ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

I SEMESTER **PATHWAY – PAPER – 1** TIME: 5 Hrs/Week

BSC 1501 (4) INTRODUCTION TO CLASSICAL BIOLOGY Max. Marks: 60

W.e.f. 2023-24 admitted batch (23AK)

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.

REFERENCES

1. Sharma O.P., 1993. Plant taxonomy. 2nd Edition. McGraw Hill publishers.
2. Pandey B.P., 2001. The textbook of botany Angiosperms. 4th edition. S. Chand publishers, New Delhi, India.
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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ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

I SEMESTER **PATHWAY – PAPER – II** TIME: 5 Hrs/Week

BSC 1502 (4) **INTRODUCTION TO APPLIED BIOLOGY** Max. Marks: 100

W.e.f. 2023-24 admitted batch (23AK)

OBJECTIVES: To enable the students to

1. Learn the foundations and principles of applied life-sciences.
2. Comprehend the quantitative and qualitative methods.
3. Familiar with the basics of bioinformatics tools and languages.

COURSE OUTCOMES: Students will

- **CO1:** Be aware of the history, ultrastructure, diversity and importance of microorganisms.
- **CO2:** Understand the structure and functions of macromolecules.
- **CO3:** Be familiarized with the biotechnology principles and its applications in food and medicine.
- **CO4:** Be expertise with the techniques, tools and their uses in diagnosis & therapy.
- **CO5:** Demonstrate the bioinformatics and statistical tools in comprehending the complex biological data.

Unit-I: Essentials of Microbiology and Immunology

1. History and Major Milestones of Microbiology; Contributions of Edward Jenner, Louis Pasteur, Robert Koch and Joseph Lister.
2. Groups of Microorganisms – Structure and characteristics of Bacteria, Fungi, Archaea and Virus.
3. Applications of microorganisms in – Food, Agriculture, Environment, and Industry.
4. Immune system – Immunity, types of immunity, cells and organs of immune system.

Unit-II: Essentials of Biochemistry

1. Biomolecules I – Carbohydrates, Lipids.
2. Biomolecules II – Amino acids & Proteins.
3. Biomolecules III – Nucleic acids -DNA and RNA.
4. Basics of Metabolism – Anabolism and catabolism.

UNIT III: Essentials of Biotechnology

1. History, scope, and significance of biotechnology. Applications of biotechnology in Plant, Animal, Industrial and Pharmaceutical sciences.
2. Environmental Biotechnology – Bioremediation and Biofuels, Biofertilizers and Biopesticides.
3. Genetic engineering – Gene manipulation using restriction enzymes and cloning vectors.
4. Physical, chemical, and biological methods of gene transfer.
5. Transgenic plants – Stress tolerant plants (biotic stress – BT cotton, abiotic stress – salt tolerance). Transgenic animals – Animal and disease models.

Unit-IV: Analytical Tools and techniques in biology – Applications

1. Applications in forensics – PCR and DNA fingerprinting.
2. Immunological techniques – Immunoblotting and ELISA.
3. Monoclonal antibodies – Applications in diagnosis and therapy.
4. Eugenics and Gene therapy

Unit-V: Biostatistics and Bioinformatics

1. Data collection and sampling. Measures of central tendency – Mean, Median, Mode.
2. Measures of dispersion – range, standard deviation and variance. Probability and tests of significance.
3. Introduction, Genomics, Proteomics, types of Biological data, biological databases- NCBI, EBI, Gen Bank; Protein 3D structures, Sequence alignment.
4. Accessing Nucleic Acid and Protein databases, NCBI Genome Workbench.

REFERENCES

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]

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ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM
II SEMESTER BIOTECHNOLGY TIME: 4 Hrs/Week
BTH-Ma-1-2701 (3) BIOMOLECULES AND ANALYTICAL TECHNIQUES
W.e.f. 2023-24 admitted batch (23AK) Max. Marks: 100

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.

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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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ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

II SEMESTER **BIOTECHNOLGY** TIME: 3 Hrs/Week

BTH-Ma-1-2751 (3) **BIOMOLECULES AND ANALYTICAL TECHNIQUES**

W.e.f. 2023-24 admitted batch (23AK) Max. Marks: 50

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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ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

II SEMESTER BIOTECHNOLGY TIME: 4 Hrs/Week

BTH-Ma-2-2701 (3) MICRO BIOLOGY & CELL BIOLOGY Max. Marks: 100

W.e.f. 2023-24 admitted batch (23AK)

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.

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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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ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

II SEMESTER **BIOTECHNOLGY** TIME: 4 Hrs/Week

BTH-Ma-2-2751 (2) **MICRO BIOLOGY & CELL BIOLOGY** Max. Marks: 60

W.e.f. 2023-24 admitted batch (23AK)

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.

REFERENCES

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.
3. Textbook of Microbiology, Anantnarayan and Paniker (2017) 4.

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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ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

III SEMESTER **BIOTECHNOLOGY** TIME: 4 Hrs/Week

BTH 3703 (3) **IMMUNOLOGY AND rDNA TECHNOLOGY** Max. Marks: 100

W.e.f 2021-22 admitted batch (21AI)

OBJECTIVES: To enable the students to –

- Acquainted with concepts of basic immunology
- Awake on vaccines and their active potential
- Learn enzymes used in recombinant DNA technology & cloning vectors
- Know various gene transfer techniques and cloning strategies
- Optimize the biological data by various software tools

COURSE OUTCOMES: Students will

- **CO1:** Be acquainted with the basics of immune system & immune response.
- **CO2:** Familiarize on vaccine strategies and well versed with concepts of immunodiagnostics.
- **CO3:** Accustomed with the tools and techniques of genetic engineering molecular cloning and expression vectors.
- **CO4:** Be acknowledged with various applications of genetic engineering.
- **CO5:** Be proficient in analyzing the biological data by various software tools.

UNIT-I: CONCEPTS, CELLS AND ORGANS OF THE IMMUNE SYSTEM

1. Terminology, antigen, hapten, antibody (types), antigenicity, immunogenicity and types of immunity: Innate and adaptive immunity.
2. Haematopoiesis, organs, tissues, cells and mediators of the immune system (primary and secondary lymphoid organs, lymphocytes and cytokines).
3. Introduction to complement components, MHC.
4. Basic concepts of humoral and cell-mediated immune response.

UNIT-II: VACCINOLOGY AND CLINICAL IMMUNOLOGY

1. Live, killed, attenuated, subunit and recombinant vaccines.
2. Role and properties of adjuvants.
3. Hybridoma technology, monoclonal antibodies and their application in immunodiagnostics.
4. Antigen and antibody interactions - precipitation, agglutination, immune diffusion and ELISA.
5. Introduction to hypersensitivity and autoimmunity.

UNIT-III: TOOLS AND TECHNIQUES OF rDNA TECHNOLOGY

1. Introduction to rDNA technology, steps involved in cloning.
2. Tools of genetic engineering: Cloning vectors – Plasmids & Cosmids & Enzymes – restriction endonucleases and DNA Ligase, Hosts – bacteria and yeast).
3. Principles and application of PCR.
4. Southern, Northern and Western Blotting.
5. DNA sequencing methods: Maxam-Gilbert, Sanger and Site-directed Mutagenesis.

UNIT – IV: CLONING STRATEGIES AND APPLICATIONS OF rDNA TECHNOLOGY

1. cDNA library & construction
2. Methods of gene transfer techniques.
3. Isolation and screening of recombinant clones.
4. Applications of rDNA technology in agriculture (transgenic plants, edible vaccines and antibodies) and medicine (disease diagnosis and DNA fingerprinting).

UNIT V: BIOINFORMATICS

1. Databases (PubMed, NCBI, EMBL and ExPASy)
2. Nucleotide and protein BLAST analysis, CLustal W and phylogenetic tree construction.
3. Introduction to Omics (proteomics, genomics and transcriptomics).
4. Introduction to nanotechnology.

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 ShubhangiSontakke, 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
6. Textbook of Biotechnology - 2007, By H.K. Das (Wiley Publications)
7. Principles of Gene Manipulation - 7th edition, 2006, By R.W. Old & S.B. Primrose, Publ: Blackwell
8. Molecular Biology & Biotechnology- 1996, By H.D. Kumar, Publ: Vikas
9. Molecular Biotechnology - 4th edition, 2010, G.R. Click and J.J. Pasternak, Publ: Panima
10. Genes and Genomes – 1991, By Maxine Singer and Paul Berg
11. Genes VII- 2000, By B. Lewin - Oxford Univ. Press
12. Molecular Biology - 4th Edition, 2008, By D. Freifelder, Publ: Narosa Publishing house New York, Delhi
13. Brown TA. (2006). Gene Cloning and DNA Analysis. 5th edition. Blackwell Publishing, Oxford, U.K.
14. Clark DP and Pazdernik NJ. (2009). Biotechnology-Applying the Genetic Revolution. Elsevier Academic Press, USA.

15. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington
16. Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7thedition. Blackwell Publishing, Oxford, U.K.
17. Sambrook J, Fritsch EF and Maniatis T. (2001). Molecular Cloning-A Laboratory Manual. 3rdedition. Cold Spring Harbor Laboratory Press.
18. Introduction to Bioinformatics – 2007, By V. Kothekar
19. Introduction to Bioinformatics – 2013, By Arthur M. Lesk
20. Bioinformatics: 2001, Sequence and Genome Analysis by David W. Mount, Cold SpringHarbor Laboratory Press
21. Biological Sequence Analysis: 1st Edition, 1998, Probabilistic Models of Proteins and Nucleic Acids by Richard Durbin, Sean R. Eddy, Anders Krogh, Graeme Mitchison, Cambridge University Press
22. Bioinformatics: 2004, A Practical Guide to the Analysis of Genes and Proteins, Andreas D. Baxevanis, B. F. Francis Ouellette, Wiley-Interscience
23. Bioinformatics tools and Resources – free online tools, software packages, Bioinformatics books and Journals, Bioinformatics web-portals.

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ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

III SEMESTER **BIOTECHNOLOGY** TIME: 3 Hrs/Week

BTH 3751 (2) **IMMUNOLOGY AND rDNA TECHNOLOGY** Max. Marks: 50

W.e.f 2021-22 Admitted (21AI Batch)

PRACTICAL SYLLABUS

OBJCECTIVE: To enable the students to

- Comprehend the concepts of immuno diagnostic tests
- To enable the students to learn the techniques of Genetic engineering
- Acquire the knowledge on analysis of genetic material

COURSE OUTCOMES: Students will

- **CO1:** Be expertise in analyzing the clinical samples through immunodiagnostic methods.
- **CO2:** Capable to optimize the protocols for analyzing the DNA samples.
- **CO3:** Understand the concepts in multiplication of DNA copies.

COURSE:

1. Determination of Blood Groups
2. Pregnancy test
3. Widal test
4. Ocuteroloney immunodiffusion
5. Radial immune diffusion
6. ELISA
7. Production of antibodies (theory exercise)
8. Bleeding, separation of serum and storage
9. Lymphoid organs (theory exercise)
10. Isolation of plasmid DNA (alkaline lysis method)
11. Analysis of plasmid DNA by Agarose gel electrophoresis
12. Southern blotting (theory exercise)
13. PCR Amplification (theory exercise)

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1. Textbook of basic and clinical immunology, 1st edition (2013), Sudha Gangal and ShubhangiSontakke, University Press, India
2. Immunology, 7th edition (2006), David Male, Jonathan Brostoff, David Roth, Ivan Roitt, Mosby, USA.
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6. Principles of Gene Manipulation - 7th edition, 2006, By R.W. Old & S.B. Primrose, Publ: Blackwell
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8. Molecular Biotechnology - 4th edition, 2010, G.R. Click and J.J. Pasternak, Publ: Panima
9. Brown TA. (2006). Gene Cloning and DNA Analysis. 5th edition. Blackwell Publishing, Oxford, U.K.
10. Clark DP and Pazdernik NJ. (2009). Biotechnology-Applying the Genetic Revolution. Elsevier Academic Press, USA.
11. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington

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ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

IV SEMESTER **BIOTECHNOLGY** TIME: 4 Hrs/ Week

BTH 4704 (3) **ENVIRONMENTAL & INDUSTRIAL BIOTECHNOLOGY**

W.e.f. 2020-21 admitted batch (20AH) Max. Marks: 100

SYLLABUS

OBJECTIVES: To enable the students to -

- Understand the role of biotechnology in industries.
- Know the use of microbes in the preparations of food and dairy product.
- Understand the role of biotechnology in the environment such bioremediation.

COURSE OUTCOMES: Students will

- **CO1:** Get the insight about the function and organization of industry.
- **CO2:** Be trained for industrial solvents production, with acquired basic design & fermenter operation. Also skilful in verification of protocols for dairy.
- **CO3:** Be proficient on health care products. Also be familiarized in generation and protection of patents, copyrights and trademarks.
- **CO4:** Be appraising the importance of enhancing the green and clean environment.
- **CO5:** Be familiarize with microbial action on crop productivity.

Unit – I: Pollution Types and Control

1. Environmental Biotechnology-Environmental Pollution: Types of pollution-air pollution & its control through Biotechnology,
2. Bio-filters, bio-scrubbers, bio-trickling filter.
3. Water pollution and its management: Measurement of water, pollution, sources of water pollution.
4. Microbiology of waste water treatment, aerobic processes, activated sludge, oxidation ponds, trickling filters, and rotating biological contactors. Anaerobic processes: Anaerobic digesters, upward flow anaerobic sludge blanket reactors.

UNIT-II: Bioremediation

1. Biodegradation and Bioremediation – Concepts & principles of Bioremediation bioremediation of hydrocarbons and its applications
2. Degradation of pesticides and other toxic chemicals by microorganism.
3. Role of genetically engineered microbes, Concept of phyto-remediation, environmental safety guidelines.

UNIT III: Bio-fuels

1. Bio fuels: bio ethanol and biodiesel, microbial groups involved in bio-fuel production & interactions.
2. Factors affecting bio-fuel production,
3. Bio-fertilizers, vermiculture.

Unit IV: Basic principles of Microbial technology

1. Industrially important microbes, its screening, selection and identification.
2. Maintenance and preservation of industrially important microbial cultures. Strain Improvement,
3. Basic concepts of fermentation: types of fermenters, Design of fermenters and applications.

Unit V: Commercial Production of Microbial products

1. Microbial technology products and applications.
2. Microbial production of Organic acids (Lactic acid, citric acid), Amino acids (Glutamic acid, Aspartic acid and Lysine).
3. Fermentation by microbes for food additives: dairy products (Cheese, Yogurt), beverages (Beer,Wine) and antibiotics (Streptomycin, Pencillin)

REFERENCES:

1. K. Vijaya Ramesh, Environmental Microbiology, 2004,MJP Publishers, Chennai.
2. A.G. Murugesan, C. Raja Kumari, Environmental Science & Biotechnology - Theory & Techniques, 2005,MJP Publishers
3. Environmental microbiology by Raina M.Maier Ian L.Pepper & Charles P.Gerba,2000,Academic press
4. Environmental Chemistry, A.K. De. Wiley Eastern Ltd.,2001, New Delhi
5. Introduction of Biodeterioration, D. Allsopp and K.J. Seal, ELBS/Edward Arnold,2008
6. Power un seen: How microbes rule the world. By Dixon, B. Freeman/ Spectrum, 1994,Oxford.
7. Environmental Microbiology. By. Mitchell. R. Wiley,1992, New York
8. Introduction to Environmental Sciences, Y. Anjaneyulu ,2004, BS Publications
9. Industrial Microbiology by A.H.Patel,2009
10. Prescott & Dum (2002) Industrial Micrbiology, Agrabios (India) ,2005,Publishers
11. Creueger W. & Crueger A.A Text of Industrial Microbiology,2000, 2nd Edition, Panima Publishers corp.

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ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

IV SEMESTER **BIOTECHNOLGY** TIME: 2 Hrs/ Week

BTH 4754 (2) **ENVIRONMENTAL & INDUSTRIAL BIOTECHNOLOGY**

W.e.f. 2020-21 admitted batch (20AH) Max. Marks: 50

PRACTICAL SYLLABUS

OBJECTIVE: To enable the student to

- Apply the different principles of Biotechnology in preparation of different industrial products.
- Be proficient in characterizing the water samples of industrial origin.
- Design the protocols for the significant enzymes and beverages.

COURSE OUTCOMES: Students will

- **CO1:** Get hands-on training to evaluate the quality of water samples from industries.
- **CO2:** Proficient in production of active strains from soil.
- **CO3:** Expertise in production and characterization of enzymes and industrial beverages.

COURSE:

1. Detection of coliforms for determination of the purity of potable water.
2. Determination of total dissolved solids of water
3. Determination of Hardness and alkalinity of water sample.
4. Determination of dissolved oxygen concentration of water sample
5. Determination of biological oxygen demand of sewage sample
6. Determination of chemical oxygen demand (COD) of sewage sample.
7. Isolation of industrially important microorganisms from soil.
8. Isolation of amylase producing organisms from soil.
9. Production of α – amylase from Bacillus Spp. By shake flask culture.
10. Production of alcohol or wine using different substrates.
11. Estimation of citric acid by titrimetry.

REFERENCES:

1. K. Vijaya Ramesh, Environmental Microbiology, 2004,MJP Publishers, Chennai.
2. A.G. Murugesan, C. Raja Kumari, Environmental Science & Biotechnology - Theory & Techniques, 2005,MJP Publishers

3. Environmental microbiology by Raina M.Maier Ian L.Pepper & Charles P.Gerba,2000,Academic press
4. Environmental Chemistry, A.K. De. Wiley Eastern Ltd.,2001, New Delhi
5. Introduction of Biodeterioration, D. Allsopp and K.J. Seal, ELBS/Edward Arnold,2008
6. Power un seen: How microbes rule the world. By Dixon, B. Freeman/ Spectrum, 1994,Oxford.
7. Environmental Microbiology. By. Mitchell. R. Wiley,1992, New York
8. Introduction to Environmental Sciences, Y. Anjaneyulu ,2004, BS Publications
9. Creueger W. & Crueger A.A Text of Industrial Microbiology,2000, 2nd Edition, Panima Publishers corp.

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ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

IV SEMESTER **BIOTECHNOLOGY** TIME: 4 Hrs /Week

BTH 4705 (3) GENETIC ENGINEERING PLANT & ANIMAL BIOTECHNOLOGY

W.e.f 2020-21 admitted batch (20AH) Max. Marks: 100

SYLLABUS

OBJECTIVES: To enable the students to –

1. Learn enzymes used in recombinant DNA technology &cloning vectors
2. Know various gene transfer techniques in r-DNA technology
3. Acquire knowledge about Plant tissue culture its uses and techniques involved in tissue culture
4. Study Animal biotechnology which includes Artificial insemination, invitro fertilization and embryo transfer.
5. Acquire knowledge about ethics, bio-safety and patent rights

COURSE OUTCOMES: Students will

- **CO1:** Accustomed with the tools and techniques of genetic engineering molecular cloning and expression vectors.
- **CO2:**Capable to identify the economized protocols for both the classical & hybrid varieties, with the available tissue culture concepts..
- **CO3:**Able to evaluate animal culture media constituents and their role tomanufacture the desired products
- **CO4:**Be abundant in producing transgenic plants.
- **CO5:**Be proficient on health care products. Also be familiarized in generation and protection of patents, copyrights and trademarks.

UNIT-I: TOOLS AND TECHNIQUES OF rDNA TECHNOLOGY

1. Introduction to rDNA technology, steps involved in cloning.
2. Tools of genetic engineering: Cloning vectors &Enzymes – restriction endonucleases and DNA Ligase, Hosts – bacteria and yeast).
3. Principles and application of PCR.
4. Southern, Northern and Western Blotting.
5. DNA sequencing methods: Maxam-Gilbert, Sanger and Site-directed Mutagenesis.
6. cDNA library & construction
7. Methods of gene transfer techniques.
8. Isolation and screening of recombinant clones.
9. Applications of rDNA technology in agriculture (transgenic plants, edible vaccines and antibodies) and medicine (disease diagnosis and DNA fingerprinting).

UNIT – II: PLANT TISSUE CULTURE TECHNIQUES & SECONDARY METABOLITES PRODUCTION

1. Plant tissue culture: totipotency, media preparation – nutrients and plant growth regulators
2. Sterilization techniques.
3. Establishment of cultures – callus culture, cell suspension culture, protoplast culture and anther culture.

4. Applications of tissue culture-micro propagation, somatic hybridization, Somatic embryogenesis; synthetic seed production. Cryopreservation.
5. Plant secondary metabolites- concept and their importance.
6. Plant transformation technology-- *Agrobacterium* mediated Gene transfer (Ti plasmid), hairy root features of Ri-plasmid.
7. Transgenic plants as bioreactors. Herbicide resistance – glyphosphate, Insect resistance- Bt-cotton.
8. Molecular markers -RAPD, RFLP and DNA fingerprinting-principles and applications.

UNIT – III: ANIMAL TISSUE CULTURE TECHNIQUES

1. Animal cell culture: cell culture media and composition.
2. Culture of mammalian cells, tissues and organs; primary culture, secondary culture, cell lines, stem cell cultures; Tests: cell viability and cytotoxicity.
3. Transfection 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, 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. Molecular Biology & Biotechnology- 1996, By H.D. Kumar, Publ: Vikas
2. Molecular Biotechnology - 4th edition, 2010, G.R. Click and J.J. Pasternak, Publ: Panima
3. Genes and Genomes – 1991, By Maxine Singer and Paul Berg
4. Plant Tissue Culture, kalyan Kumar De,199 M7,New Central Book Agency
5. Plant Tissue Culture : Theory and Practice By S.S. Bhojwani and A. Razdan,1998
6. Biotechnology – By U. Satyanarayana ;1997
7. Introduction to Plant Tissue Culture,M. K. Razdan, 2003,Science Publishers
8. A Textbook of Biotechnology,R C Dubey,S. 2014,Chand Publishing
9. Elements of Biotechnology,P. K. Gupta, 1994,Rastogi Publications
10. R. Ian Freshney, "Culture of animal cells – A manual of basic techniques" 4th edition, John Wiley & Sons, 2000 ,Inc, publication, New York.

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ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

IV SEMESTER **BIOTECHNOLOGY** TIME: 3 Hrs/ Week

BTH 4755 (2) **GENETIC ENGINEERING PLANT & ANIMAL BIOTECHNOLOGY**

W.e.f 2020-21 admitted batch (20AH) Max. Marks: 50

PRACTICAL SYLLABUS

OBJCECTIVE: To enable the students to

- To enable the students to learn the techniques of Genetic engineering
- Acquire the techniques and inoculation methods in plant tissue culture

COURSE OUTCOMES: Students will

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

COURSE:

1. Isolation of plasmid DNA (alkaline lysis method)
2. Analysis of plasmid DNA by Agarose gel electrophoresis
3. Southern blotting (theory exercise)
4. PCR Amplification (theory exercise)
5. Preparation of plant tissue culture media (Composition of MS media)
6. Raising of aseptic seedlings
7. Induction of callus from different explants
8. Micropropagation (shoot tip and Nodal culture)
9. Establishing a plant cell culture (both in solid and liquid media)
10. cell suspension culture

REFERENCES:

1. Plant Tissue Culture: Theory and Practice by S.S. Bhojwani and A. Razdan,1998
2. Dr.Anurudh K. Singh, Santhosh K. Tiwari&Dr. J. P. Yadav (2017), Practical Manual, Plant Genetic Engineering. https://www.researchgate.net/publication/322152584
3. Sambrook J, Fritsch EF and Maniatis T. (2001). Molecular Cloning-A Laboratory Manual. 3rdedition. Cold Spring Harbor Laboratory Press.
4. Vennison, S. John (2009), Laboratory manual for Genetic Engineering, Prentice Hall India Learning Private Limited.
5. Dr. SandhyaMitra, (2015) Genetic Engineering: Principles and Practice, 2nd Edition, McGraw Hill Education (India) Private Limited, New Delhi.

6. Dr.Anurudh K. Singh, Santhosh K. Tiwari&Dr. J. P. Yadav (2017), Practical Manual, Plant Genetic Engineering. https://www.researchgate.net/publication/322152584
7. P. N. Arora& P. K. Malhan. 2012, Biostatistics: Himalaya Publishing House (January 2012), ISBN-10, 8183186912.

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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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ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

V SEMESTER **BIOTECHNOLOGY** TIME: 3 Hrs/ Week

BTH 5753 (2) **TECHNIQUES IN NURSERY DEVELOPMENT** Max. Marks: 50

(Skill enhancement course (Elective)

W.e.f 20AH Batch

PRACTICAL SYLLABUS – IIIA

OBJCECTIVE: 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:** Indentify 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 layeringtechniques
4. Training of students by related subjectexperts
5. Attending special lectures, group discussions and seminars on relatedtopics
6. Preparation of videos on nursery media preparation andapplication

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ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

V SEMESTER **BIOTECHNOLOGY** TIME: 3 Hrs/Week

BTH-E1-5704 (3) **HYDROPONICS CULTIVATION** Max. Marks: 60

(Skill enhancement course (Elective)

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, CO_2, 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, Vermiculutre 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.4th Edition
2. Howard M. Resh. *Hobby Hydoponics*. 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

OBJCECTIVE: 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 NewYork.4thEdition
2. Howard M. Resh. *Hobby Hydoponics*. 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.

Co-curricular activities:

a) Mandatory: (Training of students by teacher on field relatedskills: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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