

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA

(Affiliated to Krishna University, Machilipatnam)

SYLLABUS

Subject: Biotechnology

Semester: I

Course Title: Introduction to

Course Code: 20BYCCCG13

Biotechnology, Cell Biology & Genetics

No. of Hours: 60

LTP: 400

Credits: 3

Objectives

- To understand the structures, organization and functions of basic components of eukaryotic cells, types of specialized chromosomes and cell divisions.
- To learn the basic concepts of Genetics.

Course Outcomes

CO1: Explain the scope and applications of biotechnology and the various components of the eukaryotic cell

CO2: Outline the stages of cell cycle, cell division and apoptosis

CO3: Explain the structures and organization of chromosomes in eukaryotic cells.

CO4: Summarize gene mutations and the mechanisms of repair.

CO5: Recall the postulates of Mendel laws and the basic concept of inheritance.

UNIT- I: Introduction to Biotechnology & Cell Biology (12 Hrs.)

Introduction, definition and scope of Biotechnology. Applications of Biotechnology. Eukaryotic cell: Cell wall, plasma membrane (Fluid mosaic model), cytoskeleton, cytoplasm, endoplasmic reticulum, mitochondria, Golgi complex, chloroplast, lysosomes, peroxisomes, Glyoxisomes, vacuoles, nucleus. Cell cycle. Cell division - Mitosis, Meiosis. Apoptosis- intrinsic pathway, extrinsic pathway, Caspases.

UNIT- II: Genes and Their Variations (12 Hrs.)

Gene as unit of expression, Structure of gene, histone proteins. Structure of specialized chromosomes (polytene and lampbrush). Eukaryotic chromosome organization.

UNIT- III: Gene Mutations and Repair (12 Hrs.)

Gene interaction: Epistasis, linkage, Recombination, Gene maps. Mutations: Induced, spontaneous, Missense, nonsense, frame shift mutations. Repair mechanisms: photo reactivation, base excision repair, SOS repair, mismatch repair, Recombination repair.

UNIT- IV: Mendel Laws and Inheritance**(12 Hrs.)**

Mendel laws: Monohybrid, dihybrid, test and back cross.

Multiple alleles: Skin colour of rabbit, Blood groups- ABO group system.
sex determination in Humans and Drosophila, sex linked inheritance.

UNIT- V: Skill Based**(12 Hrs.)**

Blood Grouping – ABO, Slide Preparation of Mitosis from Onion root tips,
Genetics problems, Ames test for Mutagenic agents.

Co- Curricular Activities

- Assignments on applications of Hydroponics
- Group discussions
- Student presentations and seminars
- Online quizzes

Prescribed Text Books

1. A text book of cytology, Genetics and Evolution, K. Daniel
2. A text book of Cell Biology, Genetics and Evolution, Dr. Bindu Sharma.
3. Text book of Biotechnology, T.T. Pandian, D. Kandavel.

Reference Books

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition, JohnWiley & Sons.Inc.
2. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5thedition. ASMPress& Sunderland, Washington, D.C.; Sinauer Associates, MA.
3. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2006). Principles of Genetics. VIII Edition John Wiley & Sons.
4. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics.V Edition. John Wiley and Sons Inc.
5. Russell, P. J. (2009). Genetics- A Molecular Approach.III Edition. Benjamin Cummings.
6. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. IX Edition. Introduction to Genetic Analysis, W. H. Freeman & Co.

MARIS STELLA COLLEGE (AUTONOMOUS, VIJAYAWADA-8

(Affiliated to Krishna University, Machilipatnam)

SYLLABUS

Subject: Biotechnology

Semester: I

**Course Title: Cell Biology & Genetics
- Practical**

Course code: 20BYP1CG12

No. of Hours: 30

LTP: 002

Credits: 2

Objectives

- To observe and identify the stages of Mitosis, Meiosis.
- To prepare Karyotyping of Humans and Drosophila and pedigree charts.

Course Outcomes

CO1: Experiment and observe the stages of Mitosis and Meiosis

CO2: Design the Karyotyping of Humans and Drosophila and pedigree charts.

CO3: understand the pedigree charts

List of experiments

1. Observation of permanent slides of mitosis
2. Observation of permanent slides of meiosis
3. Karyotyping in Drosophila
4. Karyotyping in human
5. Mendelian deviations in dihybrid cross.
6. Identification of Barr body in buccal epithelial cells
7. Pedigree charts of some common characters like blood group, Colour blindness.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA

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SYLLABUS

Subject: Biotechnology

Semester: II

**Course Title: Macromolecules &
Enzymology**

Course Code: 20BYCCME23

No. of Hours: 60

LTP: 400

Credits: 3

Objectives

- To study the classification, structures and metabolism of biomolecules.
- To learn and apply the concepts of enzymology.

Course Outcomes

CO1: Classify carbohydrates, amino acids, lipids and proteins.

CO2: Illustrate the structures of biomolecules

CO3: Summarize the metabolism of biomolecules.

CO4: Explain the concepts of enzymology.

CO5: Discuss the quantitative and qualitative analysis of carbohydrates, proteins and amino acids.

UNIT- I: Carbohydrates

(12 Hrs.)

Definition, classification, nomenclature of carbohydrates, structures of monosaccharides, disaccharides and polysaccharides. Concept and examples of hetero polysaccharides.

UNIT- II: Amino Acids, Proteins, Lipids and Nucleic Acids

(12 Hrs.)

Structure of amino acids occurring in proteins, classification of amino acids (pH based, polarity based). Primary, Secondary, Tertiary & Quaternary structure of proteins. Classification of lipids.

Chemistry of Porphyrines, Haem and Chlorophyll, Nucleic acids: structure and types of DNA, structure of mRNA, tRNA and rRNA

UNIT - III: Metabolism of Biomolecules

(12 Hrs.)

Concept of free energy, entropy, enthalpy and redox potential.

Metabolism of carbohydrates - HMP and Gluconeogenesis.

Metabolism of amino acids - Transamination, Deamination and decarboxylation. Lipid metabolism- beta oxidation.

UNIT- IV: Enzymology

(12 Hrs.)

Enzymology Introduction, IUBN Classification, Holoenzyme, Apoenzyme, Enzyme- properties (active site, specificity and chemical nature), Factors affecting enzyme activity, Enzyme inhibition, Michaelis Menten equation derivation.

UNIT- V: Skill/Hands on**(12 Hrs.)**

Qualitative estimation of Carbohydrates, Quantitative estimation of Proteins by Lowry's method, Quantitative estimation of reducing sugars by Barfoed's test, Qualitative estimation of Amino acids.

Co- Curricular Activities

- Assignments on amino acids
- Group discussions
- Student presentations and seminars
- Online quizzes

Prescribed Text Books

1. Biochemistry – Prof. U. Satyanarayana, 3rd revised Edition: 2006, Arunabha Sen, books and allied (P) Ltd, 8/1Chintamani Das lane, Kolkata 700009.
2. Fundamentals of Biochemistry – J. L. Jain, revised edition, S. Chand publications.

Reference Text Books

1. Biochemistry, Lubert Stryer, 6th Edition, WH Freeman, 2006.
2. Biochemistry, Donald Voet and Judith Voet, 2nd Edition, Publisher: John Wiley and Sons, 1995.
3. Fundamentals of Enzymology Nicholas Price and Lewis Stevens Oxford University Press 1999
4. Buchanan, B., Gruissem, W. and Jones, R. (2000) Biochemistry and Molecular Biology of Plants. American Society of Plant Biologists.
5. Nelson, D.L., Cox, M.M. (2004) Lehninger Principles of Biochemistry, 4th Edition, WH Freeman and Company, New York, USA.

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SYLLABUS

Subject: Biotechnology

Semester: II

Course Title: Macromolecules &

Course code: 20BYP2ME22

Enzymology - Practical

No. of Hours: 30

LTP: 002

Credits: 2

Objectives

- To learn the quantitative estimations of biomolecules.
- To impart skills on the technique of immobilization and isolation of starch from potatoes.

Course outcomes

CO1: Evaluate the types of biomolecules through quantitative analysis.

CO2: Demonstrate the isolation of starch and immobilization of enzymes.

CO3: Understand the genetic estimation

1. Quantitative estimation of sugars (Dinitrosalicylic acid) method.
2. Quantitative estimation of proteins by Biuret method.
3. Determination of saponification value of Fats
4. Estimation of DNA by Diphenylamine method.
5. Estimation of RNA by Orcinol method.
6. Preparation of starch from potato and its hydrolysis by salivary amylase.
7. Immobilization of enzymes / cells by entrapment in alginate gel

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA

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SYLLABUS

Subject: Biotechnology

Semester: III

Course Title: Biophysical Techniques

Course Code: 20BYCCBT33

No. of Hours: 60

LTP: 400

Credits: 3

Objectives

- To demonstrate the concepts, principles and instrumentation of Biophysical techniques.
- To analyze the applications and laws of core biophysical techniques.
- To know about microscopy

Course Outcomes

CO1: Explain the laws, principles and applications of different instruments

CO2: Apply laws to draw inferences, using instruments.

CO3: Explain Chromatography techniques and electrophoresis

CO4: Outline the principles and applications of microscopy and spectroscopy.

UNIT- I: Microscopy and Spectrophotometry (12 Hrs.)

1. Principle and applications of phase contrast microscopy, fluorescence and electron microscopy (TEM and SEM), Concept of electromagnetic Spectrum (absorption and transmission spectrum),
2. Beer Lamberts Law - derivation, principle, instrumentation and applications of UV and visible spectrophotometry, IR and Mass spectrometry

UNIT- II: Chromatography (12 Hrs.)

1. Partition coefficient, Applications of paper chromatography, Thin layer chromatography, column chromatography.
2. Principle and applications of Gel filtration, Ion exchange chromatography, Affinity chromatography and High pressure liquid chromatography. (HPLC)

UNIT-III: pH meter, Electrophoresis (12 Hrs.)

1. pH meter, Calomel electrode and Hydrogen ion Concentration Introduction, Principle and Measurement. Factors affecting electrophoretic mobility, Types of gels (Agarose, Polyacrylamide)
2. Principle, Procedure and applications of paper electrophoresis, Agarose gel electrophoresis, SDS- PAGE electrophoresis.

UNIT-IV: Isotopic Tracer Technique & Centrifugation (12 Hrs.)

1. Measurement of radioactivity: principle and advantages of ionization chamber, Geiger Muller counter, scintillation counter, applications of isotopes in biotechnology and metabolic studies.
2. Centrifugation: basic principle, types of centrifuges - clinical, table top and ultracentrifuge - preparative and analytical centrifuge.

UNIT-V: Practical applications (12Hrs.)

Preparation of standard buffers and determination of pH of solution

1. Principles and applications of Bright Field Microscopy
2. Paper chromatography of carbohydrates, TLC of sugars
3. Cellular fractionation and separation of cell organelles using centrifuge

Co- Curricular Activities

- Assignments on Applications of paper chromatography
- Group discussions
- Student presentations and seminars
- Online quizzes

Prescribed Text Books

1. Biophysical Chemistry – Upadhyaya & Upadhyay Nath,
Himalaya Publications, 3rd edition.
3. Biophysical Techniques- Jain D Campbell

Reference Books

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. JohnWiley& Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins.
3. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Becker, W .M. Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009 The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.

SYLLABUS

Subject: Biotechnology

Semester: III

**Course Title: Biophysical Techniques
- Practical**

Course code: 20BYP3BT32

No. of Hours: 30

LTP: 002

Credits: 2

Objectives

- To impart knowledge on hands- on- training on Chromatography, Centrifuge, and Colorimeter.
- To use analytical methods to estimate Urea and sugars.
- To demonstrate gel electrophoresis and Spectrophotometry.
- To educate the titration of strong and weak acids.

Course Outcomes

CO1: Analyze the given biomolecule through chromatography, TLC, Centrifuge, Colorimeter and spectrophotometer.

CO2: Demonstrate the separation of proteins by gel electrophoresis and Spectrophotometric analysis of DNA denaturation.

CO3: Evaluate the titration mixtures of strong and weak acids.

List of experiments

1. Paper chromatography of amino acids.
2. TLC of amino acids.
3. Estimation of urea by diacetylmonoxime method.
4. Estimation of sugars by DNS method.
5. Titration of mixture of strong and weak acid.
6. Demonstration of Gel electrophoresis of proteins.
7. Demonstration of Spectrophotometric analysis of DNA denaturation.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA – 8
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SYLLABUS

Subject: Biotechnology **Semester: IV**
Course Title: Immunology & Immunotechnology
Course Code: 20BYCCIT43
No. of Hours: 60 **LTP: 400** **Credits: 3**

Objectives

- To introduce the students to various concepts of immunology.
- To enable them to study the principles and applications of various Immunological techniques.

Course Outcomes

- CO1:** Classify and explain the types of antigen-antibody and hypersensitivity reactions.
- CO2:** Discuss the mechanism, manifestations of clinical transplantations and autoimmune deficiency diseases.
- CO3:** Enumerate the types of tumour antigens and explain cancer induction by oncogenes.
- CO4:** Summarize the preparation of vaccines and monoclonal antibodies.
- CO5:** Explain the principle and applications of various immunological techniques.

UNIT – I: Basics of Immune System **(12 Hrs.)**

1. Introduction to Immunity, immune response - primary and secondary, types of immunity (Natural and Acquired Immunity),
2. The lymphoid system: Primary and secondary lymphoid organs, Cell mediated immunity, humoral immunity, cells of immune system
3. Basic structure of Antibody, classes and functions, Types of Antigens, Antigenicity (Factors affecting antigenicity).
Haptens, Adjuvants.

UNIT – II: Immune disorders

(12 Hrs.)

1. Auto immune diseases: Introduction, Mechanism of autoimmunity, detailed account of Grave's disease, Rheumatoid arthritis, Multiple sclerosis, SLE.
2. Immunodeficiency diseases: AIDS, SCID.
3. Hypersensitivity: Types of hypersensitivity with examples.
4. Major Histocompatibility complexes – (class I and class II)

UNIT – III: Transplantation Immunology & Tumor Immunology (12 Hrs.)

1. Mechanism of graft rejection, Clinical manifestations of Graft rejection, General immunosuppressive therapy - examples, Clinical transplantations- Kidney and Bone marrow.
2. Definition and examples of Malignant and Benign tumors. Cancer induction by oncogenes. Tumor antigens- TSTA's, TATA's, Onco, and fetal tumor antigens.

UNIT – IV: Immuno Techniques

(12 Hrs.)

1. Antigen- antibody reactions: basic concept of Agglutination & precipitation reactions. Immuno diffusion- Principle and applications. ELISA- Principle, Types and applications. Recombinant vaccines, DNA vaccines, sub unit vaccines. Passive and active immunization. Production and applications of monoclonal antibodies.
2. Immuno electrophoresis- Principle and applications Immune blotting- Principle and applications. FAACS

UNIT – V: Immuno Diagnostics

(12 Hrs.)

1. Serum and Plasma separation from whole blood
2. Total WBC count
3. Rocket immune electrophoresis
4. Precipitation reactions
5. Agglutination reactions
6. Preparation of Antigen

Co- Curricular Activities

- Assignments on Principles of microbial growth
- Group discussions on Blood grouping
- Student presentations and seminars
- Online quizzes
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Prescribed Text Books

1. Medical Microbiology by Ananthanarayan , 7thedition, Orient longman private limited..
2. Essentials of Immunology by I.Roitt, 13thedition, Wileypublications.
3. Immunology by Ian R.Tizard, Saunders College Publishing, 1995
4. Immunology By J Kuby

Reference Text Books

1. Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6thedition Saunders, Publication, Philadelphia.
2. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology, 11thedition Wiley- Blackwell Scientific Publication, Oxford.
3. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition.
4. W.H.Freeman and Company, New York. Murphy K, Travers P, Walport M. (2008). Janeway's Immunobiology. 7th edition Garland Science Publishers, New York. Peakman M, and Vergani D. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers.
5. Goering R, Dockrell H, Zuckerman M and Wakelin D. (2007). Mims' Medical Microbiology, 4th edition, Elsevier.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA - 8
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SYLLABUS

Subject: Biotechnology

Semester: IV

Course Title: Immunology & Immunotechnology - Practical

Course code: 20BYP4IT42

No. of Hours: 30

LTP: 002

Credits: 2

Objectives

- To learn various antigen- antibody reactions.
- To acquire skills on immunological techniques.

Course outcomes

At the end of the course the student will be able to

CO1: Experiment on antigen- antibody reactions

CO2: Analyze the Total RBC count and Total leucocytes count.

List of Practicals

1. Pregnancy test- Strip method
2. Widal test
3. Ouchterlony immunodiffusion
4. Radial immunodiffusion
5. Demonstration of tridot ELISA
6. Demonstration of Immuno Electrophoresis
7. Total RBC count.
8. Total leucocytes count
9. Blood Grouping

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA – 8
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SYLLABUS

Subject: Biotechnology

Semester: IV

Course Title: Microbial Biotechnology

Course Code: 20BYCCMB43

No. of Hours: 60

LTP: 400

Credits: 3

Objectives

- To infer the applications of microbial fermentations, principles of microbial growth
- To production of microbial metabolites and environmental cleanup by using microbes.
- To know about enzymes

Course outcomes

CO1: Summarize the concepts of microbial growth and types of fermenters.

CO2: Discuss downstream processing.

CO3: Explain microbial metabolites and enzyme technology.

CO4: Outline the types of environmental pollution and bioremediation

CO5: Demonstrate the microbial degradation of pollutants.

UNIT-I

(12 Hrs.)

Heterologous Expression: Expression vectors and hosts Generally Regarded as Safe (GRAS) organisms. Principles of microbial growth – Batch fermentation, fed-batch fermentation – continuous Fermentation, high density cell cultures, Bioreactors – Large scale fermentation system – tandem Airlift reactors – Single stirred tank reactors.

UNIT-II

(12 Hrs.)

Downstream processing: Harvesting microbial cells – Membrane filtration system, high speed semi continuous centrifugation – disrupting microbial cells. Large scale purification of recombinant proteins – Chromatography systems and analytical methods for large scale purification. Stabilization of the proteins.

UNIT-III

(12 Hrs.)

Microbial metabolites - Organic solvents (Alcohol), Antibiotics (penicillin), Vitamins (Vitamin B12), Amino acids (Aspartic acid). Production of single cell proteins. Enzyme technology: Sources production, isolation and purification of enzymes for the industrial use. Application of enzymes in pharmaceutical, food processing and other industries.

UNIT - IV

(12 Hrs.)

Environmental pollution - Types of soil and air pollutants, methods for the measurement of air pollution. Water pollution and its control - Need for water management, sources of water pollution. Measurement of water pollution, MEOR.

UNIT-V

(12 Hrs.)

Microbiology of degradation of substituted hydrocarbons (p-nitro phenol), pesticides (2,4-D). Co-metabolism, Oil pollution, surfactants. Bioremediation of contaminated sites. (specify)

Co- Curricular Activities

- Assignments on Principles of microbial growth
- Group discussions on Blood grouping
- Student presentations and seminars
- Online quizzes

Prescribed Text Books

1. Brock biology of microorganism by Madigan MT, Martinko JM, Parker. J
2. Bacterial metabolism by Gotts chalk.
3. Microbiology by Prescott.

Reference Books

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

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SYLLABUS

Subject: Biotechnology

Semester: IV

Course Title: Microbial Biotechnology - Practical

Course Code: 20BYP5MB42

No. of Hours: 30

LTP: 002

Credits: 2

List of experiments

1. Production of alcohol by *S. cerevisiae*
2. Production and estimation of citric acid by *A. niger*
3. Production of penicillin by fermentation.
4. Production of wine from apples.
5. Production of aspartic acid.
6. Production of glucose isomerase by batch fermentation
7. Production of lysine by *Corynebacterium* sp.
8. Characterization of microbes useful in degradation of pesticides/hydrocarbons.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA-8
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SYLLABUS

Subject: Biotechnology Semester: V/VI
Course Title: Techniques in Nursery Development Course Code: 20BYSEC11TN3
No. of Hours: 45 LTP: 300 Credits: 3

Objectives

- To know about preparation of nursery beds
- To learn the landscaping in institutions
- To understand the nursery techniques for easy propagation

Course Outcomes

- 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: Acquire skills to get an employment or to become an entrepreneur.

UNIT -I: Introduction to Nursery (9 Hrs.)

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 (9 Hrs.)

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 (9 Hrs.)

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 (9 Hrs.)

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 (9 Hrs.)

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.

Co- Curricular Activities

- Assignments on applications of nursery development
- Group discussions
- Student presentations and seminars
- Online quizzes

Prescribed Text Books

1. Ratha Krishnan, M., *et al.* (2014) PlantNursery Management: Principles and Practices, Central Arid Zone Research Institute– ICMR, Jodhpur, Rajasthan.
2. Vikas Kumar, Anjali Tiwari, Practical manual of Nursery management, Agri – biotech Press, NewDelhi.

Reference Books

1. TaraiRanjan Kumar, (2020) Plant propagation and nursery management, New India Publishers.
2. P.K.Ray, (2020) Essentials of plant nurserymanagemet.
3. P.K.Ray, (2012) How to start and operate a PlantNursery.

**MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA-8
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SYLLABUS

Subject: Biotechnology

**Course Title: Techniques in Nursery
Development - Practical**

No. of Hours: 45

LTP: 003

Semester: V/VI

Course Code: 20BYP611TN2

Credits: 2

Objectives

- To know about the types of nurseries
- To learn the nursery tools and techniques
- To know about media preparation and plant production

Course Outcomes

CO1: List out different types of nurseries and beds.

CO2: Identify the nursery tools, implements and containers.

CO3: Develop skill on potting media preparation and plant production.

CO4: Learn the technique of establishing cutting, layering, grafting etc.

List of Experiments

(30 Hrs.)

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

Skill/Hands-on: Field work/ Mini project

(15 Hrs.)

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

Reference Books

1. TaraiRanjan Kumar, (2020) Plant propagation and nursery management, New India Publishers.
2. P.K.Ray,(2020). Essentials of plant nurserymanagemet.
3. P.K.Ray,(2012). How to start and operate a PlantNursery.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA-8
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SYLLABUS

Subject: Biotechnology

Course Title: Hydroponics Cultivation

No. of Hours: 45

LTP: 300

Semester: V/VI

Course Code: 20BYSEC12HC3

Credits: 3

Objectives

- To know about the soil less gardening
- To learn the cultivation practices
- To understand the hydroponic techniques

Course Outcomes

CO1: Understand the concept of hydroponics

CO2: Acquire the knowledge on soilless cultivation system

CO3: Prepare media for hydroponics cultivation

CO4: Learn the hydroponic cultivation technique

UNIT -I: Introduction to Soilless culture

(9 Hrs.)

Definition, History and origin of soilless culture, Present status of hydroponics- contrasts with soil based culture, Applications & future developments.

UNIT-II: Macronutrients, micronutrients

(9 Hrs.)

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

(9 Hrs.)

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

(9 Hrs.)

Static solution culture, continuous-flow solution culture and aeroponics.

UNIT –V: Cultivation of crop plants by hydroponics**(9 Hrs.)**

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.

Co- Curricular Activities

- Assignments on applications of Hydroponics
- Group discussions
- Student presentations and seminars
- Online quizzes

Reference Books:

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

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SYLLABUS

Subject: Biotechnology

Course Title: Hydroponics Cultivation- Practical

No. of Hours: 45

LTP: 003

Semester: V/VI

Course Code: 20BYP712HC2

Credits: 2

Objectives

- To understand the nutrients for hydroponics cultivation
- To know about the media preparation
- To identify the weed management in hydroponics

Course Outcomes

CO1: List out macronutrients, micronutrients- functions and effect on plants, deficiency symptoms

CO2: Demonstrate the importance of temperature and light in hydroponics

CO3: Develop skill of media production for Hydroponics cultivation

CO4: Equip with the skill of weed management, diseases and pest management

List of Experiments

(30 Hrs.)

1. Handling of tools required for hydroponic setup
2. Preparation of macronutrients and micronutrients solutions/stock cultures
3. Preparation of different media for hydroponics 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 hydroponics system
8. Cultivation of chilli through hydroponic cultivation

Skill/Hands-on: Field work/ Mini project

(15 Hrs.)

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.

References Books

1. Dahama A.K. Organic Farming for Sustainable Agriculture. Agrobios, India
2. Subba Rao N.S. (1995). Biofertilizers in Agriculture and Forestry. Oxford and IBH Publishing Company. Pvt. Ltd New Delhi.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA-8

(Affiliated to Krishna University, Machilipatnam)

SYLLABUS

Subject: Biotechnology

Course Title: Organic farming

No. of Hours: 45

Semester: V/VI

Course Code: 20BYSEC21OF3

Credits: 3

LTP: 300

Objectives

- To know about the natural farming techniques
- To learn the preparation of organic manure
- To understand the production of bio fertilizers

Course Outcomes

CO1: Understand the soil profile and nutrients in soil

CO2: Appreciate the importance of organic manure and bio fertilizers

CO3: Produce vermi compost, farmyard manure from bio waste

CO4: Acquire skill on isolation and maintenance of bio fertilizers

UNIT -I: Soil

(9 Hrs.)

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 dependant farming on yield and soil health.

UNIT-II: Plant Nutrition

(9 Hrs.)

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

(9 Hrs.)

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

(9 Hrs.)

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: Biofertilizer

(9 Hrs.)

Introduction, status and scope. Structure and characteristic features of bacterial biofertilizers- *Azospirillum*, *Azotobacter*, *Bacillus*, *Pseudomonas*, *Rhizobium* and *Frankia*. Cyanobacterial biofertilizers- *Anabaena*, *Nostoc*, *Hapalosiphon* and fungal biofertilizers- AM mycorrhiza and ectomycorrhiza. Mechanism of nitrogen fixation and phosphorus solubilization.

Co- Curricular Activities

- Assignments on applications of organic farming
- Group discussions
- Student presentations and seminars
- Online quizzes

Prescribed Text Books

1. Principles of Organic Farming:: by E Somasundaram, D Udhaya Nandhini, M Meyyappan ;2021
2. Organic farming in India:: by Arpita Mukherjee; 2017
3. Biofertilizer and biocontrol agents for agriculture;; by AM Pirttilä · 2021

Reference Books

1. Biofertilizers for Sustainable Agriculture and Environment
Bhoopander, Giri Ram Prasad, Qiang-Sheng Wu, Ajit Varma; 2019
2. Trends in Organic Farming in India;; by S. S. Purohit, 2006

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA-8
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SYLLABUS

Subject: Biotechnology	Semester: V/VI
Course Title: Organic Farming - Practical	Course Code: 20BYP621OF2
No. of Hours: 45	LTP: 003
	Credits: 2

Objectives

- To know about the organic farming material
- To prepare the compost production
- To understand the techniques in organic farming

Course Outcomes

- CO1:** Estimate NPK levels in the soil
- CO2:** Demonstrate the collection and processing of raw material
- CO3:** Develop skill of vermi compost production
- CO4:** Learn the technique of establishing organic farms
- CO5:** Equip with the skill of preparation of microbial media

List of Experiments

(30 Hrs.)

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 vermicastings
6. Sieving, drying and packing of vermicompost
7. Visit to animal shed and observing farm yard manure production
8. Preparation of media and isolation of biofertilizers

Skill/Hands-on: Field work/ Mini project

(15 Hrs.)

1. Comparing mineral content in different agricultural soil
2. Learning techniques of basic instruments handling related to fieldwork
3. Preparation of videos on compost preparation and application
4. Visit to local organic fields
5. Attending special lectures, group discussions and seminars on organic farming.

References Books

1. Trends in Organic Farming in India;; by S. S. Purohit,2006.
2. Biofertilizers for Sustainable Agriculture and Environment;; by BhoopanderGiri Ram Prasad, Qiang-Sheng Wu, AjitVarma;2019.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA-8
(Affiliated to Krishna University, Machilipatnam)

SYLLABUS

Subject: Biotechnology

Semester: V/VI

Course Title: Biofertilizers & Biopesticides production

Course Code: 20BYSEC22BB3

No. of Hours: 45

LTP: 300

Credits: 3

Objectives

- To know about solid and liquid biofertilizers
- To learn the importance of biopesticides
- To understand the production of fertilizers

Course Outcomes

CO1: Understand the importance of bio fertilizers for sustainable agriculture.

CO2: Appreciate the role of VAM in P solubilisation

CO3: Define bio pesticide and its nature

CO4: Produce bio fertilizers and bio pesticides on large scale

CO5: Able to prepare inoculums for field application

UNIT-I: Biofertilizer

(9 Hrs.)

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 biofertilizer

(9 Hrs.)

Importance, types, characteristic features of ecto and endomycorrhiza. Mechanism of phosphorus solubilisation. Uptake of phosphates by the roots. Consortium based inoculums and significance.

UNIT- III: Bio pesticides

(9 Hrs.)

Definition, concept, history, scope and importance of bio pesticides. Classification - botanicals, bacterial, fungal and viral based bio pesticides. Mechanism of action of *Bacillus thuringiensis* and *Trichoderma viridiae* as bio control agents.

UNIT-IV: Mass production techniques

(9 Hrs.)

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

(9 Hrs.)

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.

Co- Curricular Activities

- Assignments on applications of biofertilizer production
- Group discussions
- Student presentations and seminars
- Online quizzes

Prescribed Text Books

1. Biofertilizers: Commercial Production Technology and Quality Control, 2017 by Dr. P.Hyma
2. A Textbook of Integrated Pest Management, 2013 by Ram Singh & Vikas Jindal G.S.Dhaliwal
3. Biofertilizers for Sustainable Agriculture, 2017; by Arun K Sharma

Reference Books

1. Biofertilizers Technology, 2010, by S.Kaniyan, K.Kumar and K. Govindarajan
2. Advances In Plant Biopesticides 2021, by Dwijendra Singh, Springer India.

**MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA-8
(Affiliated to Krishna University, Machilipatnam)**

SYLLABUS

Subject: Biotechnology

Semester: V/VI

Course Title: Bio fertilizers and Bio pesticides production - Practical

Course Code: 20BYP722BB2

No. of Hours: 45

LTP: 003

Credits: 2

Objectives

- To understand the soil condition
- To know about the bio control agents
- To learn about the applications of bio fertilizers

Course Outcomes

CO1: Prepare bacterial and fungal media

CO2: Isolate and identify symbiotic and free living nitrogen fixing bacteria

CO3: Isolate fungal bio control agents from soil samples

CO4: Develop skill for large scale production of microorganisms

CO5: Learn field application techniques of biofertilizers and biopesticides

List of Experiments

(30 Hrs.)

1. Preparation of Nutrient agar, YEMA, and PDA media
2. Isolation of *Rhizobium* from root nodules
3. Isolation of *Azotobacter* 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

Skill/Hands-on: Field work/ Mini project

(15 Hrs.)

1. Training of students by the industrial experts
2. Identification and collection of botanical pesticides
3. Assignments/seminars/group discussion /quiz on bio fertilizers and biopesticides
4. Preparation of videos, charts on inoculum development and field application
5. Attending invited guest lectures on the concerned topics

References Books

1. Biofertilizers for Sustainable Agriculture, 2017; by Arun KSharma
2. Advances In Plant Biopesticides 2021, by Dwijendra Singh, SpringerIndia
3. A Textbook of Integrated Pest Management, 2013by Ram Singh &VikasJindalG.S. Dhaliwal.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA-8

(Affiliated to Krishna University, Machilipatnam)

SYLLABUS

Subject: Biotechnology
Course Title: Apiculture
No. of Hours: 45

LTP: 300

Semester: V/VI
Course Code: 20BYSEC31AP3
Credits: 3

Objectives

- To know about the honey bees
- To learn the importance of health and hygiene
- To understand the bee hives

Course Outcomes

CO1: Obtain the elementary knowledge of different species and races of honeybees

CO2: Appreciate the importance of health and hygiene in Beekeeping

CO3: Maintain the Bee hives in a scientific way

UNIT-I: Biology of Bees

(9 Hrs.)

History, Classification and Life Cycle of Honey Bees. Social Organization of Bee Colony.

UNIT - II: Rearing of Bees

(9 Hrs.)

Artificial Bee rearing (Apiary), Beehives – Newton and Langstroth. Methods of Extraction of Honey (Indigenous and Modern).

UNIT - III: Diseases and Enemies

(9 Hrs.)

Bee Diseases and Enemies. Control and Preventive measures.

UNIT -IV: Economy and Entrepreneurship

(9 Hrs.)

Products of Apiculture Industry and its Uses (Honey, Bee Wax, Propolis) and Pollen.

UNIT-V: Entrepreneurship in Apiculture

(9 Hrs.)

Bee Keeping Industry: Present and future, Role of Bees in cross pollination in horticulture and agriculture. Prospects of apiculture as self-employment venture.

Co- Curricular Activities

- Assignments on applications of Apiculture
- Group discussions
- Student presentations and seminars
- Online quizzes

Prescribed Text Books

1. Prost, P. J. (1962). Apiculture. Oxford and IBH, NewDelhi.
2. Graham, J M (1992). The hive and the honey bee. Dadant and Sons, Hamilton, Illinois.
3. Mishra R.C. (1995). Honey bees and their management in India. ICAR Publication New Delhi.
4. Singh, S. (1971). Beekeeping in India, ICARpublication.

Reference Books

1. Bisht, D.S. (2004). Agricultural Development in India, Anmol Pub. Pvt.Ltd.
2. Singh S.(1964). Beekeeping in India, Indian council of Agricultural Research, NewDelhi
3. Mehrotra, K.N. Bisht, D.S. (1981). Twenty-five years of apiculture research at IARI. Apiculture in relation toagriculture.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA-8
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SYLLABUS

Subject: Biotechnology
Course Title: Apiculture - Practical
No. of Hours: 45

LTP: 003

Semester: V/VI
Course Code: 20BYP631AP2
Credits: 2

Objectives

- To study different species of honey bees
- To learn the extraction of honey wax
- To know the techniques of apiculture
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Course Outcomes

CO1: Maintain the Bee hives in a scientific way.

CO2: Clean & Maintain Bee Boxes

CO3: Use of other tools required in Bee Keeping

CO4: Building and division of colony

CO5: Understand the methodologies of extracting, preservation and marketing of honey and other products of honeybee

List of Experiments

(30 Hrs.)

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 honeybees
4. Preparation of honey bee trays for beekeeping, maintenance and colony inspection
5. Extraction of honey and beeswax
6. Processing of honey, packing and storing
7. Identification of honey adulteration

Skill/Hands-on: Field work/ Mini project

(15 Hrs.)

1. Training of students by related industrial experts.

Assignments (including technical assignments like Identification of flora and location of site, procurement of bee box and other tools, building & division of comb and colony, manage insects and diseases and nuisance in bee hives.

2. knowledge of the scientific methods of beekeeping)
3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
4. Preparation of videos on tools and techniques on beekeeping.

5. Collection of material/figures/photos related to products of Apiculture, writing and organizing them in a systematic way in a file.
6. Visits to Apiculture facilities, firms, research organizations etc.
7. Invited lectures and presentations on related topics by field/industrial experts.

References Books

1. Bisht, D.S. (2004). Agricultural Development in India, Anmol Pub. Pvt.Ltd.
2. Singh S.(1964). Beekeeping in India, Indian council of Agricultural Research, New Delhi
3. Mehrotra, K.N. Bisht, D.S. (1981). Twenty-five years of apiculture research at IARI. Apiculture in relation to agriculture.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA-8

(Affiliated to Krishna University, Machilipatnam)

SYLLABUS

Subject: Biotechnology

Semester: V/VI

Course Title: Pearl Culture

Course Code: 20BYSEC32PC3

No. of Hours: 45

LTP: 300

Credits: 3

Objectives

- To know about fresh and marine water oysters.
- To learn the basic implantation methods
- To impart the skill on production of pearl

Course Outcomes

CO1: Understand the basic concept of pearl culture.

CO2: Obtain the elementary knowledge regarding the Anatomical and Physiological aspects of fresh water oysters.

CO3: Acquaint with the various types of implantation methods and pearl culture surgery techniques.

CO4: Acquire skill on production of pearl and its marketing for economic gain

UNIT- I: Overview of Pearl oyster

(9 Hrs.)

Biology of Pearl oyster: Pearl producing molluscs. Morphology and anatomy of Pearl oyster, Life cycle of pearl oyster.

UNIT- II: Process of Pearl formation

(9 Hrs.)

Structure and Histology of mantle. Natural Process of Pearl formation. Chemical composition of Pearls. Economic importance of pearls.

UNIT- III: Pearl oyster culture

(9 Hrs.)

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

(9 Hrs.)

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

(9 Hrs.)

Diseases and Predators of Pearl oysters' Present status, prospects and problems of pearl industry in India.

Co- Curricular Activities

- Assignments on applications of Pearl culture.
- Group discussions
- Student presentations and seminars
- Online quizzes

Prescribed Text Books

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.

Reference Books

1. Bardach, J.E.W (1972) Aquaculture farming and husbandry of freshwater and Sorting of Pearl. Marketing and economics concerned with Pearl Culture.

2. David Dobilet (1995) Pearl farming (Australia) Nat Geographic Mag publication.

3. Yuan Cha Da (2014) Environmental effects Pearl farming (China) Jiangxi People publishing house.

1. Visits to pearl culture facilities, firms, research organizations etc.
Invited lectures and presentations on related topics by field/industrial experts.

MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA-8
(Affiliated to Krishna University, Machilipatnam)

SYLLABUS

Subject: Biotechnology

Course Title: Pearl Culture - Practical

No. of Hours: 45

Semester: V/VI

Course Code: 20BYP732PC2

Credits: 2

LTP: 003

Objectives

- To know about pearl culture techniques
- To understand the implement activities on pearl culture
- To learn about the management practices in pearl harvesting.

Course Outcomes

1. Execute pre- pearl culture activities
2. Learn the technique of surgical operation
3. Develop skill of Post operation activities
4. Implement culture activities
5. Perform pearl harvesting

List of Experiments

(30 Hrs.)

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

Skill/Hands-on: Field work/ Mini project

(15 Hrs.)

2. Training of students by related industrial experts.
3. Assignments (including technical assignments like identifying tools in pearl culture and their handling, operational techniques with safety and security, IPR)
4. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
5. Preparation of videos on tools and techniques in pearl culture.
6. Collection of material/figures/photos related to products of pearl culture, writing and organizing them in a systematic way in a file.

7. Visits to pearl culture facilities, firms, research organizations etc.
Invited lectures and presentations on related topics by field/industrial experts.

References Books

1. 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
2. David Dobilet (1995). Pearl farming (Australia) Nat Geographic Magpublication
3. Yuan Cha Da (2014). Environmental effects Pearl farming (China) Jiangxi People publishing house.