SEMESTER IV			
Common core I – Marine Biology			
Code: 17PBCC41	**Hrs/week:6**	**Hrs/Semester : 90**	**Credits: 5**

Objectives

- To make the students realize the potentiality of marine environment
- To understand the marine ecosystem threats and conservation

Unit I **Marine Environment – Zonation and Biota**

Sea as a biological environment. Classification of marine environment.Plankton – classification (size, life, habitat) and adaptations. Inter-tidal, rocky, sandy and muddy shores –features of the flora, fauna and adaptations. Role of marine micro-organisms (bacteria and fungi) in nutrient cycles (nitrate, phosphate and sulphate)

Unit II **Characteristics of Sea Water**

Physical properties: waves, tides, currents- types, causes, and their impact on marine organisms. Illumination, temperature, pressure. Chemical properties: nutrients, (major, minor, and trace elements), salinity, pH, density, dissolved gases (oxygen, carbon-di-oxide).

Unit III **Marine Ecosystems**

Estuaries, salt marshes, mangroves. Coral reef - ecology and types, species interaction, adaptations and importance. Threats and conservation of coastal ecosystems (coral reef and mangroves)

Unit I V **Marine Pollution**

Sources, effects and control measures of heavy metal, radioactive, oil, and thermal pollutions. Algal blooms-sources and effects. Microbial indicators of pollution. Role of microbes in pollution abatement.

Unit V **Wealth of the sea**

Living resources: Fishery products- fish meal and fish oil. Natural pearls: formation, ornamental and medicinal importance. Non-living resources: mineral wealth (manganese nodules, beach placers, glauconite and garnet). Bioactive compounds from marine organisms (bacteria, fungi and macro algae and sponges). Phycocolloids, agar-agar and algin.

Books for Reference

1. Tait, R.V. and Dipper F.A (1998) Elements of marine ecology.-4thed. British Library Cataloguing in Publication Data.
2. Gross, G., 1993.Oceanography: A view of the Earth. Sixth edition. Prentice Hall Inc., New Jersey.
3. McCormick, J.M. and J.V.Thiruvathaakal, 1976. Elements of Oceanography. W.B. Saunders Company, Philadelphia.
4 .Nybakken, J.W. 1997. Marine Biology – An Ecological Approach. Addison Weslay Longman, Inc. California, 477pp.
5. Olivia J.Fernando 1999.Sea water-Properties and dynamics, Dhanesh Publications, Ponnagam,Thanjavur
6. Russel 1970. Marine Ecology, Academic Press- London and New York
7. Nelson and Smith 1973, Oil pollution and Marine Ecology-Plenum press
8. Benjamin- Cummings, Menlo Park, California.Vijaya Ramesh, K. (2004). Environmental Microbiology.MJP Publishers Chennai.
9. MoshrafuddinAhamed and Basumatary. S.K.(2006). Applied Microbiology. MJP Publishers Chennai
10.Daws, C.J.1981. Marine Botany John Wiley and Sons, New York.

PRACTICALS

Hrs / Week : 2

1.Determination of acidity
2 Determination of salinity
3 Determination of alkalinity
4 Determination of total hardness
5. Determination of nitrite
6. Determination of phosphate
7 .Biochemical test for micro-organisms-IMViC
8. Collection and identification of marine plankton (any three phyto and zooplanktons)
9. Identification and remarks of the following
   i. Plankton net
   ii Inter-tidal organisms
      a. Rocky shore :Sea anemone, *Chiton*
      b. Muddy shore:*Uca, Cerithidia*
      c. Sandy shore: *Arenicola, Murex*
   ii.Food fishes*: Cybium,Sardinella*
   iii Sea weeds: *Gracilaria,Sargassum*,
10. Submission: Record Note Book

Semester IV			
Core X – Plant Biotechnology			
Code: 17PBOC41	**Hrs/week:6**	**Hrs/Semester : 90**	**Credits: 5**

Objectives:

- 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.

Unit I: Biotechnology-scope. Principles of plant tissue culture: totipotency, differentiation, dedifferentiation, redifferntiation. Establishment of plant tissue culture lab: equipment, culture vessels, pretreatment of explants. Composition of various tissue culture media and their preparation. Establishing callus: dynamics of callus growth, factors influencing organogenesis, embryogenesis and somatic embryos.

Unit II: Micropropagation: stages of micropropagation, factors affecting shoot multiplication, induction of roots. Synthetic seeds: methods of making synthetic seeds and applications. Production of virus free plants. Somoclonal variation: isolation and characterization of variants -molecular basis and induced mutations, applications and limitations. Cell suspension culture and production of secondary metabolites.

Unit III: Production of haploids (anther, pollen and ovule), detection of haploids - morphology and genetic markers, application of haploids. Protoplast isolation and culture. Protoplast fusion-techniques, selection of fused protoplasts, application. Uses of somatic hybrids and cybrids.

Unit IV Molecular farming **-** Nutritional quality and quality of seed protein. Immuno protective drugs. Gene therapy **–** types of gene therapy, methods of gene therapy, production of antibodies and vaccines, monoclonal antibodies and its application. Biosafety – definition, requirement, biosafety in relation to transgenic research. Intellectual property rights – process of patenting, applications. Farmer's Rights and plant breeder's Rights.

Unit V Biofertilizers: Mass production of *Rhizobium*, *Azospirillum* and Blue Green Algae (BGA), Vesicular Arbuscular Mycorrhizal Fungi (VAM). Single cell protein. Production of antibiotic (Penicillin), organic acid (Citric acid) and vitamin (Vitamin B_{12}). Outline of green synthesis of nanoparticles and their characterization.

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
Practical

- Isolation of *Rhizobium*
- Synthesis of nanoparticles
- UV – visible characterization of nanoparticles
- Preparation of synthetic seeds

Set up / pictures / photographs/ demonstration

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

Submission - Record Note Book

SEMESTER IV			
Core XI - Plant Ecology			
Code: 17PBOC42	**Hrs/week:6**	**Hrs/Semester : 90**	**Credits : 5**

Objectives:

- To enhance the understanding of the environment, key ecological issues, concepts and principles of environmental protection to make life on earth more sustainable and beneficial to human.

Unit I Plant and the environment:climatic factors - air, water and temperature; Edaphic factors - types based on texture and colour. Components of soil-soil air, soil water, pH, mineral matter, organic matter, soil profile - soil organisms - reclamation of soil erosions and conservation. Biotic Factors - positive and negative interactions. Structure and function of major ecosystems - terrestrial (Grass land , forest and desert) aquatic (pond).

Unit II Population structure and dynamics: Basic concepts - characteristics of population,size and density, dispersion, age structure, natality, mortality, biotic potential and life table. Population dynamics - theory of population growth , Plant population dynamics, Regulation of population growth, Evolution among population and population interaction.

Unit III Ecological succession - Definitions, Causes of succession and climax, concept, Monoclimax and poly climax theories, Kinds of succession, Hydrosere and Xerosere. Adaptation of plants- hydrophytes,xerophytes and halophytes,

Unit IV Environmental Management Plan (EMP), ecological indicators. Bioremediation - *In situ* and *ex situ* bioremediation of hydrocarbon, dyes, heavy metals and xenobiotics. Biodegradation of pesticides, biodegradable plastics, bio-augmentation. Bio-filtration - mechanism and microrganisms used. Microbial leaching, bio-mining. Ecology in national affairs- carbon trading, carbon sequestration, blue carbon, climate conference, convention and summit.

Unit V Global environment problems - climate change, global warming, UV - B, green house effect - ozone layer depletion, acid rain , nuclear accidents and holocaust. Disaster management – flood, earthquake and landslides. Eco-management, Environmental Impact Assessment (EIA). Sustainable eco-development, environmental education, Environmental protection Act (EPA)1986. Man and Biosphere (MAB)

Books for Reference :

1. Asthana and Meera Asthana, 2001. Environmental problems and solutions. S.Chand and Co. Ltd., New Delhi.
2. Balasubramanian,D; C.F.a. Bryee, K.Dharmalingam, J.Green and K. Jeyaraman, 2005. Concepts in Biotechnology. Universities Press.
3. Dash, M.C.2001.Fundamentals of ecology. Tata McGraw Hill publishing Co. Ltd., New Delhi.
4. Murugesan, A.G.and Rajakumari , 2005. Environmental Science and Biotechnology, theory and Techniques . M.J.P. Publishers, chennai.
5. Sharma, P.D1999.Elements of ecology. Rastogi Publications, Shivaji Road, Meerut.
6. Trivedi P.R, P.L Sharma and KN Sundarshan 1994. Natural environment and Constitution of India, Efficient offset printers, New Delhi.
7. Tyller Miller G., 2004. Environment Science Thompson Brooks/Cole. Singapore.
8. Varshney C.K 1989. Water pollution and management, S.P. Printers, Noida.

Practical
Hrs /week: 2

- Determination of soil pH (at least 3 types of soil)
- Determination of soil texture.
- Determination of soil moisture.
- Determination of soil bulk density.
- Determination of soil porosity.
- Determination of soil organic matter content.
- Estimation of dissolved O_2 in water samples.
- Estimation of BOD in water samples.
- Estimation of COD in water samples.
- Adaptation of plants- hydrophytes,xerophytes and halophytes,

Submission - Record Note Book