SEMESTER III			
Core IX	**Marine Biotechnology**		
19PBOC31	**Hrs/week: 6**	**Hrs/Semester : 90**	**Credits: 4**

Vision:

- To give elaborate account on marine environment and its role in controlling the Earth's climate.

Mission:

- To understand the different types of marine habitats and the adaptation of life there in.
- To understand the role of marine products and their socio economic and environmental significance

Course Outcome

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	analyze how marine organism adapt to their dynamic environment	5	Un
CO-2	recall how natural events and human activities affect coastal habitats	7	Re
CO-3	critically analyze and evaluate pollution issues, their sources and the influences humans have with the dynamic marine environment	7	An
CO-4	achieve practical skills in processing, preserving and culturing marine plants	6	Ev
CO-5	evaluate the uses of marine resources and realize the role of phytoplankton and bacteria in the economy of the ocean	5	Ap
CO-6	able to signify the characteristic feature of coral reefs and their role in biodiversity conservation	1	An
CO-7	able to identify and understand the role of mangroves in coastal protection and their adaptation to its hostile environment	5	Ap
CO-8	explain the ecological relationship between organisms and their environment	2	An

SEMESTER III			
Core IX	**Marine Biotechnology**		
19PBOC31	**Hrs/week: 6**	**Hrs/Semester : 90**	**Credits: 4**

Unit I

Classification of marine habitat - ecology of pelagic, benthic and sublittoral zones, deep sea, sandy muddy and rocky shore. Characteristics of marine habitat – tides and chlorinity, upwelling, plate tectonics, tsunami, green house effect, carbon pump. Ocean and regulation of climate on earth.

Unit II

Marine biodiversity –phytoplankton - characteristics, measuring and sampling. Marine bacteria, marine fungi, seaweeds and sea grasses. Threats and conservation of seaweeds and sea grasses. Nutrient cycling: carbon, nitrogen,sulphur and phosphorus.

Unit III

Marine products - traditional uses; human food and agriculture. Marine colloids and hydrocolloids - Agar - agar, algin, alginates, carrageenan, diatomite, marine lipids, flavanoids, and carotenoids. Marine pharmacology –identification of bioactive compounds in marine organisms – mangroves, seaweeds, and sea grasses.

Unit IV

Culture of micro algae –laboratory culture, preservation and maintenance of culture and mass culture. Commercial cultivation of seaweeds. Marine pollution –thermal pollution, oil pollution, heavy metal pollution, radioactive pollution and industrial pollution. Algal blooms. Global climate changes: impact on specific diversity and productivity, ocean as carbon sink, effect on coral bleaching. Biological rhythms.

Unit V

Mangroves and salt marshes: geographical distribution, habit, adaptations, and trophic interactions. Present status and stresses on the mangroves with special reference to Sunderbans. Regeneration of mangroves. Coral reefs –ecology, species interaction, economic importance and conservation.

Books for Reference :

1. Cliton J. Dawes, 1981. *Marine Botany.* A wiley – Intersciences publication. John Wiley and sons., New York.
2. Dring, M.J. 1982. *The Biology of marine plants.* Edward Arnold.
3. Kumudranjan Naskar and Rathindranath, 1999. *Ecology and Biodiversity of Indian mangroves. Vol. II & I.* Daya publishing House, Delhi, 110 035. Mandal.
4. Michael, P. 1986. *Ecological methods for field and laboratory investigations*. Tata McGraw – Hill publishing Company Limited.
5. Sinha, P.C. 1998. *Marine pollution,* Anmol publications Pvt. Ltd. New Delhi 110 002. (India).

6. Tait, R.V. 1978. *Elements of Ecology*. Butter worths, London, Boston Sidney Wellington, Durban Toronto.
7. Warren, 1971. *Biology and water pollution control.* W.B.Saunders Company. Philadelphis, London. Toronto.

Practicals
Hrs/Week - 2

1. Determination of acidity
2. Estimation of alkalinity
3. Collection and identification of phytoplankton.
4. Determination of total hardness
5. Estimation of nitrate (Colorimetry)
6. Estimation of Phosphate (Colorimetry)

Specimens / photographs / charts

1. Plankton net
2. Seaweeds
3. Sea grasses
4. Mangroves
5. Alginates
6. Carrageenan

Books for Reference

Murugesan A.G. and Rajakumari 2005. *Environmental Science and Biotechnology and Biotechnology, Theory and Techniques,* MJP Publishers.

SEMESTER III			
Core XI	**Molecular Biology and r-DNA Technology**		
19PBOC33	**Hrs/week: 5**	**Hrs/Semester : 75**	**Credits: 4**

Vision:

- To understand the recent advancement in the biological study and concepts of gene cloning technology

Mission:

- To upgrade the knowledge about the latest concepts of prokaryotic and eukaryotic genome and their expression
- To make venture into plant genomic research.

Course Outcome

CO.No.	Upon completion of this course, students will be able to	PSO addressed	CL.
CO-1	know chemistry of genetic material and details of its replication at molecular level	2	Un
CO-2	understand the general principles of chromosome organization at different phases of cell cycle	2	Un
CO-3	explain gene regulation mechanisms at various levels by which she can learn how it controls growth and development of an organism	4	Cr
CO-4	know complexity of gene expression in eukaryotes over prokaryotes	3	Un
CO-5	understand vector mediated gene transfer techniques including screening and identification of recombinants	6	Un
CO-6	know the gene cloning tools and their mysteries in success of gene cloning technology	8	Un
CO-7	attain hands on experiences in the techniques associated there of	4	Cr
CO-8	practice the advanced techniques in genetic engineering such as DNA sequencing, blotting, DNA amplification and fingerprinting	3	Ap

SEMESTER III			
Core XI	**Molecular Biology and r-DNA Technology**		
19PBOC33	**Hrs/week: 5**	**Hrs/Semester : 75**	**Credits: 4**

Unit I

Chemistry of genetic material – DNA double helical structure-Watson and crick model, alternative models. DNA replication- Molecular mechanism of initation of DNA replication in *E. coli,* λphage and PBR322, elongation, termination. DNA replication in Eukaryotes- initation, cis and transacting elements, elongation and termination. DNA modification, DNA damages and repair mechanism , DNA repair and genetic diseases in human – Bloom's

Unit II

Organisation of genetic material –packaging of DNA-nucleosome model at molecular level; Genetic code- properties, codon assignment, wobble hypothesis; Regulation of gene expression in prokaryotes- General aspects of gene regulation, transcriptional regulation- inducible and repressible system, positive and negative regulation; operon concept- lac operon and tryp operon, relative positions of promotor and operator, master switches; Regulation of translation- protein synthesizing apparatus, molecular mechanism of translation, role of translation factors.

Unit III

Regulation of gene expression in eukaryotes – transcriptional control- initiation, multiple RNA polymerases, transcription factors; core elements; auxiliary elements - enhancers and silencers in transcription. pre initiation complex, elongation- elongation factors and termination-role of termination factors, nucleosome remodeling. Post transcriptional processing - RNA modification, splicing. Translation regulation - molecular mechanisms, initiation, elongation and termination, role of translation factors. Difference between prokaryotic and eukaryotic gene regulation.

Unit IV

Outline of genetic engineering –Enzymes used in rDNA technology, exonuclease, endonuclease, restriction endonuclease, S_i nuclease, DNA ligase, reverse transcriptase and alkaline phosphatase. Cloning vectors – plasmids – pBR ^{322}, shuttle vectors, M^{13} Bacteriophage vector, Cosmids, Ti plasmid. Isolation of genes from genomic and cDNA library.

Unit V

Gene transfer methods- vector mediated (*Agrobacterium*), direct gene transfer (physical and chemical). Screening and identification of recombinants. Mobile genetic elements – Is elements and transposons in maize and Bacteria. DNA sequencing – Maxam and Gilbert method, Dideoxy nucleotide method, Messing's shot gun method. DNA chips. Hybridization techniques – Southern, Northern and Western blotting. DNA amplification – PCR, RFLP, RAPD and finger printing.

Books for Reference

1. Benjamin Lewin, 2004. *Genes VII.* Pearson Prentice Hall.
2. Channarayappa, 2006, *Molecular Biology. Principles and Principles and practices.* Universities Press (India), Pvt. Ltd. 3.5.819. Hyderabad, 500 029.
3. David Preifelder, 2006. *Molecular Biology*. Narosa publishing House, Madras, New Delhi.
4. Gupta, R.K.2006. *Genetics.* Rastogi publications.
5. Nicholl DST, 2001. *An Introduction of genetic engineering*. Cambridge University press.
6. Old R.N. and Primrose, S.B. 2004. *Principle of gene manipulation*. Blackwell scientific publication, USA.
7. Power C. B. 2007. *Genetics Vols. I and II.* Himalaya publishing House. Kundanal chandak. Industrial Estate. Ghat Road. Nagpur- 440 018.
8. Robert H. Tamarin. 2006 *Principles of Genetics*. Tata Mc. Graw - Hill publishing company Ltd., New Delhi.
9. Sathyanarayana,U. 2006. *Biotechnology.* Book and Allied (P). LTD. Kolkatha.
10. Singh, B.D. 2005. *Genetic* Kalyani publishers, Chennai.

Practicals

Hrs/ week - 2

1. Estimation of DNA (Spectrophotometry)
2. Hyperchromisity of DNA
3. Isolation of DNA/ Plasmid from Bacteria
4. Isolation of DNA from plant materials
5. DNA amplification using PCR.
6. Seperation of DNA using AGE
7. Restriction enzyme digestion of DNA.
8. Identification of restriction bands.

Books for Reference:

Ponmurugan.P, B. Gangathara Prabhu. 2012. *Biotechniques*. MJP publishers. Chennai.

Semester III			
Core XII	**Research Methodology**		
19PBOC34	**Hrs/week:5**	**Hrs/Semester :75**	**Credits : 4**

Vision:

- To know the basic tools in research and to facilitate the students to undergo basic and application oriented research

Mission:

- To infuse the practical knowledge of using various instruments into the vast array of techniques in plant science.
- To motivate the students to do research.

Course Outcome

CO.No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	know and explain the importance of the internet in research and be able to use it for gathering their reference materials	1	Un
CO-2	acquainted with different tools and techniques essential for research work	6	Cr
CO-3	examine the basic framework of research process and able to learn how to address research problem and what is to be done to solve it.	8	An
CO-4	develop an understanding of the ethical dimensions of conducting applied research	7	An
CO-5	determine the appropriate quantitative methodologies to be used for the study	1	Ev
CO-6	understand a general concept of paradigms of research design.	7	Un
CO-7	familiarise with mixed methods of research.	6	Cr
CO-8	communicate the research findings to the scientific forums	6	Cr

Semester III			
Core XII	**Research Methodology**		
19PBOC34	**Hrs/week:5**	**Hrs/Semester :75**	**Credits : 4**

Unit I

Microscopy - basic principles, components of compound microscope, phase contrast and fluorescent microscopes. Electron microscopy-principle, components, working mechanism and applications of TEM and SEM. Micro technique: fixatives, stains, dehydration and embedding – sectioning with rotary microtome and staining. Micrometry – principle and methods of measurement of plant cells.

Unit II

pH metry -principle, electrodes, measurement of pH. Spectroscopy- visible and ultraviolet spectrophotometers – Atomic absorption spectrophotometer (AAS). FTIR - principle, working mechanism and its applications. Centrifugations: working principle and applications of clinical centrifuge, high-speed centrifuge, ultra centrifuge and analytical centrifuge.

Unit III

Chromatography- types– adsorption and partition chromatography. Principle and applications of Thin layer chromatography, Gas liquid chromatography and High performance liquid chromatography Photomicrography - principle and methods.

Unit IV

Electrophoresis - basic principles, electrophoretic mobility, factors, isoelectric focusing, types - vertical and horizontal. Agarose and polyacrylamide gel electrophoresis, detection and recovery of electrophorogram. Gel documentation system. Tracer techniques - nature of radioactivity, patterns of radioactive decay, half life - detection, radiation measurement - Geiger Muller counter, Scintillation counter, Autoradiography and applications of isotopes in biology. X- ray crystallography.

Unit V

Choosing the problem for research, literature collection – Primary, secondary and tertiary sources, Bibliography, indexing and abstracting, Reporting the results of research in conferences – Oral and Poster presentation. Manuscript processing –thesis and journal format-preparation of full paper – reviews, bibliometrics, plagiarism

Books for Reference:

1. Anbalagan, K. 1985. *Electrophoresis.* Life Science Book house. Madurai.
2. Bryan C. Williams Keith Wilson, 1983. *A biologists guide to practical techniques of practical biochemistry* second edition. Edward Arnold publications.
3. Ghatak K. L., 2011, *Techniques and methods in Biology*, PHI Learning Private Ltd, New Delhi.

4. Guruamni. N, 2006, *Research Methodology for Biological Sciences,* MJP Publishers, Chennai
5. Gurumani N., 2010. *Scientific thesis writing and paper presentation*. MJP Publishers, Chennai
6. Jayaraman J., 1985. *Laboratory manual in biochemistry*, Wiley Eastern Ltd., New Delhi.
7. Johansen,M., 1940. *Plant Microtechnique* Mc. Graw Hill.
8. Kothari C.R., 2004. *Research Methodology* – Methods and techniques New age International (P) Ltd., Publishers. New Delhi.
9. Plummer, D., 1987. *An introduction to practical Biochemistry*, Tata Mc. Graw Hill.
10 Ramadass P. and A. Wilson Aruni. 2009. *Research and writing across the disciplines,* MJP Publishers, Chennai
11 Rana S.V.S., 2012, *Biotechniques Theory And Practice,* Rastogi publications, New Delhi.
12 Subramanian, 2005. *Biophysics principles and Techniques*. MJP Publishers, Chennai.
13 Veerakumari, L., 2004. *Biochemistry* M.J.P. Publishers, Chennai.
14 Veerakumari, L., 2015. *Bioinstrumentation*, M.J.P. Publishers, Chennai.
15 Wilson, K. and J. Walker, 1997. *Practical biochemistry IV edition,* Cambridge university press.

Practical
Hrs/week: 2

1. Preparation of permanent slides using microtome
2. Measurement of plant cells using micrometer
3. Thin layer chromatographic separation of amino acids
4. Analysis of protein by PAGE
5. Analysis of DNA by AGE
6. Digital photographic display of anatomical samples/ microscopic samples
7. Demonstration-AAS and FTIR
8. Calculation of citation Index
9. Determination of Impact Factor of Author, Article and Journal.

Submission - Record Note Book

Books for Reference:

- Ruth L Willey, 1971. *Microtechnique: A Laboratory Guide*, The Mac Millan Company, NewYork
- Ponmurugan.P, B. Gangathara Prabhu. 2012. *Biotechniques.* MJP publishers. Chennai.
- Donald Alexander Johansen, 1940. *Plant Microtechnique*. New York; London, McGraw-Hill Book Company, Inc.

SEMESTER IV			
Core: XIII	**Plant Physiology**		
19PBOC41	**Hrs/week: 6**	**Hrs/Semester : 90**	**Credits: 4**

Vision:

- Able to understand the organized complexity of life process in plants.

Mission :

- Able to learn the role of physical and chemical process in plant function.
- Able to know about the responses of plant to the environment.

Course Outcome

CO.No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	understand the water relation and nutritional needs of the plant from the soil, and assess the symptom specific nutritional deficiencies and the need of fertilizers for crop improvement	6	Un
CO-2	discuss how root structure and functions influence the transfer of inorganic nutrients from the soil into the plants,	3	Un
CO-3	analyse the mechanism of their assimilation of inorganic molecules into organic molecular components.	3	Un
CO-4	analyse light enhanced photochemical reactions that culminates in the synthesis of ATP and NADPH and fixation of carbon dioxide into organic compounds	3	Un
CO-5	describe respiration with its associated carbon metabolism and releasing of energy stored in chemical bonds in a controlled manner for cellular use	3	Re
CO-6	investigate plant's functions and adaptations under altered environmental conditions	7	Cr
CO-7	comment on the hormone controlled and light mediated morphogenetic events in plants	3	An
CO-8	design and conduct scientific experiments and analyse the data critically	6	Cr

SEMESTER IV			
Core: XII	**Plant Physiology**		
19PBOC41	**Hrs/week: 6**	**Hrs/Semester : 90**	**Credits: 4**

Unit I

Water relations of plants - components of water potentials and their relation. Absorption of water - Mechanism of ascent of sap. Translocation - Mechanism of translocation of solutes- source sink relationship, phloem loading and unloading. Transpiration - stomatal movement, antitranspirants, guttation. Inorganic nutrient - ion uptake - passive and active uptake and transport. Mineral nutrition-mineral deficiencies disrupt plant metabolism and function, hydroponics and its significance.

Unit II

Photosynthesis-General concepts, Principle of light absorption-action spectrum, absorption spectrum. Pigment system and quantum yield. Photosynthetic apparatus-organization of components in the thylakoid membrane, photochemical reaction- LHS, OEC, mechanism of electron transport -z-scheme and cyclic; proton transport and chemiosmotic synthesis of ATP; regulation of photosynthetic machinery; carbon reaction-general aspects, activity of rubisco-Calvin Benson cycle, Inorganic carbon concentrating mechanism- C_4 carbon cycle, CAM, C_2 oxidative photosynthetic carbon cycle (photorespiration) significance of C_2 cycle-ecological aspects of photosynthesis

Unit III

Respiration- overview, glycolysis, regulation of glycolysis, PPP, Mitochondria- Structural organization, Citric acid cycle, e^- transport system and chemiosmotic synthesis of ATP; alternative oxidase mechanism in plants (cyanide resistance respiration in plants); respiration and coupling of other metabolism. Assimilation of mineral nutrients in plants- N_2 cycle, Nitrate assimilation. Ammonium assimilation and synthesis of aminoacids (GOGAT). Biological fixation of N_2. Assimilation of S and P in plants.

Unit IV

Physiological role, biosynthesis and mechanism of action of auxin, gibberellin, cytokinin, ethylene, abscissic acid, morphactins and brassinosteroids. Photomorphogenesis - phytochrome mediated photoresponses. Physiology of flowering; Fruit ripening. Physiology of senescence and abscission, Biological clock-occurrence of circadian rhythm in plants-examples.

Unit V

Stress physiology-Secondary metabolites and plants defense mechanisms to biotic stress-defense against pathogens, insect herbivores. Abiotic stress and mechanism of plants responses to salinity, drought, freezing, radiation and heavy metal stress. secondary messenger in plants-cAMP, Ca-calmodulin

Books for Reference

1. Beevers, L. 1976. *Nitrogen metabolism in plants.* William clowes & sons Ltd. London.
2. Bidwell, R.G.S. 1979. *Plant physiology*, Macmillan publishing company,

New york
3. Devlin, R.M. 1974. *Plant Physiology*. Narosa publishing House, New Delhi
4. Jain, V.K. 2004. *Fundamentals of Plant Physiology*, S.Chand and Co.Ltd. New Delhi.
5. Noggle, G.R. and G.J. Fritz, 2002. *Introductory plant physiology.* Prentice Hall India, New Delhi
6. Salisbury, F.B. and C.W. Ross, 2007. *Plant Physiology*. Thomson Wordsworth.
7. Taiz, L. and E. Zeiger. 1998. *Plant Physiology*. Sinauer Associates. Publishers Massachusetts, United States of America

Practical
Hrs/ week: 2

1. Hill activity - effect of different wave lengths.
2. Effect of antitranspirants and determination of stomatal index and frequency (Single leaf method & calcium chloride method)
3. Determination of water potential(any one method)
4. Membrane permeability studies.(using different solvents and temperature)
5. Nitrate reductase activity – any one factor (light coditions/age)
6. Determination of amylase activity.
7. Determination of peroxidase activity
8. Estimation of proline (Under normal and stressed conditions)
9. Determination of chlorophyll content during aging/ under different light conditions
10. Study on ion uptake.
11. Determination of sugar content in fruits during ripening process.

Submission - Record Note Book

Books for Reference:

Francis H Witham, David F Blaydes and Robert N Devlin, 1970. *Experiments in Plant Physiology.* Vanmostrand Rainhold Company, New Delhi.

Semester IV			
Core XIV	**Plant Biotechnology**		
19PBOC42	**Hrs/week:4**	**Hrs/Semester: 60**	**Credits: 4**

Vision:

- To apply techniques in biology to explore novel varieties of plants and environmental protection

Mission:

- To enumerate the role of 21st century science (biotechnology) in increasing productivity of crop plants and to enhance the production of high value metabolites.
- To develop skill to get employment in biotechnology laboratories and industries.

Course Outcome

CO. No	Upon completion of this course ,students will be able to	PSO addressed	CL
CO-1	understand principles of plant tissue culture and media preparation	3	Re,Un
CO-2	acquire knowledge and skill in various micropropagation techniques.	4	Un,Ap
CO-3	understand meristem culture, Somaclonal variations, haploid plants, androgenesis, gynogenesis, embryogenesis.	4	Un
CO-4	describe meristem culture and clonal propagation of plants	4	Re
CO-5	synthesize synthetic seeds and understand their applications	3	Un
CO-6	understand the fermentation processes and their importance in industries	3	Un
CO-7	study and apply nanotech process for her research pursuit	4	Ap
CO-8	discuss the advances in genetic engineering and production of monoclonal antibodies and their novelty	1	Re

Semester IV			
Core XIV	**Plant Biotechnology**		
19PBOC42	**Hrs/week:4**	**Hrs/Semester: 60**	**Credits: 4**

Unit I

Biotechnology: Introduction, scope. **Plant tissue culture:** Laboratory organization, tools and techniques, methods of sterilization, medium and its preparation. **Culture initiation:** callus culture, cell culture, single cell culture. **Regeneration:** organogenesis, factors affecting regeneration, regulation of regeneration.

Unit II

Somatic embryogenesis: Introduction, factors affecting embryogenesis. **Micropropagation methods:** Introduction, stages of micropropagation. Plant protoplast isolation, factors affecting protoplast isolation, protoplast culture. Protoplast fusion and somatic hybridization, regeneration from protoplast, fusion methods, selection of hybrid cells application of protoplast hybridization.

Unit III

Somaclonal variation: isolation and characterization of variants -molecular basis and induced mutations, applications and limitations. Production of secondary metabolites (alkaloids). Synthetic seed technology and applications. Production of haploids (anther, pollen and ovule), application of haploids. Meristem culture for virus free plant.

Unit IV

Biofertilizers: Mass production of *Rhizobium*, *Azospirillum* and Blue Green Algae (BGA), Vesicular Arbuscular Mycorrhizal Fungi (VAM). Single cell protein (*Scenedesmus, Spirulina, Saccharomyces)*. **Nanotechnology:** Outline of green synthesis of nanoparticles and their characterization.

Unit V

Molecular farming: Nutritional quality of seed protein. Immuno protective drugs. **Regulations in Biotechnology: Biosafety**: definition, requirement, biosafety in relation to transgenic research, biosafety guidelines and implementation. **Intellectual property rights:** process of patenting of biotechnological products. Farmer's Rights and plant breeder's Rights.

Books for Reference:

1. Colin Rattledge and K. Bjon, 2001. *Basic biotechnology*. Cambridge University
2. Dubey, R.C. 2005. *Textbook of Biotechnology*. S. Chand & Co. New Delhi
3. George, E.F. and P.D. Sherrington, 1984. *Plant propagation by tissue culture.* Exegetic Ltd. London.
4. Gupta, P.K. 2000. *Elements of Biotechnology*. Rastogi publication, Meerut.
5. Kalyan Kumar De. 2004. *An Introduction to Plant Tissue Culture*. New Central Book Agency, Calcutta.
6. Kumar, H.D. 1993. *Molecular biology and Biotechnology*. Vikas publishers, New Delhi.

7. Mahesh, 2008. *Paddy molecular Biotechnology*, New age international, publishers. (p) Limited.
8. Mukhopadhyay S.N, Prabhakar Sharma, and Rabindra Narain, 2011. *A text book of DNA recombinant technology.* Wisdom press. New Delhi.
9. Ramavat, K. G., 2000. *Plant Biotechnology*, S. Chand & Co., New Delhi
10. Reinort, J and M.M. Yeoman, 1983. *Plant cell and tissue culture*. Narosa publishing house Delhi.
11. Satyanarayana U. 2006. *Biotechnology.* Books and Allied (P) Ltd. Kolkatta.
12. Singh, B.D.2005. *Biotechnology- Expanding Horizons.* Kalyani Publishers, New Delhi.

Practical
Hrs /week: 2

1. Isolation of Rhizobium
2. Synthesis and characterization of nanoparticles
3. Preparation of synthetic seeds
4. Callus induction
5. Embryo culture
6. Single cell Isolation
7. Isolation of BGA
8. Nodal Culture
9. Protoplast isolation

Set up / pictures / photographs/ demonstration

- Apical meristem culture
- Cell suspension culture
- Protoplast Culture
- Anther Culture

Submission - Record Note Book

Books for Reference

- Chawla HS, 2009. *Introduction to Plant Biotechnology*. Oxford & IBH publishing company Pvt., Ltd. New Delhi