

1SBT(4706) Sericulture Biotechnology

Unit I

Introduction of Sericulture: Scope and Silk production. Mulberry cultivation: uses, methods of cultivation, diseases (Bacterial, viral, fungal, parasitic and nutritional deficiency) and pests.

Unit II

Silkworm: types of silkworm, morphology and life history of *Bombyx mori*. Silkworm rearing methods. Silkworm diseases (Protozoan, Bacterial, Viral and Fungal diseases). Reeling and storage of silk.

Unit III

Techniques for plant and animal cell culture. rDNA technology: principle and production of transgenic silkworms. Recent approaches of silkworm in biomedical and breeding and recombinant proteins.

Reference Books

1. Ullal S.R.Narasimhamma : Hand book of Practical sericulture, Central Silk Board, Bombay.
2. Krisha Swami, S. : New Technology of silk worm rearing, Reprinted by C.S.B. Bangalore
3. Amga: Principles of sericulture.
4. Boraiah: Lectures on sericulture
5. FAO: Sericulture training manual
6. FAO: Silk worm rearing
7. Fennermore: Applied general entomology



THE MADURA COLLEGE (Autonomous), MADURAI – 625 011
(AFFILIATED TO MADURAI KAMARAJ UNIVERSITY)
RE-ACCREDITED (3rd Cycle) WITH “A” GRADE BY NAAC

PROGRAMME: B.Sc., Biotechnology **COURSE CODE : 1ABT1(2008on)**

COURSE TITLE : Anc.Basic Microbiology **QN.NO : 4708**

TIME : 3 Hours

MAX.MARKS :75

Unit I

Structure and Classification of Bacteria (Gram's reaction) and fungi (Alexopolus and Mimms).

Unit II

Structure and classification of viruses and algae

Unit III

Culture techniques: serial dilution and plating techniques (pour, streak and spread). Microbial growth media: composition and types of media.

Unit IV

Staining: principles and types of staining (simple & differential). Storage and preservation of cultures: refrigeration and freezing (lyophilization)

Reference Books

Cappuccino, J.C. and Sherman, N. 2004. Microbiology a laboratory manual.

Pearson Education, India.

Chakraborty, P. 2001. A text book of Microbiology. New Central book agency

Pvt. Ltd. India.

Dubey, R.C. and Maheshwari, D.K. 2005. A text book of Microbiology.

S. Chand & Company limited, New Delhi.

Holl, J.G. et al. 1994. Bergey's manual of Determinative Bacteriology

(9th edition). Lippincott Williams & Wilkins, London.

Allied paper 2

1 ABT2 (4710) Biomolecules

Unit I

Structure, properties, classification and biological importance of carbohydrates.

Unit II

Structure, functions and classification of proteins. Classification and properties of amino acids.

Enzymes: classification, kinetics, co-enzymes and co-factors.

Unit III

Structure, classification and functions of lipids. Saturated, unsaturated and cyclic fatty acids. Steroid hormones: structure and importance.

Unit IV

Nucleic acids: structure, types and chemical composition. Vitamins: water soluble and fat-soluble vitamins.

Reference Books

Elliott, W.H. and Elliott, D.C. 2001. Biochemistry and Molecular Biology. Oxford University Press, London.

Lehninger, A.L., Nelson, D.L. and Cox.M.M. 1993. Principles of Biochemistry. CBS Publishers & Distributors, Delhi.

Strayer, L, 1975. Biochemistry - W.H., Freeman and Co. San' Francisco.

Voet, D. and Voet, J.H. 1995. Biochemistry (2nd edition). John Wiley & Sons, Inc. New York.

Zubay, G. 1983. Biochemistry (2nd edition). MacMillan Publishing company, New York.

SEMESTER II

Core paper 2

2BT (4714) Molecular Biology

Unit I

Introduction and experimental evidence of DNA and RNA as genetic material.

Unit II

Structure and functions of DNA and RNA: Watson & Crick model and other forms of DNA (A and Z). DNA replication: Prokaryotic and Eukaryotic DNA replication and Theta and Rolling circle model of replication.

Unit III

Molecular basis mutation. DNA repair: causes and mechanism. Structure of Prokaryotic and Eukaryotic gene: Genetic code, properties and Wobble hypothesis.

Unit IV

Recombination in Prokaryotes. Mechanism of transcription and translation in Prokaryotes and Eukaryotes.

Unit V

Regulation of Gene expression in Prokaryotes (Lac and Tryp) and Eukaryotes (transcriptional activation and galactose metabolism in yeast). Transposable elements in Maize and Drosophila.

Reference Books

Darnell, J. Lodhish, H. and Ballimore; D., 1992. Molecular Cell Biology. Scientific American Books. .

Korenberg, A., 1974. DNA replication. W.H. Freeman and company, San Francisco.

Watson, J.D. et al. 2004. Molecular Biology of cell and gene (5th edition). Pearson education, Singapore.

Watson, J.D., Hopkins, N.H., Robertis, J.W., Steiltz, J.A. and Weiner, A.M. 1998. Molecular Biology of cell and gene. Benjamin/Cummings Publishing company, Inc. California.

2SBT (4718) Aquaculture, Apiculture & Vermiculture Technology

Unit I

Introduction and importance of fresh water, brackish water and marine fish culture in India. Significance and cultural methods of prawn and pearl production.

Unit II

Importance of bee keeping. Different species of honey bees and their distribution. Management of bees, product and byproducts of apiculture and their uses.

Unit III

Introduction and importance of Vermiculture, uses of earthworms for biodegradation of organic waste materials, earthworm as protein source. Vermiculture technique.

Reference Books

1. Shammi: Applied fisheries
2. Jean: Apiculture
3. Manju Yadav: Applied entomology
4. Ashok kumar: Economic and applied entomology
5. Vaidhyanath: Introduction to applied biology & biotechnology
6. Venkataramanujam: Manual of fish biology

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ACCREDITED BY NAAC

U.G. BIOTECHNOLOGY

UPTO 2018

Allied paper 3

METABOLISM OF BIOMOLECULES

SUB.CODE : 2ABT1 (4720)

Q.No!- 4720

Unit I

Introduction of metabolism: catabolism and anabolism. Different kinds of metabolism in animals, plants and microorganisms. A2 C1

Unit II

Carbohydrate metabolism: Glycolysis, TCA cycle, HMP shunt, glycogenolysis, glycogenesis and gluconeogenesis. A2 C1

Unit III

Protein metabolism: Breakdown of proteins (deamination, transamination, decarboxylation and urea cycle). Metabolism of Glycine and tryptophan. A2 C1

Unit IV

Lipid metabolism: Oxidation of fatty acids (alpha, beta and omega oxidation). Biosynthesis of saturated and unsaturated fatty acids. Ketogenesis. A2 C1

Reference Books

Lehninger, A.L., Nelson, D.L. and Cox.M.M. 1993. Principles of Biochemistry. CBS Publishers & Distributors, Delhi.

Strayer, L, 1975. Biochemistry - W.H., Freeman and Co. San' Francisco.

Voet, D. and Voet, J.H. 1995. Biochemistry (2nd edition). John Wiley & Sons, Inc. New York.

Zubay, G. 1983. Biochemistry (2nd edition). MacMillan Publishing company, New York.

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Allied paper 4

2ABT2 (4722) Physiology

Unit I

Organization and physical structure of a cell. Transport and functional systems in cells. Hematology: Erythropoiesis, structure and function of RBC's & WBC's, destruction and fate of RBCs & WBC's. Hemostasis - components, mechanism and tests of coagulation, anticoagulants.

Unit II

Water balance: Regulation of acid-base balance. Regulation of extracellular sodium and osmolarity. Renal mechanisms for the control of blood volume, pressure and ionic composition.

Unit III

Respiration: Principles of gas exchange, oxygen-carbon dioxide transport. Environmental effects: physiology of hot, cold, high altitude, aviation, space, deep sea and hyperbaric conditions.

Unit IV

Neurophysiology: Resting membrane and action potential. Mechanisms of muscle contraction. Interneuronal communication- sensory receptors, transduction and information processing. Optics of vision, receptors and neural functions of retina.

Reference books

Giese, A.C., 1978, Cell Physiology, W.B. Saunders, Philadelphia.

Guyton, A.C. 1991. Medical Physiology (8th edition). Prirn Books Pvt. Ltd. Bangalore, India.

Joshi, V.D. 2001. Physiology (2nd edition). B.I. Churchill Livingstone, New Delhi.

Kumar, a. 2003. Animal Physiology. Discovery Publishing House, New Delhi.

Nagapushanam, R. Kodarkar, M.S. and Sarojini, R. 1983. A text book of Animal Physiology. Oxford & IBH Publishing Pvt. Ltd. New Delhi.

Prosser, C.L. 1984. Comparative Animal Physiology Third Edition, W.B. Sawners, Philadephia,

Wilson, J.A., 1980. Principles of Animal Physiology, 2nd edition, Collier-Mac Millan Publishers, London

SEMESTER III

UPTO 2016

Core I

Principles of Biotechnology

3BT1 (20050) 4726

Unit I

Origin and definition: Old Vs New Biotechnology; Historical Background; Scope and importance of Biotechnology. Introduction and applications of Biotechnological process; biotechnological products.

Unit II

Introduction to Genetic engineering and gene cloning. Types and importance vectors. Plasmids: replication, size, copy number, amplification and types.

Restriction enzymes: types, naming, target sites, nature of cut ends, host controlled restriction and modification, star activity and isoschizomers.

Unit III

Introduction to Ligases and activity; alkaline phosphatase; polynucleotide kinase; terminal deoxynucleotidyl transferase; S1 Nuclease; DNA polymerase: types; Taq DNA polymerase; Ribnuclease: Reverse transcriptase; Poly (A) polymerase; Deoxyribonuclease I.

Unit IV

Genes transfer in plant and animals: introduction of vectors for plants and animals. Mechanism of direct transformations; other methods- microinjection, lipofection, electroporation, ultrasonication; nuclear transplantation

Unit V

Introduction and mechanism of expression of induced genes: reporter gene for transient expression; β - Glucuronidase; luciferase gene; Chloramphenicol acetyl transferase gene and Anthocyanis. Promoter elements and marker genes.

Reference Books

Ignacimuthu, S. 2008. Biotechnology: An Introduction. Narosa Publishing House, New Delhi.

Purohit, S.S. 2008. Biotechnology. Student Edition, Jodhpur.

Das, H.K. 2004. Text book of Biotechnology. Wiley dream tech India Pvt. Ltd. Delhi.

UPTO 2016

Core 2

Animal Biotechnology

3BT2 4728

Unit I

History and development of cell culture; scope of animal tissue culture. Culture media: Natural media -Plasma Clot, biological fluids tissue extract; importance of Serum media. Chemical defined media: types and importance. Growth factors: Promoting proliferation of animal cells. EGF, FGF, PDGF, IL-1, IL-2, NGF and Erythropoietin.

Unit II

Animal cell culture: Primary Culture - Cell lines, and cloning - disaggregation of tissue, isolation of tissue, enzyme disaggregation, and mechanical disaggregation; Secondary Culture - transformed animal cells and continuous cell lines. Transfection of animal cell lines. HAT selection; selectable markers and antibiotic resistance; Transplantation of cultured cells.

Unit III

Measurement of viability and cytotoxicity of cell cultures. Biology and characterization of cultured cells and measuring parameters of growth. Expression of Cloned proteins in animal cell: Expression vector, over production and downstream processing of the expressed proteins. Bioreactors for large scale production of animal cells. Over production and processing of chosen proteins.

Unit IV

Embryo transfer technology; in-vivo and in-vitro fertilization, cryopreservation of embryo production; Transgenic animals: Techniques and applications and transgenic mice and sheep. Production of vaccines in animal cells: construction of recombinant vaccines; vaccine delivery methods. Production and applications of monoclonal antibodies.

Unit V

Data mining: types, analytical methods, industries and technical snags. Introduction and applications of targeted Ribozymes in therapy and developing disease models. Biology, expression and applications of Baculoviruses in Veterinary science. Application of Telomerase in animal cancer and anticancer therapeutics. Immunotherapy: types and importance.

Reference Books

Srivastava, A.K., Singh, R.K. and Yadav, M.P. 2005. Animal Biotechnology. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
Das, H.K. 2004. Text book of Biotechnology. Wiley dream tech India Pvt. Ltd. Delhi.

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UPTO 2016

Core 3

B.Sc. Biotechnology

Food preservation and processing

3BT3(2008-9) 4730 Q.No:-4730

Unit I

Historical development of microorganisms in food. Primary sources of microorganisms found in food; intrinsic and extrinsic parameters of food that affect microbial growth; Incidence and types of microorganisms in meat, poultry, seafood, dairy products and vegetables.

Unit II

Determining microorganisms in foods: culture and sampling methods -- membrane filters, microscope colony counts, most probable numbers, roll tubes and air sampling; physical, chemical and immunologic methods; bioassay methods. Types of microbial spoilage in foods

Unit III

Food preservation with chemicals: Benzoic acid, propionates, NaCl and sugars, Nitrites and Nitrates; acetic and lactic acids, antibiotics and ethylene oxides. Characteristics of radiation in food preservation; processing and applications of irradiation in food preservation; Method and applications of low and high temperature processing in food preservation

Unit IV

Method and application of Drying for food preservation. Microbial indicators of food microbial quality and safety: Principles of quality control and microbiological criteria. Food poisoning: causes by gram positive spore forming bacteria and mycotoxins; paralytic Shellfish poisoning.

Unit V

Types and control measures of food borne diseases: Staphylococcal Gastroenteritis, Gastroenteritis- *Salmonella*, *Eschericia*, *Shiegella*, *Yersinia*, *Vibrio*, *Camphylobacter*; Listeriosis, Animal parasites: protozoa, flatworms and round worms.

Reference Books

Jay, M.J. 2000. Modern Food Microbiology. CBS Publishers and Distributors. New Delhi.
Cappuccino, J.C. and Sherman, N. 2004. Microbiology a laboratory manual. Pearson Education, India.
Chakraborty, P. 2001. A text book of Microbiology. New Central book agency Pvt. Ltd. India.

Skill Based Elective

UPTO 2016

Fisheries Technology

3SBT (2008-09) 4736

Unit I

Aquaculture: genetic improvement of stock, methods of selection; different methods of selection, hybridization, genetic markers and genetic conservation in fishes.

Unit II

Fisheries technology: electricity in fishing; electronic devices for detecting fishes; devices to lure fish for Bumper catch; solar driers for hygienic drying of fish and farm produce.

Unit III

Fishery byproducts of commerce: ambergris; prospects of Indian seaweeds: seaweeds as fertilizers; profitable uses of freshwater weeds.

Reference Books

Rath, R.K. 1993. Freshwater aquaculture. Scientific publishers, New Delhi

Santhanam, R. 1990. Fisheries science. Daya Publishing house, New Delhi

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UPTO 2016

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B.Sc. Biotechnology

Instrumentation

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Q. No. 4738

Unit I

Microscopy: Introduction and types; bright field, dark field, Phase contrast, Fluorescence, Polarising microscopy; Electron microscopy: SEM and TEM.

Unit II

Centrifuge: types; mechanism of diffusion and sedimentation

Colorimetry and Spectrophotometry: Lambert-Beer's Law; Colorimetry spectroscopy:

UV, Visible, Fluorescence, Raman spectroscopy and Infrared spectroscopy.

Unit III

Chromatography: Paper Chromatography; Thin layer Chromatography; Gas Chromatography, ion exchange Chromatography.

Electrophoresis: Techniques and applications of Agarose gel, native PAGE, SDS-PAGE.

NMR spectroscopy: Introduction, principle and applications.

Reference Books

Pattabhi, V. and Gautham, N. 2002. Biophysics. Narosa Publishing house, New Delhi.

Daniel, M. 2004. Basic Biophysics. Student edition. Jodhpur. India.

B.Sc. Biotechnology

Biostatistics

3ABT2 (2015) 4740

Q. No: 4740

UPTO 2016

Unit I

Definition, application of Biostatistics. Types of data: primary, secondary, qualitative and quantitative data. Population and samples: definition; sampling methods. Tabulation and classification of data. Graphical representation of data: Bar diagram, pie diagram, frequency graph, frequency curve.

Unit II

Measures of Central tendency and dispersion: Mean, median, mode, variance and standard deviation

Unit III

Probability: concepts; binomial and normal distribution. Hypothesis testing: Null hypothesis; Students t - test

Unit IV

Chi-square test; Correlation and regression;

Reference Books

Daniel, W.W. 1987. Biostatistics: A foundation for Analysis in Health Sciences John Wiley and sons, New York.

Gurumani, N. 2004. An Introduction to Biostatistics. MJP Publishers, Chennai, India.

UPTO 2016

Non Major Elective

Biodiversity and conservation

3BT NM (2008 on) 4742

Unit I

Definition and different levels of biodiversity: Biodiversity Convention; Biodiversity of India, endemic species, biodiversity resource, resource utilization and conservation.

Unit II

Methodology in biodiversity studies: Ecological monitoring-purpose means ground monitoring population studies, cyclic changes in behavior, Indices of species diversity.

Managing natural areas in tropics: Features of areas to be protected, categories of protected areas, in gene banks, island biogeography theory and protected area management

Unit III

Conservation strategies: types - In-situ and ex-situ conservation; social conservation; Keystone species.

Economics of biodiversity: Threatened categories, red data books, threatened mammals of India, economics of biodiversity conservation.

Reference books

- Gabriel Melchias, 2001. Biodiversity & Conservation Oxford & IBH Publishing and Company
- Krishnamoorthy, K.V. 2003. An Advanced Text book on Biodiversity. Oxford & IBH Publishing house, New Delhi.
- Kumar, H.D. 1999. Biodiversity and sustainable conservation Oxford & IBH Publishing Company private limited, New Delhi.
- Magurran, A.E. 1988. Ecological diversity and its measurement. Groom Helm Limited, London.
- Agarwal, K.C. 1996. Biodiversity. Agro Botanical Publishers, New Delhi

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B.Sc. Biotechnology
SEMESTER IV

Core I

Plant Biotechnology

Unit I

4 BT 1 (2008-09) 4744
Q. NO:- 4744

Plant tissue culture: Introduction; laboratory organization: nutritional medium and sterilization techniques

Unit II

Cultural types: cytodifferentiation; organogenic differentiation; seed culture; embryo culture; callus culture; organ culture; cell culture and protoplast culture.

Protocol for seed germination; Protocol for callus induction in cereals

Unit III

Micropropagation: Axillary bud proliferation; meristem and shoot tip culture; bud culture; organogenesis; embryogenesis.

Types of suspension cultures: Batch culture; continuous culture; technique for single cell culture.

Production of secondary metabolites: Introduction and applications

Unit IV

In-vitro production of Haploids: introduction, methods and applications: anther and ovary culture.

Protoplast isolation and fusion: introduction, method and applications.

Introduction and application of somaclonal variation

Germplasm storage and cryopreservation: types and applications

Unit V

Introduction to transgenic plants; genetic manipulation of plants in *Agrobacterium*: transfection methods; advantages of Transgenic Plants. Introduction to types of resistance to biotic stresses: insect, virus, disease, abiotic, herbicide and transgenic plants.

Reference Books

Chawla, H.S. 2008. Introduction to Plant Biotechnology. Oxford & IBH Publishing Co. Pvt. Ltd.
New Delhi.

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UPTO 2016

Core 2

Bioinformatics & Computer applications

Unit I

4BT2 (removed) 4746

Introduction to macromolecular structure: nucleic acid and protein structure.

Molecular Modelling: Introduction, generation and optimizing model

Introduction and branches and applications of Bioinformatics

Unit II

Computer: purpose, types of computer system; computer softwares and hardwares; devices (input, output and auxiliary storage devices; introduction and applications Windows and MS Office

Unit III

Biological databases: Introduction, classification and retrieval systems; NCBI, Entrez; nucleotide (GenBank, EMBL Net) and protein database (SWISS - PROT); DNA microarray technology; gene chips.

Bio-algorithms and tools: Sequence alignments (BLAST); principles of gene prediction; molecular phylogeny (Clustal W) and molecular viewers (RasMol).

Unit IV

Protein modelling: Introduction; methods; homology and evaluation of protein modelling.

Drug design: introduction; SAR and QSAR techniques and molecular docking

Pharmacoinformatics and Metabolomics

Reference Books

Ghosh, Z. and Mallick, B. 2008. Bioinformatics: Principles and Applications. Oxford University Press, New Delhi.

Lesk, A.M. 2002. Introduction to Bioinformatics. Oxford University Press, London.

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UPTO 2016

Skill Based Elective

B.Sc. Biotechnology

Mushroom culture

4 SBT (2008-09) 4756

Q. NO: 4756.

Unit I

Mushroom culture: Introduction, scope, concept, different methods; economic importance

Unit II

Morphology and taxonomy of Mushroom: characters and types, classification.

Introduction to edible and poisonous Mushrooms

Methods of mushroom culture: principle, types and management

Unit III

Diseases of Mushrooms; insect-pests and nematodes of Mushrooms

Introduction to post harvest handling and processing

Introduction to transfer of Mushroom technology

Reference Books

Tripathi, D.P. 2005. Mushroom cultivation. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.

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UPTO 2016

Allied I

Production Technology

Unit I

LABT (2008 on) 4758
Q. NO - 4758

Introduction and importance of Baking technology; ingredients used in baking, functions of ingredients, the reactions of baking (mixing, leavening, baking), preparation methods of bread, cake, biscuits, cookies, pastry, buns, crackers; types of quick bread, cake, cookies

Unit II

Malting: production of malt, and malt syrup; functions of malts; beer manufacturing
Durum wheat products: types, raw materials and processing
Breakfast cereals: Introduction, history, present status, processing of hot serve cereals and ready to eat breakfast cereals; Flakes, shreds, granules, puffed cereals, sugar coated products

Unit III

Snack foods: popped and puffed snacks, factors affecting their quality; convenience cereal foods; extrusion cooking
Starch: manufacturing of food starches, modified starches, heating of starch granules.
Gelatinization, retro gradation, factors affecting gelatinization.
Chocolate based confectionery: ingredients, chocolate and cocoa products

Unit IV

Sugar based confectionery: manufacturing of raw refined and white sugar, forms of sugar
Liquid sweeteners; reactions of sugar; crystalline and amorphous confectionery. Indian confectionery.
Special dietary food and ingredients: Hot cereals for children; Quality control; Junior cereals and baby foods; Beverages

Reference Books

Norman, N., Potter, Joseph, H and Hotchkiss. 1997. Food Science. CBS Publishers and distributors, New Delhi.
Matz. Cereal technology
Shakuntala Manay. Food facts and principles.

Non Major Elective

UPTO 2016

Medical Zoology

4BTNM. 4760

Unit I

Definition: host, parasite, vector, commensalisms, mutualism; types of parasites: ectoparasites, endoparasites, facultative and obligatory; types of hosts: intermediate and definitive; Host-parasite relationship

Unit II

Morphology, life cycle, pathogenicity and control measures: Head louse, Tick and Mite.
Parasitological significance of domestic, wild life and zoonosis: Bird flu, Anthrax and Rabies

Unit III

Life cycles, pathogenicity and control measures of *Plasmodium vivax*, *Entamoeba histolytica*, *Fasciola hepatica*, *Wuchereria bancrofti*, *Ascaris lumbricoides*.

Reference Books

Askew, R.R. 1971. Parasitic insects. Heinemann Education Books, London.
Nayar, K.K., Ananthakrishnan, T.N. and David, B.V. 1976. General and Applied Entomology, Tata Mc. Graw-Hill publishing company, London.



THE MADURA COLLEGE (AUTONOMOUS) MADURAI – 11
Re-Accredited with 'A' grade by NAAC

B.Sc (Biotechnology)

UPTO 2016

Title : BIOETHICS & PATENTING

Code : 5BT4

Qn.No.: 4768

Unit I

Benefits of biotechnology; ELSI biotechnology: the legal and socioeconomic impacts of biotechnology

Unit II

Public education of the process of the processes of biotechnology involved in generating new forms of life for informed decision making biosafety regulation and national and international guidelines r-DNA guidelines; Experimental protocol approvals; levels of containment.

Unit III

Environmental aspects of biotech applications; use of genetically modified organisms and their release in environment; special procedures for r-DNA based product production

Unit IV

Intellectual property rights (IPR), TRIPS, plant breeder's rights and International conventions patents and methods application of patents, Legal implications.

Unit V

Biodiversity and farmers rights; Beneficial applications and development of research focus to the need of the poor; Identification of directions for yield effect in agriculture and aquaculture

Reference Books

Satyanarayana, U. 2007. Biotechnology. Uppala author-publisher interlinks, Vijayawada, Andhra Pradesh, India.

Sasson, A. 1988. Biotechnologies and Development. UNESCO Publications.

Singh, K. Intellectual Property Rights on Biotechnology. BCIL, New Delhi.

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THE MADURA COLLEGE (AUTONOMOUS) MADURAI – 11
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B.Sc (Biotechnology)

UPTO 2016

Title : AGRICULTURAL BIOTECHNOLOGY

Code : 5BT5

Qn.No.: 4770

Core Elective 1

Unit I

Food crops with biotechnology; conventional breeding; improvement of existing and new cultivated plants; plant breeding and concepts of crop improvement; methods of crop improvement; applications of biotechnology in rice production; forage crops; commercial crops; beverage crops and fruit crops.

Unit II

Soil Biotechnology: microorganisms survival in adverse conditions; contaminated site; suitability of the site for biotreatability tests; bioremediation monitoring and clean technology. / Bioremediation: technology; bioconstraints; bioavailability; synthetic surfactants and general recommendations.

Unit III

/ Cytokines in agriculture: cytokine gene transfer, chemical agents inhibiting; cytokine production and action; specific inhibitory cytokines; cytokine receptors; anticytokine antibodies; fusion toxins, immunotoxins and chimera toxins; antisense technology; extracorporeal removal of cytokines.

Unit IV

Molecular and biochemical basis of plant disease resistance: signaling pathways, protein kinases, and virus induced gene silencing. Molecular basis of plant resistance to various abiotic stresses / Chloroplast genetic engineering: methodology, applications in herbicide resistance, production of biopharmaceuticals, edible vaccines, foreign gene expression and limitations.

Reference Books

Kumar, A. 2006. Agricultural Biotechnology. Discovery Publishing House, New Delhi.

Altman, A. 2001. Agricultural Biotechnology. Marcel Dekker, Inc.

Chrispeels, M.J. and Sadava, D.E. 2003. Plants, Genes and Crop Biotechnology 2nd Edition. American Society of Plant Biologists, Jones and Bartlett Publishers, USA.

Buchanan B.B., Grissem, W. and Jones, R.L. 2000. Biochemistry and Molecular Biology of Plants. American Society of Plant Biologists, USA.

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Skill Based Elective

B.Sc. Biotechnology

UPTO 2016

Biofertilizers & Biocides

Sub. Code: 55BT QN.No. 4776

Unit I

636 -
 Definition of Bio-fertilizers; Bacterial suspensions/inoculants as bio-fertilizers and bio-control agents to fight insect pests, weeds or diseases in plants; Atmospheric nitrogen fixing soil bacteria (Rhizobium, Azotobacter, Acetibacter) and several cyanobacteria 635

Unit II

638
 638 + 262
 Biopesticides: use of biotechnology in biocide production; Bacteria: production of Bt: mode of action of protozoa; Fungi: ⁶⁴²Beaveria bassiana; agricultural applications of Tetranactin, Avermectins and Milbemycins

Unit III

Viruses: Baculoviruses; time, location and mechanism of viral infection; Neodiprion Sertifer Nuclear Polyhedrosis Virus. ⁶³²Herbicides: introduction and applications; introduction and applications of agricultural antibiotics; antifungal antibiotics 466

Reference Books

Purohit, S.S. 2008. Biotechnology. Student Edition, Jodhpur.



THE MADURA COLLEGE (AUTONOMOUS) MADURAI – 11
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B.Sc (Biotechnology)

Title : GENETIC ENGINEERING

Code : 6BT1(2008 ON)

Qn.No.: 4780

Core I

Unit I

Introduction to Genetic Engineering. Tools for genetic engineering: DNA manipulative enzymes: Restriction enzymes and DNA ligases; Gene cloning vectors: Plasmids, Bacteriophage and cosmids.

Unit II

In- vitro construction of recombinant DNA molecules: pBR 332, pUC 19; isolation of passenger and vector DNA; creation of r-DNA. transformation of r-DNA: transformation of r-DNA molecules into target host organism's Calcium chloride mediated, Electroporation and microinjection.

Unit III

Screening and selection of recombinant host cells: Immunological screening and colony hybridization. Gene Libraries: Genomic DNA and cDNA; Cloning techniques. Expression of cloned DNA in *E.coli*;

Unit IV

Molecular biology techniques: Electrophoretic techniques –Proteins and nucleic acids; Polymerase chain reaction (PCR); Site directed mutagenesis (SDM); Nucleic acid sequencing: Sanger's method; Blotting techniques: Southern, Western and Northern blot

Unit V

Basic principle and applications of protein and enzyme engineering. Application of r-DNA technique in human health: production of insulin; production of recombinant vaccines: Hepatitis B; production of human growth hormone.

Reference Books

Old, R.W. and Primrose, S.B. 1993. Principles of Gene manipulation: An Introduction to Genetic Engineering. Blackwell Science Publications.

Ignacimuthu, S. 2008. Biotechnology: An Introduction. Narosa Publishing House, New Delhi.

Purohit, S.S. 2008. Biotechnology. Student Edition, Jodhpur.

Das, H.K. 2004. Text book of Biotechnology. Wiley dream tech India Pvt. Ltd. Delhi.

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THE MADURA COLLEGE (AUTONOMOUS) MADURAI – 11
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B.Sc (Biotechnology)

Title : MEDICAL BIOTECHNOLOGY

Code : 6BT2 (2008 ON)

Qn.No. : 4782

Core Elective 2

Unit I

Drug Development: production of pharmaceuticals by genetically engineered cells (hormones, interferons); microbial transformation for production of important pharmaceuticals (steroids and semi-synthetic antibiotics); drug design and drug targeting

Unit II

Disease Diagnosis and Therapy: ELISA and hybridoma technology; DNA vaccine; Gene therapy; and toxicogenomics

Unit III

Proteomics in Drug Development: role of Proteomics in Drug Development; Diagnosis of disease by Proteomics; Separation and identification techniques for protein analysis; Development of antibody based protein assay for diagnosis

Unit IV

Diagnosis and Kit Development: use of enzymes in clinical diagnosis; use of biosensors for rapid clinical analysis; Diagnostic kit development for microanalysis

Unit V

Introduction to cancer; immortalization: loss of contact inhibition, invasiveness, loss of anchorage dependence, cell surface alterations; carcinogenesis; modern biotechnological products and research to cancer

Reference Books

- Ignacimuthu, S. 2008. Biotechnology: An Introduction. Narosa Publishing House, New Delhi.
Purohit, S.S. 2008. Biotechnology. Student Edition, Jodhpur.
Das, H.K. 2004. Text book of Biotechnology. Wiley dream tech India Pvt. Ltd. Delhi.





THE MADURA COLLEGE (AUTONOMOUS) MADURAI - 11

Re-Accredited with 'A' Grade by NAAC

B.Sc (Biotechnology)

Title : BIOENTREPRENEURSHIP & NANOBIO TECHNOLOGY

Code : 6SBT (2008 ON)

Qn.No. : 4788

Skill Based Elective

Unit I

Entrepreneurship: concept, nature, scope and philosophy of entrepreneurship; distinction between self employment and entrepreneurship; importance of entrepreneurship and self employment in India; entrepreneurial traits, small business strategic planning, pricing and promotion and franchising.

Unit II

Concept of various types of business organization: sole proprietorship; partnership, cooperation society, private and public limited companies, institutions support for establishment of self-employment and entrepreneurial ventures, role of various agencies.

Unit III

Nanobiotechnology: a brief history of the super small; introduction to Nanofabrication, Nanolithography Nanobiotechnology, Nanotubes and Buckyballs; applications of nanobiotechnologies: Drug delivery, drug discovery; health Risks and concerns of nanobiotechnology

Reference Books

Harold, K. and Heinz, W. 2003. Essentials of Management. 5th Edition, Tata McGraw-Hill, New Delhi.

Dando, M.R. 1994. Biological Warfare in the 21st Century.

Lee, S. and Savage, L.M. Biological Molecules in Nanotechnology.

Ratner, M. and Ratner, D. Nanotechnology.

Core 3

Bioprocess & Fermentation technology

UPTO 2016

4BT.3 (200-000) 4748

Unit I

Introduction to bioprocess technology; screening, preservation and improvement of industrially important microorganisms; raw material and media formulation for fermentation process; influence of environmental factors on growth and product formation.

Unit II

Bioreactor design:

Principle and working Process – Air lift fermentor and Continuous stirred fermentor

Growth kinetics: Microbial growth cycle, measurement of growth, growth kinetics.

Unit III

Control of process parameters: measurement of process parameters like pH, temperature, DO, foam etc. Instrumental in process control, biosensors and enzyme probes, microprocessor based control systems.

Dowstream processing: Cell separation, cell disintegration, product purification. Effluent treatment.

Unit IV

Enzyme technology: immobilization of enzymes, enzyme reactors and bioconversion.

Fermented foods: fermented foods- Yoghurt, Buttermilk and Cheese

Microbial Foods: Single cell proteins (SCP), single cell oils (SCO).

Unit V

Plant cell suspension culture for the production of food additives: Saffron and Capsaicin

Technique of mass culture of Algae: Spirulina

Microbial polysaccharides and polyesters; production of xanthan gum and polyhydroxyalkanoides

Reference Books

Whitekar and Stanbury. Principles of Fermentation Technology

Sikya. Methods in Industrial Microbiology

Pate, A.H. Industrial Microbiology



PROGRAMME: B.Sc., Biotechnology

COURSE CODE : 4BT4(Upto 16)

COURSE TITLE : Environmental

QN.NO : 4750

Biotechnology

TIME : 3 Hours

MAX.MARKS :75

Unit I

4BT4 4750 (Upto 2016)
Q.No 4750
Introduction to environmental biotechnology; types of environmental pollution; measurement of pollution level; biodegradation methods; Indian standards for inland surface waters; and minimum national standards for waste disposal.

Unit II

Classification and characterization of wastes; biological treatment, physico-chemical characterization, availability of waste materials; characteristics of specific industrial effluents and products of anaerobic digestion.

Introduction of anaerobic microorganisms digestion and metabolism; anaerobic digestion: microbiological and biochemical aspects; types of important alternative fuels

Unit III

Introduction to analytical techniques for environmental monitoring; estimation of total solids volatile solids, cellulose, starch, lignin, nitrogen and organic carbon; Gas analysis; estimation of chemical oxygen demand and biological oxygen demand; High Pressure Liquid Chromatography Biomarkers and Biosensors.

Unit IV

Introduction and principle of basic mass balance, degree of reduction and oxidation, design kinetics and aerobic treatment process. Waste water treatment processes with bioreactor Introduction of solid waste management and landfill bioreactor; Introduction of Biogas plant ethical issues involved in environmental biotechnology

Reference Books

Bhattacharyya, B.C. and Banerjee, R. 2007. Environmental Biotechnology. Oxford University Press, New Delhi.

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THE MADURA COLLEGE (AUTONOMOUS) MADURAI – 11
Re-Accredited with 'A' grade by NAAC

B.Sc (Biotechnology)

Title : IMMUNOLOGY

Code : 5BT1 (2008 ON)

Qn.No. : 4762

Unit I

Immunity: definition and history. Immune organs: primary and secondary; types of immunity: Innate and acquired; humoral and cellular immunity; phagocytosis

Unit II

Antigens: definition, type of antigen: hapten; exogenous and endogenous antigen; immunoglobulins: structure: different classes of immunoglobulin and their applications; epitope and paratope; mode of action and role of cytokines.

Unit III

Major histocompatibility complex: structure and functions; HLA typing; complement system: types and functions; endogenous and exogenous antigen processing and presentation

Unit IV

Hypersensitivity: Type I, II, III & IV; Autoimmunity: organ specific and systemic; induction of tolerance in T & B cells.

Unit V

Antigen-antibody reaction: precipitation and agglutination; Mancini and Ouchterlony technique; immunoelectrophoresis; ELISA; Western blot

Reference Books

Benjamini, E., Coico, R. and Sunshine, G. 2000. Immunology (4th edition). A John Wiley & Sons, Inc. Publishers, New York.

Kuby, J. 1997. Immunology. W.H. Freeman & Company, New York.

Rao, C.V. 2006. Immunology (2nd edition). Narosa Publishing House, New Delhi.

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B.Sc. Biotechnology (V Semester)

Core paper 1, 2, 3 & 4 (Immunology, Industrial Biotechnology, Marine Biotechnology, Bioethics & Patenting)

5BT1 (2008m)
5BT2
5BT3
5BT4

Maximum marks: 75
Duration: 3 hours

Section A

Answer any **eight**

8x2=16

- 1 question from Unit – I
- 3 question from Unit – II
- 3 question from Unit – III
- 3 question from Unit – IV
- 2 question from Unit – V

12 questions should be asked from five units, answer any **eight** questions

Section B

Answer any **two**

2x7=14

- 1 question from Unit – I or II
- 1 question from Unit – III
- 1 question from Unit – IV
- 1 question from Unit – V

4 questions should be asked from five units, answer any **two** questions

Section C

Answer any **three**

3x15=45

- 1 question from Unit – I
- 1 question from Unit – II
- 1 question from Unit – III
- 1 question from Unit – IV
- 1 question from Unit – V

5 questions should be asked from five units, answer any **three** questions



PROGRAMME: B.Sc., Biotechnology

COURSE CODE : 5BT2

COURSE TITLE : Industrial Biotechnology

QN.NO : 4764

TIME : 3 Hours

MAX.MARKS :75

Unit I

Introduction to industrial Biotechnology; screening and isolation of microorganisms; maintenance of strains improvement: mutant selection, and recombinant DNA methods

Unit II

Basic principles for the production of microbial products: citric acid, penicillin, amino acids: glutamic acid and Vitamin B12

Enzyme Biotechnology: characteristics of enzymes: amylases; industrial uses of enzymes: detergents, leather, beverage, food and pharmaceutical.

Unit III

Introduction and production principles of microbial polysaccharides, Xanthan Gum and Polyesters. Microbial transformation of steroids and sterols; asymmetric catalysis in the pharmaceutical and agrochemical industries; Large-scale biocatalytic processes.

Unit IV

Biomass: components of plant biomass; degradation of lignin, cellulose; degradation of lignocellulose by Fungi and Bacteria.

Ethanol: From feed stocks to fermented sugars; from sugars to alcohol; prospects of fuel ethanol from biomass.

Unit V

Environmental applications: microbiological degradation of Xenobiotics; microorganisms in mineral recovery and in the removal of heavy metals from aqueous effluent. Introduction of microorganisms in Textile industries: types, conditions favoring the action, types of destruction and prevention of growth of microorganisms. Introduction and applications of microorganisms in Leather industries.

Reference Books

Glazer, A.N. and Nikaido, H. 2008. Microbial Biotechnology: Fundamentals of applied microbiology. Cambridge University Press, New Delhi.

Agarwal, A.K. and Parihar, P. 2006. Industrial Microbiology. Student Editon, Jodhpur.

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RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME: B.Sc., Biotechnology

COURSE CODE : 5BT3

COURSE TITLE : Marine Biotechnology

QN.NO : 4766

TIME : 3 Hours

MAX.MARKS :75

Unit I

Introduction to marine environment; marine flora: phytoplankton, seaweeds, sea grasses and mangroves; introduction to marine fauna: zooplankton, major marine invertebrates (crustaceans & molluscs), vertebrates (Pisces) and marine mammals (dolphin and whales)

Unit II

Methods of surveying the living resources (Acoustic, Aerial and Remote sensing); Principal methods of exploitation (Indigenous and modern crafts & gears); Conservation and management in situ and ex situ, IUCN categorization, marine biosphere reserves, marine parks: heritage sites

Unit III

Oceanography: physical: waves, tides and currents; chemical: nutrient cycle, metals, minerals and trace elements; biological-primary and secondary productivity, finfish and shellfish resources.

Introduction to marine microbes; types and methods of studying the marine micro-organisms; preservation of marine microbes; Culture collection centers (ATCC, IMTECH); role of microbes in marine environment

Unit IV

Introduction to marine pharmacology: terms and definitions; medicinal compounds from marine flora and fauna; marine toxins, antiviral and antimicrobial agents.

Chromosome manipulation in marine aquaculture: hybridization; Gynogenesis, Androgenesis and sex reversal in commercially important fishes

Unit V

Marine pollution: major pollutants (heavy metal, pesticide, oil, thermal, radioactive, plastics, litter and microbial); Biological indicators (Marine microbes, algae and crustaceans) and accumulators.

Introduction of Biofouling; Biofilm formation; marine fouling and boring organisms; antifouling and anti boring treatments; corrosion process and control of marine structures.

Reference Books

Bond, C. E. 1996. Biology of Fishes 2nd Edition. W.B. Saunders Company, Philadelphia, 1996.

Milton Fingerman et al., 1999. Recent Advances in Marine Biotechnology

Agarwal et. al., 1996. Biodiversity and Environment. APH.

B.Sc (Biotechnology)

Title : TOTAL QUALITY MANAGEMENT
Code : 6ABT1 (2008 ON) Qn.No. : 4790

Allied I

Unit I

Definition of Quality; Dimensions of Quality; Quality Planning; Quality costs Analysis; Techniques for Quality Costs; Basic concepts of Total Quality Management (TQM); Principles of TQM, Leadership: Concepts, Role of Senior Management; Quality Council: Quality Statements, Strategic Planning, Deming Philosophy; Barriers to TQM Implementation.

Unit II

Customer satisfaction: Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention. Employee Involvement: Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits. Continuous Process Improvement: Juran Trilogy, PDCA Cycle, 5S, Kaizen Supplier Partnership: Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures: Basic Concepts, Strategy, Performance Measure.

Unit III

Benchmarking: Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD): House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function. Total Productive Maintenance (TPM): Concept, Improvement Needs. FMEA: Stages of FMEA.

Unit IV

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System: Elements, Implementation of Quality System, Documentation, Quality Auditing, QS 9000. ISO 14000: Concept, Requirements and Benefits.

Reference Books

- Dale, H., Besterfield., et al. 1999. Total Quality Management, Pearson Education Asia, (Indian reprint 2002).
James, R., and Lidsay, E.W. M. 2002 The Management and Control of Quality, (5th Edition), South-Western (Thomson Learning), (ISBN 0-324-06680-5).
Feigenbaum, A.V. 1991. Total Quality Management, McGraw-Hill
Zeiri, 1991. Total Quality Management for Engineers Wood Head Publishers

PTO →



Department of Biotechnology
The Madura College, Madurai-625011

Subject: Total quality Management

Code: 6ABT1 (20080m)

MAX MARKS:75

QN. NO. 4790

Part A

Answer any SEVEN

7 × 3 = 21

Unit 1-2
Unit 2-4
Unit 3-2
Unit 4-2

7/10

Part B

Answer any THREE

3 × 8 = 24

Unit 1- 1
Unit 2- 1
Unit 3- 2
Unit 4- 1

3/5

Part C

Answer any TWO

2 × 15 = 30

Unit 1- 1
Unit 2- 1
Unit 3- 1
Unit 4- 1

2/4



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RE-ACCREDITED (3rd Cycle) WITH “A” GRADE BY NAAC

PROGRAMME: B.Sc., Biotechnology **COURSE CODE : 17U1LMC1**

COURSE TITLE : Cell Biology & Genetics **QN.NO : 9601**

TIME : 3 Hours

MAX.MARKS :75

Unit 1: The Cell

Cell theory, Protoplasm theory, Organismal theory. Modern concept of cell. Structure of prokaryotic and eukaryotic cell. Chemical organization of the cell –protoplasm.

Unit 2: Organization of the cell

Cell membrane- plant cell wall, extracellular matrix, plasma membrane, theories, chemical composition. Cytoskeleton- microtubules and microfilaments. Mitochondria-chemical composition and its functions. Golgi complex- morphology, chemical composition functions. Endoplasmic reticulum – types, chemical composition and functions.

Unit 3: Cell organelles and cell cycle

Ribosomes and lysosomes- size and shape, structure, subunits, chemical nature and its functions. Centrosomes, plastids, cilia, flagella and basal bodies. Nucleus and chromosomes structure and its functions. Cell divisions– mitosis and meiosis.

Unit 4: Mendelism and genetic interaction

Introduction to genetics (Vapour, Fluid, preformation, epigenesis, particulate, pangenetic and germplasm theory), mendelism, multiple alleles, multiple gene inheritance, linkage and crossing over, chromosomal map.

Unit 5: Sex linked inheritance

Sex determination in animals, sex linked inheritance, non-disjunction, Cytoplasmic inheritance, twins, inborn errors of metabolism, syndromes, pedigree analysis, Eugenics and eugenics, inbreeding and outbreeding, population, human and microbial genetics.

Text Book(s):

1. Powar.C.B, Cell Biology- 1983,Himalaya publishing house, New Delhi.
2. Singh & Tomar, Cell biology, 10th revised edition, 2012, Rastogi publication, Meerut.

Reference Book(s):

1. E.J.Gardener, M.J.Simmons and D.P.Snustad,Principles of Genetics – John Wiley & Sons Publications.
2. DeRoberties, Cell Biology - - Blaze publishers & Distributors Pvt.Ltd., NewDelhi.
3. Strickberger M.W., Genetics –, Printice hall 4th edition, 1997.



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PROGRAMME: B.Sc., Biotechnology

COURSE CODE : 17U1LSM1

COURSE TITLE : Bioinstrumentation

QN.NO : 9602

TIME : 3 Hours

MAX.MARKS :75

Unit I: Microscopy

Microscopy: Introduction and types; bright field, dark field, Phase contrast, Fluorescence, Polarising microscopy; Electron microscopy: SEM and TEM.

Unit II: pH meter and Centrifuge

pH meter: Principle and working mechanism. Centrifuge: Basic principles of Sedimentation- types of centrifuges and types of rotors. Mechanism of diffusion and sedimentation.

Unit III: Colorimetry and Spectroscopy

Colorimetry: Beer –Lambert’s Law; Spectrophotometry: UV, Visible, Fluorescence, Raman spectroscopy and Infrared spectroscopy –principle, instrumentation and applications.

Unit IV; Chromatography

Chromatography: Paper Chromatography; Thin layer Chromatography; Gas chromatography, ion exchange Chromatography- principle, instrumentation and applications.

Unit V: Electrophoresis

Electrophoresis: Types-moving boundary and zone electrophoresis. Techniques and applications of Agarose gel electrophoresis, native PAGE, SDS-PAGE- principle, instrumentation and applications .

Text Book(s):

1. Veerakumari L., Bioinstrumentation, 3rd edition, 2009, MJP publishers
2. Plummer, D, An Introduction to Practical Biochemistry, 1987, Tata McGraw – Hill Publishing Company Ltd., New Delhi.
3. Jeyaraman, J., Laboratory Manual in Biochemistry, 1985, Wiley Eastern Limited, New Delhi.

Reference Book(s):

1. Boyer, R.F., Modern Experimental Biochemistry, 1993, The Benjamin / Cummings Publishing Company, Inc., New York.
2. Williams B.L., and Wilson, K. A Biologist’s Guide to Principles and Techniques of Practical Biochemistry, 1983, Edward Arnold Publishers Ltd., London.
3. Wilson, K and Walker, J, Principles and Techniques of Practical Biochemistry, 1995, Cambridge University Press, New York.



PROGRAMME: B.Sc., Biotechnology

COURSE CODE : 17U2LMC2

**COURSE TITLE : Biochemistry and
Biophysics**

QN.NO : 9603

TIME : 3 Hours

MAX.MARKS :75

Unit 1: Fundamentals of Biochemistry

Fundamentals of biochemistry: Elements of life; Atoms, Molecules, atomic number, Chemical bonds: Covalent, Ionic and Hydrogen, co-ordinate and Vander-Waals bond, electrolytes; pH: hydrogen ion concentration, Henderson and Hasselbach equation, buffers and osmosis.

Unit 2: Carbohydrates and its metabolism

Carbohydrates: Definition, classification, stereochemistry, cyclic structures and anomeric forms, Haworth projections. Monosaccharide, Disaccharides, Polysaccharides. Homopolysaccharides - starch, glycogen, cellulose. Heteropolysaccharides-hyaluronic acid, chondroitin sulphate and heparin. Metabolism: Glycolysis and TCA cycle.

Unit 3: Proteins and enzyme kinetics

Amino acids and peptides: Definition, amino acids as ampholytes. Structure and classification of amino acids based on chemical nature, Essential amino acids, Peptides; Structure and properties. Metabolism: Deamination, Decarboxylation, Transmethylation and Transamination. Enzymes: classification, kinetics, MM equation, co-enzymes and co-factors.

Unit 4: Lipids and Vitamins

Lipids; Definition, classification of lipids- simple, compound and derived. Compound lipids-Structure and function of phospholipids, glycolipids and lipoproteins. Derived lipids-Fatty acids-saturated and unsaturated. Essential fatty acids. Metabolism of fatty acids- β oxidation. Vitamins: Definition, classification, sources of Fat and water soluble vitamins.

Unit 5: Basics of Biophysics

Biophysics: Introduction. The free energy of a system. Chemical potential - oxidation & reduction potential. Thermodynamics: Entropy, Enthalpy. Diffusion - Fick's laws, constant laws, osmotic coefficient, Active transport Laws of thermodynamics.

Text Book(s):

1. Ambika Shanmugam, Fundamentals of Biochemistry for Medical students, 8th edition, 1998, Published by the Author, Madras.
2. Palanichamy, S. and Shanmugavelu, M. Principles of Biophysics, 2nd Edition, 2011. Palani Paramount Publications, Palani.

Reference Book(s):

1. Satyanarayana, U. and Chakrapani, U. Biochemistry, 2009. Books and Allied Pvt. Ltd., Kolkata.
2. Stryer, L., Biochemistry, Fourth edition, 2000. W.H. Freeman and Company, New York.
3. Voet, D., and J.G.Voet, Biochemistry, second edition., 1995, John Wiley & Sons Inc, New York.
4. Zubay, G. Biochemistry, third edition, 1993, W.H. Freeman and Company, Oxford, England.
5. Jain J.L., Sunjay Jain., and Nitin Jsin., Fundamentals of Biochemistry, 1st Edition, 1979, S.Chand and company Ltd., New Delhi,
6. Lehninger A.L., Biochemistry, 2nd Edition, 1992, Kalyani Publishers, Ludhiana,



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PROGRAMME: B.Sc., Biotechnology

COURSE CODE : 17U2LSM2

COURSE TITLE : Concepts of Biotechnology

QN.NO : 9605

TIME : 3 Hours

MAX.MARKS :75

UNIT-I : Biotechnology: Scope and Importance

Biotechnology: History of Biotechnology, Traditional and Modern Biotechnology, Potential of Modern Biotechnology, Biotechnology as an interdisciplinary area- Biotechnology Tree. Achievements of Biotechnology.

UNIT-II : Gene concept and Tools

Gene concept: Definition; Size of a gene, Cistron, Muton and Recon; Gene expression and functions of gene. Tools in Biotechnology: Restriction enzymes: types, naming, target sites, nature of cut ends, host controlled restriction and modification and isoschizomers.

UNIT-III: Biotechnology and environment

Environmental pollution: Bioremediation – Insitu and Exsitu Bioremediation, Xenobiotics. Biodegradation, Biosorption, Bioaugmentation, Mechanism of Biofiltration, Bioleaching.

UNIT-IV: Bioethics and Biosafety

Benefits of Biotechnology, ELSI Biotechnology, Risks and ethics of Biotechnology, Release of Genetically engineered Organisms, Biological warfare. Biosafety guidelines and regulations.

UNIT-V: Rules and Regulations in Biotechnology

Intellectual Property Rights, Intellectual Property Protection, Forms of protection. Patents, Copyrights, WIPO, TRIPS, GATT. Patenting of Biological materials and its significance.

Text Book(s):

1. V.Kumaresan, A text of biotechnology, Saras publication
2. R.C.Dubey, A text book of Biotechnology, 1st revised edition, 2010,S.Chand Publication

Reference Book(s):

1. U.Sathyanarayana, Biotechnology, 2016, Books and allied (P)ltd
2. S.C.Rastogi, Biotechnology principles and Applications 2016, Narosa publication
3. S.S. Purohit, Biotechnology fundamentals and Applications 2010, Fourth edition
4. H.K.Das., Text book of Biotechnology. Willey India publication fourth edition
5. Old & Primrose, Principles of Gene Manipulation, 3rd edition 1989.



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PROGRAMME: B.Sc., Biotechnology

COURSE CODE : 17U3LMC3

COURSE TITLE : Molecular Biology

QN.NO : 9606

TIME : 3 Hours

MAX.MARKS :75

OBJECTIVES

- To understand the basics of molecular biology.
- To provide fundamental concepts of DNA and RNA.
- To learn the intricacies of prokaryotic and eukaryotic replication, transcription and translation.

LEARNING OUTCOME

- Gain the significance of central dogma of Molecular biology.
- Compare and contrast mechanisms of replication, transcription and translation in prokaryotes and eukaryotes.
- Applicable to many frontier areas of research.

UNIT I Genome Organization

History and scope of molecular biology, DNA structure – B DNA, Z DNA, super coiled DNA, Watson and Crick model, RNA structure– rRNA, tRNA and mRNA, experimental evidence of DNA and RNA as genetic material - transformation experiment, functions of DNA and RNA, genomic organization of prokaryotes and eukaryotes, chromosomal proteins - histone and non-histone proteins, central dogma of molecular biology.

UNIT II Replication

Prokaryotic and eukaryotic DNA replication - mechanism of DNA replication – initiation, replication fork, chromatin assembly, enzymes and accessory proteins, types of DNA replication- semi conservative, conservative, dispersive, rolling circle and bidirectional replication, inhibitors of DNA synthesis.

UNIT III Transcription

Prokaryotic and eukaryotic transcription - RNA polymerases, general and specific factors, regulatory elements and mechanism, transcriptional and post transcriptional modification in RNA - gene silencing, 5' cap formation, 3' end processing, polyadenylation, editing, splicing, nuclear export of mRNA and mRNA stability.

UNIT IV Translation

Genetic code - characteristics of genetic code, Wobble hypothesis. Prokaryotic and eukaryotic translation - structure and chemical composition of ribosomes, mechanism - initiation, elongation and termination, post translational modification of proteins, inhibitors and modifiers of protein synthesis.

UNIT V DNA damage and repair

Mutation – spontaneous and induced, mutagens- physical, chemical and biological, molecular mechanisms of mutagenesis – transition, transversion, frameshift, mis-sense and non-sense mutation, DNA repair mechanism - photo reactivation, excision, recombination and SOS.

TEXT BOOKS

1. David Freifelder, 2015. Molecular Biology, 4th Edition. Narosa Publishing house New Delhi.
2. Verma and Agarwal, 2016. Cell and Molecular Biology. S.Chand publications, New Delhi.

REFERENCE BOOKS

1. Ramawat and Shaily Goyal, 2010. Molecular Biology and Biotechnology. S.Chand publications, New Delhi.
2. Benjamin Lewin, 2008. Gene VII, 7th Edition. Oxford university press, Nelson cox.
3. Burton E. Tropp, 2012. Molecular Biology Genes to proteins. Jones and Bartlett learning, LLC.
4. S.Wolf, 1993. Molecular and Cellular Biology. Wadsworth Publishing Co., California. USA.

WEBSITE REFERENCES

- <https://biology.duke.edu/undergraduate/major/concentrations/cell-molecular>
- <https://www.elte.hu/en/molecular-biology-selected-topics>

YOU TUBE LECTURE VIDEOS

- <https://www.youtube.com/watch?v=yRDpOiTXQwI>
- <https://www.youtube.com/watch?v=MHR9yoPWv90>

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RE-ACCREDITED (3rd Cycle) WITH “A” GRADE BY NAAC

PROGRAMME: UG NME - Biotechnology COURSE CODE : 17U3LNM1

COURSE TITLE : Basics of Biotechnology QN.NO : 9607

TIME : 3 Hours

MAX.MARKS :75

OBJECTIVES

- To educate the essentials of Biotechnology in various fields.
- To appraise the ethical and regulatory issues of Biotechnology.
- To gain knowledge on the applied aspects of Biotechnology.

LEARNING OUTCOME

- Provides basic knowledge on the subject – Biotechnology.
- Inculcate the role of biotechnology in various fields.
- Provides an insight about bioethics and biosafety.

Unit I Biotechnology in Animal husbandry

Introduction, history and scope of animal biotechnology, Biotechnology in India – DBT, Transgenic animal – Dolly.

Unit II Biotechnology in Agriculture

Plant tissue culture – definition, history, techniques – microinjection and electroporation, advantages and disadvantages, transgenic plant – *Bt* Cotton.

Unit III Biotechnology in Food industry

Single cell protein- sources, nutritive values and uses. Fermented foods - processing of idli, dosa batter, butter milk, cheese and yoghurt.

Unit IV Environmental Biotechnology

Role of biotechnology in environmental protection – global warming, waste water treatment – activated sludge method, biogas production and advantages, bioremediation- superbug.

Unit V Bioethics and biosafety

Ethical, legal and social implications of biotechnology, biosafety - positive and negative effects of GMO foods.

TEXT BOOKS

1. U. Satyanarayana. 2015. Biotechnology. 9th edition. Books and Allied P (Ltd), Kolkata, India.
2. V. Kumaresan. 2010. Biotechnology, revised edition, Saras publication, Kanyakumari.

P.T.O

REFERENCE BOOKS

1. R.C. Dubey. 2014. A Text book of Biotechnology, 5th revised edition, S.Chand publication, NewDelhi.
2. S.S Purohit and S.K. Mathur 2002. Biotechnology – Fundamentals and applications, Agro-Bios publishers, New Delhi.
3. S.N. Jogdand, 2010. Environmental biotechnology, 5th edition, Himalaya Publication, Mumbai.

WEBSITE REFERENCES

- <http://www.biologydiscussion.com/biotechnology/biotechnology-introduction-scope-and-applications-of-biotechnology/11608>
- <https://byjus.com/biology/application-biotechnology-medicine/>

YOU TUBE LECTURE VIDEOS

- https://www.youtube.com/watch?v=DNysyCG_U9c
- <https://www.youtube.com/watch?v=2NUEMpL9kfk>

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RE-ACCREDITED (3rd Cycle) WITH “A” GRADE BY NAAC

PROGRAMME: B.Sc., Biotechnology

COURSE CODE : 17U4LMC4

COURSE TITLE : Animal Biotechnology

QN.NO : 9608

TIME : 3 Hours

MAX.MARKS :75

OBJECTIVES

- To study the role of different media used in animal cell culture.
- To understand the gene transfer techniques in mammalian cells.
- To learn the significance of transgenic animals.

LEARNING OUTCOME

- Provides essentials of animal cell culture and techniques.
- Gain knowledge on characteristics of cultured cells.
- Acquires the significance and applications of transgenic animals.

UNIT I Introduction to animal cell culture

History, scope, minimal requirements for cell culture, culture media- definition, types - natural media, artificial media, serum media, serum free media, physiochemical properties of media – pH, CO₂, O₂, temperature and osmolality.

UNIT II Animal cell culture techniques

Primary cell culture – definition, techniques - mechanical, enzymatic disaggregation, primary explants, secondary culture – finite, continuous cell line, selection and maintenance.

UNIT III Characterization of cultured cells

Characteristics of cultured cells – cell adhesion, proliferation, differentiation, metabolism, initiation, evolution and development, measurement of growth parameters of cultured cell, cell synchronization, senescence and apoptosis.

UNIT IV Transgenic animals

Animal cloning – introduction, importance, methods - retroviral, micro injection, embryonic stem cell in transgenic mice, sheep and its applications.

UNIT V Embryo transfer technology

Animal propagation - In vitro fertilization technology, artificial insemination in cattle, embryo transfer technique and superovulation in farm animals.

TEXT BOOKS

1. P.K.Gupta 2017. Animal Biotechnology, first edition, Rastogi publication, Meerut.
2. U.Satyanarayana, 2015. Biotechnology. Books and Allied P (Ltd), Kolkata, India V.
3. Srivastava Singh and M.P. Yadhav. 2005, Animal Biotechnology. Oxford publishing Co.Pvt. Ltd., New Delhi.
4. Kumaresan 2010. Animal Biotechnology, revised edition, Saras publication, Kanyakumari.

P.T.O

REFERNCE BOOKS

1. B.R.Glick, and J.J. Pasternak, 2003. Molecular Biotechnology, Principles and application of recombinant DNA. ASM Press, Washington.
2. M. Prakash and K.Arora, 1999. Cell tissue culture, Anormal Publication.
3. S.N.Jogdand, 2001. Advanced in biotechnology, Himalaya Publication, Mumbai.

WEBSITE REFERENCE

- <https://www.cliffsnotes.com/study-guides/biology/biology/recombinant-dna-and-biotechnology/transgenic-animals>
- http://www.biotechnology4u.com/animal_biotechnology_animal_cell_culture.html

YOU TUBE LECTURE VIDEOS

- <https://www.youtube.com/watch?v=qCIvAuwaf-o>
- <https://www.youtube.com/watch?v=ie8wjl2ETNo>

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RE-ACCREDITED (3rd Cycle) WITH “A” GRADE BY NAAC

PROGRAMME: B.Sc., Biotechnology

COURSE CODE : 17U4LSM3

COURSE TITLE : Bioinformatics

QN.NO : 9610

TIME : 3 Hours

MAX.MARKS :75

OBJECTIVES

- To understand the role of computer in biological research.
- To analyze the biological data.
- To learn the concepts involved in protein structure prediction.

LEARNING OUTCOME

- Basic knowledge on Bioinformatics and its applications.
- Gain information on many biological databases and software tools for research analysis.
- Basic idea in structure prediction and phylogenetic analysis.

UNIT I Overview of Bioinformatics

Introduction to Bioinformatics, history of Bioinformatics, scope of Bioinformatics, Bioinformatics- a multi-disciplinary approach, application of Bioinformatics.

UNIT II Biological Databases

Major bioinformatics databases- NCBI, Nucleotide database -Genbank, EMBL and DDBJ, protein database - primary sequence database– Swissprot and PIR, secondary sequence database- PROSITE, PRINTS and pfam, protein structural database- PDB, SCOP and CATH.

UNIT III Sequence Alignment

Retrieval of sequence – SRS and ENTREZ, sequence alignment, BLAST, FASTA, local and global alignment. Pair wise sequence alignment – Dot-matrix and K-tuple method, multiple sequence alignment – CLUSTALW, applications of multiple sequence alignment.

UNIT IV Phylogenetic analysis

Phylogenetic tree- structure of typical phylogenetic tree, rooted and unrooted tree, construction of phylogenetic tree, phenetic method - UPGMA and neighbour joining, cladistic method - maximum parsimony and maximum likelihood, phylogenetic softwares available in the web.

UNIT V Protein structure prediction

Protein structure – classification and protein structure prediction – *ab initio* modelling, comparative modelling - homology modelling, SWISS modeller, protein threading, evaluation of predicted structure -Ramachandran plot, molecular visualisation tools -Rasmol and Swiss PDB viewer.

TEXT BOOKS

1. S.C.Rastogi et al., 2006. Bioinformatics concepts, skills and applications.2nd edition, CBS Publishers and Distributors, Pvt. Ltd.
2. C.Subramanian, 2015. A text book of Bioinformatics. 1st edition, Dominant publishers, NewDelhi.
3. B.G. Curran et al., 2010. Bioinformatics.1st edition, CBS Publishers and Distributors, Pvt. Ltd.

REFERENCE BOOKS

1. Z. Ghoshand, B. Mallick. 2008. Bioinformatics: Principles and Applications. Oxford University Press, New Delhi.
2. Lesk, A.M. 2002. Introduction to Bioinformatics. Oxford University Press, London.
3. N.J.Chikale and V.S.Gomase.2007. Bioinformatics.1st edition. Himalaya publishing house ltd, Mumbai.
4. Vittal R. Srinivas, 2005. Bioinformatics a modern approach. Prentice Hall of India pvt.Ltd. New Delhi.

WEBSITE REFERENCES

- <https://www.ncbi.nlm.nih.gov/>
- <http://www.rcsb.org/>

YOU TUBE LECTURE VIDEOS

- <https://www.youtube.com/watch?v=liNblw4x50E>
- <https://www.youtube.com/watch?v=eZfyWdHnzR0>

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PROGRAMME: B.Sc., Biotechnology

COURSE CODE : 17U5LME1

COURSE TITLE : Biostatistics

QN.NO : 9611

TIME : 3 Hours

MAX.MARKS :75

Objectives

- To understand the basic concepts in biostatistics
- To gain knowledge on the various methods of data collection and diagrammatic representation of data
- To learn about the various measures of central tendency and dispersions
- To acquire knowledge about the test of significance

Learning Outcome

- Acquire knowledge on basic concepts in Statistics
- Gain information on applications of statistics in the field of lifesciences

Unit-1

Introduction to Biostatistics

Definition, Types – Descriptive & Inferential statistics, Terms – Population, Sample, Unit, Variables, Constant, Parameter, Data, Inference, Accuracy and Precision. Collection of data-primary, secondary, qualitative and quantitative data. Classification and tabulation of data, Frequency distribution.

Unit-II

Diagrammatic and graphical representation of Data

Significance of Diagrams & Graphs: Diagrams – line, bar, pie, pictogram, cartogram, Significance and limitations of Diagrammatic representation. Graphic Representation - Types - Histogram, frequency polygon, frequency curve and cumulative frequency curve, Significance and limitations of graphical representations.

Unit-III

Measures of central tendency and dispersion

Central tendency - definition and characteristics-. Mean, median and mode. Dispersion - definition, methods of measuring dispersion - range, means, standard deviation, variance, standard error, Measures of Skewness and kurtosis

Unit-IV

Correlation and regression

Correlation - Definition & significance. Types - Positive and negative, simple and multiple, linear and non-linear, Methods of correlation analysis - Scatter diagram, graphical diagram and co-efficient of correlation. Regression – Definition, Types of regression analysis, Regression lines and equations, Regression co-efficient.

Unit-V

Test of Hypothesis and Significance

Null and alternative hypothesis. Chi- square test, t-test, ANOVA - One-way.

Textbooks

1. Ramakrishnan P. 2010. Introduction to Biostatistics. Saras Publication
2. Veer Bala Rastogi. 2006. Fundamentals of Biostatistics. Ane Books India

References

1. Khan and Khanum. 2004. Fundamentals of Biostatistics, Ukaaz Publications, Hyderabad
2. Gurumani N. 2010. An Introduction to Biostatistics. MJP Publications, Chennai
3. Ashcroft S and Pereira C. 2003. Practical Statistics for the Biological Sciences. Palgrave Macmillan.

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PROGRAMME: B.Sc., Biotechnology

COURSE CODE : 17U5LMC5

COURSE TITLE : Immunology

QN.NO : 9612

TIME : 3 Hours

MAX.MARKS :75

Objectives

- To understand the basic principles of immunology
- To gain knowledge on the various cells and organs of immune system
- To learn about the various mechanisms of immune response
- To acquire knowledge about the antigen-antibody interaction

Learning Outcome

- Acquire knowledge on basic concepts in Immunology
- Create awareness to hypersensitivity and transplantation
- Gain information on applications of Immunotechniques

Unit -I

Introduction to Immunology

History of Immunology, types of immunity –innate, specific, acquired, active and passive, organs of the immune system - primary and secondary lymphoid organs. Characteristic features of immunogens, antigens, haptens, epitopes, adjuvants. Cells of immunity-Neutrophils, macrophages, natural killer cells, null cells, basophils, mast cells, B cells & T Cells

Unit –II

Components of Immune System

Immunoglobulins - Classes, Structure, biological properties and functions, B cells - maturation, activation, proliferation, germinal centers, plasma cells, memory cells, class switching, T-cells - receptor, activation, maturation, differentiation, MHC- types, structure and functions, self MHC restriction

Unit- III

Immune Response

Complement – components, activation, complement pathways - Classical, Alternate, Biological activities. Hypersensitivity - Type I, II, III, IV reactions

Unit -IV

Autoimmune disorder and Transplantation

Immune tolerance and autoimmunity - autoimmune diseases-mechanisms for the induction, Organ-Specific –Hashimoto’s thyroiditis , Grave’s disease, Myasthenia gravis, Systemic- SLE, scleroderma, Rheumatoid arthritis, Multiple sclerosis. Transplantation - types of graft, graft rejection, Graft Versus Host, Tissue typing, immunosuppressive agents.

P.T.O.

Unit V

Immunotechniques and Vaccine

Antigen-antibody interactions - Agglutination- hemagglutination, bacterial agglutination, passive agglutination, agglutination inhibition, Precipitation techniques- RID, ODD, Radio Immunoassay, ELISA- indirect, sandwich, competitive, Immunofluorescence assays - Fluorescence activated cell sorter (FACS) technique, ELISPOT, Vaccine-Active and passive immunization, attenuated, heat-killed, subunit vaccines, Vaccination schedule, route of administration, Production of monoclonal antibodies - principles, techniques and applications .

Textbooks

1. Benjamin E, Coico R, Sunshine G. 2015. Immunology: A Short Course. 7th Edition Wiley – Blackwell.
2. Owen JA, Punt J, Stranford. 2013. Kuby Immunology. W. H. Freeman & Company.

References

1. Abbas AK, Andrew H. Lichtman H, Shiv Pillai. 2015. Basic Immunology: Functions and disorders of the Immune System. Elsevier.
2. Tizard IR. 1995. Immunology –An Introduction. Saunders college publications.
3. Rao CV. 2006. Immunology. Narosa Publishing House. New Delhi.

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PROGRAMME: B.Sc., Biotechnology

COURSE CODE : 17U5LMC6

COURSE TITLE : Industrial Biotechnology

QN.NO : 9613

TIME : 3 Hours

MAX.MARKS :75

Objectives

- To understand the basic principles of bioprocess technology
- To gain knowledge on the various fermentation processes
- To learn about the various up-stream and down-stream process
- To acquire knowledge about the enzyme technology

Learning Outcome

- Acquire knowledge on basic concepts of fermentation technology
- Create awareness to various microbial products produced by fermentation
- Gain information on applications of Biomass to energy

Unit I

Bioprocess Technology

Bioreactors – types - continuous stirred tank, bubble column, airlift, fluidized and packed bed. Features and operation of bioreactors – sterilization, inoculation, aeration, control system. Solid state fermentation, Media for industrial fermentation - substrates used as carbon, nitrogen, growth factor sources, sterilization - heat, physical methods. Isolation of microbes - enrichment methods, strains from unusual environment, preservation. Genetic improvement of strains-selection of mutants, genetic recombination. Culture methods - batch culture, fed - batch, semi-continuous, continuous.

Unit II

Scale - up and Downstream process

Fermentation process - type I, II, III, Inoculum build up, pre-fermenter culture, production fermentation. Measurement and control of bioprocess parameters, Scale - up, Downstream process- solid liquid separation ,flotation, flocculation, filtration, centrifugation, release of intracellular products - cell disruption - mechanical, chemical and enzymatic, concentration, evaporation, extraction, membrane filtration, precipitation, purification by chromatography, formulation.

Unit III

Enzyme Technology

Applications of enzymes, commercial production of enzymes - selection of organisms, formulation of medium, production process, recovery and purification. Regulation of microbial enzyme production - induction, feedback repression, nutrient repression. Genetic engineering for microbial enzyme production - cloning strategies. Immobilization-methods, choice of immobilization techniques, applications –production of L-amino acids, production of high fructose syrup, biosensors – types and applications

Unit IV

Microbial production

Microbial production of organic solvents - ethanol, acetone and butanol, organic acids - citric acid, vinegar, antibiotics - penicillin, streptomycin, aminoacids - glutamic acid, L-lysine, Vitamin - B12, riboflavin.

Unit V

Biopolymers and biomass

Microbial polysaccharide - general features, biosynthesis, production, applications – LPS, Xanthan, Dextran, alginate, polyhydroxyalkonates, polyhydroxybutyrate. Biomass – composition - cellulose, hemicelluloses, lignin, production of alcohol and biogas from biomass.

Text book

1. Sathyanarayana U. 2017. Biotechnology, Book and Allied (P) Ltd.
2. Dubey RC. 2014. A Textbook of Biotechnology. S. Chand.

References

1. Stanbury PF. 2008. Principles of Fermentation technology, Elsevier publications.
2. Glazer AN, Nikaido H. 2007. Microbial Biotechnology. Second edition. Cambridge University Press.
3. Pandian TT, Kandavel IK. 2008. Text book of Biotechnology. International Publishing House PVT Ltd.

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PROGRAMME: B.Sc., Biotechnology

COURSE CODE : 17U5LMC7

COURSE TITLE : Plant Biotechnology

QN.NO : 9614

TIME : 3 Hours

MAX.MARKS :75

Objectives

- To understand the basics in Plant Tissue Culture
- To gain knowledge on the various Tissue culture methods
- To learn about the germplasm conservation and cryopreservation
- To acquire knowledge about the applications of transgenic plants

Learning Outcome

- Acquire knowledge on basic concepts in Plant tissue culture
- Create awareness to transgenic plants
- Gain information on various applications of plant tissue culture

Unit-I

Introduction to Plant tissue culture

Plant tissue culture – Definition, history, Culture media- composition, types – MS, White, constituents –inorganic, organic supplements, growth regulators

Unit-II

Plant Tissue culture methods

Callus culture - explants, factors affecting culture, applications, Organ Culture - Seed, Embryo, Anther, pollen, Cell culture - Isolation of single cells, suspension culture - types and synchronization, Protoplast-Isolation ,culture , regeneration, fusion-methods

Unit III

Micropropagation, Germplasm conservation and cryopreservation

Micropropagation - definition, technique, Factors affecting micropropagation, in vitro Clonal Propagation - Meristem and shoot tip culture, bud culture - single node, axillary, Organogenesis, Somatic embryogenesis, Applications of micropropagation, Germplasm conservation - types - *in-situ*, *ex-situ* and cryopreservation

Unit-IV

Gene Transfer methods

Vector mediated - *Agrobacterium* mediated - Ti Plasmid, Virus mediated - Caulimoviruses and Gemini Viruses, Vectorless DNA transfer - Electroporation, particle bombardment, microinjection, liposome, silicon carbide fibre mediated, Chemical methods - PEG mediated, Calcium phosphate co-precipitation, DEAE dextran method. Marker genes for plant

transformation - selectable and reporter - Antibiotics resistance *npt-II*, *hpt*, *aadA*, Antimetabolite marker *dhfr*, Herbicide resistance genes - *bar*, *AroA* and *bxn*, *gfp*, bacterial luciferase.

Unit-V

Genetically modified organisms

GMOs - Bt toxin, Longer shelf - life of fruits, vegetables, oils, golden rice, plantibodies, cloning of edible vaccines, pest resistant, virus resistant, drought resistant, oxidative stress resistance- cytoplasm, plastids, cotton fibres, terminator seed technology.

Text Book

1. Satyanarayana U. 2017. Biotechnology. Books and Allied Pvt Ltd.
2. Chawla HS. 2017. An Introduction to Plant Biotechnology. CBS Publishers

References

1. Razdan MK. 2005. Introduction to Plant Tissue Culture. Oxford & Ibh.
2. Slater A. 2006. Plant Biotechnology – The Genetic Manipulation of Plants. Oxford press.
3. Altman A and Hasegawa PM. 2012. Plant Biotechnology and Agriculture: Prospects for the 21st Century. Academic Press.

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THE MADURA COLLEGE (AUTONOMOUS). MADURAI -11
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Reaccredited (3rd Cycle) with “A” Grade by NAAC

CLASS : B.Sc., Bio-technology

SUB. CODE : 18U3LAC1

TITLE : Fundamentals of Biotechnology

QN.NO : 9615

TIME : 3Hrs

Max. Marks: 75

OBJECTIVES

- To understand the basic concepts in frontier areas of biotechnology.
- To learn the applications of the biotechnology and its products.
- To inculcate the students on current scenario in biotechnology.

LEARNING OUTCOME

- Gain the significance of fundamental aspects in biotechnology.
- Provides information on emerging cloning techniques and bioremediation.
- Provides an insight about IPR and patenting.

UNIT I Biotechnology: Scope and Importance

History of biotechnology, traditional and modern biotechnology, potentials of modern biotechnology, biotechnology as an interdisciplinary area- biotechnology tree. Achievements in biotechnology.

UNIT II Gene concept and Tools

Definition, size of a gene, cistron, muton and recon. Tools in biotechnology- restriction enzymes - types, naming, target sites, nature of cut ends – cohesive and blunt end.

UNIT III Animal Biotechnology

Animal cloning- introduction, method - nuclear transfer- dolly. Assisted reproductive technology- definition, methods- artificial insemination, gamete intra-fallopian transfer, embryo transfer.

UNIT IV Environmental biotechnology

Xenobiotics - definition, biodegrading agents, superbug- construction of superbug- application of superbug, modification of bacterial strains, treatment of toxic pollutants- bioremediation – phytoremediation.

P.T.O.

UNIT V Regulations in biotechnology

Biosafety guidelines - definition, possible dangers of GEO's, biohazardous of rDNA technology. Intellectual Property Rights, patenting of biotechnological products, copyrights, design and trademark.

TEXT BOOKS

1. V.Kumaresan, 2010. A text of biotechnology, 5th edition, Saras publication.
2. R.C.Dubey, 2010. A text book of Biotechnology, 1st revised edition, S.Chand Publication.

REFERENCE BOOKS

1. U.Sathyanarayana, 2016. Biotechnology 9th edition, Books and allied (P) ltd.
2. S.C.Rastogi, 2016. Biotechnology principles and Applications, Narosa publication.
3. S.S. Purohit, 2010. Biotechnology fundamentals and Applications, Fourth edition, STUDENT EDITION, Jodhpur.
4. H.K.Das, 2017. Text book of Biotechnology, 5th edition, Willey India publication, NewDelhi.

WEBSITE REFERENCES

- <https://www.swissbiotech.org/biotechnology/applications-biotechnology>
- <https://www.tc.cz/files/projekty/czbiotechnology>

YOU TUBE LECTURE VIDEOS

- https://www.youtube.com/watch?v=OVf_ASEGuns
- <https://www.youtube.com/watch?v=5ffl-0OYVQU>

PATTERN OF QUESTION PAPER

TIME: 3 Hours

MAXIMUM MARKS: 75

SECTION – A (10 x 1 =10)

Answer All the Questions (Multiple Choice Questions)

Question No. 1, 2 from	Unit – I
Question No. 3, 4 from	Unit - II
Question No. 5, 6 from	Unit – III
Question No. 7, 8 from	Unit – IV
Question No. 9, 10 from	Unit - V

SECTION – B (5 x 7 = 35)

Answer All the Questions (Either OR Pattern) each answer not exceeding 3 pages

Question No. 11(a) (OR) Question No. 11(b)	} From Unit -I
Question No. 12(a) (OR) Question No. 12(b)	} From Unit -II
Question No. 13(a) (OR) Question No. 13(b)	} From Unit -III
Question No. 14(a) (OR) Question No. 14(b)	} From Unit -IV
Question No. 15(a) (OR) Question No. 15(b)	} From Unit -V

SECTION – C (3 x 10 = 30)

Answer 3 out of 5 Questions (Open choice) each answer not exceeding 4 pages.

Question No. 16 from Unit - I
Question No. 17 from Unit - II
Question No. 18 from Unit - III
Question No. 19 from Unit - IV
Question No. 20 from Unit - V



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PROGRAMME: B.Sc., Biotechnology

COURSE CODE : 17U6LME2

COURSE TITLE : Environmental Biotechnology QN.NO : 9616

TIME : 3 Hours

MAX.MARKS :75

Objectives

- To understand the basic concepts of pollution
- To gain knowledge on the various methods of bioremediation
- To learn about the various waste water treatment
- To acquire knowledge about biofertilizers and biopesticides

Learning Outcome

- Acquire knowledge on basic concepts of Environmental Pollution
- Create awareness to biofertilizers and biocides
- Gain information on waste management

Unit-I

Sewage water and Treatment

Water pollution – nature of pollutants – organic, inorganic, microbial, radioactive materials, Sewage – composition, types, Measurement – detection of pathogenic organisms, coliform bacteria, Water Treatment : Primary, Secondary – Aerobic suspended growth treatment, Aerobic attached growth treatment, Anaerobic suspended growth treatment, Anaerobic attached growth treatment, Pond Treatment, Tertiary Treatment – Solids removal, nitrogen removal, phosphorous removal.

Unit-II

Sludge and solid waste treatment

Sources and characteristics of sludge, Sludge thickening, stabilization, Composting – mechanism, methods, Vermi-composting, conditioning, disinfection of sludge, heat drying, disposal of sludge – land filling, lagooning, septage disposal, solid waste disposal, separation and composting plants.

Unit- III

Biodegradation and Bioremediation

Biodegradation – *Pseudomonas* uses, Factors affecting biodegradation, enzyme systems, Recalcitrant Xenobiotics, Types of bioremediation – *in situ*, *ex-situ* bioremediation, metabolic effects of microbes on xenobiotics, types of bioremediation reactions – aerobic and anaerobic, Biodegradation of hydrocarbons, pesticides and herbicides, Genetically engineered bacteria for bioremediation, Bioremediation of contaminated soil and water, Heavy metals – Metal microbe interaction, Mechanisms – metabolism dependent, metabolism independent, Extracellular precipitation and complexation.

Unit-IV

Biofertilizers and Biopesticides

Rhizobium, Azotobacter, Azospirillum, Blue green algae, Nostoc, VAM fungi, Azolla – production and application, Phosphate solubilizing bacteria. Biopesticides – Bacteria, fungi and virus - *Beauveria bassiana*, *Fusarium pallidorozeum*, *Trichoderma*, *Metarhizium* and *Pseudomonas fluorescens*.

Unit-V

Biofiltration and Bioleaching

Biofilters – micro-organisms used in biofilters - media, mechanisms, Microbial Leaching – microbes used, bioleaching - copper, uranium, gold, silver, silica.

Textbook

1. Satyanarayana U. 2017. Biotechnology. Books and Allied Pvt.
2. Dubey RC. 2014. A Textbook of Biotechnology. S Chand

References

1. Jogdand SN. 2015. Environmental Biotechnology. Himalaya Publishing House
2. Kumaresan V. 2014. Biotechnology. Saras Publications.
3. Scaragg A. 2007. Environmental Biotechnology. Oxford University Press.

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PROGRAMME: B.Sc., Biotechnology

COURSE CODE : 17U6LME3

COURSE TITLE : Medical Biotechnology

QN.NO : 9617

TIME : 3 Hours

MAX.MARKS :75

Objectives

- To understand the basic principles of gene therapy
- To gain knowledge on the various molecular based diagnostics
- To learn about the recombinant vaccines and monoclonal antibodies
- To acquire knowledge about the ART

Learning Outcome

- Acquire knowledge on basic concepts in Gene therapy
- Create awareness to Assisted Reproductive Technology
- Gain information on applications of molecular therapy and diagnostic tools.

Unit I

Gene Therapy

Gene therapy- approaches, types - *ex vivo*, *in vivo*. *ex vivo* - vectors - viral, Human Artificial Chromosomes, Retroviruses, treating ADA deficiency, hypercholesterolemia, haemophilia. *in vivo* - gene delivery by viruses system - retrovirus, Adenoviral, Adeno associated, treating Cystic Fibrosis. Non viral gene delivery - methods - pure DNA constructs, Lipoplexes, DNA molecular conjugates, efficiency of gene delivery. Antisense therapy - Cancer, AIDS.

Unit II

DNA in Disease diagnosis and Medical Forensics

Nucleic acid hybridization - DNA probes, mechanism of action of DNA probes, Radioactive and Non Radioactive detection system, PCR and signal amplification, DNA chip - Microarray - techniques and applications. DNA in diagnosis - infectious diseases - Malaria, Chagas, AIDS, genetic diseases - Cystic fibrosis, sickle cell Anemia, Duchenne's muscular dystrophy. DNA fingerprinting, RFLP, VNTR and SNP in diagnosis.

Unit III

Pharmaceutical products of DNA Technology

Human protein replacement - production of recombinant Insulin, recombinant hGH, Clotting Factor VIII. Therapeutic agents for human diseases - production of Tissue Plasminogen Activator, Interferons, Erythropoietin and DNase.

P.T.O.

Unit IV

Recombinant Vaccine and Monoclonal Antibodies

Recombinant Vaccines - types - Subunit vaccine against - Hepatitis B, Herpes Simplex virus, HIV, DNA Vaccine - delivery methods, screening of pathogenic genome for selecting DNA vaccines, Advantage, Attenuated - vaccine for cholera, thyphoid, Vector Recombinant - vaccines against Vaccinia virus - production. Principles of Hydridoma technology, monoclonal antibodies production, purification. Production of Human Mouse MAbs, production of MAbs in *E. coli*, Applications of monoclonal antibodies - Diagnostics and Therapeutics.

Unit V

Assisted Reproductive Technology

Manipulations of Reproduction in animals - artificial insemination, Embryo transfer-superovulation, MOET, Embryo - splitting, biopsy, sexing. IVF- stages limitation, Embryo cloning. Manipulation of reproduction in humans - causes of infertility and applications of ART, techniques employed - IVF, ET, GIFT, ZIFT, IVC. Micromanipulation-intracytoplasmic sperm injection, Cryopreservation, Assisted Hatching, Negative aspects of ART.

Text book

1. Satyanarayana U. 2017. Biotechnology. Books and Allied Pvt.
2. Jogdand SN. 2008. Medical Biotechnology. Himalaya Publishing House.

References

1. Glick BR, Delovitch TL, Patten CL. 2014. Medical Biotechnology. ASM Press, Washington.
2. [Pongracz J](#), [Keen M](#). 2008. Medical Biotechnology. Elsevier Health Sciences.
3. Ignacimuthu S. 2008. Biotechnology - An Introduction. Narosa Publishing House.

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PROGRAMME: B.Sc., Biotechnology

COURSE CODE : 17U6LMC8

COURSE TITLE : Genetic Engineering

QN.NO : 9618

TIME : 3 Hours

MAX.MARKS :75

Objectives

- To understand the basic principles of cloning
- To gain knowledge on the various tools used in genetic engineering
- To learn about the various cloning strategies
- To acquire knowledge about the gene expression in host cells

Learning Outcome

- Acquire knowledge on basic concepts in genetic engineering
- Create awareness to Human genome project
- Gain information on applications of Genetic Engineering in various fields

Unit-I

Tools of Genetic Engineering

Introduction to genetic engineering- history of recombinant DNA technology, Molecular tools of genetic engineering -DNA modifying enzymes – exo & endo nucleases. Restriction Enzymes -nomenclature and classification, ligases, alkaline phosphatase, terminal transferase, reverse transcriptase, DNA Polymerase, Klenow polymerase. Linkers, adaptors, Homopolymer tailing.

Unit-II

Cloning Vectors

Plasmids - pBR and pUC, Bacteriophage vectors- λ vectors, M13 vector, Cosmids, Yeast Vectors. Special vectors - expression vectors and shuttle vectors, artificial mini chromosome-BAC, YAC.

Unit III

Methods of gene transfer

Physical, chemical and biological methods of Gene transfer: Bacterial Conjugation, Transformation, Transduction, Microinjection, Electroporation, Shotgun method, Ultrasonication, Liposome fusion, Calcium-mediated gene transfer.

Unit-IV

Gene cloning strategies and selection of recombinants

Isolation and purification of nucleic acid, preparation of cDNA, Purification of plasmid DNA, Insertion of gene into vectors, Screening and selection of recombinants- blue-white, antibiotic and immunochemical methods. Hybridization techniques – Southern, Northern, Western, PCR- amplification of DNA – types of PCR & applications.

Unit-V

Manipulation of gene expression in host cells

Manipulation of gene expression in prokaryotes, eukaryotes - selection of host cell for gene expression, regulatable promoters, integration of cloned DNA into the host chromosomes. Cloning in yeast- vectors for *Saccharomyces cerevisiae*, Mammalian cell expression vector. Gene expression to produce proteins, collection and purification of recombinant proteins. Human Genome project-mapping of the human genome, approaches for genome sequencing, benefits and applications of human genome sequencing.

Textbooks

1. Satyanarayana U. 2017. Biotechnology. Books and Allied Pvt.
2. Mitra S. 2015. Genetic Engineering. Principles and Practice. Second edition. Mcgraw Higher Ed.

References

1. Brown TA. 2010. Gene Cloning and DNA Analysis. 6th Edition. Blackwell Publishing Ltd.
2. Primrose SB and Twyman RM. 2006. Principles of Gene Manipulation and Genomics. 7th Edition Blackwell Publishing.
3. Ignacimuthu S. 2008. Biotechnology- An Introduction. Narosa Publishing House.

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RE-ACCREDITED (3rd Cycle) WITH “A” GRADE BY NAAC

PROGRAMME: B.Sc., Biotechnology

COURSE CODE : 17U6LSM4

COURSE TITLE : Fisheries Technology

QN.NO : 9621

TIME : 3 Hours

MAX.MARKS :75

Objectives

- To understand the basics of fisheries technology
- To gain knowledge on the crafts and gears used in fishing
- To learn about the preservation techniques of fish
- To acquire knowledge about by-products of fishery industries

Learning Outcome

- Acquire knowledge on fishery practices
- Create awareness about transgenic fishes and its applications

Unit-I

Fish culture Techniques

Definition, Sewage Culture - Carp culture – pond culture, Reservoir culture , Integrated fish culture - Poultry cum fish, Dairy cum fish, Pig cum fish culture, Monosex culture - necessity, Tilapia culture, breeding methods, advantages.

Unit-II

Fish Breeding and Genetic Manipulation

Methods of breeding-Natural, artificial – Stripping method, induced breeding - Hypophysation, Stages of hypophysation – Collection, preparation of pituitary extracts, selection of breeders, injection, breeding, hatching. Ovaprim – advantages. Genetic manipulation - Transgenic fish production

Unit-III

Fishing Techniques

Crafts – Trawlers - Beam, Pair, outrigger, Seiners, Dredgers, gill, nutters, lift nutters, Line vessels, Trap Setters. Fishing Gears – Nets-Surrounding, Trawler, Dredgers, lift, gill, trap nets. Electricity in fishing, electronic devices for fish detection, Bumper catching Devices.

Unit-IV

Fish Preservation

Fish Spoilage – Chemical action, Autolysis, Microbial action, Principles of Fish preservation – Cleaning, low temperature, high temperature, dehydration, radiation, Use of salt and Preservatives, Methods of Preservation – Curing-Wet, dry, drying – Solar driers, monacuring, smoking, Pickling, icing, refrigeration, Deep freezing, Freeze drying, Canning.

Unit-V

Fisheries Byproducts

Products – Liver oil, Body oil, fish meal, Fish silage, Fish glue, Isinglass, Leather, Cavier, Marconi, Shark Fin soup, Fish pulp, Fish paste, Ensilage, Amergris, Freshwater weeds, seaweeds

Textbooks

1. Zade SB, Khune CJ, Sitre SR, Tijare RV. 2011. Principles of Aquaculture. Himalaya Publishing House.
2. Santhnam R. 1990. Fisheries Science. Daya Publishing House, New Delhi.

References

1. Arumugam N. 2014. Aquaculture. Saras Publications.
2. Pandey K, Shukla JP. 2015. Fish and Fisheries. Rastogi Publications.
3. Webster CD, Jana BB. 2003. Sustainable Aquaculture. Atlantic Publishers & Distributors.

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PROGRAMME: B.Sc.,

COURSE CODE : 18U4LAC2

COURSE TITLE : An Introduction to Immunology QN.NO : 9622

TIME : 3 Hours

MAX.MARKS :75

OBJECTIVES

- To understand the basic principles of Immunology.
- To study the organs and cells involved in the immune system.
- To learn the mechanism of immune response.
- To gain knowledge on antigen-antibody reactions and their applications.

LEARNING OUTCOME

- Acquire knowledge on basic concepts in Immunology.
- Create awareness to hypersensitivity, transplantation and tumour immunology.
- Gain information on applications of immunotechniques in various fields.

UNIT I Cells and organs of immune system

Immunity- definition, history, types of immunity- innate and acquired, lymphoid organs- primary and secondary-structure and functions, cells of the immune system- stem cells – origin and differentiation, lymphocytes- T cell-types , B cell , plasma cells, null cells, macrophages, eosinophils, basophils, antigen presenting cells, mast cells and platelets.

UNIT II Antigen and Antibody

Antigen, Immunogen, Hapten- definition, immunogenicity, types of antigens. Immunoglobulin- structure, different classes of immunoglobulins- structure and biological properties, Allotypes, Idiotypes, principle of antigen - antibody interactions- Agglutination, Precipitation, Opsonization, C-Activation, Neutralization and Cell lysis.

UNIT III Complement and Hypersensitivity

Immune response - kinetics of immune response, primary and secondary immune response, cell mediated immune response. Complement pathways- classical and alternative. Hypersensitive Reactions- Type I, Type II, Type III and Type IV.

UNIT IV Transplantation and Tumour immunology

Transplantation antigens, types of transplantation, GVHD, prevention of graft rejection. Tumour antigens, immunity to tumour, immune evasion to tumour, tumour immunodiagnosis.

UNIT V Applications of immunotechniques

Applications of Antigen- Antibody reactions- Mancini and Ouchterlony technique, ABO blood grouping, Enzyme linked Immunosorbent assay, Hybridoma technology, vaccine –killed, attenuated and recombinant.

TEXT BOOKS

1. Akram Hossain, Md.2003. Immunology: A short Textbook, Medical publishers, New Delhi.
2. Benjamini E., Sunshine G and Leskowitz S, Immunology: A short course, 5th Ed, New York: John Wiley & Sons - Inc, 2003.

REFERENCE BOOKS

1. Abbas A.K and Lichtman A.H, Cellular and Molecular Immunology, 5th Ed, Philadelphia, Saunder's Publishers, 2003.
2. Abbas A.K and Lichtman A.H, Basic Immunology, 2nd Ed, New Delhi, Elsevier Inc, 2004.
3. Chakravarthy A.K, Immunology and Immunotechnology, New Delhi, Oxford University Press, India, 2006.
4. Coleman R.M, Fundamental Immunology, 3rd Ed, USA, Wm.C.Brown Publishers, 1994.

WEBSITE REFERENCES

- www.mednotes.net/notes/immunology/
- www.easybiologyclass.com/immunology-free-lecture-notes-online-tutorials-lecture-notes

YOU TUBE LECTURE VIDEOS

- <https://www.youtube.com/watch?v=Jshw2sHrk8Y>
- <https://www.youtube.com/watch?v=lhkOLJ5A5BQ>

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THE MADURA COLLEGE (Autonomous), MADURAI – 625 011
(AFFILIATED TO MADURAI KAMARAJ UNIVERSITY)
RE-ACCREDITED (3rd Cycle) WITH “A” GRADE BY NAAC

PROGRAMME : B.Sc., Biotechnology

COURSE CODE: 18U5LAC3

COURSE TITLE : Food Preservation and Processing

QN.NO: 9624

TIME : 3Hrs

Max. Marks: 75

Objectives

- To understand the basic principles of food processing
- To gain knowledge on the various methods of food preservation
- To learn about packaging technology

Learning Outcome

- Acquire knowledge on basic concepts in food process technology
- Create awareness on improved methods of food processing

UNIT I

Cereal technology

Agents causing spoilages, chemical changes in the grains, storage, handling and processing.

UNIT

Legume technology

Important legume grown, toxic factors in legume, effects of processing on nutrients composition and quality. New improved technologies of legume processing.

UNIT III

Processing of Miscellaneous foods

Fatty foods, essential oils, spices and other condiments, bottled beverages, salt, nut meats.

UNIT IV

Preservation and Processing of Sugar Products

Contamination – sucrose, maple syrup, honey, candy, spoilage and preservation.

UNIT V

Packaging Technology

Introduction, packaging materials, types of packaging, effects of packaging on the nutritive value

Text Books

1. Subbulakshmi G, Udipi SA. 2001. Food processing and Preservation, New Age International Publishers
2. Frazier WC, Westhoff DC .1995. Food Microbiology, Tata McGraw-Hill, 4th Edition.

References

1. Varzakas T, Tzia C. 2015. Handbook of Food Processing: Food Preservation. CRC Press.
2. [Sivasankar](#) B. 2002. Food Processing and Preservation. PHI Learning Pvt. Ltd.
3. Fellows PJ. 2009. Food Processing Technology. Elsevier.



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RE-ACCREDITED (3rd Cycle) WITH “A” GRADE BY NAAC

PROGRAMME: B.Sc., Biotechnology

COURSE CODE: 18U5LSA1

COURSE TITLE : Aquaculture

QN.NO: 9625

TIME : 3Hrs

Max. Marks: 75

Objectives

- To understand the need and scope of aquaculture
- To study the economically important fishes, culture practices and management
- To encourage students for self employment

Learning outcome

- Acquire knowledge on aquaculture practices
- Motivates students to become entrepreneurs

Unit - I

Introduction to Aquaculture

Definition, Scope, role in economic development, Types – fresh water, brackish water, mariculture

Unit - II

Culture Practices

Cultivable fishes – Qualities, Types – Fin and Shell fishes, Practices – extensive, semi-extensive, intensive, Monosex culture, cage culture, sewage fed fish culture, Integrated fish farming – Paddy cum fish – types.

Unit-III

Fish breeding and Hatchery

Breeding - Natural, Artificial breeding - Stripping, Induced – Hypophysation, Hatching – Traditional and modern methods

Unit – IV

Fish feed and feeding

Live feed, Artificial feed – simple, compound, composition of ideal feed, qualities of good artificial feed

Unit – V

Fish diseases and management

Bacterial diseases – Furunculosis, Columiariis, tail and fin rot, gill diseases, Fungal – Saprolegniasis, Branchiomyosis, Protozoans – Whirling, Trypanosomiasis, Costiasis – Treatment

Text Book

1. Zade SB, Khune CJ, Sitre SR, Tijare RV. 2011. Principles of Aquaculture. Himalaya Publishing House.
2. Arumugam N. Aquaculture. Saras Publications

References

1. Santhnam R. 1990. Fisheries Science. Daya Publishing House, New Delhi.
2. Pandey K, Shukla JP. 2015. Fish and Fisheries. Rastogi Publications.
3. Webster CD, Jana BB. 2003. Sustainable Aquaculture. Atlantic Publishers & Distributors



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RE-ACCREDITED (3rd Cycle) WITH “A” GRADE BY NAAC

PROGRAMME: B.Sc., Biotechnology

COURSE CODE : 18U6LAC4

**COURSE TITLE : Recombinant DNA
Technology in Human Health**

QN.NO : 9626

TIME : 3 Hours

MAX.MARKS :75

Objectives

- To understand the basic principles of gene therapy
- To gain knowledge on the various molecular based diagnostics
- To learn about the recombinant vaccines and monoclonal antibodies
- To acquire knowledge about the ART

Learning Outcome

- Acquire knowledge on basic concepts in Gene therapy
- Gain information on applications of molecular therapy and diagnostic tools
- Create awareness to Assisted Reproductive Technology

Unit - I

Gene Therapy

Gene therapy - types, treatment - ADA deficiency, haemophilia, Cystic Fibrosis. Gene delivery methods, Gene therapy strategies and antisense therapy - Cancer, AIDS. Stem cells - types, culture, applications.

Unit - II

DNA in Disease diagnosis

Nucleic acid hybridization- DNA probes ,mechanism of action of DNA probes, Radioactive and Non Radioactive detection system, PCR and signal amplification, DNA chip – Microarray - techniques and applications.

Unit - III

Pharmaceutical products of DNA Technology

Human protein replacement - production of recombinant therapeutic agents-Insulin, hGH, Clotting Factor VIII, Tissue Plasminogen Activator, Interferons.

Unit – IV

Recombinant Vaccine and Therapeutic Products

Recombinant Vaccines - Subunit vaccines - Hep B, HIV, DNA Vaccine, RNA vaccines, Edible vaccines. Industrial production of Insulin and Humalin.

Unit – V

Assisted Reproductive Technology

Manipulations of Reproduction in animals- artificial insemination, Embryo transfer-superovulation, MOET, Embryo cloning. Manipulation of reproduction in humans- causes of infertility and applications of ART, techniques employed – IVF, GIFT, IVC. Negative aspects of ART.

Text books

1. Satyanarayana U. 2017. Biotechnology. Books and Allied Pvt.
2. Jogdand SN. 2008. Medical Biotechnology. Himalaya Publishing House

References

1. Glick BR, Delovitch TL, Patten CL. 2014. Medical Biotechnology. ASM Press.
2. [Pongracz J](#), [Keen M](#). 2008. Medical Biotechnology. Elsevier Health Sciences.
3. Dubey RC. 2000. A text Book of Biotechnology. S. Chand & Company Ltd.



PROGRAMME: UG NME- Biotechnology **COURSE CODE : 17U4LNM2**
COURSE TITLE : Basics of Biotechnology **QN.NO : 9628**
TIME : 3 Hours **MAX.MARKS :75**

OBJECTIVES

- To educate the essentials of Biotechnology in various fields.
- To appraise the ethical and regulatory issues of Biotechnology.
- To gain knowledge on the applied aspects of Biotechnology.

LEARNING OUTCOME

- Provides basic knowledge on the subject – Biotechnology.
- Inculcate the role of biotechnology in various fields.
- Provides an insight about bioethics and biosafety.

Unit I Biotechnology in Animal husbandry

Introduction, history and scope of animal biotechnology, Biotechnology in India – DBT, Transgenic animal – Dolly.

Unit II Biotechnology in Agriculture

Plant tissue culture – definition, history, techniques – microinjection and electroporation, advantages and disadvantages, transgenic plant – *Bt* Cotton.

Unit III Biotechnology in Food industry

Single cell protein- sources, nutritive values and uses. Fermented foods - processing of idli, dosa batter, butter milk, cheese and yoghurt.

Unit IV Environmental Biotechnology

Role of biotechnology in environmental protection – global warming, waste water treatment – activated sludge method, biogas production and advantages, bioremediation- superbug.

Unit V Bioethics and biosafety

Ethical, legal and social implications of biotechnology, biosafety - positive and negative effects of GMO foods.

TEXT BOOKS

1. U. Satyanarayana. 2015. Biotechnology. 9th edition. Books and Allied P (Ltd), Kolkata, India.
2. V. Kumaresan. 2010. Biotechnology, revised edition, Saras publication, Kanyakumari.

REFERENCE BOOKS

1. R.C. Dubey. 2014. A Text book of Biotechnology, 5th revised edition, S.Chand publication, NewDelhi.
2. S.S Purohit and S.K. Mathur 2002. Biotechnology – Fundamentals and applications, Agro-Bios publishers, New Delhi.
3. S.N. Jogdand, 2010. Environmental biotechnology, 5th edition, Himalaya Publication, Mumbai.

WEBSITE REFERENCES

- <http://www.biologydiscussion.com/biotechnology/biotechnology-introduction-scope-and-applications-of-biotechnology/11608>
- <https://byjus.com/biology/application-biotechnology-medicine/>

YOU TUBE LECTURE VIDEOS

- https://www.youtube.com/watch?v=DNysyCG_U9c
- <https://www.youtube.com/watch?v=2NUEMpL9kfk>



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RE-ACCREDITED (3rd Cycle) WITH “A” GRADE BY NAAC

PROGRAMME: B.Sc., Biotechnology

COURSE CODE : 20U1LMC1

COURSE TITLE : Genetics

QN.NO : 11501

TIME : 3 Hours

MAX.MARKS :75

<i>DEPARTMENT OF BIOTECHNOLOGY</i>				<i>CLASS: I B.Sc. Biotechnology</i>				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
I	Core-1	20U1LMC1	Genetics	3	3	25	75	100

Course Objectives:

1. To apply the principles of inheritance as formulated by Mendel.
2. To understand principles of extensions to Mendelian inheritance, including multiple alleles, lethal alleles, gene interactions, and sex-linked transmission.
3. To describe the cause and consequences of alterations in chromosome number and/or structure.

UNIT-I: Mendelian Inheritance

Historical Background of Genetics. Definition –alleles, homozygous and heterozygous, back cross, test cross and reciprocal cross. Mendel’s laws and his experiments –Law of dominance, segregation and independent assortment – Experiments in pea plants. Multiple alleles – ABO Blood groups and Rh factor. Multiple gene inheritance – Skin colour in man, Kernel colour in wheat.

UNIT-II: Deviations from Mendelism

Gene Interactions: complete and incomplete dominance, co-dominance and epistasis. Inter allelic-Complementary gene interaction (9:7) – *Lathyrus odoratus*, Supplementary gene interaction (9:3:4) Grain color in Maize, Epistasis - Dominant - Fruit color in *Cucurbita pepo*, Recessive - Coat color in Mice. Non- Epistasis - Comb pattern in Poultry

UNIT-III: Sex determination, sex-linked and cytoplasmic inheritance

Genetic balance theory of Bridges, Environment and Sex determination - *Drosophila*, Hormonal control of sex determination. Sex linked inheritance and sex influenced inheritance. Cytoplasmic inheritance - Kappa particles in *Paramecium*, shell coiling in snail and plastid inheritance in *Mirabilis*

Unit-IV: Linkage and Crossing Over

Linkage: Theory and types of Linkage, linkage groups, factors affecting linkage, Crossing over -mechanism, factors affecting crossing over, tetrad analysis and significance of crossing over.

UNIT-V: Chromosomal aberrations and Population genetics

Chromosomal mutations – types: changes in number and structure, Karyotyping, Non-disjunction - Down syndrome, Klinefelter's syndrome and Turner's syndrome. Eugenics: Positive and Negative Eugenics, Pedigree analysis. Allelic and genotype frequencies, Hardy Weinberg law, factors affecting Hardy Weinberg law, Significance in Population Genetics.

Books for Study

1. Verma PS and Agarwal VK. 2008. Genetics. Eighth Edition. S. Chand Publications
2. Singh BD. 2002. Genetics. Kalyani Publications

Books for Reference

1. Snustad and Simmons. 2012. Principles of Genetics. John Wiley & Sons, Inc.
2. Klug and Cummings. 2012. Concepts in Genetics. Pearson
3. Brooker RJ. 2012. Genetics-Analysis & Principles. The McGraw-Hill Companies, Inc.
4. Sinnott, Dunn and Dobzhansky. Principles of Genetics.

Web Resources

1. <http://www.gwumc.edu>
2. <http://nptel.ac.in>
3. <http://swayam.gov.in>

Pedagogy

The teaching methods may include Chalk and talk, PowerPoint, demonstrations, assignments and group discussions and Problem solving

Course Learning Outcomes:

On completion of this course the students will be able to

#	CLOs	K - Level
CLO-1	Identify the laws of inheritance	Up to K-3
CLO-2	Compare and contrast Mendelian inheritance and Non Mendelian Inheritance	Up to K-3
CLO-3	Interpret the inheritance pattern in both plants and animals	Up to K-4
CLO-4	Comprehensive and detailed understanding of Population Genetics	Up to K-2
CLO-5	Apply reasoning skills to solve genetic problems	Up to K-4

Mapping of Course outcomes with Program specific Outcomes:

CLO/PSO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7
CLO-1	3	3	1	1	1	--	3
CLO-2	3	2	1	2	2	--	--
CLO-3	3	3	2	2	1	2	--
CLO-4	3	3	3	3	2	1	--
CLO-5	3	3	3	2	2	3	2

Advance application-3; Intermediate level-2; Basic level-1

Mapping of Course outcomes with Program Outcomes:

CO/PO	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	3	3	--	3	2
CLO-2	2	--	1	--	3
CLO-3	3	3	1	2	3
CLO-4	1	2	2	2	1
CLO-5	3	2	2	2	3

Advance application-3; Intermediate level-2; Basic level-1

Contd.,

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Genetics Course

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K 3	2	K1 & K2	1	K1	2 (K1&K1)	1(K3)
2.	CLO 2	Up to K 4	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
3.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4.	CLO 4	Up to K 2	2	K1 & K2	1	K2	2 (K2&K2)	1(K2)
5.	CLO 5	Up to K 4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1 Question from Unit-I (K3 Level)
		2 Questions from Unit-II (K3 Level)	1 Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1 Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K2 Level)	1 Question from Unit-IV (K2 Level)
		2 Questions from Unit-V (K4 Level)	1 Question from Unit-V (K3 Level)

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Course content designed by Dr. N. Krithiga

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RE-ACCREDITED (3rd Cycle) WITH “A” GRADE BY NAAC

PROGRAMME: B.Sc., Biotechnology

COURSE CODE : 20U1LMC2

COURSE TITLE : Basics of Biotechnology

QN.NO : 11502

TIME : 3 Hours

MAX.MARKS :75

DEPARTMENT OF BIOTECHNOLOGY				CLASS: I B.Sc. Biotechnology				
Sem	Course Type	Course Code	Course Title	Credits	Contact Hours/week	CIA	Ext	Total
I	Core-2	20U1LMC2	Basics of Biotechnology	3	3	25	75	100

Course Objectives:

1. To introduce basic concepts of Biotechnology to the students.
2. To make students aware of tools and techniques of Biotechnology.
3. To motivate the students to aspire for research/industrial career in the field of Biotechnology.
4. To make students aware of bioethics and judicious usage of biotechnological applications.

UNIT-I: History and Gene concept

History of Biotechnology – traditional - ghee, butter, fermentation - curd, idli, wine and modern approaches - pasteurization, vaccination, biofuels, and GM crops. Central dogma - gene, RNA, protein-mutability of DNA - types of mutation, mutagens, mutagenesis, Ames test.

UNIT-II:Tools of Biotechnology

Organism of interest in Biotechnology - *Escherichia coli*. Restriction enzymes-types, naming, target sites, cohesive and blunt end, DNA methylases, DNA ligases. Plasmids - origin of replication, copy number, selection markers-antibiotic resistance genes. Types of vectors – Cloning: pBR 322, pUC, Expression Vectors and Shuttle vectors.

UNIT-III: Microbial and animal biotechnology

Experimental models - *Saccharomyces cerevisiae*, zebrafish and mice. Gene transfer methods - transformation, electroporation, gene gun. Engineered microbes - production of alcohol, amino-acids and proteins. Animal cell culture - stem cells - pluripotency. Construction of transgenic mice - gene knockout, gene silencing - gene transfer. Construction of genetically engineered sheep - Dolly.

UNIT-IV:Plant and Environmental biotechnology

Plant tissue culture - callus, totipotency. *Agrobacterium tumefaciens*- crown gall, Ti-plasmid, T-DNA transfer. Genetically engineered plants-pest resistant plant - *Bacillus thuringiensis*- Bt toxin. Environmental pollution and threat - Xenobiotics, biomagnification. Bioremediation - *In-situ* and *Ex situ*. Heavy metal bioremediation - microbes, phytoremediation - *Brassica juncea* and *Ambrosia* sp.

Contd.,

UNIT-V: Medical Applications and Bio-ethics

In-vitro fertilization - test tube baby. Gene therapy - adenosine deaminase - SCID. Diagnosis of diseases and disorders - FISH. Recombinant vaccines. Patent: definition and form of patent, patent rights, patent filing. Ethics- construction and usage of genetically engineered microbes, plants, animals-drug trials.

Books for Study

1. Satyanarayana. U. 2009. Biotechnology. Books and Allied Pvt. Ltd.
2. Kumaresan. 2015. Biotechnology. Saras Publications.

Books for Reference

1. Brown TA. 2012. Gene Cloning and DNA Analysis- An Introduction. Wiley Blackwell.
2. Balasubramaniam D, CFA Bryce, K Dharmalingam, J Green, Kunthala Jayaraman. Concepts in Biotechnology, University Press Reference Book.
3. Primrose SB and Twyman R. Principles of Gene Manipulation and Genomics, Blackwell.
4. Dubey RC. 2012. A textbook of Biotechnology, S. Chand Publications.

Web Resources

1. <http://dbtindia.gov.in/>
2. <http://www.brsi.in/>
3. <https://www.easybiologyclass.com/topic-biotechnology/>

Pedagogy

The teaching methods may include Chalk and talk, PowerPoint, assignments, group discussions and quiz.

Course Learning Outcomes:

On completion of this course the students will be able to

#	CLOs	K - Level
CLO-1	Elaborate with the history of biotechnology and understand the gene concept	Up to K-2
CLO-2	Develop knowledge on the principles and applications of essential biotechnological tools and methods	Up to K-3
CLO-3	Dissect the methods and applications of microbial and animal biotechnology	Up to K-4
CLO-4	Identify the applications and values of plant and environmental biotechnology strategies	Up to K-3
CLO-5	Analyze the merits and demerits of biotechnological applications	Up to K-4

Contd.,

Mapping of Course outcomes with Program specific Outcomes:

CLO/PSO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7
CLO-1	1	2	1	2	1	--	-
CLO-2	3	1	3	2	2	1	--
CLO-3	2	3	2	3	2	--	--
CLO-4	3	2	3	2	2	3	3
CLO-5	1	2	2	3	3	--	2

Advance application-3; Intermediate level-2; Basic level-1

Mapping of Course learning outcomes with Program Outcomes:

CO/PO	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	3	--	2	2	--
CLO-2	3	3	2	2	3
CLO-3	3	2	2	--	3
CLO-4	3	2	2	3	--
CLO-5	3	3	2	3	--

Advance application-3; Intermediate level-2; Basic level-1

**Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Basics of Biotechnology Course
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)**

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1.	CLO 1	Up to K 3	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 4	2	K1 & K2	1	K1	2 (K2&K2)	1(K3)
3.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4.	CLO 4	Up to K 2	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
5.	CLO 5	Up to K 4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

Contd.,

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1 Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K2 Level)	1 Question from Unit-II (K3 Level)
		2 Questions from Unit-IV (K3 Level)	1 Question from Unit-IV (K4 Level)
		2 Questions from Unit-III (K3 Level)	1 Question from Unit-III (K3 Level)
		2 Questions from Unit-V (K4 Level)	1 Question from Unit-V (K3 Level)

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Course content designed by Dr. N. Arul Muthu Kumaran

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RE-ACCREDITED (3rd Cycle) WITH “A” GRADE BY NAAC

PROGRAMME: B.Sc., Biotechnology

COURSE CODE : 20U1LMC3

COURSE TITLE : General Physiology

QN.NO : 11504

TIME : 3 Hours

MAX.MARKS :75

<i>DEPARTMENT OF BIOTECHNOLOGY</i>				<i>CLASS: I B.Sc. Biotechnology</i>		
Sem	Course Type	Course Code	Course Title	Time	Maximum	Question Number
II	Core-3	20U2LMC3	General Physiology	3 hrs	75 marks	11504

Course Objectives:

1. To learn the basics of physiological processes in both plant and animals
2. To understand adaptive mechanisms against various stress conditions
3. Apply the physiological processes in the field of Biotechnology
4. Describe significance of physiological processes
5. Motivate the students to explore interaction between internal systems

Unit-I: Organization of Animal and plant tissue

Animal tissues – Types, Structure and functions of Epithelial, Connective, Muscle and Nervous tissues, Plant tissues – Types, Structure and functions of Ground (Parenchyma, Collenchyma & Sclerenchyma), Vascular (Xylem & Phloem) & Dermal (Epidermis & Periderm)

Unit-II: Transportation in Plant and Animal Digestion

Water Potential, Diffusion, Osmosis. Water absorption – apoplast and symplast. Active and passive, transport in xylem and Phloem. Structure & functions of digestive glands, Digestion and absorption of carbohydrates, proteins and lipids and its regulation

Unit-III: Respiration & Circulation

Respiratory organs - Tracheal system, gills and lungs, Transport of gases, respiratory pigments, Hemoglobin as oxygen carrier, respiratory quotient; Mechanism of gas exchange in tissues. Circulation - Open and closed system, components and functions of blood, mechanism of circulation, blood clotting mechanism

Unit-IV: Transpiration and Excretion

Transpiration - stomata opening and closing- Mechanism and hormonal regulation. Excretion - Excretory organs in animals, excretory products; structure and functions of human kidney, mechanism of urine formation. Dysfunction of kidney - renal failure, diagnosis and treatment.

Unit-V: Neural System & Endocrine System

Nervous system - CNS and ANS; neurons; propagation of nerve impulses - synaptic transmission. Reflex action and reflex arc, structure and physiology of hearing and vision. Endocrine system - structure and function of endocrine glands (pituitary, thyroid parathyroid, adrenal glands, Islets of Langerhans, thymus), Mode of action of hormones.

Books for Study

1. Mohan Arora. 2008. Animal Physiology. Himalya Publications
2. Russell JP. 2008. Plant and Animal Physiology. Brooks & Cole Publications

P.T.O.

Books for References

1. Moyes. 2011. Principles of Animal Physiology. Pearson publications
2. Brooker RJ. 2011. Biology. The McGraw-Hill Companies, Inc
3. Hoar. WS. 2004. General and Comparative Physiology. 3rd Edition. Prentics-Hall of India.
4. Bidlack JE & Jansky SH. 2011. Stern's Introductory Plant Biology. The McGraw-Hill Companies, Inc.

Web Resources

1. <https://www.edx.org/xseries/harvardx-fundamentals-of-neuroscience>
2. <http://www.mblab.gla.ac.uk/~julian/DowLab.html>

Pedagogy

The teaching methods may include Chalk and talk, PowerPoint, demonstrations through video, assignments and group discussions

Course Learning Outcomes:

On completion of this course the students will be able to

#	CLOs	K - Level
CLO-1	Illustrate the structural organization of various systems within an animal body	Up to K-2
CLO-2	Explain the functions of various organ systems	Up to K-4
CLO-3	Classify the role of hormones in physiological processes	Up to K-4
CLO-4	Correlate interaction between various organ system	Up to K-4
CLO-5	Categorize the signal transduction mechanism	Up to K-4

Mapping of Course outcomes with Program specific Outcomes:

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7
CLO-1	1	2	1	3	1	--	--
CLO-2	1	3	2	2	1	2	--
CLO-3	2	3	1	2	2	3	--
CLO-4	3	3	1	2	1	--	--
CLO-5	2	2	3	2	1	3	2

Advance application-3; Intermediate level-2; Basic level-1

Mapping of Course learning outcomes with Program Outcomes:

CO/PO	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	3	--	2	--	--
CLO-2	3	2	2	--	--
CLO-3	3	2	2	3	--
CLO-4	3	2	2	3	--
CLO-5	3	--	3	1	--

Advance application-3; Intermediate level-2; Basic level-1

P.T.O.

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – General Physiology Course
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K- Level		
1.	CLO 1	Up to K 3	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 4	2	K1 & K2	1	K1	2 (K2&K2)	1(K3)
3.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
4.	CLO 4	Up to K 2	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
5.	CLO 5	Up to K 4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

P.T.O.

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1 Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K2 Level)	1 Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1 Question from Unit-IV (K3 Level)
		2 Questions from Unit-IV (K4 Level)	1 Question from Unit-III (K3 Level)
		2 Questions from Unit-V (K3 Level)	1 Question from Unit-V (K4 Level)

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

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THE MADURA COLLEGE (Autonomous), MADURAI – 625 011

(AFFILIATED TO MADURAI KAMARAJ UNIVERSITY)

RE-ACCREDITED (3rd Cycle) WITH “A” GRADE BY NAAC

PROGRAMME: B.Sc., Biotechnology

COURSE CODE : 20U1LMC4

COURSE TITLE : Bioinstrumentation

QN.NO : 11505

TIME : 3 Hours

MAX.MARKS :75

<i>DEPARTMENT OF BIOTECHNOLOGY</i>				<i>CLASS: I B.Sc. Biotechnology</i>		
Sem	Course Type	Course Code	Course Title	Time	Maximum	Question Number
II	Core-4	20U2LMC4	Bioinstrumentation	3 hrs	75 marks	11505

Course Objectives

1. To introduce students to various analytical instrumentation used in biotechnology labs.
2. To understand the physical principles of emerging bio-analytical techniques.
3. To identify and interpret results of bio-analytical techniques.
4. To critically assess the advances in the field of bio-analytical chemistry

Unit-I: Microscopy

Microscopy: Introduction –magnification, resolving power and numerical aperture and types - bright field, dark field, Phase contrast, Fluorescence, Polarising microscopy; Electron microscopy- SEM and TEM.

Unit-II: pH meter and Centrifuge

pH meter: Principle, working and applications. Centrifuge: Basic principles of Sedimentation- types of centrifuges and types of rotors. Mechanism of diffusion and sedimentation.

Unit-III: Colorimetry and Spectroscopy

Colorimetry: Beer - Lambert’s Law – principle and applications; Spectrophotometry - UV, Visible, Fluorescence and Infrared spectroscopy –principle, instrumentation and applications.

Unit-IV: Chromatography

Chromatography: Paper Chromatography; Thin layer Chromatography; Gas chromatography, ion exchange, High pressure Liquid Chromatography- principle, instrumentation and applications.

Unit-V: Electrophoresis and Radio-activity

Electrophoresis: Types-moving boundary and zone electrophoresis. Techniques and applications of Agarose gel electrophoresis, native PAGE, SDS-PAGE- principle, instrumentation and applications. Radio isotope techniques: natural radiations, nature of radioactivity – Detection and measurement of radioactivity – Geiger-Muller counter– Autoradiography Applications of radioisotopes in Biological sciences – Hazards and containment of radioactivity.

Books for Study

1. Jeyaraman J. 1985. Laboratory Manual in Biochemistry. Wiley Eastern Limited, New Delhi.
2. Plummer D. 1987. An Introduction to Practical Biochemistry. Tata McGraw – Hill Publishing Company Ltd., New Delhi.
3. Veerakumari L. 2009. Bioinstrumentation. MJP publishers.

P.T.O.

Books for Reference

1. Wilson, K and Walker, J, Principles and Techniques of Practical Biochemistry, 1995, Cambridge University Press, New York.
2. Boyer, R.F., Modern Experimental Biochemistry, 1993, The Benjamin / Cummings Publishing Company, Inc., New York.
3. Switzer RL, Garrity LF. 1999. Experimental Biochemistry. W. H. Freeman and Co.

Web Resources

1. <http://nptel.ac.in>
2. <http://swayam.gov.in>

Pedagogy

The teaching methods may include Chalk and talk, PowerPoint, Assignments and group discussions, Problem solving

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K - Level
CLO-1	Explain the principle, components and application of different types of microscopes.	Up to K-2
CLO-2	Infer the principle, working and applications of different centrifuges and pH meter	Up to K-4
CLO-3	Apply the concept of electromagnetic radiation, absorption spectrum, Beer's – Lambert's law and verification of the law.	Up to K-3
CLO-4	Analyse various chromatographic techniques by its working principle and applications	Up to K-4
CLO-5	Categorize the various electrophoretic techniques and radioactivity measurements	Up to K-4

Mapping of Course outcomes with Program specific Outcomes:

CLO/PSO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7
CLO-1	3	3	3	3	1	3	--
CLO-2	3	1	2	1	1	3	--
CLO-3	3	3	1	3	1	3	--
CLO-4	3	3	2	2	2	3	--
CLO-5	3	3	2	3	3	3	--

Advance application-3; Intermediate level-2; Basic level-1

Mapping of Course learning outcomes with Program Outcomes:

CO/PSO	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	3	2	2	2	3
CLO-2	3	2	--	2	3
CLO-3	3	3	1	--	--
CLO-4	3	3	2	--	--
CLO-5	3	3	2	--	--

Advance application-3; Intermediate level-2; Basic level-1

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K 3	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 4	2	K1 & K2	1	K1	2 (K2&K2)	1(K3)
3.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
4.	CLO 4	Up to K 2	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
5.	CLO 5	Up to K 4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1 Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K2 Level)	1 Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1 Question from Unit-IV (K3 Level)
		2 Questions from Unit-IV (K4 Level)	1 Question from Unit-III (K3 Level)
		2 Questions from Unit-V (K3 Level)	1 Question from Unit-V (K4 Level)

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

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THE MADURA COLLEGE (Autonomous), MADURAI – 625 011
(AFFILIATED TO MADURAI KAMARAJ UNIVERSITY)
RE-ACCREDITED (3rd Cycle) WITH “A” GRADE BY NAAC

PROGRAMME : B.Sc., Biotechnology

COURSE CODE : 20U3LMC5

COURSE TITLE : Biochemistry

QN.NO : 11507

TIME : 3 Hours

MAX.MARKS :75

Course Objectives

1	To provide students with an understanding of biomolecules, the basic building blocks of living organisms.
2	To focus on the structure, unique properties, biological roles and functions of biomolecules.
3	Emphasis on the association between structure and function of various biomolecules at a chemical level with a biological perspective.

Unit	Description	Hours	K-level	CLO
I	The foundations of biochemistry Chemical basis of life, Water: unique properties, weak interactions in aqueous systems, weak acids & bases - buffering action, pH, hydrogen ion concentration, Henderson and Hasselbach equation. Chemical bond- covalent, ionic, hydrogen, co-ordinate and VanderWaals force.	15	Up to K-2	1
II	Carbohydrates and Glycobiology Definition, classification and functions of carbohydrates. Monosaccharides - structure of aldoses and ketoses; Ring structure of sugars, conformations of sugars, mutarotation, anomers, epimers and enantiomers, oxidation and reduction of sugars, Disaccharides - reducing and non-reducing disaccharides - lactose, maltose, sucrose. Polysaccharides – homo- and heteropolysaccharides. Carbohydrates metabolism – glycolysis and kreb cycle.	15	Up to K-3	2
III	Amino acids and Protein Amino acids- Structure and classification, optical properties, Chemical properties - acid base properties, titration curve. Proteins - classification & general characteristics, primary, secondary, tertiary and quaternary structure of proteins. Enzymes- definition, activation energy, theories of enzymes action - Lock and key model, induced fit theory, classification, nomenclature, enzyme kinetics - MM plot, LB plot, Coenzyme and Cofactors. Factors affecting enzyme activity, Types of inhibitions –reversible and irreversible	15	Up to K-4	3
IV	Lipids and Vitamins Lipids – classification and functions of lipids, fatty acids – saturated and unsaturated, nomenclature, essential fatty acids, Storage lipids - triacyl glycerol and waxes; Structural lipids in membranes – glycerophospholipids, galactolipids and sulpholipids, sphingolipids and sterols. Metabolism of fatty acids- β oxidation of fatty acids. Structure and active forms of water soluble and fat - soluble vitamins; Deficiency diseases, hypervitaminosis	15	Up to K-3	4
V	Nucleic acids Nucleotides - structure and properties of bases, pentoses, nucleosides, Chargaff's rule; Nucleic acid structure – Watson-Crick model of DNA, forms of DNA – A, B & Z; Structure of mRNA, tRNA and rRNA; Properties of nucleic acids – denaturation, renaturation, hyperchromicity. Functions of nucleotides – sources of energy, secondary messengers.	15	Up to K-4	5

Books for study

1. Jain JL. 2005. Fundamentals of Biochemistry. S. Chand & Company Ltd.
2. Stryer L. 2000 Biochemistry, Fourth edition. W.H. Freeman and Company. New York.

Books for reference

1. Satyanarayana U and Chakrapani U. 2009. Biochemistry. Books and Allied Pvt Ltd. Kolkata.
2. Nelson DL and Cox MM. 2013. Lehninger's Principles of Biochemistry. 6th edition. W.H. Freeman and Company. New York.
3. Voet DJ, Voet JG and Pratt CW. Principles of Biochemistry. 2008. 3rd edition. John Wiley & Sons, Inc. New York.

Rationale for Nature of the course

This major core paper focuses on students' ability to understand the macromolecules of living organisms. They would discern about the way by which the macromolecules are metabolised and utilised for various cellular functions.

Activities having direct bearing on Skill development / Employability / Entrepreneurship

- Creating mind map
- Learning the metabolism using flowchart method
- Case study to analysis the disease associated with the disorders in metabolism

Web resources

www.nptel.ac.in

www.swayam.gov.in

Pedagogy

The teaching methods may include Chalk and talk, PowerPoint, demonstrations, assignments, group discussions and Problem solving

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K – Level
CLO-1	Explain the chemical and molecular foundations of life and appreciate the role of water in biological systems.	Up to K-2
CLO-2	Illustrate the structure, properties and roles of carbohydrates.	Up to K-3
CLO-3	Analyse the structure, function and properties of amino acids, proteins and enzymes	Up to K-4
CLO-4	Relate lipids with their biological roles	Up to K-3
CLO-5	Distinguish the various components of nucleic acid and their significance.	Up to K-4

Mapping of Course outcomes with Program Outcomes

CO/PO	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	3	3	1	2	2
CLO-2	3	2	2	2	1
CLO-3	3	3	3	3	3
CLO-4	3	1	2	2	1
CLO-5	3	3	3	3	3

Advance application-3; Intermediate level-2 & Basic level-1

Mapping of Course outcomes with Program specific Outcomes

CLO/PSO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	--	--	--	1
CLO-2	3	2	1	--	--

CLO-3	3	2	3	3	3
CLO-4	3	2	--	3	-
CLO-5	3	2	3	3	3

Advance application-3; Intermediate level-2 & Basic level-1

LESSON PLAN

Unit	Description	Hours	Mode
UNIT - I	Chemical basis of life, Water: unique properties, weak interactions in aqueous systems	5	Chalk and talk
	Weak acids & bases - buffering action, pH, hydrogen ion concentration, Henderson and Hasselbach equation.	5	Chalk and talk Problem solving
	Bonds in biology – Chemical bond- covalent, ionic, hydrogen, coordinate and vanderwaals bond.	5	Chalk and talk
UNIT - II	Definition, classification and functions of carbohydrates. Monosaccharides - structure of aldoses and ketoses	5	Chalk and talk
	Ring structure of sugars, conformations of sugars, mutarotation, anomers, epimers and enantiomers, oxidation and reduction of sugars	5	Chalk and talk
	Disaccharides - reducing and non-reducing disaccharides - lactose, maltose, sucrose. Polysaccharides – homo - and heteropolysaccharides	3	Chalk and talk PPT
	Carbohydrates metabolism – glycolysis and kreb cycle	2	Chalk and talk PPT
UNIT - III	Amino acids- Structure and classification, optical properties (Stereoisomerism), Chemical properties.	5	Chalk and talk
	Proteins - classification & general characteristics, primary, secondary, tertiary and quaternary structure of proteins.	5	Chalk and talk
	Enzymes- definition, activation energy, theories of enzymes action - Lock and key theory, induced fit theory, classification, nomenclature, enzyme kinetics - MM plot, LB plot Co enzyme and cofactors. Factors affecting enzyme activity, Types of inhibitions –reversible and irreversible.	5	Chalk and talk
UNIT-IV	Lipids -classification and functions of lipids, fatty acids – saturated and unsaturated, nomenclature, essential fatty acids, Storage lipids - triacyl glycerol and waxes	5	Chalk and talk PPT
	Structural lipids in membranes – glycerophospholipids, galactolipids and sulpholipids, sphingolipids and sterols. Metabolism of fatty acids- β oxidation of fatty acids.	5	Chalk and talk
	Structure and active forms of water soluble and fat - soluble vitamins; Deficiency diseases, hypervitaminosis	5	
UNIT - V	Nucleotides - structure and properties of bases, pentoses, nucleosides, Chargaff's rule	5	Chalk and talk
	Nucleic acid structure – Watson-Crick model of DNA, forms of DNA – A, B & Z; Structure of mRNA, tRNA and rRNA	5	Chalk and talk Problem solving
	Properties of nucleic acids – denaturation, renaturation, hyperchromity. Functions of nucleotides – sources of energy, secondary messengers.	5	Chalk and talk Problem solving

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Biochemistry Course

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

BLUE PRINT FOR INTERNAL ASSESSMENT – II

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
2.	CLO 4	Up to K 3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – Biochemistry Course

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1	CLO 1	Up to K-2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2	CLO 2	Up to K-3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
3	CLO 3	Up to K-4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)
4	CLO 4	Up to K-3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
5	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)

No. of Questions to be asked	10		5		10	5
No. of Questions to be answered	10		5		5	3
Marks for each Question	1		2		5	10
Total Marks for each Section	10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1 Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K3 Level)	1 Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1 Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K2 Level)	1 Question from Unit-IV (K3 Level)
		2 Questions from Unit-V (K4 Level)	1 Question from Unit-V (K3 Level)

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make inferences with evidences

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THE MADURA COLLEGE (Autonomous), MADURAI – 625 011
(AFFILIATED TO MADURAI KAMARAJ UNIVERSITY)
RE-ACCREDITED (3rd Cycle) WITH “A” GRADE BY NAAC

PROGRAMME : B.Sc., Microbiology
COURSE TITLE : Allied Biotechnology
TIME : 3 Hours

COURSE CODE : 20U3LAC1
QN.NO : 11509
MAX.MARKS :75

Course Objectives

1.	To introduce fundamental concepts, tools and techniques of Biotechnology
2.	To make students aware of various types of fermenters
3.	To motivate the students to aspire for research in Biotechnology
4.	To make students aware of bioethics and patenting process of biological materials

Unit	Description	Hours	K level	CLOs
I	Introduction to Biotechnology Biotechnology-introduction and historical perspectives. Tools of genetic engineering: Nucleases, Ligases, Polymerases, alkaline phosphatase. Vectors –types of vectors: Plasmid - pBR322, pUC, lambda bacteriophage vectors & M13 vectors. Gene transfer methods – transformation, transduction, electroporation, particle bombardment, Calcium mediated gene transfer. Screening of clones – Insertional inactivation, Blue white colony selection, replica plating method.	12	Up to K-3	1
II	Industrial & Microbial Biotechnology Fermentation - definition, process. Bioreactor - types - continuous stirred tank, bubble column, airlift, fluidized and packed bed. Media for industrial fermentation - substrates used as carbon, nitrogen, growth factor sources. Isolation of microbes - enrichment methods, strains from unusual environment, preservation. Genetic improvement of strains-selection of mutants. Regulation of production – feedback, nutrients and induction.	12	Up to K-3	2
III	Plant & animal Biotechnology Plant tissue culture – Composition of plant tissue culture medium. Culture methods -callus culture, suspension culture, Protoplast culture, organ culture – anther & pollen, embryo. Agrobacterium mediated gene transfer – Ti plasmids. Animal Biotechnology – Primary and Secondary cell culture, culture medium, cloning methods – microinjection, embryonic stem cell transfer.	12	Up to K-4	3
IV	Environmental Biotechnology Sewage– composition, waste water treatment : Primary, Secondary – Aerobic and Anaerobic treatment, Tertiary Treatment – Solids removal, nitrogen removal, phosphorous removal, bioremediation types– <i>in situ</i> , <i>ex-situ</i> , Biopesticides – <i>Bacillus thuringiensis</i> , <i>Beauveria bassiana</i> , <i>Fusarium pallidoroseum</i> , Nuclear Polyhedrosis virus, Phytoremediation.	12	Up to K-4	4
V	Intellectual Property Rights & Ethics Intellectual Property Rights, Intellectual Property Protection, Forms of protection. Patents, Copyrights, Trademarks, Ethics- construction and usage of genetically engineered microbes, plants, animals - drug trials.	12	Up to K-2	5

Books for Study

1. Satyanarayana. U. 2009. Biotechnology. Books and Allied Pvt. Ltd.
2. Dubey RC. 2012. A textbook of Biotechnology, S. Chand Publications.

Books for Reference

1. Brown TA. 2012. Gene Cloning and DNA Analysis- An Introduction. Wiley Blackwell.
2. Primrose SB and Twyman R. Principles of Gene Manipulation and Genomics, Blackwell.
3. Dubey RC. 2016. Advanced Biotechnology, S. Chand Publications

Web References

<http://dbtindia.gov.in/>

<https://www.easybiologyclass.com/topic-biotechnology/>

Rationale for Nature of the course

This ancillary paper enriches the understanding of fundamental concepts, principles and techniques used in biotechnology to microbiology major students. Students can get awareness about bioethics and patenting process which are essential practices in modern biology

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Model/chart making for biotechnological process
- Literature survey on recent trends in biotechnology field
- Individual presentation to improve communicative skills

Pedagogy

The teaching methods may include Chalk and talk, PowerPoint, demonstrations, assignments and group discussions and Problem solving.

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K - Level
CLO-1	Relate tools and methods used in biotechnology	Up to K-3
CLO-2	Identify various types fermenters and fermentation process	Up to K-3
CLO-3	Dissect strategies and applications of animal and plant biotechnology	Up to K-4
CLO-4	Analyse significance of biotechnological principles in environmental protection	Up to K-4
CLO-5	Explain the patenting process and elaborate ethics related to biotechnology	Up to K-2

Mapping of Course outcomes with Program Outcomes

CO/PO	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	3	2	2	3	2
CLO-2	3	2	2	2	2
CLO-3	3	2	3	2	2
CLO-4	3	2	3	2	2
CLO-5	3	3	3	2	2

Advance application-3; Intermediate level-2 &Basic level-1

Mapping of Course outcomes with Program specific Outcomes

CLO/PSO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
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CLO-1	3	3	1	1	1
CLO-2	3	2	1	2	2
CLO-3	3	3	2	2	1
CLO-4	3	3	3	3	2
CLO-5	3	3	3	2	2

Advance application-3; Intermediate level-2 & Basic level-1

LESSON PLAN

Unit	Description	Staff Name	Hours	Mode
I	Biotechnology-introduction and historical perspectives. Tools of genetic engineering: Nucleases, Ligases, Polymerases, alkaline phosphatase.		4	Chalk and talk PPT
	Vectors –types of vectors: Plasmid - pBR322, pUC, lambda bacteriophage vectors & M13 vectors		4	Chalk and talk
	Gene transfer methods – transformation, transduction, electroporation, particle bombardment, and Calcium mediated gene transfer. Screening of clones – Insertional inactivation, Blue white colony selection, replica plating method.		4	Chalk and talk PPT
II	Fermentation – process. Bioreactor – types - continuous stirred tank, bubble column, airlift, fluidized and packed bed.		4	Chalk and talk
	Media for industrial fermentation - substrates used as carbon, nitrogen, growth factor sources.		4	Chalk and talk
	Isolation of microbes - enrichment methods, strains from unusual environment, preservation. Genetic improvement of strains-selection of mutants, Regulation of production – feedback, nutrients and induction.		4	Chalk and talk PPT
III	Plant tissue culture – Composition of plant tissue culture medium.		3	Chalk and talk
	Culture methods -callus culture, suspension culture, Protoplast culture, organ culture – anther & pollen, embryo.		5	Chalk and talk PPT
	Agrobacterium mediated gene transfer – Ti plasmids.		2	PPT
	Animal Biotechnology – Primary and Secondary cell culture, culture medium, cloning methods – microinjection, embryonic stem cell transfer.		2	Chalk and talk PPT
IV	Sewage– composition, Waste water Treatment : Primary, Secondary – Aerobic and Anaerobic treatment, Tertiary Treatment		5	Chalk and talk PPT
	bioremediation types – <i>in situ</i> , <i>ex-situ</i> , Phytoremediation		2	Chalk and talk
	Biopesticides – <i>Bacillus thuringiensis</i> , <i>Beauveria bassiana</i> , <i>Fusarium pallidoroseum</i> , Nuclear Polyhedrosis virus.		5	Chalk and talk PPT
V	Intellectual Property Rights, Intellectual Property Protection		4	Chalk and talk
	Forms of protection. Patents, Copyrights, Trademarks		4	Chalk and talk
	Ethics- construction and usage of genetically engineered microbes, plants, animals-drug trials.		4	Chalk and talk
			60	

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Concepts in Biotechnology Course
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K 3	2	K1 & K2	1	K1	2 (K1&K1)	1(K3)
2.	CLO 2	Up to K 3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

BLUE PRINT FOR INTERNAL ASSESSMENT – II

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 3	Up to K 4	2	K1 & K2	1	K1	2 (K3&K3)	1(K4)
2.	CLO 4	Up to K 4	2	K1 & K2	1	K1	2 (K4&K4)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Concepts in Biotechnology Course
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K 3	2	K1 & K2	1	K1	2 (K1&K1)	1(K3)
2.	CLO 2	Up to K 3	2	K1 & K2	1	K1	2 (K3&K3)	1(K3)
3.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2 (K3&K3)	1(K4)

4.	CLO 4	Up to K 4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
5.	CLO 5	Up to K 2	2	K1 & K2	1	K2	2 (K2&K2)	1(K2)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (NoChoice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	42%
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1Question from Unit-I (K3 Level)
		2 Questions from Unit-II (K3 Level)	1Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K4 Level)	1Question from Unit-IV (K3 Level)
		2 Questions from Unit-V (K2Level)	1Question from Unit-V (K2 Level)

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

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THE MADURA COLLEGE (Autonomous), MADURAI – 625 011
(AFFILIATED TO MADURAI KAMARAJ UNIVERSITY)
RE-ACCREDITED (3rd Cycle) WITH “A” GRADE BY NAAC

PROGRAMME : B.Sc., Biotechnology

COURSE CODE : 20U3LSM1

**COURSE TITLE : Biophysics and
Bioenergetics**

QN.NO : 11511

TIME : 3 Hours

MAX.MARKS :75

Course Objectives

1	To understand the concepts of energy in biological system.
2	To gain knowledge about biological oxidation.
3	To apprehend the biophysical property of proteins.

Unit	Description	Hours	K-level	CLO
I	Thermodynamics of Biological system First and second law of thermodynamics, activation energy. Biological systems as open, non-equilibrium systems, Concept of free energy, entropy, heat content of food, bomb calorimetry, Enthalpy, Standard free energy change, actual free energy depend on reactant and product concentration, standard free energy changes are additive	6	Up to K-2	1
II	Redox potential Oxidation and reduction, redox potential and its calculation by Nernst equation, examples of redox potential in biological system. Standard electrode potentials & its determination, its relationship with emf.	6	Up to K-3	2
III	Bioenergetics Concept of energy coupling in biological processes, Energy requirements in cell metabolism, structure and role of mitochondria, high energy phosphate bond, energy currency of cell, Biological oxidation, Electron-transport chain, Oxidative Phosphorylation including chemiosmotic hypothesis. Inhibitors of ETC, inhibitors of oxidative phosphorylation, uncouplers.	6	Up to K-4	3
IV	Protein structure and Kinetics Ramachandra plot, Structure of heme, Structure of Myoglobin and hemoglobin, Oxygen binding mechanism, Oxygen binding co-operativity, Hill equation, Hill coefficient, Allosteric protein, Allostery in hemoglobin, Bohr effect.	6	Up to K-3	4
V	Dynamics of biomolecules Diffusion, Laws of diffusion, Active transport, Facilitated diffusion, Osmosis, Osmotic pressure, Osmoregulation, Viscosity and its biological importance, Surface tension, Factors influencing surface tension.	6	Up to K-4	5

Books for Study

1. Jain JL. 2005. Fundamentals of Biochemistry. S.Chand &company Ltd.
2. Nelson DL and CoxMM. 2013. Lehninger's Principles of Biochemistry. 6th edition. W.H. Freeman and Company. New York.

Books for Reference

1. Voet DJ, Voet JG and Pratt CW. Principles of Biochemistry. 2008. 3rd edition. John Wiley & Sons, Inc. New York.
2. StryerL. Biochemistry. 2000. Fourth edition. W.H. Freeman and Company. New York.

Web Resources

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<http://swayam.gov.in>

Rationale for Nature of the course

The skill based elective paper focuses on the ability to discern about the energy concepts in biological system. They would gain knowledge on various dynamics of macromolecules.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Critical thinking and analysis on concepts related to energetics.
- Problem solving with thermodynamics in biological system.
- Model making to explain electron transport system in Mitochondria and chloroplast.
- Review about the 3D structure with kinetics and function.

Pedagogy

The teaching methods may include Chalk and talk, PowerPoint, demonstrations, assignments and group discussions and Problem solving

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K - Level
CLO-1	Discuss about the energy transfer as applicable to biological system.	Up to K-2
CLO-2	Interpret the concept of redox potential in living system.	Up to K-3
CLO-3	Explain the concept of energy coupling in biological processes.	Up to K-4
CLO-4	Apply the physical process of ligand binding to macromolecules.	Up to K-3
CLO-5	Distinguish the various dynamics of bio molecules.	Up to K-4

Mapping of Course outcomes with Program Outcomes

CO/PO	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	3	2	2	1	2
CLO-2	3	1	3	2	1
CLO-3	3	2	2	2	2
CLO-4	3	2	3	2	3
CLO-5	3	1	2	2	1

Advance application-3; Intermediate level-2 & Basic level-1

Mapping of Course outcomes with Program specific Outcomes

CLO/PSO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	2	1	2	2
CLO-2	3	2	2	2	1
CLO-3	3	3	2	1	1
CLO-4	3	3	3	3	3
CLO-5	3	2	1	2	2

Advance application-3; Intermediate level-2 & Basic level-1

LESSON PLAN

Unit	Description	Hours	Mode
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UNIT - I	First and second law of thermodynamics, activation energy. Biological systems as open, non-equilibrium systems	2	Chalk and talk Problem solving
	Concept of free energy, entropy, heat content of food, bomb calorimetry	2	Chalk and talk Problem solving
	Enthalpy, Standard free energy change, actual free energy depend on reactant and product concentration, standard free energy changes are additive.	2	Chalk and talk Problem solving
UNIT - II	Oxidation and reduction, redox potential and its calculation by Nernst equation	2	Chalk and talk Problem solving
	Examples of redox potential in biological system.	2	Chalk and talk
	standard electrode potentials & its determination , its relationship with emf	2	Chalk and talk
UNIT - III	Concept of energy coupling in biological processes, Energy requirements in cell metabolism	2	Chalk and talk
	structure and role of mitochondria, high energy phosphate bond, energy currency of cell, Biological oxidation	2	Chalk and talk
	Electron-transport chain, Oxidative Phosphorylation including chemiosmotic hypothesis. Inhibitors of ETC, inhibitors of oxidative phosphorylation, uncouplers	2	Chalk and talk PPT
UNIT-IV	Ramachandraplot, Structure of heme, Structure of Myoglobin and hemoglobin, Oxygen binding mechanism	3	Chalk and talk PPT
	Oxygen binding co-operativity, Hill equation, Hill coefficient, Allosteric protein, Allostery in hemoglobin, Bohr effect.	3	Chalk and talk
UNIT - V	Diffusion, Laws of diffusion, Active transport, Facilitated diffusion, Osmosis, Osmotic pressure	2	Chalk and talk
	Osmoregulation, Viscosity and biological importance	2	Chalk and talk Problem solving
	Surface tension, Factors influencing surface tension.	2	Chalk and talk Problem solving

**Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Biophysics and Bioenergetics Course
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)**

BLUE PRINT FOR INTERNAL ASSESSMENT – I

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2

Marks for each Question	1		2		5	10
Total Marks for each Section	4		6		10	30

BLUE PRINT FOR INTERNAL ASSESSMENT – II

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
3.	CLO 3	Up to K 4	2	K1 & K2	1	K1	2 (K3&K3)	1(K4)
4.	CLO 4	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
No. of Questions to be asked			4		3		4	3
No. of Questions to be answered			4		3		2	2
Marks for each Question			1		2		5	10
Total Marks for each Section			4		6		10	30

**Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Biophysics and Bioenergetics Course
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)**

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K-2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K-3	2	K1 & K2	1	K2	2 (K2&K2)	1(K3)
3.	CLO 3	Up to K-4	2	K1 & K2	1	K1	2 (K3&K3)	1(K4)
4.	CLO 4	Up to K-3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
5.	CLO 5	Up to K-4	2	K1 & K2	1	K2	2 (K4&K4)	1(K3)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	19	15.83	
K2	5	6	10	10	31	25.83	
K3	-	-	20	30	50	41.67	42%
K4	-	-	10	10	20	16.67	16%
Total Marks	10	10	50	50	120	100.00	100%

Distribution of Unit-wise questions with K Levels

Section A	Section B	Section C	Section D
2 Questions for each Unit (K1 & K2 Level)	1 Question from each Unit (K1 & K2 Level)	2 Questions from Unit-I (K1 Level)	1 Question from Unit-I (K2 Level)
		2 Questions from Unit-II (K2 Level)	1 Question from Unit-II (K3 Level)
		2 Questions from Unit-III (K3 Level)	1 Question from Unit-III (K4 Level)
		2 Questions from Unit-IV (K3 Level)	1 Question from Unit-IV (K3 Level)
		2 Questions from Unit-V (K4 Level)	1 Question from Unit-V (K3 Level)

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make inferences with evidences





THE MADURA COLLEGE (Autonomous), MADURAI – 625 011
(AFFILIATED TO MADURAI KAMARAJ UNIVERSITY)
RE-ACCREDITED (3rd Cycle) WITH “A” GRADE BY NAAC

PROGRAMME :NME - Biotechnology

COURSE CODE : 20U3LNM1

COURSE TITLE : Introduction to Biotechnology

QN.NO : 11512

TIME : 3 Hours

MAX.MARKS :75

Course Objectives

1	To understand the basic concepts in frontier areas of biotechnology.
2	To provide students with a basic understanding and knowledge of biotechnology
3	To learn the applications of the biotechnology and its products.
4	To inculcate the students on current scenario in biotechnology.

Unit	Description	Hours	K-level	CLO
I	History, importance and scope of Biotechnology Cells – prokaryotic & eukaryotic, animal & plant cells – comparison. Central dogma – definition, Definition – Traditional and modern history of biotechnology, biotechnology in medicine and industries, biotechnology and the environment, biotechnology and agricultural	6	Up to K-2	1
II	Tools of Cloning Genes: definition and structure - Enzymes: restriction endonucleases and ligases. Vectors: definition and types (plasmid and cosmids). Host organisms: prokaryotic – <i>E.coli</i> and eukaryotic organisms – yeast and mouse.	6	Up to K-2	2
III	Transgenic Plants and Animals Transgenic plants: gene transfer methods – particle bombardments, Bt cotton and transgenic tomato, advantages and disadvantages of transgenic plants. Transgenic animal: methods of gene transfer – microinjection, advantages and disadvantages of transgenic animal - Dolly	6	Up to K-2	3
IV	Bio-processing (Fermentation) Definition – Bioreactors: conventional fermenter and its features – Types of fermentation process (Batch, semi-continuous and continuous process) – Downstream process: Separation, concentration, and purification	6	Up to K-2	4
V	Bioethics and biosafety guidelines in Biotechnology Definition - National and International level biosafety regulations - Hazardous materials used in biotechnology (handling and disposal), Intellectual Property Rights (IPR) - Implication of IPRs and agricultural technology – Patents and copyrights	6	Up to K-2	5

Books for Study

1. Satyanarayana. U. 2009. Biotechnology. Books and Allied Pvt. Ltd.
2. Kumaresan. 2015. Biotechnology. Saras Publications.

Books for Reference

1. Balasubramaniam D, CFA Bryce, K Dharmalingam, J Green, KunthalaJayaraman. Concepts in Biotechnology. University Press Reference Book.
2. Dubey RC. 2012. A textbook of Biotechnology. S. Chand Publications.

Web resources

- www.nptel.ac.in
www.swayam.gov.in

Rationale for Nature of the course

The modern biotechnology, involving cloning, vaccine production, genetic engineering, genomics and its assisted techniques, is important technological revolutions in the 21st century. The theoretical knowledge helps to understand the concepts and principles of ancient technology not only for biotechnology students but also non-biotechnology students. However the biotechnological techniques also raise much controversial debate about ethics and biosafety among the people. To address this problem and emphasize the various techniques of biotechnology for all under graduates the course is offering as non-major elective paper.

Activities having direct bearing on Skill development / Employability /Entrepreneurship

- Seminar
- Poster preparation
- Scientific discussion
- Critical thinking and analysis on theoretical concepts

Pedagogy

The teaching methods may include Chalk and talk, PowerPoint, demonstrations, assignments, group discussions and Problem solving

Course Learning Outcomes

On completion of this course the students will be able to

#	CLOs	K – Level
CLO-1	Summarize the historical perspectives of biotechnology	Up to K-2
CLO-2	Relate the tools of genetic engineering with its role.	Up to K-2
CLO-3	Explain the cloning strategies and their applications.	Up to K-2
CLO-4	Outline the bioprocess technology.	Up to K-2
CLO-5	Distinguish the various implications of IPR.	Up to K-2

Mapping of Course outcomes with Program Outcomes

CO/PO	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	3	1	2	2	2
CLO-2	3	1	1	1	2
CLO-3	3	2	2	3	1
CLO-4	3	1	3	2	1
CLO-5	3	3	3	3	1

Advance application-3; Intermediate level-2 & Basic level-1

Mapping of Course outcomes with Program specific Outcomes

CLO/PSO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	2	1	2	1
CLO-2	3	2	1	2	2
CLO-3	3	2	3	3	3
CLO-4	3	2	2	3	2
CLO-5	3	2	3	3	3

Advance application-3; Intermediate level-2 & Basic level-1

LESSON PLAN

Unit	Description	Hours	Mode
UNIT - I	Definition – Traditional and modern history of biotechnology – biotechnology tree.	3	Chalk and talk

	-Biotechnology in medicine and industries, biotechnology and the environment, biotechnology and agricultural	3	Chalk and talk Problem solving
UNIT - II	Genes: definition and structure - Enzymes: restriction endonucleases and ligases.	2	Chalk and talk
	Vectors: definition and types (plasmid and cosmids).	2	Chalk and talk
	Host organisms: prokaryotic – <i>E.coli</i> and eukaryotic organisms – yeast and mouse. Methods of gene transfer - transformation and electroporation	2	Chalk and talk PPT
UNIT - III	Transgenic plants: gene transfer methods – particle bombardments, Bt cotton and transgenic tomato, advantages and disadvantages of transgenic plants.	3	Chalk and talk
	Transgenic animal: methods of gene transfer – microinjection, advantages and disadvantages of transgenic animal - Dolly	3	Chalk and talk
UNIT-IV	Definition – Bioreactors: conventional fermenter and its features – Types of fermentation process	3	Chalk and talk PPT
	Downstream process: Separation, concentration, and purification	3	Chalk and talk
UNIT - V	Definition - National and International level biosafety regulations - Hazardous materials used in biotechnology (handling and disposal)	3	Chalk and talk
	Intellectual Property Rights (IPR) - Implication of IPRs and agricultural technology – Patents and copyrights	3	Chalk and talk

**Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Introduction to Biotechnology Course (CIA-I & II)
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)**

CLOs	K- Level	Section A		Section B		Section C	
		Short Answers		(Either/or Choice)		(Open Choice)	
		No. of Questions	K- Level	No. of Questions	K- Level	No. of Questions	K- Level
CLO x	Up to K2	1	K1	1	K2/K2	1	K1
CLO y	Up to K2	2	K1	1	K2/K2	2	K1
No. of Questions to be asked		3		2		3	
No. of Questions to be answered		3		2		2	
Marks for each question		2		7		10	
Total Marks for each section		6		14		20	

Distribution of Section-wise Marks with K Levels (CIA I & II)

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated %
K1	6	-	30	-	36	56.25	
K2	-	28	-	-	28	43.75	

K3	-	-	-	-	-	-	-
K4	-	-	-	-	-	-	-
Total Marks	6	14	30	-	64	100.00	100%

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – Introduction to Biotechnology Course
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

Units	CLOs	K-Level	Section – A		Section – B		Section – C	
			Short Answers		(Either / or Choice)		(Open Choice)	
			No. of Questions	K-Level	No. of Questions	K-Level	No. of Questions	K-Level
1	CLO 1	Up to K2	1	K1	1	K2/K2	1	K1
2	CLO 2	Up to K2	1	K1	1	K2/K2	1	K1
3	CLO 3	Up to K2	1	K1	1	K2/K2	1	K1
4	CLO 4	Up to K2	1	K1	1	K2/K2	1	K1
5	CLO 5	Up to K2	1	K1	1	K2/K2	1	K1
No. of Questions to be asked			5		5		5	
No. of Questions to be answered			5		5		3	
Marks for each question			2		7		10	
Total Marks for each section			10		35		30	

Distribution of Section-Wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (No Choice)	Section D (No Choice)	Total Marks	% of Marks (without choice)	Consolidated
K1	10	-	50	-	60	46.15	100
K2	-	70	-	-	70	53.85	
K3	-	-	-	-	-	-	-
K4	-	-	-	-	-	-	-
Total Marks	10	35	50	-	130	100.00	100

K1 – Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

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Unit-I: History, Importance and scope of Biotechnology

Section-A [K-1]

1. Comment on central dogma.
2. Define fermentation
3. Mention the significance of lactic acid bacteria
4. What is gene therapy?
5. Define bioremediation.
6. Define biotechnology
7. What is golden rice?
8. List any 4 characters of mitochondria.
9. Define nucleus.
10. Give few examples for traditional biotechnological approach.

Section - B [K-2]

1. Describe the traditional & modern approaches of biotechnology.
2. Write about the role of biotechnology in agriculture.
3. Illustrate the prokaryotic cells with suitable diagram.
4. Explain the animal cells with suitable diagram.

Section - C [K-1]

1. Explain in detail about the central dogma of molecular biology.
2. Compare and contrast plant and animal cells.
3. Compare and contrast prokaryotic and eukaryotic cells.

Unit II: Tools of Cloning

Section - A [K-1]

1. What are palindromic sequences?
2. Define gene.
3. Show the vector map of pBR322
4. Elaborate expression and cloning vectors
5. Summarize any 4 key features of pUC 18 vectors
6. Mention the action of ligase enzyme
7. Why yeast cells used to clone genes for eukaryotic cell?
8. Define cloning vector.
9. What are plasmids
10. Mention any 2 advantages to use *E.coli* as cloning vector.

Section - B [K-2]

1. Outline the applications of restriction enzymes in biotechnology.
2. Discuss the characteristic features of plasmid vectors.
3. Illustrate the vector map of pBR322 with description.
4. Explain about the use of yeast in biotechnology.

Section - C [K-1]

1. Explain about restriction endonucleases types, nature of cut and their applications
2. Write about various steps involved in rDNA technology

Unit III: Transgenic Plants and Animals

Section - A [K-1]

1. List some of the genetically engineered organisms.
2. Represent a flow chart for construction of a transgene
3. What is Bt cotton.
4. Define transgenic animals.
5. What is microinjection?
6. List any two gene transfer method used to produce transgenic plants.
7. Mention the significance of Dolly.
8. Comment of transgenic potato.

Section - B [K-2]

1. Prepare the methodology to construct the transgenic sheep –Dolly
2. Write about gene transfer method used in plant cells & tissues
3. Write the advantages and disadvantages of transgenic plants.
4. How will you transfer a gene using particle bombardment method

Section - C [K-1]

1. Prepare the methodology to construct the Bt Cotton.
2. Explain about the microinjection to develop transgenic animals.
3. Write the advantages and disadvantages of transgenic animals.

Unit IV: Bio-processing [Fermentation]

Section - A [K-1]

1. Define fermentation.
2. Define bioreactors.
3. What is bioprocess technology?
4. List any 4 types of bioreactors
5. What is downstream process?

Section - B [K-2]

1. Describe about the common features of conventional bioreactors.
2. Explain about the advantage and disadvantage of solid state fermentation.
3. Explain about the various carbohydrate source used as energy form the industrial fermentation.
4. Describe about the various stages in bacterial cell growth.
5. Using a flow chart describe about the various stages in downstreaming process.

Section - C [K-1]

1. What are the various steps in the operation of conventional bioreactors?
2. Describe in detail about the solid liquid separation in downstream process.
3. Explain in detail about the various methods followed to release the intracellular products in downstream process.

UNIT V: Bioethics and Biosafety guidelines in Biotechnology

Section - A [K-1]

1. Define biosafety
2. Define genetically modified organisms [GMOs]
3. Define containment
4. What are GEMs and give an example.
5. Name any two organisation related to biosafety
6. What is a patent?
7. What is the validity of a patent?

Section - B [K-2]

1. What is Risk assessment? Explain the various levels of risk assessment.
2. What are various forms of IPR protection?
3. What do you know about the various harmonization of patent law?
4. How do you justify the need for Plant breeder's right?
5. What do you know about choice of IPR protection?
6. What are the advantages and disadvantages of GMO's?

Section - C [K-1]

1. What do you know about the different types of containment? Explain with suitable examples
2. What are the biosafety guidelines followed in India?
3. Write the procedure to fill a patent.