

**SWAMI RAMANAND TEERTH MARATHWADA
UNIVERSITY, NANDED.**

**B.Sc. Biotechnology (Semester Pattern)
B.Sc. Third Year**

With Effect from June - 2010

Revised FrameWork (Workload)

B.Sc. Biotechnology Semester Pattern.

w.e.f. June-2010.

B.Sc. First Semester :

Code No.	Subject Title	Teaching Periods/ Week	Maximum Marks T/P (A)	Internal Test Marks (B)	Total Marks (A+B)	Duration of Exam (in Hrs)
BTT.1	English & Communication Skill	04	80	20	100	03
BTT.2	Introduction to Biotechnology	04	80	20	100	03
BTT.3	Basic Biosciences	04	80	20	100	03
BTT.4	Principles of Chemistry	04	80	20	100	03
BTP.1	Lab Course I (Practicals based on BTT.1 +BTT2)*	03+03	100	-	100	03
BTP.2	Lab Course II (Practicals based on BTT.3 +BTT.4)	03+03	100	-	100	03
Total					600	

* BTT.1 : The Practicals should be conducted based on the content of English and Communication Skill.

BTT.2 : Students Must visit atleast five Biotechnology Research Centers/Industries and Prepare a Report based on there observation.

B.Sc. Second Semester :

Code No.	Subject Title	Teaching Periods/ Week	Maximum Marks T/P (A)	Internal Test Marks (B)	Total Marks (A+B)	Duration of Exam (in Hrs)
BTT.5	Microbiology	04	80	20	100	03
BTT.6	Genetics	04	80	20	100	03
BTT.7	Biochemistry	04	80	20	100	03
BTT.8	Bioinstrumentation	04	80	20	100	03
BTP.3	Lab Course III (Practical based on BTT.5+BTT.6)	03+03	100	-	100	03
BTP.4	Lab Course IV (Practical based on BTT.7+BTT.8)	03+03	100	-	100	03
Total					600	

B.Sc. Third Semester :

Code No.	Subject Title	Teaching Periods / Week	Maximum Marks T/P (A)	Internal Test Marks (B)	Total Marks (A+B)	Duration of Exam (in Hrs)
BTT.9	Cell Biology	04	80	20	100	03
BTT.10	Metabolism	04	80	20	100	03
BTT.11	Applied Microbiology	04	80	20	100	03
BTT.12	Mathematics Biostatistics and Computers	04	80	20	100	03
BTP.5	Lab Course V Practical Based on (BTT9 & BTT10)	03+03	100	-	100	03
BTP.6	Lab Course VI Practical Based on (BTT11 & BTT12)	03+03	100	-	100	03
Total Mark					600	

B.Sc. Fourth Semester :

Code No.	Subject Title	Teaching Periods / Week	Maximum Marks T/P (A)	Internal Test Marks (B)	Total Marks (A+B)	Duration of Exam (in Hrs)
BTT.13	Molecular Biology	04	80	20	100	03
BTT.14	Virology and Immunology	04	80	20	100	03
BTT.15	Advanced Biochemistry and Enzymology	04	80	20	100	03
BTT.16	Animal and Plant Tissue Culture	04	80	20	100	03
BTP.7	Lab Course VII Practical Based on (BTT13 & BTT14)	03+03	100	-	100	03
BTP.8	Lab Course VIII Practical Based on (BTT15 & BTT16)	03+03	100	-	100	03
Total Marks					600	

B.Sc. Third Year (Fifth Semester):

Code No.	Subject Title	Teaching Periods/ Week	Maximum Marks T/P (A)	Internal Test Marks (B)	Total Marks (A+B)	Duration of Exam (in Hrs)
BTT.17	Recombinant DNA Technology	04	80	20	100	03
BTT.18	Bioprocess Engineering	04	80	20	100	03
BTT.19	Agriculture Biotechnology	04	80	20	100	03
BTT.20	Environmental Science & Technology	04	80	20	100	03
BTP.9	Lab Course IX (Practical based on BTT 17 +BTT18)	03+03	100	-	100	03
BTP.10	Lab Course X (Practical based on BTT 19 +BTT 20)	03+03	100	-	100	03
Total					600	

B.Sc. Third Year (Six Semester):

Code No.	Subject Title	Teaching Periods/ Week	Maximum Marks T/P (A)	Internal Test Marks (B)	Total Marks (A+B)	Duration of Exam (in Hrs)
BTT.21	Animal and Plant Development	04	80	20	100	03
BTT.22	Industrial Biotechnology	04	80	20	100	03
BTT.23	Pharmaceutical Biotechnology	04	80	20	100	03
BTT.24	An Introduction to Bioinformatics	04	80	20	100	03
BTP.11	Lab Course III (Practical based on BTT.21+BTT.22/23/24/)	03+03	100	-	100	03
BTP.12	Lab Course IV (Project Work)	03+03	100	-	100	03
Total					600	

Swami Ramanand Teerth Marathwada University, Nanded
Scheme of Marking
B.Sc. Biotechnology (Semester Pattern)

Class	Semester	Marks	Total
B.Sc. I	First semester	600	1200
	Second semester	600	
B.Sc. II	Third semester	600	1200
	Fourth semester	600	
B.Sc. III	Fifth semester	600	1200
	Sixth semester	600	
Total			3600

B.Sc. Biotechnology (Semester Pattern)

V-Semester

Code : BTT.17 : Recombinant DNA technology

Marks : 80

Hours : 50

Objective:

This paper aims to improve the knowledge on genomic structure of microbes,,techniques useful in recombinant DNA technology and application of genetic engineering

UNIT-I:

Principles of Gene cloning

Molecular Tools of Genetic Engineering- Types of Restriction Endonucleases, DNA Ligases, Alkaline phosphatase. Vectors- Plasmids (pBR322, pUC18/19), Bacteriophages (ϕ Phage, M 13 Phage).and Cosmids. Choice of Vector. Methods of Gene Transfer : Transformation, Conjugation,Electroporation, Direct transfer of DNA. Gene Cloning Strategies.

UNIT -II:

r- DNA Techniques.

Electrophoresis: Agarose Gel Electrophoresis, Blotting techniques : Southern Blotting , Northern Blotting,Western Blotting ,Dot Blot Blotting, Autoradiography.DNA Sequencing: Sanger's and Maxam Gilbert's Method.PCR: Mechanism, Types and Application.DNA chips (Micro array)

UNIT-III:

c DNA Library

Library construction and screening-genomic library, cDNA library. Nucleic Acid Probe, Screening of library-Probe based direct and indirect methods.

UNIT - IV:

Applications of r-DNA technology.

Agricultural and Industrial Applications : i) BT-Cotton, ii) Transgenic maize, iii)Golden rice iv) Protein engineering to Improve Detergent Enzymes.

Pharmaceutical Applications : i) Recombinant Human Insulin ii)Hepatitis B-vaccine

iii) Monoclonal Antibodies iv) Clotting factors v) Tissue Plasminogen Activator
vi) Erythropoietin v) Human growth hormone.

Text & References:

1. Principles of Gene Manipulation and Cloning - Old & Primrose.
2. Gene Manipulation and Cloning – Christopher Howe.
3. Molecular Biotechnology -Glick
4. Molecular Cloning- A practical approach-T.A. Brown.
5. Genomes 3 - T.A.Brown.
6. Genetic Engineering – Sandhya Mitra
7. Genes – B. Lewin
8. Text book of Biotechnology – U Satyanarayan Arora M.P (2003), Biotechnology, Himalaya Pub.House, Mumbai.
9. Jogdand S.N (2006)- Gene Biotechnology, Himalaya Publishing House, Mumbai.
10. Joshi P (2002) - Genetic Engineering and its applications, Agrobios Pub, Jodhpur.
11. Mitra Sandhya (2006) - genetic Engineering, MacMillan India Ltd, Delhi.
12. Satyanarayana U. (2007) - Biotechnology, Books and Allied Pvt. Ltd .Kolkata.

B.Sc. Biotechnology (Semester Pattern)
V-Semester

Code: BTT.18 : Bioprocess Engineering

Marks 80

Hours:50

Objective:

This paper aims to improve the students with various designs of fermenters, growth kinetics and process kinetics of fermentation processes

UNIT-I :

Introduction to Concepts of Bioprocess engineering: Definition of Bioprocesses engineering. Introduction to Simple engineering calculations, Mass & Energy Balances Fermenters, Bioreactors : Construction, Design & Operation, Materials of Constructions, Welding, Surface treatment Components of the fermenters & their specifications

UNIT-II :

Air & Media sterilization : Air Sterilization Principles, Mechanisms of capture of particles in Air, Depth & Screen Filters, Sizing, Testing & validation of filters for air Sterilization. Principles of Media Sterilization, Decimal reduction, Design of sterilization, cycle using kinetics of thermal death of microbes Equipments used in sterilization; Batch & Continuous Media for large-scale processes & their optimization. Constituents of media, their estimation & quantification. Design of media. Costing of media

UNIT-III :

Types of Bioprocesses : Biotransformations (enzyme, whole cell), Batch, Fed-batch, Cell recycle & continuous. Enzyme & cell immobilization (industrial aspects)
Measurement & Control of Bioprocesses Parameters. Cell growth. pH, temperature, Substrate consumption, product formation, Measurement of O₂/CO₂ uptake, evolution. Specific rates of consumption substrate & formation of product. Strategies for fermentation control.

UNIT-IV :

Computer controlled fermentations. Formation of heat, cooling requirements, Foam & its control. Oxygen uptake rate (OUR), K_a, Viscosity & its control. Scale up in Bioprocesses fermentations, Factors used in scale up
Quality Control, Quality assurance, Standard Operating Procedures (SOP) & Good Manufacturing Practices (GMP)

Text & References:

1. Principles of Fermentation Technology - Whittaker & Stanbury, Pergamon Press
2. Bioprocess Engineering Principles - Pauline Doran, Academic Press 1995
3. Operational Modes of Bioreactors, BIOTOL series - Butterworth, Heinemann 1992
4. Bioreactor Design & Product Yield, BIOTOL series - Butterworth Heinemann 1992
5. Bioprocess Engineering: Systems, Equipment & Facilities - Ed. B. Lydersen, N.A. Delia & K.M. Nelson, John Wiley & Sons Inc, 1993
6. Bioseparation & Bioprocessing - Ed. G. Subramaniam, Wiley-VCH, 1998
7. Product Recovery in Bioprocess Technology, 'BIOTOL series, Butterworth Heinemann 1992
8. Bioseparation : Downstream Processing for Biotechnology - Paul A. Belter, E.L. Cussler, Wei-Shou Hu, Academic Press
9. Solvent Extraction in Biotechnology - Larl Schuger, Springer Verlag, 1994

B.Sc. Biotechnology (Semester Pattern)

V-Semester

Code: BTT.19 : Agricultural Biotechnology

Marks 80
Hours 50

Objective:

This paper enables students to gain information on role of biotechnology in the field of agriculture and applications of transformation techniques

UNIT- I:

Nitrogen Fixation and Phytohormones.

Symbiotic N₂ fixation - Legume, Rhizobium symbiosis, Host specificity, Infection, Nodule Development, Mechanism of N₂ Fixation.

Non Symbiotic N₂ Fixation - Diazotrophy, Sites of N₂ Fixation, Nitrogenase Complex, Cyanobacteria, Azotobacter, Azospirillum.

Phytohormones- Definition, Classification, Physiological Effects, Functions of Auxin, Cytokinin, Gibberellins.

Assimilation of Sulphur and Phosphorus in Plants.

UNIT- II :

Biofertilizers

Concept and Types of Biofertilizer. Microbial Inoculum - Rhizobium Inoculant, Blue-Green algae, Azotobacter, Sulphur and Phosphate Solubilizing Biofertilize. Applications of Biofertilizer.

UNIT- III:

Plant Pathology.

Concept of Plant Pathology. Host Pathogen Relationship. Classification of Plant Diseases based on Symptoms.

Plant Diseases: Causative agent, Symptoms, Mechanism of Action, Control Measures (Chemical and Biological) i) Bacterial Blight of Cotton ii) Whip Smut of Sugar Cane, iii) Powdery Mildew of Wheat. iv) Citrus Canker of Lemon.

UNIT- IV :

Agro-Biotechnology.

Single Cell Protein and its Nutritive Value eg. Spirulina.

Mushroom production.

Bio-pesticides- Definition and Types (Microbial and Botanical) Advantages of Biopesticides over chemical pesticides.

Bio-Processing Technologies : Agricultural Biotech Products in the market.

Biomass : Composition , Types, Biomass as a energy Source ,Biomass conversion and Utilization. Enzymatic, Aerobic and Anaerobic digestion.

Text & References :

1. Bilgrami K.S and Dube H.G.(1994) - Textbook of Modern Plant Pathology, Vikas Publications, New Delhi.
2. Gupta P.K. (1998) - Genetics and Biotechnology in Crop Improvement, Rastogi Publications, Meerut.
3. Pathak V.N, Khatri N.K., Pathak M. (1996) - Fundamentals of Plant Pathology, Agrobotanical Publications, Bikaner.
4. Powar C.B., Dagainawala H.F., (1990) - General Microbiology, Vol. II, Himalaya Publishing House, Mumbai.
5. Purohit S.S. (2002) - Agricultural Biotechnology, Agrobios India, Jodhpur.
6. Satyanarayana U. (2007) - Biotechnology, Books and Allied Pvt.Ltd. Kolkata.
7. Vyas S.C., Vyas S., Vyas S., and Modi H.A. (1998) - Biofertilizer and Organic Farming, Akta Prakashan, Nadiad, G.S, Meerut.
8. Vyas S.C., Vyas S., Vyas S., and Modi H.A (1998) - Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom cultivation, Vishwa Prakashan, New age international (p) Ltd., New Delhi.
9. Kalaichelvan P.T. and Dandiya P.C (2004), Microbiology and Biotechnology: A Laboratory Manual, MJP Publishers, Chennai.
1. Purohit S.S. (1995), A . Aneja K.R. - Laboratory manual of Plant Biotechnology, Agrobotanical Pub. India.
12. Schmauder Hans Peter (1997) - Methods in Biotechnology, Taylor and Francis, London.
13. Schuler M. A. and Zielinski R. E. (1989) - Methods in Plant Molecular Biology.
14. Vyas S.P. and Kohli D.V. (2002) - Methods in Biotechnology and Bioengineering, CBS Publishers and Distributors, New Delhi.

B.Sc. Biotechnology (Semester Pattern)

V-Semester

Code BTT.20 : Environmental Biotechnology

Marks : 80

Hours : 50

Objective:

To impart knowledge on different aspects of environmental science and techniques implemented to solve environmental problems ;waste water treatment, biodegradation techniques, bioremediation & xenobiotics degradation.

UNIT- I :

Waste Water Treatment.

Domestic Waste Water Treatments: Primary, Secondary and Tertiary.

Important microorganisms in waste water treatment, Principles of their growth and Plasmid Borne Metabolic Activities. Aerobic Biological Treatments: Activated sludge process Rotating Biological Contactors. Anaerobic Biological Treatments: Air Lift Membrane Bioreactors Packed Bed (Column Reactor.)

UNIT- II :

Biodegradation techniques

Biodegradation: Definition and Concept, Ready Biodegradation, Ultimate Biodegradation and Inherent Biodegradation. Aerobic and Anaerobic degradation pathways in Microbes.

Biodegradation of Hydrocarbon with Suitable Example

UNIT -III :

Bioremediation

Introduction, Definition and Concept, Methods of Bioremediation (In Situ and Ex Situ Methods) Bioremediation of Soil (Saline Soil and Alkaline Soil) Phytoremediation: Concept and Types. Applications of Bioremediation.

UNIT –IV:

Xenobiotics

Xenobiotics and Recalcitrancy. Xenobiotics Degradation: Pesticide Degradation (Principle with suitable example) Herbicide Degradation (Principle with suitable example) Metabolism of Xenobiotics: Cytochrome P450 System, Phase I, Phase II, Metabolic reactions

Text & References :

1. Asthana D.K. and Asthana M.(2001),Environment : Problems and Solutions, S.Chand and Company Ltd, New Delhi.
2. Chatterji A.K.(2002),Introduction to Environmental Biotechnology, Prentice Hall of India Pvt. Ltd ,New Delhi.
3. Evan G.M.and Furlong J.C (2003),Environmental Biotechnology:Theory and Applications, John Wiley and Sons Ltd., England.
4. Gupta P.K. (2004), Biotechnology and Genomics, Rastogi Publication,Meerut.
5. Jogdand S.N.(2006), Environmental Biotechnology,3rd Edi., Himalaya Publishing House,Mumbai
6. Kalaichelvan P.T., I Arul Pandi (2007),Bioprocess Technology, MJP Publishers,Chennai.
7. Murugesan A. G.and Rajakumari C.(2005), Environmental Science and Biotechnology: Theory and Techniques, MJP Publishers, Chennai.
8. Rittmann B. E. And McCarty P. L. (2001), Environmental Biotechnology Principles And Applications, McGraw Hill,USA

Code : BTP.9 : Lab Course IX (Practicals based on BTT-17 and BTT-18)

Practicals :

1. Isolation of Genomic DNA from Plant, Animal, Bacteria
2. Isolation of Plasmid DNA
3. Electrophoresis of DNA
4. Restriction digestion of DNA
5. Ligation of DNA
6. Preparation of Competent Cell
7. Transformation

8. GFP cloning
9. Techniques- Southern, Western
10. PCR
11. RFLP,
12. RAPD
13. Visit to Molecular Biology & Genetic Engineering Research Laboratory
Isolation and Screening of Industrially important Microbes-Acid, Antibiotics, Enzymes
14. Strain improvement
15. Sterilization Techniques
16. Maintenance of pure Culture
17. Growth Curve
18. Growth kinetics: Effect of pH & Temp
19. Media Formulation
20. Sterilizer Design- TDP, TDT
21. Cell and Enzyme immobilization
22. Visit to Fermentation Industry

Code BTP-10 Lab Course X (Practicals based on BTT-19 and BTT-20)

1. Study of Stomatal Physiology.
2. Determination of IAA Oxidase activity.
3. Estimation of leg haemoglobin from root nodule of leguminous plant.
4. Isolation and identification of plant pathogen (*Xanthomonas citri*) from infected citrus fruit or leaf.
5. Preparation and Application of Biofertilizers.
6. Isolation of *Rhizobium* sp. from root nodule of leguminous plant.
7. Isolation and Culture of Plant Protoplast
8. Determination of minimum size of quadrat by 'Species-Area-Curve' method.
9. Study of Community by quadrat method (Frequency, Density and Abundance of
 - a. Different Species in Community.
10. Visit to Cell Culture Facilities /Production /Biofertilizer Industry.
11. Determination of Dissolved Oxygen and Biological Oxygen Demand of polluted water.
12. Determination of Chemical Oxygen Demand of polluted water.
13. Bacterial Examination of Water by MPN Test: Presumptive and Confirmed Coliform test.
14. Determination of soil pH and Total organic carbon.
15. Determination of Total Carbohydrates and Phosphorus of soil.
16. Determination of Alkalinity and Hardness of water.
17. Demonstration of Total Nitrogen estimation by Kjeldahl's Method.
18. Visit to food/dairy/pharmaceutical industry.

B.Sc. Biotechnology (Semester Pattern)

VI - Semester

Code : BTT.21: Animal and Plant Development

Marks : 80

Hours : 50

Objective:

To provide an understanding of basics of gametogenesis, fertilization, stem cells, cloning & embryogenesis and developmental biology in plants & animals.

Unit -I:

Gametogenesis, Fertilization, Development. Types and patterns of cleavage, blastulation
Gastrulation in frog and chick up to formation of three germinal layers. Concepts of competence, determination, commitment and differentiation, dedifferentiation, redifferentiation, transdifferentiation, developmental plasticity in plant and animal development

Unit-II:

Role of gene/s in patterning and development. Concept of Stem cells, Progenitor cells, cell lineages in plants and animals. Ageing and apoptosis, abnormal development and teratogenesis in plants and animals: cancer

Unit -III:

Cloning in mammals, transgenic technology in plants and animals. Cell fusion and somatic cell genetics, hybridomas, Immunoglobulin genes and antibody diversity

Unit -IV :

Embryogenesis in plants (monocotyledons and dicotyledons), Meristem structure and activity, Plant hormones- role in development Organogenesis, somatic embryogenesis, regeneration of plants. Arabidopsis- as a plant development model system- shoot and root patterning, floral patterning

Text & Reference:

1. An Introduction to Embryology - B.I. Balinsky
2. Development Biology - S.F. Gilbert
3. Developmental Biology - K.V. Rao
4. Developmental Biology - S.C. Goel
5. Developmental Biology – Wolpert
6. Embryology of Angiosperms – S.S. Bhojwani and S.P. Bhatnagar
7. An Introduction to Plant Cell Development – J. Burgess

B.Sc. Biotechnology (Semester Pattern)
VI-Semester

Code: BTT.22 : Industrial Biotechnology

Marks : 80

Hours : 50

Objective:

To provide knowledge of many procedures in industries, role of microorganisms in industries and techniques used to improve product formation in industries.

UNIT - I :

Strain Improvement.

Selection of Mutants producing improved level of Primary Metabolites with suitable

Example. Isolation of mutants which do not produce feedback inhibitors or repressors.

Isolation of mutants which do not recognize presence of inhibitors or repressors.

Modification of Permeability.

UNIT - II :

Down Stream Processing.

Removal and Recovery of cell mass (Precipitation, Filtration and Centrifugation.)

Cell disruption - Physical and Chemical methods. Purification of Product Liquid-liquid extraction : Solvent Recovery. Chromatography : Adsorption, Ion-exchange, HPLC

Membrane processes: Ultrafiltration and Reverse Osmosis. Drying and Crystallization.

UNIT -III :

Fermentation Processes.

Fermentation processes: Microorganisms involved, Inoculum preparation, Medium used,

Fermentation process, Recovery. Enzyme: Protease, pectinase. Organic acid: Citric

acid. Antibiotic: Penicillin, erythromycin. Vitamin: Vitamin B12, vitamin B2.

UNIT- IV :

Quality Control, Process Economics and GLP.

Sterility testing. Pyrogen testing. Carcinogenicity testing. Toxicity testing. Fermentation Economics: Cost Estimates ,Process Design ,Capital Cost Estimates, Operating Cost Estimates. Good Laboratory Practices.

Text & References :

1. Casida L.E (1991) - Industrial Microbiology, Wiley Eastern, New Delhi.
2. Crueger W and Crueger A (2000) - Biotechnology: A Textbook of Industrial Microbiology, 2nd Edi. Panima Publishing Corporation, New Delhi.
3. Patel A.H. (2004) - Industrial Microbiology, Macmillan India Ltd.,New Delhi.
4. Peppler H.J and Perlman D (2006) - Microbial Technology, Vol I and II,Academic Press,New York.
5. Parihar Pradeep (2007) - A textbook of Biotechnology, Student edition, Jodhpur.
6. Stanbury P.F., Whitaker A. and Hall S.J (1997) - Principles of Fermentation Technology, Aditya Books Pub., Ltd., New Delhi.
7. Satyanarayana U. (2007) - Biotechnology, Books and Allied Pvt.Ltd.Kolkata.

B.Sc. Biotechnology (Semester Pattern)

VI-Semester

Code: BTT.23 : Pharmaceutical Biotechnology

Marks 80
Hours: 50

Objective:

To enable students to understand the role of secondary metabolites in pharmaceutical industries and to provide knowledge on drug designing & delivery.

UNIT -I :

Secondary Metabolites.

Introduction to Secondary Metabolites.Types and Medicinal Applications of Secondary metabolites. Production of Secondary metabolites in Plants Through hairy Root Culture. Factors affecting Secondary metabolite production (Precursors, Growth Factors,and Nutrients.)

UNIT-II :

Chemotherapy.

Types of Antibiotics: Classification of antibiotics with example. General characteristics of an Antimicrobial Drug. Mechanism of action of antimicrobial agent (General account) Bacterial Resistance to antibiotics (Types and Mechanism), Application of antibiotics in various fields. Assaying antimicrobial activity: Principle and Methods of microbial assay (MIC and Different types of agar diffusion.)

UNIT-III:

Protein Engineering and Chemotherapeutics Agents.

Protein engineering : Principles and Application.Structure, Mechanism of Action and Applications of :Antibacterial drug: Sulfonamides, Quinolones.Antiviral drug: Amantadine, Azidothymidine.Antifungal drug: Nystatin, Griseofulvin.

UNIT IV:

Drug Discovery, Designing and Delivery

Introduction to Indian and International Pharmacopoeia.

Drug Discovery: History, Molecular Biology and Combinatorial drug discovery.

Drug Designing: Introduction, Computer aided drug designing, Approaches for rational designing of drug. Drug Delivery: Advantages, Disadvantages and Applications of Liposome .drug delivery system.

Text & References :

1. Gupta P.K. (2004) - Biotechnology and Genomics, Rastogi Publication, Meerut.
2. Hugo W. B. and Russell A. D. (1983) - Pharmaceutical Microbiology 3rd ed. P.G. Publishing Pvt. Ltd. Singapore.
3. Jogdand S.N (2004) - Medical Biotechnology, Himalaya Publishing House, Mumbai.
4. Jogdand S.N (2008) - Biopharmaceuticals, Himalaya Publishing House, Mumbai.
5. Parihar Pradeep (2007) - A textbook of Biotechnology, Student edition, Jodhpur.
6. Purohit S. S. (1999) - Agricultural Biotechnology 2nd edi. Agrobios India Pvt.Ltd.Jodhpur.
7. Ramawat K.G;Merillon J.M (2003) - Biotechnology:Secondary Metabolites,Oxford and IBH Pub.Co.Pvt.ltd,New Delhi.

B.Sc. Biotechnology (Semester Pattern)

VI-Semester

Code: BTT.24 :An Introduction to Bioinformatics

Marks:80

Hours : 50

Objective:

To provide information on understanding of computational biology, Role of information technology and computer techniques for data generation, datamining and to solve problems in biology

Unit –I :

Various Definitions; History of Bioinformatics; Bioinformatics in business;
Scope of Bioinformatics; Bioinformatics Applications

Unit-II:

Internet and Bioinformatics: fundamentals of Internet; www; HTML;
URL browsers-Opera/Netscape/Explorer;
Search engines- Google;

Unit -III:

Information Molecule and Information Flow: Central dogma of molecular biology; Basic components; chemistry of DNA and RNA; Basics of DNA replication; Introduction to protein- amino acids and protein structure; primary, secondary, tertiary and quaternary.

Unit –IV :

Introduction to Database: What is Database; Types of Database; biological databases
NCBI; EMBL; DDBJ; PDB; SwissProt; TrEMBL; Information retrieval from biological
databases-Entrez; GenBank; PubMed; Unigene; SRS;

Text & Reference:

1. S.C Rastogi, Namita Mendirata, Parag Rastogi. - "Bioinformatics Concepts Skills and Applications, CBS publishers
2. Arthur M. Lesk, (2002), - "Introduction to Bioinformatics" Oxford University Press.
3. Arora M.P (2003) - Biotechnology, Himalaya Pub.House,Mumbai.
4. Clavene J.M and Notredame C (2003) - Bioinformatics: A Beginner's Guide,Wiley-Dreamtech India Pvt.ltd., New Delhi)
1. Rashidi H.H and Buahler L.K (2000) - Bioinformatics : Applications in Biological Science and Medicine,CRC Press,USA.
2. Satyanarayana U. (2007), Biotechnology, Books and Allied Pvt.Ltd.Kolkata

Code : BTP.11 Lab Course XI (Practicals based on BTT.21 and BTT.22**BTT.23 and BTT.24)**

1. Study of different types of eggs
2. Study of staging & staining of Chick embryos
3. Study of frog development, observation of frog embryo different development stages
4. Study of different types of sperms by smear preparation.
5. Frequency of genetic traits in human
6. Sex-linked inheritance
7. Multiple allelism
8. Study of plant development.
9. Microsporogenesis
10. .Development of male and female gametophytes
11. Developmental stages during plant Embryogenesis
12. .Analysis of histochemical changes during transition of vegetative shoot to reproductive apex
13. .Histochemical analysis of the activity of cambium

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14. Estimation of fermentative product (Acetic acid from vinegar).
 15. Fermentative production of antibiotics/ vitamins.
 16. Fermentative production of alcohol. using *Sacharomyces cerevisiae*.
 17. .Wine production & estimation of alcohol
 18. Immobilization of whole cells of yeasts in calcium alginate gel.
 19. Isolation and Screening of Industrially important Microbes-Acid, Antibiotics, Enzymes
 20. .Production of cheese using different substrate fro microorganism.
 21. .Isolation & identification of bacteria from different milk & water samples.
 22. Visit to Fermentation Industry

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23. Determination of Minimum Inhibitory Concentration (MIC) of Antibiotic.
 24. Estimation of penicillin/streptomycin by chemical assay.
 25. Estimation of penicillin/streptomycin by biological assay.
 26. Sterility testing of injectable as per IP.
 27. .Assay of antimicrobial activity of penicillin
 28. .Assay of antimicrobial activity of Chloramphenicol
 29. .Assay of antimicrobial activity of Tetracyclin
 30. .Assay of antifungal drug susceptibility
 31. .Determination of MIC of selected antibiotics
 32. Sterility testing of commercial pharmaceuticals.
 33. .Effect of chemical disinfectant on growth of bacteria.
 34. Testing of antibiotic resistance.
 35. .Study of microbial spoilage of pharmaceuticals.

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36. Demonstration of various domains (search engines) for bioinformatics through Internet.
 37. Concept of Databases: accessing database.
 38. Searching for gene and protein sequences and accessing information from web.
 39. BLAST - pairwise seq. alignment
 40. .working with biology workbench- Multiple Seq. alignment using Clustal-W, EMBOSS
 41. Finding consensus sequences using - Texshade, Boxshade, Clustal dist
 42. .Phylogenetic analysis - using Dendrograms
 43. .Protein structure prediction - Primary, Secondary, Tertiary structure using EXPASY

Tools

BTP.12 Lab Course XII (Project Work)

SKELETON OF THEORY QUESTION PAPER

B.Sc. BIOTECHNOLOGY SEMESTER PATTERN

THEORY PAPER

Time: Three hours

Maximum Marks: 80

Note: - (i) Attempt all questions
(ii) All questions carry equal marks
(iii) Draw neat and well labeled diagrams wherever necessary

Q.1.	a)		10
	b)		10
Q.2	a)		08
	b)		07
		OR	
Q.2	a)		08
	b)		07
Q.3.	a)		08
	b)		07
		OR	
Q.3	a)		08
	b)		07
Q.4.	a)		08
	b)		07
		OR	
Q.4	a)		08
	b)		07
Q.5.	Write short notes on (Any Three)		15
	a)		
	b)		
	C)		
	d)		

PROFORMA FOR PRACTICAL EXAMINATION
SWAMI RAMANAND TREETH MARATHWADA UNIVERSITY, NANDED
Faculty of Science
B. Sc. Biotechnology
Semester pattern
Practical Examination

Time: 10.00 am to 1.00 pm

Marks: 100

Q 1) Major Question	25
Q 2) Minor Question	15
Q 3) Major Question	25
Q 4) Minor Question	15
Q 5) Viva-Voce	10
Q 6) Record Book	10