

OBJECTIVES: To enable the students to

1. Learn the diversity and classification of living organisms.
2. Understand the chemical, cytological, evolutionary and genetic principles of living organisms.
3. Familiar with the basic concept of cell biology and genetics.

COURSE OUTCOMES: Students will

- **CO1:** Be aware of the principles of classification and preservation of biodiversity.
- **CO2:** Understand the plant anatomical, physiological and reproductive processes.
- **CO3:** Be familiarized with animal classification, physiology, embryonic development and their economic importance.
- **CO4:** Be known cell components, cell processes like cell division, heredity and molecular processes.
- **CO5:** Comprehend the chemical principles in shaping and driving the macromolecules and life processes.

Unit-I: Introduction to systematics, taxonomy and ecology

1. Systematics – Definition and concept, Taxonomy – Definition and hierarchy.
2. Nomenclature – ICBN and ICZN, Binomial and trinomial nomenclature.
3. Ecology – Concept of ecosystem, Biodiversity and conservation.
4. Pollution and climate change.

Unit-II: Essentials of Botany

1. The classification of plant kingdom.
2. Plant physiological processes (Photosynthesis, Respiration, Transpiration, phytohormones).
3. Structure of flower – Micro and macro sporogenesis, pollination, fertilization and structure of mono and dicot embryos.
4. Mushroom cultivation, floriculture and landscaping.

UNIT III: Essentials of Zoology

1. The classification of Kingdom Animalia and Chordata.
2. Animal Physiology – Basics of Organ Systems & their functions, Hormones and Disorders
3. Developmental Biology – Basic process of development (Gametogenesis, Fertilization, Cleavage and Organogenesis)
4. Economic Zoology – Sericulture, Apiculture, Aquaculture.

Unit-IV: Cell biology, Genetics and Evolution

1. Cell theory, Ultrastructure of prokaryotic and eukaryotic cell, cell cycle.
2. Chromosomes and heredity – Structure of chromosomes, concept of gene.
3. Central Dogma of Molecular Biology.
4. Origin of life.

Unit-V: Essentials of chemistry

1. Definition and scope of chemistry, applications of chemistry in daily life.
2. Branches of chemistry.
3. Chemical bonds – ionic, covalent, non-covalent – Vander Waals, hydrophobic, hydrogen bonds.
4. Green chemistry.

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3. Jordan E.L., Verma P.S., 2018. Chordate Zoology. S. Chand publishers, New Delhi, India.
4. Rastogi, S.C., 2019. Essentials of animal physiology. 4th Edition. New Age International Publishers.
5. Verma P.S., Agarwal V.K., 2006. Cell biology, genetics, Molecular Biology, Evolution and Ecology. S. Chand publishers, New Delhi, India.
6. Satyanarayana U., Chakrapani, U., 2013. Biochemistry. 4th Edition. Elsevier publishers.
7. Jain J.L., Sunjay Jain, Nitin Jain, 2000. Fundamentals of Biochemistry. S. Chand publishers, New Delhi, India.
8. Karen Timberlake, William Timberlake, 2019. Basic chemistry. 5th Edition. Pearson publishers.
9. Subrata Sen Gupta, 2014. Organic chemistry. 1st Edition. Oxford publishers.

ACTIVITIES:

1. Make a display chart of life cycle of nonflowering plants.
2. Make a display chart of life cycle of flowering plants.
3. Study of stomata
4. Activity to prove that chlorophyll is essential for photosynthesis.
5. Study of pollen grains.
6. Observation of pollen germination.
7. Ikebana.
8. Differentiate between edible and poisonous mushrooms.
9. Visit a nearby mushroom cultivation unit and know the economics of mushroom cultivation.
10. Draw the Ultrastructure of Prokaryotic and Eukaryotic Cell.
11. Visit to Zoology Lab and observe different types of preservation of specimens.
12. Hands-on experience of various equipment – Microscopes, Centrifuge, pH Meter, Electronic Weighing Balance, Laminar Air Flow.
13. Visit to Zoo / Sericulture / Apiculture / Aquaculture unit.
14. List out different hormonal, genetic and physiological disorders from the society

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1. Gerard J., Tortora, Berdell R. Funke, Christine L. Case., 2016. Microbiology: An Introduction. 11th Edition. Pearson publications, London, England.
2. Micale, J. Pelczar Jr., E.C.S. Chan., Noel R. Kraig., 2002. Pelczar Microbiology. 5 th Edition. McGraw Education, New York, USA.
3. Sathyanarayana U., Chakrapani, U., 2013. Biochemistry. 4th Edition. Elsevier publishers.
4. Jain J.L., Sunjay Jain, Nitin Jain, 2000. Fundamentals of Biochemistry. S. Chand publishers, New Delhi, India.
5. R.C. Dubey, 2014. Advanced Biotechnology. S. Chand Publishers, New Delhi, India.
6. Colin Ratledge, Bjorn, Kristiansen, 2008. Basic Biotechnology. 3rd Edition. Cambridge Publishers.
7. U. Sathyanarayana, 2005. Biotechnology. 1st Edition. Books and Allied Publishers pvt. ltd., Kolkata.
8. Upadhyay, Upadhyay and Nath. 2016. Biophysical Chemistry, Principles and Techniques. Himalaya Publishing House.
9. Arthur M. Lesk. Introduction to Bioinformatics. 5th Edition. Oxford publishers.
10. AP Kulkarni, 2020. Basics of Biostatistics. 2nd Edition. CBS publishers.

ACTIVITIES:

1. Identification of given organism as harmful or beneficial.
2. Observation of microorganisms from house dust under microscope.
3. Finding microorganism from pond water.
4. Visit to a microbiology industry or biotech company.
5. Visit to a waste water treatment plant.
6. Retrieving a DNA or protein sequence of a gene.’
7. Performing a BLAST analysis for DNA and protein.
8. Problems on biostatistics.
9. Field trip and awareness programs on environmental pollution by different types of wastes and hazardous materials.
10. Demonstration on basic biotechnology lab equipment.
11. Preparation of 3D models of genetic engineering techniques.
12. Preparation of 3D models of transgenic plants and animals.

[NOTE: In the colleges where there is availability of faculty for microbiology and biotechnology, those chapters need to be handled by microbiology and biotechnology faculty. In other colleges, the above topics shall be dealt by Botany and Zoology faculty]

SYLLABUS

OBJECTIVES: To enable the students to

1. Comprehend the structure, properties and functions of biomolecules.
2. Learn about structure and functions of DNA, RNA, Vitamins & bioenergetics.
3. Have expertise in characterization of biomolecules using analytical techniques.
4. Get insight on principles of spectroscopy, microscopy & techniques.
5. Understand the basic concept on biostatistics.

COURSE OUTCOMES: Students will

- **CO1:** Be aware of structure and properties of carbohydrates, proteins and lipids.
- **CO2:** Be familiarized with DNA & RNA; and have insight into glucose metabolism
- **CO3:** Be acquainted with different methods in centrifugation, chromatography & electrophoresis
- **CO4:** Be proficient in concepts of spectroscopy, microscopy and radioactivity.
- **CO5:** Acquire knowledge on various methods in statistics

Unit-I: Carbohydrates, Proteins and Lipids

1. Classification, structure, properties of carbohydrates, amino acids, peptide bond and peptides.
2. Classification, structure (primary, secondary, tertiary, quaternary) and functions of proteins. denaturation and renaturation of proteins.
3. Classification structure and properties of saturated and unsaturated fatty acids.

Unit-II: Nucleic acids, Vitamins and Bio-energetics

1. Structure and functions of DNA and RNA.
2. Source, structure, biological role and deficiency manifestation of vitamins A, B, C, D, E and K. Free energy, entropy, enthalpy and redox potential.
3. High energy compounds, Electron-Transport System and Oxidative Phosphorylation.

UNIT III: Centrifugation, Chromatography and Electrophoresis

1. Basic principles of sedimentation and types of centrifugations.
2. Principle, instrumentation and application of partition, absorption, paper, TLC, ion exchange, gel permeation, affinity chromatography.
3. Basic principles and types of electrophoresis, factors affecting electrophoretic migration. PAGE (Native, SDS-PAGE). Introduction to 2D electrophoresis & Isoelectric Focusing.

Unit-IV: Spectroscopy, Microscopy and Radioactivity

1. Beer-Lambert law, light absorption and transmission. Extinction coefficient. Design and applications of photoelectric colorimeter and UV-visible spectrophotometer. Introduction to crystallography and application.
2. Types and design of microscopes - compound, phase contrast, fluorescent electron microscopy (TEM, SEM).
3. Introduction to radioisotopes, measurement of radioactivity (scintillation counter and autoradiography).

Unit-V: Biostatistics

1. Mean, median, mode, standard deviation
2. One-way ANOVA, Two-way ANOVA.
3. T-test, F-test and chi-square.

REFERENCES

1. Outlines of Biochemistry, 5th Edition, (2009), Erice Conn & Paul Stumpf; John Wiley and Sons, USA
2. Principles of Biochemistry, 4th edition, (1997), Jeffory Zubey; McGraw-Hill College, USA
3. Principles of Biochemistry, 5th Edition (2008), Lehninger, David Nelson & Michael Cox; W.H. Freeman and Company, NY
4. Fundamentals of Biochemistry, 3rd Edition (2008), Donald Voet & Judith Voet; John Wiley and Sons, Inc. USA
5. Biochemistry, 7th Edition, (2012), Jeremy Berg & Lubert Stryer; W.H.Freeman and Company, NY
6. An Introduction to Practical Biochemistry, 3rd Edition, (2001), David Plummer; Tata McGraw Hill Edu. Pvt.Ltd. New Delhi, India
7. Biochemical Methods, 1st Edition, (1995), S.Sadashivam, A.Manickam; New Age International Publishers, India
8. Textbook of Biochemistry with Clinical Correlations, 7th Edition, (2010), Thomas M. Devlin; John Wiley and Sons, USA
9. Proteins: biotechnology and biochemistry, 1st edition, (2001), Gary Walsch; Wiley, USA
10. Biochemical Calculations, 2nd Ed., (1997), Segel Irvin H; John Wiley and Sons, NY
11. Biophysical Chemistry Principles & Techniques Handbook, (2003), A. Upadhyay, K. Upadhyay, and N. Nath

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PRACTICAL SYLLABUS

OBJECTIVES: To enable the students to –

- Expertise with sophisticated techniques
- Familiarize on quantitative and qualitative estimations of biomolecules

COURSE OUTCOMES: Students will

- **CO1:** Attain knowledge in quantitative estimation of biomolecules.
- **CO2:** Be proficient in separation of molecules with regard to their physico-chemical criterion.
- **CO3:** Be skillful in statistical methods.

COURSE:

1. Introduction to basic instruments (Principle standard operation procedure) demonstration and record
2. Calculation of molarity, normality and molecular weight of compounds.
3. Qualitative analysis of carbohydrates (sugars)
4. Quantitative analysis of carbohydrates
5. Quantitative estimation of protein - Lowery method
6. Estimation of DNA by diphenylamine reagent
7. Estimation of RNA by orcinol reagent
8. Assay of protease activity
9. Preparation of starch from potato and its hydrolyze by salivary amylase
10. Preparation of standard buffer and pH determination
11. Separation of amino acids by paper chromatography
12. Separation of lipids of TLC
13. Agarose gel electrophoresis
14. Calculation of mean, median and mode

REFERENCES

1. P.Gunasekaran. 2007. Laboratory Manual in Microbiology. New Age International.
2. D O Hall, S E Hawkins. 1974. Laboratory Manual of Cell Biology. British Society for Cell Biology, Published by Crane, Russia.
3. Mary L. Ledbetter. 1993. Cell Biology: Laboratory Manual. Edition: 2. Published by Ron Jon Publishing. Incorporated.
4. Gunasekaran, P. 2009. Laboratory Manual in Microbiology. 1st Edition. New Age International Publishers.

5. Dr. T. Sundararaj. Microbiology Laboratory Manual. 2005. Dr.A.L. MPGIBMS, University of Madras, Taramani, Chennai – 600 113.
6. James G. Cappuccino and Natalie Sherman. 2013. Microbiology: A Laboratory Manual. 10th Edition. Benjamin Cummings.
7. Dr. David A Thompson. 2011. Cell and Molecular Biology Lab Manual.

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SYLLABUS

OBJECTIVES: To enable the students to

1. Comprehend the historical perspective of microbiology, techniques of studying and culturing of microorganisms.
2. Get knowledge on classification of microbes and their industrial applications.
3. Learn about cell structure and function.
4. Understand the cell signaling and control mechanisms.
5. Get an insight of genome organization of prokaryotic and eukaryotic organisms.

COURSE OUTCOMES: Students will

- **CO1:** Be consciousness in microbial world & expertise in Ultra structure and physiology.
- **CO2:** Be approved in characterization of microbial forms with the available methods. Also bolster about viruses and bacteriophages
- **CO3:** Acquainted with the ultra structure of nucleus and its organization
- **CO4:** Be proficient in cell cycle and cell division.
- **CO5:** Be expertise in DNA replication & repair, transcription, translation

Unit-I- Scope and Techniques of Microbiology

1. History and contribution of Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister and Alexander Fleming.
2. Ultra structure of bacteria and growth curve. Pure culture techniques.
3. Sterilization techniques, principles and application of physical methods (autoclave, hot air oven, incineration), chemical methods and radiation methods. Simple, gram, acid-fast staining.

Unit-II-Microbial Taxonomy and Metabolism

1. Concepts of microbial species and strains. Classification of bacteria based on morphology, nutrition and environment. General characteristics, transmission and cultivation of viruses.
2. Structure and properties of plant (tobacco mosaic virus, TMV), animal (Newcastle disease virus, NDV), human (Human immunodeficiency virus, HIV) and bacterial viruses (T4 phage). Emerging and reemerging viruses (dengue virus), zoonotic viruses (rabies, SARS-CoV-2).
3. Microbial production of penicillin. Bacterial toxins, tuberculosis, typhoid. Introduction to fungi, algae and mycoplasma.

UNIT III: Cell Structure and Functions

1. Structure, properties and functions of cellular organelles (E.R, Golgi bodies, Mitochondria, Ribosomes and Vacuoles) of eukaryotic cells.
2. Cell cycle and its regulation.
3. Cell division (mitosis and meiosis).

Unit-IV- Cell Signaling

1. Chemical composition and dynamic nature of the membrane.
2. Cell surface receptors
3. Cell signaling and communication (GPCR – cAMP, cGMP, IP3-DAG).

Unit – V - Central Dogma of Molecular Biology

1. Genome organization of prokaryotic and eukaryotic organisms.
2. Enzymes involved in replication, transcription and translation.
3. DNA repair mechanism.

REFERENCES

1. Microbiology–6th Edition, (2006), Pelczar M.J., Chan E.C.S., Krieg N.R.; The McGrawHill Companies Inc. NY
2. Prescott's Microbiology, 8th edition, (2010), Joanne M Willey, Joanne Willey, Linda Sherwood, Linda M Sherwood, Christopher J Woolverton, Chris Woolverton; McGrawHill Science Engineering, USA
3. Textbook of Microbiology, Anantnarayan and Paniker (2017)
4. Cell and Molecular Biology: Concepts and Experiments, 6th Edition, Karp, G. 2010.; John Wiley & Sons. Inc.
5. David A. Thompson. 2011. Cell and Molecular Biology Lab. Manual.
6. Cell Biology & Genetics by Varma & Agarwal (2008-2009) S.Chand Publications.

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PRACTICAL SYLLABUS

OBJECTIVES: To enable the students to –

1. Learn about preparation of media for culturing of various microorganisms.
2. Learn about isolation of microorganisms from different sources.
3. Get the knowledge about staining techniques and biochemical identification of bacteria.
4. Be proficient about different stages of cell division.

COURSE OUTCOMES: Students will

- **CO1:** Get hands on experience on bio-safety instruments
- **CO2:** Be proactive at characterization of microbes
- **CO3:** Be expert in quantification of nucleic acids

COURSE:-

1. Cleaning and preparation of glassware
2. Preparation of nutrient agar medium for bacteria
3. Preparation of PDA medium for fungi
4. Sterilization techniques (autoclave, hot air oven, filter)
5. Isolation of bacteria from soil
6. Simple staining technique
7. Differential staining technique
8. Microbial counting by Haemocytometer
9. Identification of different bacteria
10. Motility test by hanging drop
11. Biochemical identification of bacteria
12. Preparation of pure culture by slab, slant, streak culture
13. Study of stages of cell division
14. Extraction and Isolation of DNA from bacteria.

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1. Microbiology–6th Edition, (2006), Pelczar M.J., Chan E.C.S., Krieg N.R.; The McGrawHill Companies Inc. NY 2.
2. Prescott's Microbiology, 8th edition, (2010), Joanne M Willey, Joanne Willey, Linda Sherwood, Linda M Sherwood, Christopher J Woolverton, Chris Woolverton; McGrawHill Science Engineering, USA 3.
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4. Brock biology of microorganisms, 2003, Brock, T. D., Madigan, M. T., Martinko, J. M., & Parker, J.; Upper Saddle River (NJ): Prentice-Hall, 2003. 5.
5. Genes XI, 11th edition, (2012), Benjamin Lewin; Publisher - Jones and Barlett Inc. USA 6.
6. Molecular Biology of the Gene, 6th Edition, (2008), James D. Watson, J. D., Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R.; Cold Spring Harbour Lab. Press, Pearson Pub. 7.
7. Molecular Biology, 5th Edition, (2011), Weaver R.; McGraw Hill Science. USA 8.
8. Fundamentals of Molecular Biology, (2009), Pal J.K. and Saroj Ghaskadbi; Oxford University Press. 9.
9. Molecular Biology: Genes to Proteins, 4th edition (2011), Burton E Tropp Jones& Bartlett Learning, USA. 10.
10. Cell and Molecular Biology: Concepts and Experiments, 6th Edition, Karp, G. 2010.; John Wiley & Sons. Inc.

VI. CO-Curricular Activities

a) Suggested Co-Curricular Activities

1. Assignments
2. Seminars, Group Discussions on related topics
3. Charts on Replication, cell cycle, cell signaling.

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3. Trans-fection methods (calcium phosphate precipitation, electroporation, Microinjection) and applications.

UNIT – IV: Transgenic Animals & Gene Therapy

1. Production of vaccines, diagnostics, hormones and other recombinant DNA products in medicine (insulin, somatostatin, vaccines)
2. IVF (*In-vitro* Fertilization)
3. Concept of Gene therapy.
4. Concept of transgenic animals – Merits and demerits -ethical issues in animal biotechnology

UNIT V: Bioethics, Bio-Safety and IPR

1. Bioethics in cloning and stem cell research, Human and animal experimentation, animal rights/welfare.
2. Bio-safety-introduction to biological safety cabinets; primary containment for biohazards; bio-safety levels; GLP, GMP.
3. Introduction to IP-Types of IP: patents, trademarks & copyright

REFERENCES

1. Introduction to Plant Tissue Culture..M.K. Razdan ,2003,Science Publishers
 2. Plant Tissue Culture, kalyan Kumar De,199 M7,New Central Book Agency
 3. Plant Tissue Culture : Theory and Practice By S.S. Bhojwani and A. Razdan,1998
 4. Biotechnology – By U. Satyanarayana ;1997
 5. Plant Cell, Tissue and Organ Culture, Applied and Fundamental Aspects By Y.P.S. Bajaj and A. Reinhard ,2001
 6. Introduction to Plant Tissue Culture,M. K. Razdan, 2003,Science Publishers
 7. A Textbook of Biotechnology,R C Dubey,S. 2014,Chand Publishing
 8. Elements of Biotechnology,P. K. Gupta, 1994,Rastogi Publications
 9. R. Ian Freshney, “Culture of animal cells –A manual of basic techniques” 4thedition, John Wiley & Sons, 2000 ,Inc, publication, New York
 10. Daniel R. Marshak, Richard L. Gardner, David Gottlieb “Stem cell Biology” edited by Daniel 2001,Cold Spring Harbour Laboratory press, New York
 11. M.M. Ranga, Animal Biotechnology; Agrobios (India) ,2006.
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PRACTICAL SYLLABUS

OBJECTIVES: To enable the students to –

1. Acquire the techniques and inoculation methods in plant tissue culture.
2. Gain the basic idea about the animal tissue culture
3. Familiarize on quantitative estimation of both antigens of HIV

COURSE OUTCOMES: Students will

- **CO1:** Attain Be expertise in formulating the concentrations of tissue culture media constituents
- **CO2:** Be proficient Capable to identify the economized protocols for both the classical & hybrid varieties, with the available tissue culture concepts.
- **CO3:** Be Able to breed the haploid cultivars and enhance vegetative propagation, virus free stocks, flexible to current agriculture practice
- **CO4:** Be expertise in analyzing the clinical samples through immunodiagnostic methods.

I. COURSE:

1. Plant culture media and composition of MS media
2. Raising of aseptic seedlings
3. Induction of callus from different explants
4. Plant propagation through Tissue culture (shoot tip and Nodal culture)
5. Establishing a plant cell culture (both in solid and liquid media)
6. suspension cell culture
7. Cell count by hemocytometer.
8. Establishing primary cell culture of chicken embryo fibroblasts.
9. Animal tissue culture –maintenance of established cell lines.
10. Animal tissue culture –virus cultivation.
11. Estimation of cell viability by dye exclusion (Trypan blue).
12. ELISA –Demonstration

II. REFERENCES

1. Introduction to Plant Tissue Culture..M.K. Razdan ,2003,Science Publishers
2. Plant Tissue Culture, kalyan Kumar De,199 M7,New Central Book Agency
3. Plant Tissue Culture : Theory and Practice By S.S. Bhojwani and A. Razdan,1998
4. Biotechnology – By U. Satyanarayana ;1997
5. Plant Cell, Tissue and Organ Culture, Applied and Fundamental Aspects By Y.P.S. Bajaj and A. Reinhard ,2001
6. Introduction to Plant Tissue Culture,M. K. Razdan, 2003,Science Publishers
7. A Textbook of Biotechnology,R C Dubey,S. 2014,Chand Publishing
8. Elements of Biotechnology,P. K. Gupta, 1994,Rastogi Publications
9. R. Ian Freshney, “Culture of animal cells –A manual of basic techniques” 4thedition, John Wiley & Sons, 2000 ,Inc, publication, New York
10. Daniel R. Marshak, Richard L. Gardner, David Gottlieb “Stem cell Biology” edited by Daniel 2001,Cold Spring Harbour Laboratory press, New York
11. M.M. Ranga, Animal Biotechnology; Agrobios (India) ,2006.

III. CO-Curricular Activities

a) Suggested Co-Curricular Activities

1. Assignments
 2. Seminars, Group Discussions on related topics
 3. Charts on different medias
 4. Visit to plant tissue culture lab
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SYLLABUS

OBJECTIVES: To enable the students to

1. Acquire knowledge about structure and organization of genetic material.
2. Swot about the basic mechanism in DNA replication.
3. Get an insight on transcription in both prokaryotes and eukaryotes.
4. Gain the basic concepts in gene expression and regulation.
5. Acquire knowledge about genetic code and protein synthesis.

COURSE OUTCOMES: Students will

- **CO1:** Capable to identify the genome structure and organization in both prokaryotes and eukaryotes.
- **CO2:** Be abundant in mechanism and enzymes of DNA replication.
- **CO3:** Able to learn about enzymatic synthesis and features of transcription.
- **CO4:** Be proficient in Lac operon and expression of clustered & mRNA genes.
- **CO5:** Acquire knowledge on determination of protein.

UNIT-I: Genome Structure

1. Watson and Crick model of DNA.
2. Genome organization with specific reference to prokaryotic and eukaryotic genomes; Genome size.
3. Concepts of Genetic Material, Gene, Chromosome and Genome.
4. Experiments to prove DNA as genetic material (Griffith experiment, Hershey-Chase experiment).

UNIT – II: DNA Replication

1. Enzymology of replication: (DNA polymerase-I, Pol-II and Pol-III, helicases, topoisomerases, single strand binding proteins (SSB's), DNA melting proteins, primase & DNA Ligase.
2. Proof of semi-conservative replication, Replication origins (Ori-C).
3. Rolling circle replication of DNA.

UNIT – III: Transcription

1. Enzymatic synthesis of RNA: Basic features of transcription, the structure of prokaryotic RNA polymerase (core enzyme and holo enzyme, sigma factor).
2. Concept of promoter (Pribnow box, -10 and -35 sequences).
3. Four steps of transcription (promoter binding and activation, RNA chain initiation, chain elongation, termination and release).
4. Differences between prokaryotic and eukaryotic transcription.
5. Reverse transcription.

UNIT – IV: Gene Expression and Regulation

1. Regulation of gene expression; Clustered genes.
2. The concept of Regulon & Operon – Negative & Positive control of the Lac-Operon, Trp-Operon.
3. Control of gene expression.
4. Poly and Mono Cistronic m-RNA.

UNIT V: Genetic Code and Protein Synthesis

1. Genetic code: Features of genetic code, Structure of mRNA & tRNA.
2. The adaptor hypothesis, attachment of amino acids to tRNA.
3. Codon – Anticodon interaction: The Wobble hypothesis.
4. Initiation, elongation & termination of Protein synthesis.
5. Differences between prokaryotic and eukaryotic translation.

REFERENCES

1. Cell and Molecular Biology, 8th edition. De Robertis, E.D.P. and De Robertis, E.M.F. 2006; Lippincott Williams and Wilkins, Philadelphia.
 2. Cell Biology, (2017), De Robertis & De Roberis, Blaze Publishers & Distributors Pvt. Ltd.
 3. The Cell: A Molecular Approach. 5th edition. Cooper, G.M. and Hausman, R.E. 2009. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
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 7. D O Hall, S E Hawkins. 1974. Laboratory Manual of Cell Biology. British Society for Cell Biology, Published by Crane, Russia.
 8. Mary L. Ledbetter. 1993. Cell Biology: Laboratory Manual. Edition: 2. Published by Ron Jon Publishing. Incorporated.
 9. Gunasekaran, P. 2009. Laboratory Manual in Microbiology. 1st Edition. New Age International Publishers.
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 11. James G. Cappuccino and Natalie Sherman. 2013. Microbiology: A Laboratory Manual. 10th Edition. Benjamin Cummings.
 12. Dr. David A Thompson. 2011. Cell and Molecular Biology Lab Manual.
 13. George M. Malacinski. 2013. Freifeder's Essentials of Molecular Biology. Narosa Publishing House.
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PRACTICAL SYLLABUS

OBJECTIVES: To enable the students to –

1. Gain the knowledge on quantitative estimation of Nucleic acids.
2. Be trained in isolation of DNA from the different sources.
3. Familiarize on purity analysis of nucleic acids.

COURSE OUTCOMES: Students will

- **CO1:** Be proficient in determination of growth kinetics through UV radiations.
- **CO2:** Attain expertise in quantitative estimation of Nucleic acids.
- **CO3:** Be Able to isolate DNA from different plant resources.
- **CO4:** Be expertise in analyzing the purity of DNA.

I. COURSE:

1. Effect of UV radiations on the growth of microorganisms.
2. Determination of absorption maxima of DNA and RNA and their quantification
3. Quantitative estimation of RNA
4. Quantitative estimation of DNA
5. Isolation of plasmid DNA from bacteria
6. Isolation of genomic DNA from *E.coli*
7. Isolation of DNA from sheep liver
8. Isolation of DNA from plant leaves (Rice or Tobacco or any other plant)
9. Separation of DNA by Agarose gel Electrophoresis
10. Purity analysis of the Nucleic acids

II. REFERENCES

1. Cell and Molecular Biology, 8th edition. De Robertis, E.D.P. and De Robertis, E.M.F. 2006; Lippincott Williams and Wilkins, Philadelphia.
2. Cell Biology, (2017), De Robertis & De Roberis, Blaze Publishers & Distributors Pvt. Ltd.
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13. George M. Malacinski. 2013. Freifeder's Essentials of Molecular Biology. Narosa Publishing House.

III. CO-Curricular Activities

a) Suggested Co-Curricular Activities

1. Assignments
 2. Seminars, Group Discussions on related topics
 3. Charts on Replication, Transcription and Translation.
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SYLLABUS

OBJECTIVES: To enable the students to

1. Acquire knowledge about the history and tools of genetic engineering.
2. Comprehend the usage of cloning vectors.
3. Swot the advanced genetic hybridization techniques.
4. Gain the basic concepts in construction of gene libraries & expressions.
5. Acquire knowledge about gene engineering, mutagenesis & sequencing.

COURSE OUTCOMES: Students will

- **CO1:** Accustomed with the tools & techniques of genetic engineering and molecular cloning.
- **CO2:** Be comprehend about different cloning vectors.
- **CO3:** Acquire insights in probes and PCR reactions.
- **CO4:** Be proficient at DNA library construction & vector screening techniques.
- **CO5:** Acquire knowledge on gene editing, mutagenesis & sequencing.

UNIT-I: Recombinant DNA Technology – 1

1. Basics, history, scope, and recent developments in Genetic Engineering; guidelines; strategies in plant and animal genetic engineering.
2. Molecular tools in genetic engineering – Restriction enzymes: Endo & Exo nucleases. Enzymes used in rDNA Technology: Polymerases, ligases, phosphatases, methylases, Kinases and nucleases.
3. Ligation (cohesive & blunt end ligation) – linkers & adaptor.

UNIT – II: Recombinant DNA Technology – 2

1. Cloning vectors: plasmid -definition, properties and types. pUC19 & pBR322 & phage vectors (λ & M13),
2. Cosmid vectors, Shuttle and expression vectors; YAC (*S.cerevisiae* as a model) & BAC (*E.coli*).
3. Gene transfer methods.
4. Screening and selection of recombinants.

UNIT – III: Techniques in Genetic Engineering

1. Hybridization techniques: Probes (radioactive & non-radioactive), detection.
2. Polymerase Chain Reaction (PCR) – Principle, Applications and types of PCR
3. Labeling of DNA-Nick translation, Random priming method & labeling by primer extension.

UNIT – IV: Gene Libraries and Expression patterns

1. Construction of genomic & c DNA libraries.
2. Vector engineering & codon optimization (Change in mRNA constitution), strategies of gene delivery, *in-vitro* translation
3. Expression in bacteria, yeast, insects, plant & mammalian cells

UNIT V: Gene editing and DNA Sequencing

1. Chromosome engineering, targeted gene replacement.
2. Gene editing, gene regulation & silencing.
3. Site-directed mutagenesis.
4. DNA sequencing – Maxam Gilbert (chemical) & Sanger's, Nicolson sequencing, Pyro-sequencing. Human Genome Project.

REFERENCES

1. Textbook of Biotechnology - 2007, By H.K. Das (Wiley Publications)
2. Principles of Gene Manipulation - 7th edition, 2006, By R.W. Old & S.B. Primrose, Publ: Blackwell
3. Molecular Biology & Biotechnology- 1996, By H.D. Kumar, Publ: Vikas
4. Molecular Biotechnology - 4th edition, 2010, G.R. Click and J.J. Pasternak, Publ: Panima
5. Genes and Genomes – 1991, By Maxine Singer and Paul Berg
6. Genes VII- 2000, By B. Lewin - Oxford Univ. Press
7. Molecular Biology - 4th Edition, 2008, By D. Freifelder, Publ: Narosa Publishing house New York, Delhi
8. Brown TA. (2006). Gene Cloning and DNA Analysis. 5th edition. Blackwell Publishing, Oxford, U.K.
9. Clark DP and Pazdernik NJ. (2009). Biotechnology-Appling the Genetic Revolution. Elsevier Academic Press, USA.
10. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology-Principles and Applications of recombinant DNA. ASM Press, Washington
11. Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7th edition. Blackwell Publishing, Oxford, U.K.
12. Sambrook J, Fritsch EF and Maniatis T. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. Cold Spring Harbor Laboratory Press.

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PRACTICAL SYLLABUS

OBJECTIVES: To enable the students to –

1. Improve the awareness on genetic engineering problems.
2. Be trained in restriction digestion of DNA.
3. Observe the nucleases action on DNA/RNA.
4. Be proficient in isolation of Plasmid DNA

COURSE OUTCOMES: Students will

- **CO1:** Be proficient in transformation in bacteria.
- **CO2:** Attain expertise in restriction digestion and its evaluation.
- **CO3:** Be Able to evaluate the kinetics of nucleases activity.
- **CO4:** Be expertise in isolation of Plasmid DNA.

I. COURSE:

1. Problem in Genetic engineering.
2. Transformation in Bacteria using plasmid
3. Restriction digestion of DNA and its electrophoretic separation.
4. Ligation of DNA molecules and their testing using electrophoresis.
5. Activity of DNAase and RNAse on DNA and RNA.
6. Isolation of Plasmid DNA
7. Demonstration of PCR

II. REFERENCES

1. Textbook of Biotechnology - 2007, By H.K. Das (Wiley Publications)
2. Principles of Gene Manipulation - 7th edition, 2006, By R.W. Old & S.B. Primrose,
Publ: Blackwell
3. Molecular Biology & Biotechnology- 1996, By H.D. Kumar, Publ: Vikas
4. Molecular Biotechnology - 4th edition, 2010, G.R. Click and J.J. Pasternak, Publ:
Panima
5. Genes and Genomes – 1991, By Maxine Singer and Paul Berg
6. Genes VII- 2000, By B. Lewin - Oxford Univ. Press
7. Molecular Biology - 4th Edition, 2008, By D. Freifelder, Publ: Narosa Publishing
house New York, Delhi

8. Brown TA. (2006). Gene Cloning and DNA Analysis. 5th edition. Blackwell Publishing, Oxford, U.K.
9. Clark DP and Pazdernik NJ. (2009). Biotechnology-Appling the Genetic Revolution. Elsevier Academic Press, USA.
10. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology-Principles and Applications of recombinant DNA. ASM Press, Washington
11. Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7th edition. Blackwell Publishing, Oxford, U.K.
12. Sambrook J, Fritsch EF and Maniatis T. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. Cold Spring Harbor Laboratory Press.

III. CO-Curricular Activities

a) Suggested Co-Curricular Activities

1. Assignments
 2. Seminars, Group Discussions on related topics
 3. Visit to instrumentation labs.
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UNIT V: Enzyme Kinetics

1. Michaelis–Menten equation, Factors affecting enzyme activity: substrate concentration, enzyme concentration, pH and temperature.
2. Enzyme inhibition kinetics – competitive, uncompetitive, and non-competitive.
3. Immobilized enzymes and their applications.

REFERENCES

1. Understanding enzymes: Palmer T., Ellis Harwood ltd., 2001.
 2. Enzyme structure and mechanism. Alan Fersht, Freeman & Co. 1997
 3. Principles of enzymology for food sciences: Whitaker Marc Dekker 1972.
 4. Principles of Biochemistry, White. A, Handler, P and Smith.
 5. Biochemistry, Lehninger A.L.
 6. Biochemistry, Lubert Stryer.
 7. Review of physiological chemistry, Harold A. Harper.
 8. Text of Biochemistry, West and Todd.
 9. Metabolic pathways – Greenberg.
-

PRACTICAL SYLLABUS

OBJECTIVES: To enable the students to

1. Learn the basic concepts in immobilization and evaluate the factors.
2. Comprehend various specific enzyme assays.
3. Evaluate the amount of starch from vegetables.
4. Expertise in qualitative determination of carbohydrates and proteins.

COURSE OUTCOMES: Students will

- **CO1:** Familiarized with immobilization & entrapment of enzymes with gels.
- **CO2:** Determine the specific enzyme assays.
- **CO3:** Acquaint with isolation protocols for starch.
- **CO4:** Be proficient in determining the concentrations of carbohydrates and proteins.

I. COURSE:

1. Immobilization of enzymes /cells by entrapment in alginate gel-19. Effect of temperature/pH on enzyme activity.
2. Assay of protease activity.
3. Assay of alkaline phosphatase.
4. Preparation of starch from Potato and its hydrolysis by salivary amylase.
5. Isolation of urease and demonstration of its activity
6. Estimation of amino acids by ninhydrin method
7. Estimation of protein by Biuret method
8. Estimation of glucose by DNS method
9. Estimation of glucose by Benedicts titrimetric method
10. Estimation of total carbohydrates by anthrone method

II. REFERENCES

1. Understanding enzymes: Palmer T., Ellis Harwood ltd., 2001.
2. Enzyme structure and mechanism. Alan Fersht, Freeman & Co. 1997
3. Principles of enzymology for food sciences: Whitaker Marc Dekker 1972.
4. Principles of Biochemistry, White. A, Handler, P and Smith.
5. Biochemistry, Lehninger A.L.
6. Biochemistry, Lubert Stryer.
7. Review of physiological chemistry, Harold A. Harper.

8. Text of Biochemistry, West and Todd.
9. Metabolic pathways – Greenberg.

III. CO-Curricular Activities

a) Suggested Co-Curricular Activities

1. Assignments
 2. Seminars, Group Discussions on related topics
 3. Charts on cycles – Carbohydrate, lipid and amino acid metabolism.
-

2. Hybridoma technology: Monoclonal antibodies and their applications in immuno diagnosis.
3. ELISA, RIA, immuno electrophoretic, Rocket electrophoresis.

REFERENCES

1. Kuby immunology, Judy Owen, Jenni Punt, Sharon Stranford., 7th edition (2012), Freeman and Co., NY
2. Textbook of basic and clinical immunology, 1st edition (2013), Sudha Gangal and Shubhangi Sontakke, University Press, India
3. Immunology, 7th edition (2006), David Male, Jonathan Brostoff, David Roth, Ivan Roitt, Mosby, USA.
4. Immuno diagnostics, 1996, By S.C. Rastogi, Publ: New Age
5. Introduction to Immunology- 2002, C. V. Rao- Narosa Publishing House



PRACTICAL SYLLABUS

OBJECTIVES: To enable the students to –

1. Identify the basic reactions between antigen and antibody.
2. Gain the basic idea about various immunodiagnostics.
3. Familiarize on quantitative estimation of both antigens of HIV

COURSE OUTCOMES: Students will

- **CO1:** Be expertise in evaluating the concentrations of antigen and antibody in blood.
- **CO2:** Be proficient in determination of HCG concentration in urine.
- **CO3:** Be Able to determine the quantity of both antigen and antibody.
- **CO4:** Be expertise in analysing the clinical samples through immunodiagnostic methods.

I. COURSE:

1. Antigen – antibody reaction – determination of Blood group, Cross reactivity
2. Pregnancy test
3. Widal test
4. Ouchterloney immuno diffusion
5. Radial immuno diffusion
6. ELISA
7. Isolation of casein by isoelectric precipitation
8. Production of antibodies and their titration

II. REFERENCES

1. Kuby immunology, Judy Owen, Jenni Punt, Sharon Stranford., 7th edition (2012), Freeman and Co., NY
2. Textbook of basic and clinical immunology, 1st edition (2013), Sudha Gangal and Shubhangi Sontakke, University Press, India
3. Immunology, 7th edition (2006), David Male, Jonathan Brostoff, David Roth, Ivan Roitt, Mosby, USA.

4. Immuno diagnostics, 1996, By S.C. Rastogi, Publ: New Age
5. Introduction to Immunology- 2002, C. V. Rao- Narosa Publishing House

III. CO-Curricular Activities

a) Suggested Co-Curricular Activities

1. Assignments
 2. Seminars, Group Discussions on related topics
 3. Charts on cell mediated immunity.
 4. Models on antibodies.
-

SYLLABUS

OBJECTIVES: To enable the students to

1. Familiar about the concept and areas of bioinformatics.
2. Understand various biological databases.
3. Find the relationships among the species.
4. Awake the basic principles in statistics.
5. Understand the population studies through various statistical methods.

COURSE OUTCOMES: Students will

- **CO1:** Analyse gene annotation and analysis tools in bioinformatics.
- **CO2:** Comprehend Biological databases and retrieve data
- **CO3:** Acquaint in sequence alignments and identify similarities between nucleic acid sequences.
- **CO4:** Be proficient in measurement of central tendency.
- **CO5:** Acquire various test hypothesis.

UNIT-I: History and Scope of Bioinformatics

1. Scope of computers in biological research.
2. Introduction to Bioinformatics: Definition, nature and scope of bioinformatics.
3. Bioinformatics versus computational biology.
4. Branches of bioinformatics. Basic concepts in bioinformatics.

UNIT – II: Biological data bases and Omics

1. Basic concepts of system biology. Protein Data Bases -visualization of proteins using database
2. Overview of computer-aided drug design.
3. Searching sequence database using BLAST.
4. Concept of genomics and proteomics

UNIT – III: Software and Tools

1. Computational phylogenetics –various applications.
2. Phylip software. Microarray,
3. Bio informatics –Experimental design & Over view of data analysis.

UNIT – IV: Basic principles of Statistics

1. Measurement of central tendency (mean, mode and range)
2. Dispersion (standard error and standard deviation).
3. Probability and distribution. Poisson and binomial distributions. Normal distribution

UNIT V: Statistical methods

1. Population and sampling test of significance. Test hypothesis.
2. Student t-test for small samples. ANOVA, Chi2 test for analysis, correlation and regression.
3. Computer applications in Biotechnology

REFERENCES

1. Fowler, J., Cohen, L. and Jarvis, P. (1998). Practical Statistics for Field Biology. John Wiley and Sons, 2nd ed.
 2. Bland, M. (2006). An Introduction to Medical Statistics. Oxford University Press, 3rd ed.
 3. Finney, D.J. (1980). Statistics for Biologists. Chapman and Hall Ltd.
 4. Wayne, W, Daniel (1999). Biostatistics: A Foundation for Analysis in Health Sciences. John Wiley and Sons, 7th ed.
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PRACTICAL SYLLABUS

OBJECTIVES: To enable the students to –

1. Learn and solve the various problems in statistics.
2. Gain the basic idea about various test hypotheses.
3. Familiarize in sequence retrieval from various databases.

COURSE OUTCOMES: Students will

- **CO1:** Be expertise in evaluating the problems in mean, mode and median.
- **CO2:** Be proficient in test hypothesis.
- **CO3:** Be Able to determine the sequence retrieval from NCBI & PDB.

I. COURSE:

1. Mean, Median, Mode
2. Standard deviation, variance and coefficient of variation
3. Testing of hypotheses regarding population mean
4. Testing of hypotheses about the difference between population means
5. Chi-square test
6. Testing of Correlation Coefficient
7. Fitting of simple linear regression
8. Sequence retrieval (protein and gene) from NCBI, Structure download (protein and DNA) from PDB

II. REFERENCES

1. Fowler, J., Cohen, L. and Jarvis, P. (1998). Practical Statistics for Field Biology. John Wiley and Sons, 2nd ed.
2. Bland, M. (2006). An Introduction to Medical Statistics. Oxford University Press, 3rd ed.
3. Finney, D.J. (1980). Statistics for Biologists. Chapman and Hall Ltd.
4. Wayne, W, Daniel (1999). Biostatistics: A Foundation for Analysis in Health

III. CO-Curricular Activities

a) Suggested Co-Curricular Activities

1. Assignments
 2. Seminars, Group Discussions on related topics
 3. Charts on data bases.
-

SYLLABUS

OBJECTIVES: To enable the students to

1. Identify the diseases caused by microbial sources.
2. Understand the general bacteriology of common diseases.
3. Ascertain the fungal, viral and protozoan diseases.
4. Awake the basic principles of gene therapy.
5. Understand the concept of drug discovery and therapeutic applications.

COURSE OUTCOMES: Students will

- **CO1:** Analyse various diseases caused by microbial source.
- **CO2:** Comprehend epidemiology, pathogenicity, disease diagnosis, prevention and control of bacterial diseases.
- **CO3:** Acquaint in mycosis, subcutaneous; pneumonia, mumps, AIDS & malaria.
- **CO4:** Be proficient about gene therapy and viral vectors in gene therapy.
- **CO5:** Acquire knowledge on various neurological disorders.

UNIT-I:

1. Diseases, introduction, types : genetic, chromosomal aberrations, numerical and structural autoimmune disorders
2. Disease caused by microbial sources. mechanism of pathogenicity, pathogenic islands, molecular basis of diseases
3. Antimicrobial compounds and their mode of action

UNIT – II:

1. Characteristics of infectious diseases, herd immunity
2. Disease cycle (source of disease , reservoir, carries) , transmission of pathogens (air borne, contact transmission, and vector transmission)
3. Bacterial diseases –epidemiology, pathogenicity, laboratory, diagnosis, prevention and control of the following diseases –tuberculosis, typhoid, tetanus, leprosy

UNIT – III:

1. General account of fungal diseases : mycosis, subcutaneous and deep
2. General account of viral and protozoan diseases-pneumonia, mumps, AIDS, malaria
3. Brief account of sexually transmitted diseases

UNIT – IV:

1. Gene therapy –*Ex-vivo*, *In-vivo*, *In-situ* gene therapy
2. Strategies of gene therapy, gene augmentation
3. Vectors used in gene therapy, biological vectors –retrovirus, adeno virus, herpes. Synthetic vectors -liposomes, receptor mediate gene transfer

UNIT V:

1. Introduction to drug discovery. Stem cell based drug discovery , drug screening and toxicology
2. Therapeutic applications –neurological disorders -Parkinson’s diseases, Alzheimer’s disease.
3. Antiviral therapy for AIDS, DNA/RNA based diagnosis, hepatitis.

REFERENCES

1. Text book of microbiology R. Ananthanarayana and C.K. Jayaram Paniker, Orient longman 1997
2. Medical microbiology, vol 1 microbial infections: Mackie and Ma Carty, Churchill Livingstone 1996
3. Bailey and Scotts Diagnostic microbiology : Baron EJ Peterson LR and Finegold SM Mosby 1990
4. Broude A.I (1981) Medical microbiology and infectious diseases , W.B Saunders &Co Philadelphia



PRACTICAL SYLLABUS

OBJECTIVES: To enable the students to –

1. Learn the general laboratory guidelines.
2. Be expertise in staining protocols.
3. Familiarize in cultivation of microbes and their characterization.
4. Learn about serological analysis of diseases.

COURSE OUTCOMES: Students will

- **CO1:** Be expertise in evaluating the Laboratory safety regulations.
- **CO2:** Be proficient in various staining techniques.
- **CO3:** Be Able to cultivate and characterize specific bacteria.
- **CO4:** Adopt the serological analysis for sexually transmitted diseases.

I. COURSE:

1. Laboratory Safety Regulations
2. Culture media & isolation of pure culture
3. Smear Preparation & Simple stain
4. Gram stain
5. Culture of bacteria and its cultural characteristics
6. C Reactive protein test
7. Widal test
8. Serological diagnosis of tuberculosis
9. Serological diagnosis of HIV

II. REFERENCES

1. Text book of microbiology R. Ananthanarayana and C.K. Jayaram Paniker, Orient longman 1997
2. Medical microbiology , vol 1 microbial infections : Mackie and MaCarty, Churchill Livingstone 1996

3. Bailey and Scotts Diagnostic microbiology : Baron EJ Peterson LR and Finegold SM
Mosby 1990
4. Broude A.I (1981) Medical microbiology and infectious diseases , W.B Saunders & Co
Philadelphia.

III. CO-Curricular Activities

a) Suggested Co-Curricular Activities

1. Assignments
 2. Seminars, Group Discussions on related topics
 3. Charts/models on bacterial/fungal/viral/protozoan diseases.
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ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM
V SEMESTER **BIOTECHNOLOGY** TIME: 3 Hrs/ Week
BTH-E1-5703 (3) **TECHNIQUES IN NURSERY DEVELOPMENT** Max. Marks: 100
(Skill enhancement course (Elective))

W.e.f 20AH batch

OBJECTIVES: To enable the students to –

- Get awareness on establishment of nursery and related SOP's
- Acquire the necessary equipments and economized administrative principles
- Obtain the sustainable methodologies for sowing and plant let propagation
- Adopt the effective practices for seasonal plantations and to control measures to weed and pests
- Gain comprehensive knowledge on various grafting technology

COURSE OUTCOMES: Students will

- **CO1:** Understand different types of nurseries
- **CO2:** Identify various facilities required to set up of a nursery
- **CO3:** Understand expertise related to various practices in a nursery
- **CO4:** Adopt the efficient SOP's on seasonal plantation and their management
- **CO5:** Acquire skills to get an employment or to become an entrepreneur

UNIT-I: Introduction to Nursery

1. Definition, objectives and importance
2. Basic requirements for a nursery layout and components of a good nursery
3. Types of nurseries
4. Bureau of Indian standards (BIS – 2008) related to nursery

UNIT – II: Nursery Inputs

1. Tools, implements and containers.
2. Nursery media – Electricity, equipment and machinery management
3. Types of nursery beds and their preparations.
4. Precautions and maintenance of nursery beds

UNIT – III: Seeds and Propagules

1. Selection of seed and different sowing methods
2. Use of different plant parts for vegetative propagation to raise nursery
3. Different techniques of vegetative propagation

UNIT – IV: Management Practices

1. Routine seasonal operations in a nursery
2. Supply of water, nutrients and removal of weeds
3. Identification of pests and diseases, control & prevention methods

UNIT V: Grafting Techniques

1. Introduction to grafting, definition, types and tools for grafting
2. Steps involved in simple, splice graft, tongue graft, whip graft, cleft graft and wedge graft
3. Grafting of horticultural & floricultural crops and applications

REFERENCES

1. Ratha Krishnan, M., *et al.* (2014) Plant Nursery
2. Management: Principles and Practices, Central Arid Zone Research Institute– ICMR, Jodhpur, Rajasthan.
3. Vikas Kumar, Anjali Tiwari, Practical manual of Nursery management, Agri – biotech Press, New Delhi.
4. Tarai Ranjan Kumar, (2020) Plant propagation and nursery management, New India Publishers.
5. P.K.Ray, (2020) Essentials of plant nursery management.
6. P.K.Ray, (2012) How to start and operate a Plant Nursery.

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W.e.f 20AH Batch

PRACTICAL SYLLABUS – IIIA

OBJECTIVE: To enable the students to

- To enable the students to learn the techniques of Nursery and its management
- Acquire the techniques, managerial methods and weed & pest management in Nursery

COURSE OUTCOMES: Students will

- **CO1:** Be able to list out different types of nurseries and beds
- **CO2:** Identify the nursery tools, implements and containers.
- **CO3:** Develop skill on potting media preparation and plant production
- **CO4:** Learn the technique of establishing cutting, layering, grafting etc.

PRACTICAL COURSE:

1. Demonstration of different types of nurseries
2. Handling of nursery tools, equipment and types of containers
3. Laying of nursery bed with soil and compost
4. Seed collection, treatment and rising of seedlings on nursery bed
5. Handling of grafting and layering techniques in the nursery
6. Watering, weeding and management of nursery
7. Maintaining of the seedlings / cuttings in the nursery

REFERENCES

1. Ratha Krishnan, M., *et al.* (2014) Plant Nursery
2. Management: Principles and Practices, Central Arid Zone Research Institute– ICMR, Jodhpur, Rajasthan.
3. Vikas Kumar, Anjali Tiwari, Practical manual of Nursery management, Agri – biotech Press, New Delhi.
4. Tarai Ranjan Kumar, (2020) Plant propagation and nursery management, New India Publishers.
5. P.K.Ray, (2020) Essentials of plant nursery management.
6. P.K.Ray, (2012) How to start and operate a Plant Nursery.

I. Co-curricular activities:

a) Mandatory: (Training of students by teacher on field related skills:15hrs)

- 1. For teachers:** Training of students by teacher in laboratory and field for a total of 15hrs on nursery types and infrastructure of a nursery. Pre sowing treatment and seed sowing methods. Plucking, transplantation, layering and grafting methods
- 2. For students;** Visit to local nursery farm, observing the crop growth raised in nurseries. Submission of field work report of 10 pages in the prescribed format.
- 3.** Maximum marks for field work report: 05
- 4.** Suggested format for field work report: Title page, student details, content page, introduction, work done, findings, conclusion and acknowledgements.
- 5.** Unit test(IE)

b) Suggested co-curricular activities:

- 1.** Visit to local nurseries
- 2.** Learning techniques of basic tools and instruments handling related to fieldwork
- 3.** Sowing of seeds by adopting different methods, grafting and layering techniques
- 4.** Training of students by related subject experts
- 5.** Attending special lectures, group discussions and seminars on related topics
- 6.** Preparation of videos on nursery media preparation and application

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W.e.f 20AH Batch

SYLLABUS

OBJECTIVES: Enable the students to –

- Get a concept on advantages and disadvantages of hydroponics
- Know the formulations of media constituents
- Understand various nutritional systems for hydroponics
- Be aware of available techniques in hydroponics
- Ascertain the skills for crop cultivation

COURSE OUTCOMES: Students will

- **CO1:** Understand the concept of hydroponics and acquire the knowledge on soilless cultivation system
- **CO2:** Be capable to evaluate the role of both organic & inorganic nutrients and as well as abiotic factors
- **CO3:** Able to formulate the various media for hydroponics cultivation
- **CO4:** Be expertise in different techniques of hydroponics
- **CO5:** Be proficient in several cultivation methods for crop plants

UNIT-I: INTRODUCTION TO SOIL LESS CULTURE

1. Definition, history and origin of soilless culture
2. Present status of hydroponics – contrasts with soil based culture
3. Applications and future developments

UNIT – II: MACRONUTRIENTS & MICRONUTRIENTS

1. Functions and effect on plants
2. Deficiency symptoms of the following essential minerals
N, P, Mg, Ca, K, S, Fe, Mn, Cu, Zn, B, Mo
3. Deficiency and symptoms of physical factors: Light (Quantity, energy & Photoperiodism etc.), Temperature (Heating & Cooling), Humidity, CO₂, ppm, pH & TDS

UNIT – III: CULTURAL CONDITIONS

1. Plant nutrition – Inorganic salts (Fertilizers): Major & minor nutrients formulating, monitoring and analysing
2. Selection of fertilizers and media used for hydroponics – Expanded clay, Rock wool, Coir, Perlite, Pumice, Vermiculite and Sand gravel etc.
3. Weed management, diseases and pest control

UNIT – IV: TECHNIQUES IN HYDROPONICS

1. Static solution culture
2. Continuous – flow solution culture & aeroponics

UNIT V: Cultivation of crop plants by hydroponics

1. Passive sub – irrigation, Ebb and flow or flood and chain irrigation
2. Deep water culture protocols for –
 - a) Tomato cultivation through Dutch bucket method
 - b) Chilly cultivation through Nutrient Film Technique system
 - c) Spinach through Raft system
3. Measurements of crop plant productivity

REFERENCES

1. Keith Roberto, *How to Hydroponics*. The future Garden Press NewYork.4thEdition
2. Howard M. Resh. *Hobby Hydroponics*. CRC Press,USA.
3. Prasad S and Kumar U. *Green House management for Horticultural crops*.Agro-Bios India.
4. Dahama A.K. *Organic Farming for Sustainable Agriculture*. Agrobios,India
5. Subba Rao N.S. (1995).*Biofertilizers in Agriculture and Forestry*. Oxford andIBH Publishing Company. Pvt. Ltd NewDelhi.

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ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM
V SEMESTER **BIOTECHNOLOGY** TIME: 3 Hrs/ Week
BTH-E1-5754 (2) **HYDROPHONICS CULTIVATION** Max. Marks: 50
(Skill enhancement course (Elective))

W.e.f 20AH Batch

PRACTICAL SYLLABUS – IIIB

OBJECTIVE: To enable the students to

1. List out macronutrients, micronutrients- functions and effect on plants, deficiency symptoms.
2. Demonstrate the importance of temperature and light in hydroponics
3. Develop skill of media production for Hydroponics cultivation
4. Equip with the skill of weed management, diseases and pest management

COURSE OUTCOMES: Students will

- **CO1:** Be able to acquire awareness on hydroponic setup and maintain the hydroponic plants/crops
- **CO2:** Demonstrate the skills to manage the pests and diseases
- **CO3:** Explain the cultivation methods for various crops

PRACTICAL COURSE:

1. Handling of tools required for hydroponic setup
2. Preparation of macronutrients and micronutrients solutions/stock cultures
3. Preparation of different media for hydroponic system.
4. Evaluating the effect of bio fertilizers on hydroponic cultivation
5. Weeding management techniques -demonstration
6. Demonstration of pests and diseases control and prevention methods
7. Cultivation of tomato by hydroponic system
8. Cultivation of chilli through hydroponic cultivation

REFERENCES

1. Keith Roberto, *How to Hydroponics*. The future Garden Press New York. 4th Edition
2. Howard M. Resh. *Hobby Hydroponics*. CRC Press, USA.
3. Prasad S and Kumar U. *Green House management for Horticultural crops*. Agro-Bios India.
4. Dahama A.K. *Organic Farming for Sustainable Agriculture*. Agrobios, India
5. Subba Rao N.S. (1995). *Biofertilizers in Agriculture and Forestry*. Oxford and IBH Publishing Company. Pvt. Ltd New Delhi.

Co-curricular activities:

a) Mandatory: (Training of students by teacher on field related skills: 15hrs)

1. **For teachers:** Training of students by teacher in laboratory and field for a total of 15hrs on soilless culture system. Demonstrating importance of nutrients/light/temperature for successful hydroponic cultivation.
2. **For students:** Visit to local Hydroponics cultivation farm, observing the crop growths. Submission of field work report of 10 pages in the prescribed format.
3. Maximum marks for field work report: 05
4. Suggested format for field work report: Title page, student details, content page, introduction, work done, findings, conclusion and acknowledgements.
5. Unit test(IE)

b) Suggested co-curricular activities:

1. Visit to local hydroponics cultivation farm
2. Learning techniques of basic tools and instruments handling related to hydroponics
3. Training of students by related subject experts
4. Preparation of videos on media preparation and application in hydroponics
5. Attending special lectures, group discussions and seminars on related topics

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