

॥ अंतरी पेटवु कानप्योत ॥  
उत्तर महाराष्ट्र विद्यापीठ, जम्हांव

जा. क्र. उमधि/१२/३३/७९६/२७

दिनांक :- १०.११.१९९७

प्रति,

मा. विभागप्रमुख,  
नार्डफ तापन्नेत विभाग,  
उमधि, जम्हांव.

विषय :- एम. एस्ती. मायक्रोबायोलॉजी, बायोकेमिस्ट्री व  
बायोटेक्नॉलॉजी विषयाचा सुधारित अभ्यासक्रम  
पाठविलेबाबत.

महोदय,

उपरोक्त विषयाच्या अनुषंगाने विदित करण्यात येते की, उत्तर  
महाराष्ट्र विद्यापीठाच्या नार्डफ तापन्नेत विभागांतर्गत एम. एस्ती. मायक्रोबायोलॉजी,  
बायोकेमिस्ट्री व बायोटेक्नॉलॉजी टेमिस्टर-१ व २ साठी नविन सुधारित  
अभ्यासक्रम तयार करण्यात आला असून, सदरचा नविन सुधारित अभ्यासक्रम हा  
जून, १९९७ पासून अंमलात आला आहे. त्यासाठी सदर सुधारित अभ्यासक्रमाची  
प्रत यापत्रासोबत आपणाकडे पाठविली आहे.

आपले,

सौख्य :- वरीलप्रमाणे.

आपला विवाहू.

उपकुलसचिव.

प्रत माहितोसाठी रवाना :-

१) मा. परीक्षा निदेशक, उमधि, जम्हांव.

२) मा. उपकुलसचिव, परीक्षा-पूर्वार्ध/उत्तरार्ध विभाग,  
उमधि, जम्हांव.

३) मा. प्रोग्रामर, तंत्रज्ञ विभाग, उमधि, जम्हांव.

उपकुलसचिव

दुबाता. /

Rs. 5/-

**NORTH MAHARASHTRA UNIVERSITY,  
JALGAON - 425 001**

**SYLLABUS**

**FOR**

**(M.Sc.: - Microbiology, Bio-Technology, Bio-Chemistry)**

**(Department of Life Sciences)**

**with effect from July 1997**

**SEMESTER I & II**

SCHOOL OF LIFE SCIENCES  
NORTH MAHARASHTRA UNIVERSITY, JALGAON

[with effect from July, 1997]

**OBJECTIVE OF THE NEW SYLLABUS:-**

Modification of the existing syllabus introduced in 1991 was needed in the light of (i) focus desired for Agro-biotechnology /Industrial orientation and (ii) requirement of managers for integration of Indian Economy with Global Economy for 21st century. On these premises, the syllabus is modified. While modifying the existing syllabus (i) redundant/repetitive topics are deleted, (ii) desired topics are logically reorganized theme-wise, (iii) topics on applications in industry and agriculture are added, (iv) topics in NET syllabus covered and (v) overall syllabus revised for meaningful teaching/practicals/M.Sc. dissertations/R & D.

**ELIGIBILITY :**

M.Sc. (Micro)	B.Sc. microbiology
M.Sc. (Biochem)	B.Sc. Biochem., chemistry, botany, zoology, life science, Agri. science with chemistry at subsidiary level.
M.Sc. (Biotech)	B.Sc. with chemistry, biochemistry, microbiology, botany, zoology, life science, agri. science.

The admissions will be on the basis of merit ranking.

**COURSE CONTENT :**

The syllabus is designed semester-wise and distributed over four semesters. While doing so, syllabus for semester I and II is shaped into Foundation Courses, thereby introducing more permeability/interaction in Microbiology/Biochemistry/Biotechnology courses, which even otherwise are inherently interdisciplinary. Each semester will have three theory courses, of 100 marks each and two practical courses, of 100 marks each, totaling to 500 marks per semester and 2000 marks per course. The courses LS - 101 to LS - 105 will be covered in semester I and LS - 201 to LS - 205 in semester II.

**SYLLABUS STRUCTURE :**

First year Semester I

Course number	Title
LS - 101	Foundation course in Microbiology.
LS - 102	Foundation course in Biochemistry.
LS - 103	Biostatistics and Essential techniques in Life Sciences.
LS - 104	Laboratory techniques in Microbiology.
LS - 105	Laboratory techniques in Biochemistry.

First year - Semester II

Course number	Title
LS - 201	Metabolism.
LS - 202	Enzymology.
LS - 203	Agricultural Biotechnology & Biochemical Techniques.
LS - 204	Laboratory course in Enzymology.
LS - 205	Laboratory course in Biotechnology & computer applications.

**SCHEME OF INSTRUCTIONS :**

Each theory course will be covered in four periods, each of sixty mins. duration per week including lectures, tutorials and seminars.

Each practical course will be covered in two periods, each of 180 mins. duration per week .

**SCHEME OF EXAMINATIONS :**

Examination of all the theory and practical courses will take place at the end of the semester. Each theory and practical course will carry 60 marks for external assessment and 40 marks for internal assessment.

**IMPLEMENTATION :**

The modified syllabus is implemented with effect from July,1997.

**FUTURE MODIFICATIONS / REVISIONS :**

The life of this syllabus will be five years, after which it will be open for necessary revision in the light of deficiencies which may be experienced during this period and requirements of 21st century education.

LS - 101

Foundation Course In Microbiology

1. Ultrastructure of prokaryotic and eukaryotic cells : Cell membrane, cell wall, nucleus / nuclear zone, mitochondria, chloroplast, golgi apparatus, ribosomes, endoplasmic reticulum, lysosomes, cytoplasmic inclusions.	06
2. Yeast and moulds : structure, nutritional requirements and industrial applications.	05
3. Viruses : Classification on the basis of RNA / DNA, life cycle, lytic and lysogeny.	06
4. Relevance of biochemical and genetic aspect of classification.	06
5. Techniques of sterilization and disinfection, Use of physical and chemical agents.	04
6. Principles of nutrition for growth and secretion of end products, micro and macro nutrients, growth factors, Media designing for chemoautotrophs, heterotrophs and auxotrophs, growth curve.	06
7. Kinetics of bacterial growth continuous and synchronous cultures and industrial application.	06
8. Methods of estimation of bacterial growth.	04
9. Techniques of isolation, concept of purity and criteria of purity.	04
10. Quality control methods of pharmaceutical / food products.	04

Reference books :

1. R. Y. Stanier : General Microbiology 5th Edition
2. Pelczar, Chan and Reid : Microbiology

XXXXXXXXXX

## FOUNDATION COURSE IN BIOCHEMISTRY

1. Carbohydrates : Classification, mono-, oligo- and polysaccharides, physical and chemical properties and their industrial significance, sugar acids and amino sugars. (10)
2. Amino acids : Classification, properties, peptide bond. (6)
3. Proteins : Classification, physico-chemical properties, biological & industrial applications, structure (primary, secondary, tertiary and quaternary), significance of complex proteins, stabilizing bonds, principles of amino acids sequencing. (10)
4. Lipids : Classification (simple, compound and derived lipids), structure, function and biological and industrial significance, circulating lipids with relevance to pathological changes. (10)
5. Vitamins & Co-enzymes : Water and fat soluble vitamins, structure and co-enzymatic role. (10)
6. Introduction to mineral metabolism : P, Fe, Mg & Ca. (04)

## BOOKS

1. A.L. Lehninger : Principles of Biochemistry, Kalyani Publisher, New Delhi.
2. L Strayer : Biochemistry, W. H. Freeman & Co., New York.
3. Harper's Physiological Chemistry, Prantice Hall International.

=x=x=x=x=x=x=x=

LS - 103 A

Biostatistics

( 25 )

1. Principles and practices of statistical methods in biological research. (5)
2. Samples and population. (2)
3. Basic statistics - averages, statistics of dispersion, coefficient of variation. (5)
4. Standard error. (1)
5. Confidence limits. (1)
6. Probability distribution (Binomial, Poisson and Normal). (2)
7. Tests of statistical significance. (2)
8. Simple correlation of regression. (4)
9. Analysis of variance. (1)
10. Examples of the above for clarity of concepts. (2)

## BOOKS

1. S.C. Gupta : Fundamentals of Statistics, Himalaya Publishing House, New Delhi.
2. Khan : Biostatistics, Tata McGraw Hill Publishers.

=x=x=x=x=x=x=x=

## Essential techniques in Life Sciences

1. Principles of buffer and pH metery (calculation of molarity). (02)
2. Concept of partition coefficient. (01)
3. Chromatography : adsorption, paper (PC), thin layer (TLC), ion exchange, high pressure (HPLC) and gas liquid (GLC) and affinity chromatography. (05)
4. Applications of each chromatography technique in Biological Sciences. (08)
5. Principles (Beer's law), methodology and applications of UV and visible spectorscopy (colorimetry and spectrophotometry). (02)
6. Colorimetry with respect to determination of reducing sugars, proteins and phosphate. (03)
7. Spectrophotometry with respect to purine and pyrimidine bases and proteins. (04)

## Books :

1. D.Frifielder : Physical Biochemistry
2. D. Holmes and H. : PeckAnalytical Biochemistry

=XXXXXXXXX=

LS - 104

## Laboratory Techniques In Microbiology

1. Microscopic examination ( Motility, Monochrome staining and Gram staining ).
2. Media designing / pour plate technique / streak plate technique .
3. Sterilization : steam / dry heat / filter / U.V. / Chemical.
4. Isolation of bacterial / fungal culture by pour / streak plate method.
5. Preservation of pure cultures (Slant techniques).
6. Growth curve of E. coli / B. subtilis.
7. Growth curve of yeast / Aspergillus Sp.
8. Determination of total viable count.
9. Physical and chemical mutagenesis and survival curve
10. Isolation of auxotrophs
11. Plaque assay for phages
12. Microbial assay of antibiotics / vitamins

## Books:-

- 1> Satish Gupta : Practical Microbiology
- 2> Benson H. J. : Microbiological Applications  
A Laboratory Manual In General Microbiology.

=XXXXXXXXX=

LABORATORY TECHNIQUES IN BIOCHEMISTRY

1. Introduction to safe laboratory practices, first aid, hazardous/ inflammable chemicals, antidotes to toxic chemicals; care and handling of glassware, instruments, planning, execution and recording of data.
2. Concept of buffers, pH, molarity, normality.
3. Amino acids separation and identification by paper chromatography.
4. Estimation of amino acids by ninhydrin method.
5. Estimation of protein by Lowry/Biuret method.
6. Acid, alkaline and enzymatic hydrolysis of protein and their evaluation by gel filtration.
7. Carbohydrate separation and identification by thin layer chromatography.
8. Estimation of reducing sugars by DNSA method.
9. Total carbohydrates estimation by phenol sulphuric acid method.
10. Vitamin C estimation.
11. Colorimetric estimation of cholesterol.
12. Estimation of inorganic phosphate.
13. Preparation of egg albumin, milk casein, cystine and starch.

BOOKS

1. D. Plummer : An Introduction to Practical Biochemistry, Tata McGraw Hill Publisher.
2. J. Jayaraman : Laboratory manual in Biochemistry, New Age International Publisher.
3. S. Sadasivam & A Manikam : Methods in Agriculture Biochemistry, Wiley Eastern Ltd., New Delhi.

=====



## METABOLISM

1. Glycogen, starch and cellulose biosynthesis; Gluconeogenesis. (5)
2. Glycolytic pathway and energy balance sheet, Alcoholic fermentation, citric acid cycle and bioenergetics, pentose phosphate pathway, Glyoxylate cycle, glucuronic acid cycle. (10)
3. Cell bioenergetics, ATP and high energy phosphate compounds, ETC and oxidative phosphorylation. (6)
4. Biosynthesis of triglycerides, phospholipids and sterols. (5)
5. B-Oxidation of fatty acids, ketone bodies, fatty liver. (4)
6. Proteolysis, transamination, acetyl CO-A, decarboxylation, urea cycle, ammonia excretion. (7)
7. Amino acid biosynthesis and degradation (lysine, methionine, glutamic acid), nutritional aspects, essential amino acids, peptides and polyamines, Glutathione. (7)
8. Integration of lipid, carbohydrates and protein metabolism. (3)
9. Use of radio isotopes in studying food chain, energy flow and intermediary metabolism. (3)

## BOOKS

1. A.L.Lehninger : Biochemistry
2. Greenberg : Metabolic Pathways
3. G.Zubay : Biochemistry
4. L.Strayer : Biochemistry

XXXXXXXXXX

## ENZYMOLGY

1. Extraction, purification and criteria of purity; classification and nomenclature. [6]
2. Enzyme kinetics, regulation of enzyme activity, single substrate/ double substrate kinetics, negative and positive co-operativity, substrate specificity, active site, activators and inhibitors, isoenzymes, allosteric enzymes. [12]
3. Mechanism of enzyme action, orientation effect (micro-environment), active site studies, mechanism of action of alpha amylase, chymotrypsin and penicillin acylase. [10]
4. Clinical aspects of enzymes with respect to LDH isozymes, SGOT, SGPT, creatine kinase, alpha amylase and inborn errors of metabolism. [7]
5. Rationale and methods of immobilization, properties and applications of immobilized enzymes. [7]
6. Industrially significant enzymes their turn over, and applications. [8]

## BOOKS

1. G.G.Hammer : Enzymes, Academic Press
2. G.E.Rell and E.T.Bell : Proteins and Enzymes, Prentice Hall
3. N.C.Price and L.Stevens: Fundamentals of Enzymology

XXXXXXXXXX

LS-203  
A. AGRICULTURAL BIOTECHNOLOGY

1. Cyclic turnover of elements. (C, O, S, N & P). [3]
2. Nitrogen cycle, nitrogenase and nitrate reductase, & non-symbiotic symbiotic nitrogen fixation. [5]
3. Photosynthesis, light and dark reactions, photosynthetic pigments, energetics of photosynthesis, ETC, PSI and PSII, C4- pathway, photorespiration. Bacterial photosynthesis. [8]
4. Fertilizers and biofertilizers, natural and synthetic soil conditioners. Role of phosphate solubilizing microbes and mycorrhizae. [5]
5. Plant hormones, auxin, cytokinin, gibberellic acid and abscisic acid. [4]

BOOKS

1. H.L.Tandon : Fertilizers
2. A Varma and M.Bock : Mycorrhizae
3. O.Hesse : Plant Physiology, Springer International

B. BIOCHEMICAL TECHNIQUES

1. Dialysis and electro dialysis, filtration and ultrafiltration, factors governing the choice of membranes. [4]
2. Electrophoresis, principles, types, parameters affecting electrophoretic separation, gradient electrophoresis and iso-electrofocussing, peptide mapping. [6]
3. Principles of microscopy, transmission electron microscopy (TEM), scanning electron microscopy (SEM). [4]
4. Principles and applications of lyophilization, Laminar air flow benches, principle and applications. [4]
5. Principles and applications of centrifugation to biological systems, Basket centrifugation, density gradient centrifugation. [4]
6. Principles of IR, NMR, atomic fluorescence spectroscopy, CD, ORD, X-ray diffraction techniques. [3]

BOOKS

The same as for LS-103B.

XXXXXXXXXX

LS-204

LABORATORY COURSE IN ENZYMOLOGY

1. Purification of a typical enzyme (B amylase)
2. Effect of pH, temperature, activators and inhibitors on enzyme activity.
3. Determination of specific activity and turn over no.of salivary amylase.
4. Determination of Km and Vmax of amylase by double reciprocal plot.
5. Application of proteolytic enzymes for the preparation of peptides of desired specifications for warm beverages.
6. Immobilisation of a typical enzyme.
7. Stabilisation of an enzyme as a function of temperature and storage duration.

BOOKS:

- i) An introduction to practical biochemistry -D.Plummer, Tata McGraw Hill Publishers.
- ii) A laboratory manual in biochemistry - J.JayRaman - New Age International Publishers.

XXXXXXXXXX 2

LABORATORY COURSE IN BIOTECHNOLOGY AND COMPUTER APPLICATIONS

**A) Biotechnology :**

1. Estimation of nitrogen by Kjeldahl method.
2. Spectral characteristics and estimation of chlorophylls.
3. Dialysis, filtration and ultrafiltration.
4. Paper electrophoresis.
5. Polyacrylamide gel electrophoresis.

**BOOKS :**

1. Methods in agricultural biochemistry : S. Sadasivan and K. Manikam.
2. An introduction to practical biochemistry : D. Plummer.

**B) Computer applications :**

1. Basic programming
2. Writing of few basic programmes related to biology.
3. Practice on packages ( Wordstar, Lotus, d-base ).
4. Use of packaged statistical programme for statistical analysis.
5. Introduction to windows -95 and internet.

**BOOKS :**

1. Computing for biologists : A. Fielding .
2. Microcomputers in Biochemical education : E. J. Wood.

XXXXXXXXXX