, ionic interactions.
2. Acid-base chemistry, aqueous solutions, equilibrium constants, acids and bases, buffers.
3. Hydrodynamic properties - viscosity, diffusion, M.W., osmotic pressure, surface tension etc.
4. Biochemical energetics - energy yielding and energy requiring reactions. Calculations of equilibrium concentrations, oxidation and reduction reaction. Metabolism and ATP yield. Photosynthetic phosphorylation, Active transport, enthalpy and entropy and activation analysis.
5. Spectrophotometry and other optical methods.
6. Isotopes and radioactive decay. Solution of radioactive compounds. Assays using radioactive substrate, double label analysis. Biological half-lives, turnover. Radioactive tracer dilution analysis. Biological half-lives, turnover. Radioactive tracer dilution analysis. Radioactivity. counting errors.

BT-102B : STATISTICS

Statistical population, sample from population, random sample

Tabular and graphical presentation,

Mean and standard deviation of group and ungrouped data.

Probability, relative frequency, probability distribution. binomial, Poisson and normal distribution.

Test of significance, test for proportion, means and standard deviations, T and t test, chi-square test for goodness of fit.

Theory of errors, errors and residuals, precision, measure of regression, probable error of function, rejection of observation. Methods of averages and least squares. Correlation and linear regression, associated test of significance. Analysis of variance for one and two way classification. Design of experiments, randomization, replication, local control, completely randomized and randomized block design.

BT-103 : CELL AND DEVELOPMENTAL BIOLOGY

1] Cell ultrastructure and chemical composition -recapitulation

2] Plasma Membrane and Cell surface

Structure	:	Models
Chemistry	:	Glycoproteins, lipids, enzymes
Receptors	:	Receptor function
Transport	:	Passive and active

Pinocytosis and Phagocytosis

Neurotransmission across the synapse

Cell Junctions	:	Types, ultrastructure, functions
Cell surface	:	Microvilli, glycocalyx

- 3] Mitochondria
- 4] Chloroplast : Structure & function, photosynthesis
- 5] Cytoplasmic vacuolar system :
Endoplasmic Reticulum : Rough, smooth, Sarcoplasmic
structure function

Golgi complex : Structure, Chemistry, function & origin
Lysosomes : Polymorphism, function
Peroxisomes : Structure, function
Glyoxysomes : Structure, function
Cytoskeleton and Cell movement (2 lecturers)
- 6] Cell Division :
Mitosis : Mitotic apparatus, centrioles
Meiosis : Synaptonemal complex Crossing over
and its modern interpretation*
- 7] Cell fusion and Somatic cell hybridization
- 8] Structure and development of egg and sperm
- 9] Models of fertilization mechanism, Cleavage patterns & their
control. Concept of morphogenesis and histogenesis, cell
deaths
- 10] Concept of growth at sub-cellular, cellular & organ level
in vitro and in vivo
11. Concept of cellular differentiation, stability of the
differentiated state, metaplasia, neoplasia,
transdifferentiation, Transdetermination, cell
transformation, synthesis, transport and uptake of
vitellogenesis during oogenesis. Synthesis and storage of
nucleic acids and proteins during early embryogenesis
12. Nucleo cytoplasmic interactions (Amoeba and acetubularia)
13. Cellular excitability
14. Mechanism of hormone action
15. Formation of seed, germination of seeds and development of
plant from embryo, vegetative gra.

REFERENCES

- Robertis, et al. Cell Biology 1980 or later edition. Alberts,
et al. Molecular Biology of Cell, 1983.

SEMESTER-II

BT-201 BIOPHYSICAL AND BIOCHEMICAL TECHNIQUES

1. Chromatography - adsorption, affinity, partition (gas- liquid-gas, HPLC, TLC RPC, etc). Immobilized cells.
2. Electrophoresis colloidal solutions of biopolymers and their electrochemical properties, different methods of electrophoresis for proteins, nucleic acids, small W.W. compounds immunoprecipitates etc. (4 L).
3. Peptide mapping and combination of electrofocusing and SDS-PAGE (G/Farrell).
4. Structure of biomembranes and their electrochemical properties, membrane potential, action potential and propagation of impulses (3 L).
5. Principles and application of a) Spectroscopic methods, (UV, VIS, IR, Photoacoustic, Fluorescence, ORD, CD, Mossbauer) to biological system (15 L)
6. Use of radioactive and stable isotopes and their detection in biological systems (1 L)
7. Principles and working of light and electron microscope, X-ray diffraction and neutron scattering (2 L)
8. Theory of lyophilization and its applications to biological systems (1 L)
9. Manometric methods and their applications in biological system (1 L)
10. Theory of centrifugation and application to biological systems. Rotor angle/swing out/vertical/zonal continuous flow. Buoyant density centrifugation, (4 L).
11. PCR
12. Flow cytometry

BT-202 MOLECULAR BIOLOGY AND GENETICS

Classification of bacteriophages and structure.

Ultrastructures chemical composition and organization of interphase nucleus, nucleolus, nuclear infrastructure and nuclear membrane including nuclear pres. DNA structure and evidence that DNA is genetic material - genetic code. Structure of chromatin, organization of bacterial and eukaryotic genomes. Transcriptional units in eukaryotes and T7 bacteriophage. Structure and organization of genes for globin, IgG and rRNA Transcription and processing of rDNA and mRNA - transport DNA replication.

Ribosomes structure, composition and role in protein synthesis. Mechanism of protein synthesis, processing and transport.

Nuclear and cytoplasmic ribonucleoprotein free and organelle bound structure and role of small RNAs

Transformation, conjugation, theories of crossing over, Recombination between DNA duplexes - Molecular basis of recombination and repair - mutations and deletions

Bacterial operons - lactose, his - gal, complex gene clusters - induction / repression / and product inhibition.

.GOTO, DO UNTIL, ELSE etc.

Handling arrays, Procedures

Phase lambda ineffective pathways - phage morphogenesis.

Use of standard packages.

Genetic systems of T-even and T-old phages/ single strand DNA phages / RNA phages : Transduction.

Chromosomal gene mapping, transposable element / Mu bacteriophage system, Plasmid episomes

Retroposons.

203A: BIOCHEMISTRY CHEMISTRY UNIT-II

Kinetics of enzymes catalyzed reaction, (single substrate and bisubstrate reactions), factors affects enzymes reactions, activators, inhibitors, co-enzymes, metalloenzyme, isoenzyme, active site determination, enzyme mechanism, multienzyme complex, regulatory enzyme covalent modification, zymogen activation, allosteric regulation and kinetics, induction zymogen kinetics, induction and repression of enzyme.

Mitochondria : structure of mitochondria, organization of respiratory chain, oxidative phosphorylation and its inhibitors.

203B : COMPUTER PROGRAMMING

Overview of computers microcomputers, VDU and printer
What is programming ? algorithms,

INPUT, PRINT and END statements, arithmetic expressions etc.
GOTO, DO UNTIL, ELSE etc.

Handling arrays, Procedures

Color, sound and graphics

Use of standard packages.

BT-204 : PRACTICAL COURSE-I
(Mol. Biology & Genetics)

BT-205 : PRACTICAL COURSE - II
(Biochemical Techniques & Computer Programming)

Reference

Elements of computer science, M.Chandwani, A. Jain. N.S. Chaudhri, Jain Publishers, New Delhi (1993).

SEMESTER-III

BT-301 FUNDAMENTALS OF TISSUE CULTURE

A) PLANT TISSUE CULTURE TECHNIQUES

In in vitro system

- a) in vitro condition - composition of nutrient media role of ingredients, physical conditions, light quality, quality and duration, temperature and humidity.
- b) explant - structure, composition, function and physiological status at the time of isolation, effects of isolation, totipotency of plant cells, processing plant cells for inoculation.
- c) Incubation systems - advantages, limitations and applications of each system
- d) culture systems - organs, anther, tissue, cell, protoplast response of the explant vis-a-vis "in vitro" conditions
 1. growth and differentiation
 2. morphogenesis - organogenesis and embryogenesis
 3. metabolism and whole system hormonal control
 4. cellular, biochemical and molecular basis of growth and differentiation.

Assessment of growth and differentiation in vitro
- polyploidy, deletions, translocations,
recombinations, transpositions, spontaneous
mutations, somaclonal variations

B) PRINCIPLES OF ANIMAL & TISSUE CULTURE - 25 LECTURES

1. History and development of tissue culture
2. Tissue culture systems - Cell culture, tissue fragments organ, embryo culture, their merits and limitations. Slide, tube & bottle cultures.
3. Cell and microenvironment
4. Effective use of Microscopy - compound, phase, interference, fluorescence.
5. Preparatory techniques: decontamination, washing, cleaning (alkalies acids soaps, detergents, ultrasonication), packing, labeling. Sterilization (hot air, steam under pressure). UV and gamma ray irradiation, gases etc. Quality control of glassware, water, plasticware, sterility and toxicity testing).
6. Work benches, utility, function, laminar flow systems.
7. Preparation of media, mixing, sterilization, testing and storage (B.S.S., synthetic, natural media, growth factors, selective media), Buffering methods, Development of synthetic media.
8. Methods of cell dissociation and preparation of primary cell culture.

9. Characterization of cells in vitro.
10. Short term cultures (Leukocytes)
11. Poikilotherm cells in culture.
12. Cell culture growth parameters (Quantitative studies on cells in vitro)
13. Design and organization of tissue culture laboratory, air handling - unit activities (washing, sterilization, storage, clean work, preparation room, cryopreservation, etc.)
14. Contamination in tissue culture, (detection, prevention, decontamination)

BT-302A : RECOMBINANT DNA TECHNOLOGY

1. Bacterial phages, plasmids, cosmids, charron phages, chimeric plasmids.
2. Choice of vector/vehicle and host strains - E. coli, B. subtilis yeast, animal cells, etc.
3. Bacterial transformation with plasmids (R factor and F factor).
4. Chimeric plasmids
5. Enzymes in genetic engineering:-
DNA polymers, Polynucleotide ligase, Nick-translation system, Terminal deoxynucleotidyl transferase (end-addition), reverse transcriptase, restriction endonuclease of type I & II.
6. DNA extraction procedure for a) high M.W. DNA and b) plasmid DNA
7. DNA restriction fragment analysis
8. Shotgun procedure for genomic DNA cloning-gene libraries and recloning cloned fragments.
9. Shotgun procedure for cDNA libraries
10. Isolation of mRNA and synthesis of single stranded and double stranded cDNA.
11. Southern blotting, Northern blotting, Dot blots etc.
12. Western blots and immune blots for detection of expression of cloned genes.
13. Fragments for specific gene functions and location of gene maps.
14. Colony hybridisation, in-situ hybridisation procedures
15. Site-specific mutagenesis

BT-302B: RECENT ADVANCES IN MOLECULAR BIOLOGY

Gene amplification during oogenesis

Localization and reiteration of 5 s RNA genes
Polytene chromosomes. DNA and RNA puffs. Independent control of DNA replication in polytene chromosomes organisation.

Organization, structure and expression of SV 40 genome, SV 40 life cycle structure and composition. Organization and expression of adenovirus genome

Quantitative and qualitative changes in cytoplasmic mRNA populations - stability and turn-over

Role of cyclic AMP as the second messenger

DNA damage and mechanisms of repair - role in the conservation of genome integrity - relationship to the life span and ageing process. Synthesis and degradation of nucleosides and nucleotides.

Control of cellular proliferation. Molecular basis of oncogenesis.

Gene therapy.

Controlling Eucaryotic Gene expression.

Structure & regulation of genes for HLA.

BT-303 IMMUNOLOGY

1. Cellular basis of immunity: immunological memory specificity, diversity, discrimination between self and nonself, primary & secondary lymphoid organs, cell mediated and humoral immune responses. T and B lymphocytes, autoimmune reactions.
2. Antigen and antibody: antigen, antigenic determinant, immunopotency, Structure of antibody; constant and variable regions, Fab, F(ab)₂ & Fc fragments, different classes of antibodies and their functions. Fine structure of antibodies: X-ray diffraction studies, isotypes, allotypes and idiotypes.
3. Measurement of antigen-antibody interaction -diffusion, immunodiffusion, immunoelectrophoresis, radioimmunoassay, immunofluorescence, ELISA, Western blotting.
4. Clonal selection theory of antibody production, Monoclonal and polyclonal antibodies.
5. Complement system: classical and alternate pathway.
6. T lymphocytes and cell mediated immunity, T cell subpopulations, immune response genes. MHC gene complex polymorphism, graft rejection, graft versus host response.
7. Hypersensitivity, immunodeficiency diseases.
8. Vaccines, interferon, AIDS.
9. Blood antigens: blood group substances and Rh factor.
10. Introduction to Tumor Immunology.
11. CMI Reactions - DTH, MI, ADCC & LI.
12. Immuno modulations.

Reference Books

1. Essentials of immunology (5th Edition) Roit, Blackwell Scientific Publishing, London.
2. Basic and clinical immunology, Lange Medical Publication Maruzen Asia.

BT-401 MICROBIAL BIOTECHNOLOGY

1. Principles of fermentation technology screening, strain improvement & maintenance fermentor,
2. Antibiotic fermentations - Penicillin, streptomycin
3. Production of vitamins & organic acids by fermentation - Vit B/2, citric acid
4. Production of ethanol wine, Beer
5. Energy from microorganisms - ethanol, Biogas, H₂.
6. Microbial productions of food - SCP Algal biotechnology
7. Mining & metal biotechnology
8. Immobilization of enzymes & whole cells methods & applications.
9. Molecular basis of Nitrogen fixation and biofertilizer

BT-402A PLANT PHYSIOLOGY & PHYTOCHEMISTRY (25 L)

1. Plant growth:
 - a. Concept - definition
 - b. Patterns of growth
 - c. Growth kinetics
 - d. Growth of plant organs
 - e. Factors controlling growth
2. Differential - Directional Growth - Tropism:
 - a. Phototropism
 - b. Gravitropism
 - c. Thigmotropism
3. Photomorphogenesis:
 - a. Concept - definition
 - b. Phytochrome - discovery; physical and chemical properties; distribution; role in seed germination, seedling establishment and vegetative growth.
4. Photoperiodism:
 - a. General principles
 - b. Short day plants, long day plants & day neutral plants
 - c. Role of dark period and phytochrome
 - d. Florigen concept - flowering hormones
 - e. Reproductive growth
5. Plant Growth Regulators:
 - a. Biosynthesis - degradation - disposal
 - b. Mechanism of action
 - c. Hormonal control of whole plant development
6. Biosynthesis, chemical properties, distribution, classification and function(s) of:
 - a. Glycosides
 - b. Alkaloids
 - c. Terpenoids
 - e. Phenolics
 - f. Unusual amino acids.

BT-402B APPLICATIONS OF PLANT CELL TISSUE CULTURE (25 L)

Plant propagation through tissue culture

- a. Agricultural crops
- b. fruit crops
- c. forest trees
- d. ornamental plants
- e. medicinal plants
- f. endangered/rare plant species

Germplasm preservation, synthetic seeds

- a. Objectives, methods and limitations
- b. selection of semi clonal variants
- c. induction and selection of mutants
- d. somatic hybridization, cybridization - intraspecific, intergeneric.
- e. gene transfer- direct through vector, through liposomes through spheroplast, by microinjection and electroporation.
- f. improvements in cereals, legumes, vegetables, and tuber crops
- g. haploids, endosperm and embryo culture

Disease elimination

Application in basic research

- a. in vitro system for bioassay
- b. in vitro system for studying metabolism
- c. in vitro system for studying growth and development.

BT-403 BIOCHEM PROCESSES & BIOTECHNOLOGY

1. Large scale process analysis for :
 - a. blood products (fractionation of plasma proteins and their therapeutic use)
 - b. recombinant DNA technology
 - c. virus based products
 - d. monoclonal antibodies
 - e. antibiotics & chemotherapeutic agents
 - f. enzymes
 - g. fine chemicals
 - f. biotransformation
 - g. food products
 - h. vaccines

Downstream processing - flocculation, sedimentation, filtration
centrifugation, floatation

-microbial cell disruption

-membrane separation

-liquid-liquid solvent extractions

-Novel downstream processing

Application of recombinant DNA technology in Agriculture,
Medicine and industry,

Blood products.

=0=

JBB/WS/SYLL/BIOT.SYL/010197