S.V.K.P& Dr K.S.RAJU ARTS & SCIENCE COLLEGE (A), PENUGONDA

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(Affiliated to ADIKAVI NANNAYA UNIVERSITY)

B.Sc., BIOTECHNOLOGY SYLLABUS, SEMESTER I TO V

2024-2025

Phone : 08819 - 246126 / 246926 website:www.svkpandksrajucollege.edu.in
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PENUGONDA-534 320, West Godavari District., (A.P.)

I Semester Syllabus
BIOTECHNOLOGY
(w.e.f. 2023-24 Admitted Batch)
23BSC11 INTRODUCTION TO CLASSICAL BIOLOGY

Hours/Week: 5 **Credits : 4**

Unit1: Introduction to systematics, taxonomy and ecology.

1.1 Systematics– Definition and concept, Taxonomy –Definition and hierarchy.
1.2 Nomenclature– ICBN and ICZN, Binomial and trinomial nomenclature.
1.3 Ecology– Concept of ecosystem, Biodiversity and conservation.
1.4 Pollution and climate change.

Unit 2: Essentials of Botany.

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

Unit 3: Essentials of Zoology

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

Unit4: Cell biology, Genetics and Evolution

4.1 Cell theory, Ultrastructure of prokaryotic and eukaryotic cell, cell cycle.
4.2 Chromosomes and heredity–Structure of chromosomes, concept of gene.
4.3 Central Dogma of Molecular Biology.
4.4 Origin of life

Unit 5: Essentials of chemistry

5.1 Definition and scope of chemistry, applications of chemistry in daily life.
5.2 Branches of chemistry
5.3 Chemical bonds–ionic, covalent, non-covalent– Vander Waals, hydrophobic, hydrogen bonds.
5.4 Green chemistry

References

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3. Rastogi,S.C.,2019.Essentials of animal physiology.4th Edition.New Age International Publishers.
4. Verma P.S., Agarwal V.K.,2006.Cellbiology,genetics,Molecular Biology,Evolution and Ecology. S. Chand publishers, New Delhi, India.
5. SathyanarayanaU.,Chakrapani,U.,2013.Biochemistry.4th Edition. Elsevierpublishers.
6. JainJ.L.,SunjayJain,NitinJain, 2000.Fundamentals of Biochemistry.S.Chand publishers, New Delhi, India.
7. KarenTimberlake,WilliamTimberlake,2019.Basic chemistry.5th Edition. Pearson publishers.
8. SubrataSenGupta,2014. Organic chemistry.1st Edition.Oxford publishers.

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I Semester Syllabus
BIOTECHNOLOGY
(w.e.f. 2023-24 Admitted Batch)
23BSC12 INTRODUCTION TO APPLIED BIOLOGY

Hours/Week: 5 **Credits: 4**

Unit 1: Essentials of Microbiology and Immunology

1.1 History and Major Milestones of Microbiology; Contributions of Edward Jenner, Louis Pasteur, Robert Koch and Joseph Lister.

1.2 Groups of Microorganisms– Structure and characteristics of Bacteria, Fungi, Archaea and Virus.

1.3 Applications of Microorganisms in– Food, Agriculture, Environment and Industry.

1.4 Immune system–Immunity, types of immunity, cells and organs of immune system.

Unit 2: Essentials of Biochemistry

2.1 Biomolecules I– Carbohydrates, Lipids.

2.2 Biomolecules II– Amino acids & Proteins.

2.3 Biomolecules III– Nucleic acids -DNA and RNA.

2.4 Basics of Metabolism– Anabolism and catabolism.

Unit 3: Essentials of Biotechnology

3.1 History, scope and significance of biotechnology. Applications of biotechnology in Plant, Animal, Industrial and Pharmaceutical sciences.

3.2 Environmental Biotechnology– Bioremediation and Biofuels, Biofertilizers and Biopesticides.

3.3 Genetic engineering– Gene manipulation using restriction enzymes and cloning vectors; Physical, chemical and biological methods of gene transfer.

3.4 Transgenic plants–Stress tolerant plants (bioticstress–BTcotton, abiotic stress–salt tolerance). Transgenic animals – Animal and disease models.

Unit 4: Analytical Tools and techniques in biology– Applications

4.1 Applications in forensics–PCR and DNA fingerprinting

4.2 Immunological techniques– Immuno blotting and ELISA.

4.3 Monoclonal antibodies–Applications in diagnosis and therapy.

4.4 Eugenics and Gene therapy.

Unit 5: Biostatistics and Bioinformatics

5.1 Data collection and sampling. Measures of central tendency –Mean, Median, Mode.

5.2 Measures of dispersion– range, standard deviation and variance. Probability and tests of significance.

5.3 Introduction, Genomics, Proteomics, types of Biological data, biological databases- NCBI,

EBI, Gen Bank; Protein 3D structures, Sequence alignment

5.4 Accessing Nucleic Acid and Protein databases, NCBI Genome Workbench

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1. GerardJ.,Tortora,BerdellR. Funke,Christine L.Case.,2016.Microbiology:An Introduction. 11th Edition. Pearson publications, London, England.
2. Micale,J.PelczarJr.,E.C.S.Chan.,NoelR.Kraig.,2002.Pelczar Microbiology.5th Edition. McGraw Education, New York,USA.
3. Sathyanarayana.U, Chakrapani.U.,2013.Biochemistry.4thEdition.Elsevierpublishers.
4. JainJ.L.,SunjayJain, NitinJain,2000.Fundamentals of Biochemistry.S.Chand publishers, New Delhi, India.
5. R.C.Dubey,2014.Advanced Biotechnology.S.ChandPublishers,NewDelhi,India.
6. ColinRatledge,Bjorn, Kristiansen,2008.Basic Biotechnology. 3rdEdition.Cambridge Publishers.
7. U.Sathyanarayana,2005. Biotechnology.1stEdition.Books and Allied Publishers pvt. ltd., Kolkata.
8. Upadhyay,UpadhyayandNath.2016. Biophysical Chemistry, Principles and Techniques. Himalaya Publishing House.
9. ArthurM. Lesk. Introduction to Bioinformatics. 5thEdition.Oxford publishers.
10. APKulkarni,2020. Basics of Biostatistics.2ndEdition.CBS publishers.

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II Semester Syllabus
BIOTECHNOLOGY HONOURS (23BT21 MAJOR/MINOR)
(W.e.f. 2023-24 Admitted Batch)
BIOMOLECULES AND ANALYTICAL TECHNIQUES

Hours/week-3 **Credits-3**

Unit-I-Carbohydrates, Protein 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 acid, Vitamins, and Bioenergetics

1. Structure and functions of DNA and RNA.
2. Source, structure, biological role, and deficiency manifestation of vitamin 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, and affinity chromatography.
3. Basic principles and types of electrophoresis, factors affecting electrophoretic migration. PAGE(Native, SDS-PAGE). Introduction to 2D & Isoelectric Focusing.

Unit - IV-Spectroscopy, Microscopy and Laser Techniques

1. Beer-Lambert law, light absorption and transmission. Extinction coefficient, Design and application 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 auto radiography

Unit –V- Biostatistics

1. Mean, median, mode, standard deviation,

2. One-way ANOVA, Two-way Anova
3. t-test, F-test and chi-square.

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II Semester Syllabus (w.e.f. 20203-24 Admitted Batch)
23BT21P BIOTECHNOLOGY
PRACTICAL SYLLABUS

Hours/week-2 **Credits-1**

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. 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 andSons, 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 McGrawHill Edu. Pvt.Ltd. New Delhi, India
7. Biochemical Methods,1st Edition, (1995), S.Sadashivam, A.Manickam; New Age InternationalPublishers, 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
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12. Enzymes: Biochemistry, Biotechnology & Clinical chemistry, (2001), Palmer Trevor, Publisher:Horwood Pub. Co., England.
13. Analytical Biochemistry, 3rdedition, (1998), David Holmes, H.Peck, Prentice-Hall, UK
14. Introductory Biostatistics, 1st edition, (2003), Chap T. Le; John Wiley, USA.

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II Semester Syllabus
BIOTECHNOLOGY
(w.e.f. 2023-24 Admitted Batch)
23BT22 MICROBIOLOGY, CELL BIOLOGY

Hours/week-3 **Credits-3**

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 and 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) and Zoonotic viruses (Rabies, SARS-CoV-2).
3. Microbial production of penicillin. Bacterial toxins, tuberculosis, typhoid. Introduction to fungi, algae and mycoplasm.

Unit-III- Cell Structure and Functions

1. Structure, properties and functions of cellular organelles (E.R, Golgibodies, Mitochondria, Ribosomes, lysosomes, Nucleus) of eukaryotic cells.
2. Cell cycle and its regulation
3. Cell division (Mitosis and Meiosis).

Unit-IV- CELL SIGNALLING

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

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II Semester Syllabus (w.e.f. 20203-24 Admitted Batch)
23BT22P BIOTECHNOLOGY
PRACTICAL SYLLABUS

Hours/week-2 **Credits-1**

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 Hemocytometer
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

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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. Brock biology of microorganisms, 2003, Brock, T. D., Madigan, M. T., Martinko, J. M., &Parker, J.; Upper Saddle River (NJ): Prentice-Hall, 2003
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6. Molecular Biology of the Gene, 6th Edition, (2008), James D. Watson, J. D., Baker T.A., Bell,
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SEMESTER-III

(w.e.f. 2023-24 Admitted Batch)

PLANT AND ANIMAL BIOTECHNOLOGY – 23BT31

Theory Credits: 3 3 hrs/week

Syllabus

Unit - I Plant tissue culture techniques & secondary metabolites production

1. Totipotency, media preparation – nutrients and plant hormones; sterilization techniques;establishment of cultures – callus culture, cell suspension culture
2. Applications of tissue culture-Micro propagation; Somatic embryogenesis
3. Synthetic seed production; protoplast culture and somatic hybridization - applications.Cryopreservation, Plant secondary metabolites- concept and their importance.

   Additional input- Protoplast isolation.

Unit – II Trans genesis and Molecular markers

1. Plant transformation technology—Agrobacterium-mediated Gene transfer (Ti plasmid), hairyroot features of Ri plasmid, Transgenic plants as bioreactors.
2. Herbicide resistance – Glyphosate, Insect resistance- Bt cotton
3. Molecular markers - RAPD, RFLP and DNA finger printing- principles and applications.

Unit – III Animal tissue culture techniques

1. Cell culture media and reagents; culture of mammalian cells, tissues and organs; primary culture,secondary culture, cell lines, stem cell cultures.
2. Tests: cell viability and cytotoxicity, Cryopreservation.
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 inmedicine (insulin, somato statin, vaccines), IVF.
2. Concept of Gene therapy.
3. 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

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(w.e.f. 2023-24 Admitted Batch)
SEMESTER-III, PRACTICAL SYLLABUS
PLANT AND ANIMAL BIOTECHNOLOGY -23BT31P

Practical Credits: 1 2 hrs/week

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

V. REFERENCES

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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
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11. M.M. Ranga, Animal Biotechnology; Agrobios (India) ,2006.

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SEMESTER-III

(w.e.f. 2023-24 Admitted Batch)

MOLECULAR BIOLOGY- 23BT32

Theory Credits: 3 3 hrs/week

Syllabus

Unit I Genome Structure

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

   Additional input- RNA as genetic material

Unit II DNA Replication

1. Enzymology of replication (DNA polymerase I, Pol II and III, helicases, topoisomerases,single strand binding proteins, DNA melting proteins, primase.)
2. Proof of semiconservative replication, Replication origins.
3. Rolling circle replication of DNA.

   Additional input- Steps involved in Replication. DNA Ligase

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, chainelongation, termination and release). Reverse transcription.

   Additional input- Post transcriptional modifications (5'capping, Homopolymer tailing, Splicing)

Unit IV Gene Expression and regulation

1. Regulation of gene expression; Clustered genes
2. the operon concepts - Negative and positive control of the Lac Operon, trp operon,
3. Control of gene expression. Poly and Mono cistronic m-RNA,

Unit V Genetic Code and Protein Synthesis

1. Genetic code: Features of genetic code, Structure of m RNA, brief structure of tRNA.
2. The adaptor hypothesis, attachment of amino acids to tRNA.
3. Codon-anticodon interaction - The wobble hypothesis. Initiation, elongation, termination protein synthesis.

Additional inputs- Inhibitors of protein synthesis

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SEMESTER-III, PRACTICAL SYLLABUS
MOLECULAR BIOLOGY -23BT32P

Practical Credits: 1 2 hrs/week

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

REFERENCES

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3. The Cell: A Molecular Approach. 5th edition. Cooper, G.M. and Hausman, R.E. 2009.ASMPress & Sunderland, Washington, D.C.; Sinauer Associates, MA.
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SEMESTER-III

(w.e.f. 2023-24 Admitted Batch)

GENETIC ENGINEERING – 23BT33

Theory Credits: 3 3 hrs/week

Syllabus

UNIT-I

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 & Exonucleases. Modifyingenzymes
3. Ligation (cohesive & blunt end ligation) – linkers & adaptor.
   Additional input- Homopolymer tailing.

UNIT-II

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. Screening and selection of recombinants; Gene transfer methods

UNIT-III

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

1. Construction of genomic & c DNA libraries.
2. Vector engineering & codon optimization, strategies of gene delivery, invitro translation
3. Expression in bacteria, yeast, insects, plant & mammalian cells

UNIT-V

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

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SEMESTER-III, PRACTICAL SYLLABUS
GENETIC ENGINEERING – 23BT33P

Practical Credits: 1 2 hrs/week

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

REFERENCES

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2. Principles of Gene Manipulation - 7th edition, 2006, By R.W. Old & S.B. Primrose, Publ:Blackwell
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6. Genes VII- 2000, By B. Lewin - Oxford Univ. Press
7. Molecular Biology - 4th Edition, 2008, By D. Freifelder, Publ: Narosa Publishing house NewYork, 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-Applying the Genetic Revolution.Elsevier Academic Press, USA.
10. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications ofrecombinant DNA. ASM Press, Washington
11. Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics,7thedition. Blackwell Publishing, Oxford, U.K.
12. Sambrook J, Fritsch EF and Maniatis T. (2001). Molecular Cloning-A Laboratory Manual.3rdedition. Cold Spring Harbor Laboratory Press.

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SEMESTER-III
(w.e.f. 2023-24 Admitted Batch)
COURSE 8: METABOLISM – 23BT34

Theory Credits: 3 3 hrs/week

Syllabus

Unit I : Carbohydrate metabolism

1. Anabolism & catabolism , Photosynthesis – light and dark reactions. C3 cycle, C4 pathway,
2. Glycolysis – formation of lactate and pyruvate, TCA cycle and its regulation
3. gluconeogenesis, HMP stunt pathway , Disorders of Carbohydrate metabolism- Diabetesmellitus.

Additional input- Glycogen metabolism

Unit II : Lipids metabolism

1. Denovo synthesis of Fatty Acids , Biosynthesis & degradation of TAG (Triacyl Glycerol),
2. Disorders of Lipid metabolism
3. Biosynthesis of cholesterol , Ketogenesis

Unit III :Amino acid Metabolism

1. General reactions of amino acids, deamination, decarboxylation & transamination.
2. Urea cycle. Biosynthesis of creatine
3. Inborn errors of aromatic and branched-chain amino acid metabolism.

Additional input- Thyrosine metabolism.

UNIT IV Enzymes:

1. Difference between chemical and biological catalyst, definitions of Holoenzyme apoenzyme coenzyme
2. Classification and nomenclature of enzymes.
3. Enzyme specificity , interaction between enzyme and substrate -lock and key and induced fitmodels.

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

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(w.e.f. 2023-24 Admitted Batch)
SEMESTER-III, PRACTICAL SYLLABUS

METABOLISM – 23BT34P

Practical **Credits: 1** **2 hrs/week**

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

10 Estimation of total carbohydrates by Anthrone method

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.

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SEMESTER-IV
(w.e.f. 2023-24 Admitted Batch)
IMMUNOLOGY – 23BT41

Theory Credits: 3 3 hrs/week

Syllabus

UNIT I

Immune system:

1. History and scope of immunology, cells of the immune system –T cells , B cells
2. Immunity, innate immune mechanism, Acquired immune mechanism
3. Organs of the immune system (Bone marrow, spleen, thymus, MALT)

UNIT II

Antibody and Antigen:

1. Antibody structure and classes(Ig G, Ig M, Ig A, Ig E, I g D) , Antibody diversity
2. Antigen -Types of Antigens Antigenicity (factors affecting antigenicity).
3. Antigenic determinants – adjuvants and haptens , epitopes

UNIT III

Immunity:

1. Humoral immunity, cell-mediated immunity -TC-mediated immunity, NK cell-mediatedimmunity, ADCC,
2. Brief description of cytokines , Interleukins
3. Major histocompatibility complex (MHC)-Structure and Functions of Class I, II, MHCMolecules.

UNIT IV

Hypersensitivity and Vaccination :

1. General features of hypersensitivity, various types of hypersensitivity,
2. Vaccination: Discovery, principles, significance,
3. Types of Vaccines -live, attenuated, killed , recombinant, subunit

Additional input- Auto immunity.

UNIT V

Immunological Techniques:

1. Antigen-antibody reactions: Precipitation, agglutination, complement fixation, immunodiffusion, - Radial immune diffusion, ouchterlony , Double immune diffusion
2. Hybridoma technology: Monoclonal antibodies and their applications in immunodiagnosis.
3. ELISA , RIA , immunoelectrophoretic , Rocket electrophoresis

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(w.e.f. 2023-24 Admitted Batch)
SEMESTER-IV, PRACTICAL SYLLABUS

IMMUNOLOGY – 23BT41P

Practical Credits: 1 2 hrs/week

Practical Syllabus:

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

REFERENCES

1. Kuby immunology, Judy Owen, Jenni Punt, Sharon Stranford., 7th edition (2012), Freeman andCo., 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

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SEMESTER-IV

(w.e.f. 2023-24 Admitted Batch)

BIOINFORMATICS AND BIOSTATISTICS -23BT42

Theory Credits: 3 3 hrs/week

Syllabus

UNIT – I

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

UNIT – II

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. Concept of genomics and proteomics

Additional input- Nucleotide data bases

UNIT – III

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

UNIT – IV

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

Additional input- Median

UNIT – V

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

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SEMESTER-IV, PRACTICAL SYLLABUS
BIOINFORMATICS AND BIOSTATISTICS – 23BT42P

Practical Credits: 1 2 hrs/week

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

REFERENCES

1. Fowler, J., Cohen, L. and Jarvis, P. (1998). Practical Statistics for Field Biology. John Wiley andSons, 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 Wileyand Sons, 7th ed.

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SEMESTER-IV

(w.e.f. 2023-24 Admitted Batch)

MEDICAL BIOTECHNOLOGY -23BT43

Theory Credits: 3 3 hrs/week

Syllabus

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 ofthe 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 disease.

   Additional input- Filariasis

Unit -IV

1. Gene therapy – Exvivo, Invivo, Insitu gene therapy
2. strategies of gene therapy , gene augmentation
3. Vectors used in gene therapy , biological vectors – retrovirus , adeno virus, herpes. Syntheticvectors - liposomes , receptor medicate 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

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SEMESTER-IV, PRACTICAL SYLLABUS
MEDICAL BIOTECHNOLOGY – 23BT43P

Practical Credits: 1 2 hrs/week

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 10.diagnosis

of HIV

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, Churcil Livingsione 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

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V Semester Syllabus
BIOTECHNOLOGY
(w.e.f. 2020-21 Admitted Batch)
TECHNIQUES IN NURSERY DEVELOPMENT (20BT5A1)

UNIT I: **Introduction to Nursery** (10h)

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

UNIT II: **Nursery inputs** (10h)

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

UNIT III: **Seeds and Propagules** (10h)

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

UNIT IV: Management Practices (10h)

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

UNIT V: Grafting techniques (10h)

Introduction to grafting, definition, types and tools for grafting. Steps involved in simple, splice graft, tongue graft, Whip graft, cleft graft and wedge graft. 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 managemnet.
6. P.K.Ray,(2012) How to start and operate a Plant Nursery.

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V Semester Syllabus (w.e.f. 2020-21 Admitted Batch)
BIOTECHNOLOGY

BSc	Semester:V(SkillEnhancementCourse-Elective)	Credits:1
Course: 20BT5A1	Techniques in nursery development Lab	Hrs/Wk:2

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

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V Semester Syllabus
BIOTECHNOLOGY
(w.e.f. 2020-21 Admitted Batch)
HYDROPONICS CULTIVATION 20BT5A2

UNIT I: Introduction to Soilless culture (10h)
Definition, History and origin of soilless culture, Present status of hydroponics-contrasts with soil based culture, Applications & future developments.

UNIT II: Macronutrients, micronutrients (10h)
Functions and effect on plants, deficiency symptoms of the following essential minerals N, P, Mg, Ca, K, S, Fe, Mn, Cu, Zn, B, Mo, Physical factors, light (Quantity, energy, photoperiodism *etc*), Temperature (Heating and cooling), Humidity, CO2, ppm, pH and TDS.

UNIT III: Cultural conditions (10h)
Plant nutrition. Inorganic salts (fertilizers) major and minor nutrients formulating, monitoring and analysing. Selection of fertilizers, media used for hydroponics-expanded clay, rock wool, coir, perlite, pumice, vermiculite, sand gravel *etc*. Weed management, diseases and pest control.

UNIT IV: Techniques in hydroponics (10h)
Static solution culture, continuous-flow solution culture and aeroponics.

UNIT V: Cultivation of crop plants by hydroponics (10h)
Passive sub-irrigation, Ebb and flow or flood and chain irrigation. Deep water culture protocols for –Tomato cultivation through Dutch bucket method, chilly cultivation through NFT system, Spinach through raft System and measurements of yield.

REFERENCES:

1. Keith Roberto, *How to Hydroponics*. The future Garden Press New York.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 and IBH Publishing Company. Pvt. Ltd New Delhi.

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BIOTECHNOLOGY

BSc	Semester:V(SkillEnhancementCourse-Elective)	Credits:1
Course: 20BT5A2	**Hydroponics cultivation Lab**	**Hrs/Wk:2**

1. Handling of tools required for hydroponic set up

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

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V Semester Syllabus
BIOTECHNOLOGY
(w.e.f. 2020-21 Admitted Batch)
20BT5B1 ORGANIC FARMING

UNIT I: Soil: (10h)
Definition, soil formation, composition and characteristics. Types of soils. Distribution of soil groups in India. Acidic, Alkaline and heavy metal contaminated soil. Methods of reclamation. Effects of chemical dependent farming on yield and soil health.

UNIT II: Plant Nutrition (10h)
Macro and micro nutrients, functions of nutrients in plant growth and development. Nutrient uptake and utilization by plant. Types of fertilizers. Organic, inorganic and bio fertilizers. Chemical fertilizer. Advantages & disadvantages of their use. Importance of organic and bio fertilizers.

UNIT III: Organic Farming (10h)
Definition, concept, benefits. Integrated farming system (combination of organic and inorganic). Mixed farming system. Concept of different cropping systems in relation to organic farming, Inter cropping, crop rotation. Organic farming process. Organic fertilizers, crop nutrients and effective microorganisms in Organic farming.

UNIT IV: Organic compost (10h)
Definition, types of compost, farm yard compost, green leaf compost, animal husbandry, animal housing, animal feeding, animal health, breeding goals.
Vermi compost: Introduction, vermi composting material, species of earthworms, small scale, large scale composting process. Vermi castings, harvesting, processing and drying. Nutrient content of vermi compost. Field application methods.

UNIT V: Biofertilizers (10h)
Introduction, status and scope. Structure and characteristic features of bacterial bio fertilizers- *Azospirillum, Azotobacter, Bacillus, Pseudomonas, Rhizobium* and *Frankia*. Cynobacterial biofertilizers- *Anabaena, Nostoc, Hapalosiphon*and fungal biofertilizers- AM mycorrhiza and ectomycorrhiza. Mechanism of nitrogen fixation and phosphorus solubilization.

REFERENCES:
1. Principles of Organic Farming:: by E Somasundaram,DUdhayaNandhini,MMeyyappan;2021
2. Organic farming in India:: by Arpita Mukherjee; 2017
3. Biofertizer and biocontrol agents for agriculture;; by AM Pirttilä · 2021
4. Trends in Organic Farming in India;; by S. S. Purohit, 2006
5. Biofertilizers for Sustainable Agriculture and Environment;; by BhoopanderGiri Ram Prasad, Qiang-Sheng Wu, Ajit Varma; 2019

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V Semester Syllabus (w.e.f. 2020-21 Admitted Batch)
BIOTECHNOLOGY

BSc	Semester:V(SkillEnhancementCourse-Elective)	Credits:1
Course:20BT5B1P	Organic Farming Lab	Hrs/Wk:2

1. Collection of different soil samples
2. Qualitative estimation of nitrogen, phosphorus and potassium in soil samples
3. Collection of fruit, vegetable and other domestic waste
4. Preparation of compost beds and introducing earthworms
5. Collection of vermi castings
6. Sieving, drying and packing of vermi compost
7. Visit to animal shed and observing farm yard manure production
8. Preparation of media and isolation of bio fertilizers

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V Semester Syllabus
BIOTECHNOLOGY
(w.e.f. 2020-21 Admitted Batch)
20BT5B2- BIOFERTILIZERS AND BIOPESTICIDES PRODUCTION

UNIT I: Bio fertilizers (10h)
Introduction, history, concept, scope of bio fertilizers in India. Classification, microorganisms used as bio fertilizers. Bacterial, fungal and algal bio fertilizers. Symbiotic and a symbiotic microorganisms. Mechanism of nodulation and nitrogen fixation.
.

UNIT II: Mycorrhizal bio fertilizers (10h)
Importance, types, characteristic features of ecto and endo mycorrhiza. Mechanism of phosphorus solubilization. Uptake of phosphates by the roots. Consortium based inoculums and significance.

UNIT III: Bio pesticides (10h)
Definition, concept, history, scope and importance of biopesticides.
Classification - botanicals, bacterial, fungal and viral based biopesticides. Mechanism of action of *Bacillus thuringiensis* and *Trichoderma viridae*as bio control agents.

UNIT IV: Mass production techniques (10h)
Media, types, preparation. Methods of isolation, streak plate, spread plate and pour plate techniques, purification and identification of microorganisms used as bio fertilizers and bio pesticides. Mass production and packing techniques.

UNIT V: Field application methods (10h)
Preparation of carrier based inoculum. Sphagnum, peat, vermiculite as inoculums carriers. Dosage standardisation. Seed treatment, foliar application, root dressing and soil application techniques. Storage and maintenance of inoculum.

REFERENCES:
1. Biofertilizers: Commercial Production Technology and Quality Control, 2017 by Dr. P.Hyma
2. Biofertilizers Technology, 2010, by S.Kaniyan, K.Kumar and K. Govindarajan
3. Biofertilizers for Sustainable Agriculture, 2017; by Arun K Sharma
4. Advances In Plant Biopesticides 2021, by Dwijendra Singh, Springer India
5. A Textbook of Integrated Pest Management, 2013by Ram Singh & Vikas Jindal G.S. Dhaliwal

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V Semester Syllabus (w.e.f. 2020-21 Admitted Batch)
BIOTECHNOLOGY

BSc	Semester:V(SkillEnhancementCourse-Elective)	Credits:1
Course:20BT5BP	Biofertilizers and Biopesticides production Lab	Hrs/Wk:2

1. Preparation of Nutrient agar, YEMA, and PDA media
2. Isolation of *Rhizobium* from root nodules
3. Isolation of *Azatobacter*from soil samples
4. Isolation of *Trichoderma*
5. Gram staining of bacteria
6. VAM root staining
7. Raising of legume seedlings with *Rhizobium* treatment
8. Visit to commercial bio control units and Krishi seva Kendra

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V Semester Syllabus
BIOTECHNOLOGY
(w.e.f. 2020-21 Admitted Batch)
APICULTURE -20BT5C1

UNIT I: Biology of Bees 10 hrs
History, Classification and Life Cycle of Honey Bees. Social Organization of Bee Colony.

UNIT II: Rearing of Bees 10 hrs
Artificial Bee rearing (Apiary), Beehives – Newton and Langstroth. Methods of Extraction of Hon- ey (Indigenous and Modern).

UNIT III: Diseases and Enemies 10 hrs
Bee Diseases and Enemies. Control and Preventive measures.

UNIT IV: Economy and Entrepreneurship 10 hrs
Products of Apiculture Industry and its Uses (Honey, Bee Wax, Propolis) and Pollen.

UNIT V: Entrepreneurship in Apiculture 10 hrs
Bee Keeping Industry: Present and future, Role of Bees in cross pollination in horticulture and agri- culture. Prospects of apiculture as self-employment venture.

REFERENCES:
1. Prost, P. J. (1962). Apiculture. Oxford and IBH, New Delhi.
2. Graham, J M (1992) The hive and the honey bee. Dadant and Sons, Hamilton, IIIinois.
3. Mishra R.C. (1995) Honey bees and their management in India. ICAR Publication New Delhi.
4. Singh, S. (1971) Beekeeping in India, ICAR publication..
5. Bisht, D.S. (2004). Agricultural Development in India, Anmol Pub. Pvt. Ltd.
6. Singh S.(1964). Beekeeping in India, Indian council of Agricultural Research, NewDelhi
7. Mehrotra, K.N. Bisht, D.S. (1981). Twenty-five years of apiculture research at IARI. Apiculture in relation to agriculture.

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V Semester Syllabus (w.e.f. 2020-21 Admitted Batch)
BIOTECHNOLOGY

BSc	Semester:V(SkillEnhancementCourse-Elective)	Credits:4
Course: 20BT5C1	Apiculture Lab	Hrs/Wk:4

1. Handling of tools and techniques for Apiculture
2. To study the morphological and anatomical characteristics of queen and worker bees
3. Identification of different species of honey bees
4. Preparation of honey bee trays for beekeeping, maintenance and colony inspection
5. Extraction of honey and bee wax
6. Processing of honey, packing and storing
7. Identification of honey adulteration

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S.V.K.P. & Dr. K.S. RAJU ARTS & SCIENCE COLLEGE
(Autonomous)
Recognized by UGC as "College with Potential for Excellence"
Accredited by NAAC with "A" Grade
(Affiliated to ADIKAVI NANNAYA UNIVERSITY - Recognised by Govt. of Andhra Pradesh)
PENUGONDA-534 320, West Godavari District., (A.P.)

V Semester Syllabus
BIOTECHNOLOGY
(w.e.f. 2020-21 Admitted Batch)
PEARL CULTURE 20BTC2

UNIT I: Overview of Pearl oyster (10h)
Biology of Pearl oyster: Pearl producing molluscs. Morphology and anatomy of Pearl oyster, Life cycle of pearl oyster.

UNIT II: Process of Pearl formation (10h)
Structure and Histology of mantle. Natural Process of Pearl formation. Chemical composition of Pearls. Economic importance of pearls.

UNIT III: Pearl oyster culture (10h)
Pearl oyster culture Techniques of pearl oyster culture (Fresh water and Marine water) for artificial production of pearls. Pearl culture techniques -Rafts, long lines, Pearls oyster baskets, under water platforms, mother oyster culture/Collection of oysters, rearing of oysters, Environmental parameters.

UNIT IV: Pearl Oyster surgery (10h)
Selection of Oyster, Graft tissue preparation, Nucleus insertion, Conditioning for surgery, Post-operative culture, harvesting of pearl, clearing of pearl.

UNIT V: Pearl culture Economy (10h)
Diseases and Predators of Pearl oysters' Present status, prospects and problems of pearl industry in India.

REFERENCES:
1. Haws Maria (2002). The basics of pearl farming: a Layman's manual: (U.S.A). CTSA publications.
2. Alexander E .Farn (1986) pearls :(U.S.A.).Butterworth Heinemann publications.
3. Le Jia Li (2014) new technologies to promote freshwater pearl culture (China) Ocean Press publications.
4. Bardach, J.E.W (1972) Aquaculture farming and husbandry of freshwater and Sorting of Pearl. Marketing and economics concerned with Pearl Culture. Generation marine organisms
5. David Dobilet (1995) Pearl farming (Australia) Nat Geographic Mag publication
6. Yuan Cha Da (2014) Environmental effects Pearl farming (China) Jiangxi People publishing house.

S.V.K.P& Dr K.S.RAJU ARTS & SCIENCE COLLEGE (A), PENUGONDA
V Semester Syllabus (w.e.f. 2020-21 Admitted Batch)
BIOTECHNOLOGY

BSc	Semester:V(SkillEnhancementCourse-Elective)	Credits:1
Course:20BTC2	Pearl Culture Lab	Hrs/Wk:2

1. Technique for measurement of soil and water
2. Culture technique of microorganism for pond maintenance. Surgical techniques
3. Graft tissue preparation, implantation techniques, post operation care
4. Designed pearl culture techniques, bleaching, collection of pearls, cleaning of pearls
5. Sorting of pearls, marketing of pearls.