SEMESTER V			
Core VII Biotechnology (Common Core)			
Code: 18UBCC51	Hrs/Week:4	Hrs/Sem: 60	Credit: 3

Vision

To gain knowledge about the importance of Biotechnology in different fields
To create graduates who endeavor for the welfare of mankind.
Create opportunities for multi-disciplinary education, training and research in Biotechnology

Mission

Impart quality education for lifelong professional growth and opportunity in a wide range of careers. To create awareness towards socio-ethical implications of potentials of biotechnology. Provide a platform for Biotechnology education, training and research at the interface of multiple disciplines

Course Outcome

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	describe different cloning vehicles and learn the different type of vectors	1	Kn, Un
CO-2	gain knowledge about techniques of biotechnology.	2	Un
CO-3	summarise the different techniques in animal biotechnology	2	Un, An
CO-4	compare the various techniques in plant and animal biotechnology	4	Cr
CO-5	enumerate cell culture, organ culture and stem cell culture and point out implications in health care	6	Kn, An
CO-6	distinguishes methods of alleviating environmental pollution and understand the synthesis of industrial products	5	An
CO-7	relate biotechnology and its benefits to mankind	6	Ap, Ev
CO-8	design, conduct experiments, analyse and interpret data for investigating problems in Biotechnology and allied fields	7,8	Ap

SEMESTER V			
Core VII Biotechnology (Common Core)			
Code: 18UBCC51	Hrs/Week:4	Hrs/Sem: 60	Credits: 3

Unit I Cloning Vectors

Introduction – Scope and importance of biotechnology – cloning vehicles – bacterial plasmid vectors – pBR322 and Ti plasmid – bacteriophage vectors – lambda – M13 – Plant viral vector – CaMV- Gemini virus and tobamovirus – animal viral vector – SV40- Role of restriction and modification enzymes

Unit II Gene Cloning and Screening

Gene cloning – methods of introduction of cloned genes into host cells – transformation – liposome mediated transfer – electroporation – particle bombardment gun – viral vector method – DNA library – PCR – hybridization technique – blotting techniques – Southern, Northern and Western.

Unit –III Cell, Tissue and Organ culture

Culture media – cell culture techniques – monolayer culture and immobilized culture of cell lines –callus culture – suspension culture and anther culture – techniques and applications of human embryonic stem cell culture – plant embryo culture- invitro pollination – organ culture – techniques – tissue engineering of artificial skin and cartilage.

Unit – IV Environmental and Bioprocess technology

Biotechnological methods for sewage and waste water treatment – bioremediation – degradation of xenobiotic (hydrocarbons and pesticides) – role of genetically engineered microbes – biomining – bioleaching – industrial production of penicillin and ethanol – Biodiesel – Biofertilizer – mass cultivation and application of Azolla

Unit –V Health Care Biotechnology

DNA probes and diagnosis of genetic disorders – DNA fingerprinting technique – gene therapy and treatment of genetic diseases – vaccines – recombinant DNA vaccines and viral vaccines – edible vaccines- Bt cotton – Golden rice- Human Genome Project – types – methods of sequencing – potential benefits of mankind

Text Books

1. Dubey R.C.S. 2004. *Atext book of Biotechnology*. Chand and Comp.Ltd, New Delhi,
2. Kumaresan, V. 2010 *Biotechnology*. - Saras Publication, Nagercoil - 2010.

Books for Reference

1. Singh, B.D. 2005. *Biotechnology*. Revised edition, Kalyani Publishers, Chennai.
2. Dubey, R.C. 2006. *Text Book of Biotechnlogy*. 4th edition, S. Chand and Co Ltd, New Delhi.

3. Rema, L.P. 2009. *Applied Biotechnology*, MJP Publishers, Chennai.
4. Shailendra Singh. 2007. *Applied Biotechnology*. 1st edition, Campus Books International New Delhi.
5. Clark, and J. Pazdernik. 2009. *Biotechnology*. Elsevier Academic Press, California, USA.
6. Ramadass, P. 2009. *Animal Biotechnology* – Recent Concepts and Development. MJP Publishers, Chennai.

SEMESTER –VI			
Core X: Immunology and Microbiology			
Code: 18UZOC61	**Hrs/week : 5**	**Hrs/sem: 75**	**Credits: 4**

Vision

To highlight the importance of various immune systems, lymphoid organs and the culture techniques of microbes.

Mission

Acquire knowledge about the immune response, antigens, antibodies, immunoglobulins and the culture techniques of microbes.

Course outcome

CO. No	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	understand the importance of immune system, immune organs and immunoglobulins.	2	Cr
CO -2	identify structure and characteristics of different types of Lymphoid organs	3	Un
CO-3	analyse the structure and functions of immune systems	4	Un
CO-4	narrate and explain antigen and antibody	5	Un
CO-5	analyse the types of immunoglobulins	2	Cr
CO-6	understand the structure, classification and culture techniques of microbes	7	Un
CO-7	analyse and distinguish food poisoning, food spoilage and preservation methods	8	An
CO-8	determine the nature of the microbes and to realize their beneficial and harmful effects	3	Un

SEMESTER –VI			
Core X: Immunology and Microbiology			
Code: 18UZOC61	Hrs/week : 5	Hrs/Sem: 75	Credits: 4

Unit I **Immunity Types and Lymphoid Organs**

History and scope of Immunology. Immunity – types – innate immunity – factors controlling innate immunity – acquired immunity – types – active and passive immunity. Lymphoid organs – thymus - bone marrow – Bursa of fabricius – spleen and lymphnodes.

Unit II **Immune Response**

Cells of the immune system – development and fate of stem cells - Lymphocytes, B Lymphocytes, T Lymphocytes - types of T cells and macrophages – Immune response - humoral - primary and secondary – B cell activation- factors controlling antibody formation - cell mediated immune response – T cell activation – biological functions of cell mediated immunity.

Unit III **Antigens and Antibodies**

Antigens - definition – epitopes – general properties - cross reactive antigen - heterophile antigen – Frossman antigen – haptens. Antibodies (Immunoglobulins) - definition – basic structure of immunoglobulin – Ig classes - IgG, IgA, IgM, IgD and IgE - biological properties – general functions.

Unit IV **Structure, Shape and Culture of Microbes**

Importance and scope of Microbiology – classification of bacteria- general structure of bacteria, fungus and virus - culture media, continuous and batch culture techniques - bacterial growth curve.

Unit V **Food and Medical Microbiology**

Food Microbiology - food poisoning, food spoilage and preservation methods. Medical Microbiology - causative agent, symptoms, treatment and prevention of diseases. Bacterial diseases - diphtheria, tuberculosis, typhoid, leprosy, gonorrhea. Fungal diseases – candidiasis and dermatophytosis. Viral diseases - AIDS, poliomyelitis, chickenpox, hepatitis, dengue and swine flu.

Text book

1. Arumugam, N., Mani, A., Narayanan, L.M., Dulsy Fatima and A.M. Selvaraj. 2015. *Immunology and Microbiology*. Saras Publication, Nagercoil.

Books for Reference

1. Ivan M.Roitt. 1994. *Essential Immunology*. 6th Edition. ELBS English Language B Society/ Blackwell Scientific Publications.
2. Rao, C.V. 2005. *An Introduction to Immunology*. Narosa Publishing House, New Dell
3. Joshi K.R and Osamo N.O. 1994 *Immunology*. 4th Edition Agro Botanical Publisl India.
4. Kannan I. 2007. *Immunology*. MJP Publishers, Chennai.
5. Surendra Naha, 2012. *Fundamentals of Immunology*. Dominant Publishers & Distribu Pvt. Ltd., New Delhi.
6. Pelczar, M.J, Chan, E.C.S. and N.R. Krieg. 1986. *Microbiology* Mc Graw – Hill Book Company, New Delhi.
7. Chakraborty, P.A. 1995. *Text Book of Microbiology*. New Central Book Agency (P) Limited, Kolkata
8. Powar and Daginawala. 1988. *General Microbiology*. Himalaya Publishing House, Mumbai.
9. Arti Kapil. 2013. *Text Book of Microbiology*. 9th Edition. Universities Press (India) Pvt Ltd.

PRACTICALS

Hours / Week : 2 **Credit - 1**

Immunology

1. ABO blood grouping
2. Rh factor typing.
3. Lymphoid organs of rat (chart)
4. Single Radial Immunodiffusion (Demonstration)
5. Double Immunodiffusion (Demonstration)
6. Cells of the immune system – stem cells, lymphocytes, macrophages.

Microbiology

1. Sterilization techniques
2. Preparation of culture media
3. Serial dilution technique
4. Simple staining of bacteria
5. Gram staining of bacteria
6. Hanging drop technique.
7. Study of distribution of microorganisms in nature – soil, water and air.
8. Spotters – autoclave, hot air oven, laminar hood, inoculation needle, agar plate.
9. Detection of coliforms for determination of the purity of potable water.
10. Culture and counting of bacterial colonies using colony counter.

Books for Reference

1. Jayasurya, Dulsy Fatima, Meyyan, R.P., Arumugam, N. and V. Kumaresan. 2013. *Practical Zoology. (Cell biology-embryolgy- Animal Physiology- Immunology- Ecology-Genetics-Evolution - Microbiology - Biochemistry - Biophysics*) Saras Publication, Kottar P.O., Nagercoil.
2. Arumugam, N. Mani, A., Narayanan, L.M., Dulsy Fatima and A.M. Selvaraj. 2015. I*mmunology and Microbiology*. Saras Publication, Nagercoil.

SEMESTER V			
Core Integral I : Marine Biology			
Code: 18UZOI51	**Hrs/Week: 4**	**Hrs/Sem: 60**	**Credits: 4**

Vision

To provide quality education and training in the field of marine biology and environment

Mission

Provides an excellent education in marine biology, emphasizing the flora and fauna of marine environment

To raise awareness about marine environments for the community and the society

Course Outcome

CO.No	Upon completion of this course, students will be able to	PSO addressed	CL
CO - 1	classify the different ecological zones of marine environment, diversity of marine organisms and their adaptations	1,2	Un
CO - 2	explain the physical and chemical properties of sea water and their significance to marine life	1,4	Un, Ev
CO - 3	appraise the ocean production, characteristics and types of coral reefs, mangroves and estuaries	3	Ev
CO - 4	outline the formation, types and properties of the dynamics of ocean	1,2	Un
CO - 5	analyse various types of marine resources and assess the various environmental concerns related to the use and abuse of marine resources	5,6	An, Cr
CO - 6	gain specialized skills in a range of theoretical and practical applications	8,	Cr
CO - 7	develop awareness of scientific issues in marine biology within the larger social context	6	Ap, Cr
CO - 8	design and implement effective solutions to problems in marine environment	7,8	Cr

SEMESTER V			
Core Integral I : Marine Biology			
Code: 18UZOI51	Hrs/Week: 4	Hrs/Sem: 60	Credits: 4

Unit I **Marine Habitat**

Classification of marine habitat. Characteristics of pelagic and benthic divisions – intertidal, rocky, sandy and muddy shores – the features of flora, fauna and adaptations.

Unit II **Physical and Chemical Properties of Sea Water**

Physical properties – temperature, temperature distribution, dissolved gases, T/S diagram. Chemical properties - Nutrients (major, minor and trace elements) illumination, salinity - distribution.

Unit III **Biological Characteristics of the sea**

Plankton – classification, adaptations and methods of collection. Ocean production - Energy flow in the marine environment. Coral reef, mangroves, estuaries - characteristics and types.

Unit IV **Dynamics of the Ocean**

Tides - generating forces, types, effects of tides in coastal areas; Waves - formation, properties, types - tsunami.

Unit V **Resources of the Sea**

Chemical resources - manganese nodules, beach placers, Oil resource (Petroleum) Fishery products - fish meal and fish oil. Formation, ornamental and medicinal importance of natural pearls.

Text Book

1. Olivia J. Fernando. 1999. *Sea water - Properties and dynamics.* Dhanesh Publications, Ponnagam, Thanjavur.

Books for Reference

1. Gross, G., 1993. *Oceanography: A view of the Earth*. Sixth edition. Prentice Hall Inc., New Jersey.
2. McCormick, J.M. and J.V. Thiruvathaakal. 1976. *Elements of Oceanography*. W.B. Saunders Company, Philadelphia.
3. Nybakken, J.W. 1997. *Marine Biology – An Ecological Approach*. Addison Weslay Longman, Inc. California, 477pp.
4. Girish Chopra, 2006. *Coastal and Marine Geography*, Common Wealth Publisher, Delhi.
5. Veena. 2012. *Understanding Marine Biology*- Discovery Publishing House PVT.LTD New Delhi
6. Russel. 1970. *Marine Ecology*. Academic Press- London and New York.
7. Nelson and Smith. 1973. *Oil Pollution and Marine Ecology*-Plenum press, New York.

SEMESTER – V			
Core Integral II: Commercial Aquaculture			
Code:18UZOI52	**Hrs/ Week: 4**	**Hrs/ Sem:60**	**Credits: 4**

Vision

To highlight the importance of aquaculture to augment food production

Mission

To impart knowledge on fish culture techniques, health management measures and fish preservation

Course Outcome

CO.No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	understand the biology of a variety of commercially important food fishes.	1	Un
CO-2	analyse the different methods of integrated fish farming	7	An
CO-3	understand the conditioning factors and how they can be manipulated	1, 2	Un
CO-4	interpret the basic culture methodologies of commercially important species	8	Ev
CO-5	acquire knowledge on feed organisms and feed formulation	1	Un
CO-6	identify the common aquaculture diseases and apply appropriate measures for fish health management	8	Ap
CO-7	explain the different techniques of fish processing and preservation	4	Un, Ev
CO-8	apply principles and concepts to solve problems that may be encountered in commercial production	7	Ap

SEMESTER – V			
Core Integral II: Commercial Aquaculture			
Code:18UZOI52	Hrs/ Week: 4	Hrs/ Sem:60	Credits: 4

Unit I **Cultivable Species**

Importance of aquaculture – Current status of aquaculture in India – Cultivable organisms and their qualities. Fin fishes – carps and live fishes. Shell fishes- shrimp, lobster – edible oyster, mussel, pearl oyster. Cultivable sea weeds.

Unit II **Culture Methods and Farm Management**

Polyculture, integrated fish farming – paddy - cum fish culture, animal husbandry - cum fish culture, Management of culture ponds - control of water quality parameters - fertilization - control of predators and weeds.

Unit III **Culture Techniques**

Fin fish - culture of Indian major carp (Catla) - seed collection, breeding and culture techniques

Shell fish - culture of marine prawn, pearl oyster

Unit IV **Fish feed and Disease management**

Fish feed – artificial feed - feed formulation and composition of formulated feed, live feed organisms. Common diseases – white spot disease, dropsy, fin rot, gill rot, saprolegniasis. Parasites - argulus, lernea - prevention and management. Principles of fish health management

Unit V **Fish Processing and Preservation**

Fish preservation – freezing, canning, dry curing, salt curing, smoke curing, Irradiation, special cured products. Preservation and export techniques.

Text Book

1. Santhana Kumar and A.M. Selvaraj. 2006. *Concepts of Aquaculture*. Mac ram Publications, Nagercoil.

Books for Reference

1. Santhanam, R., Sukumaran, M. and P. Natarajan. 1990. *A Manual of Freshwater Aquaculture.* Oxford & IBH publishing Co Pvt. Ltd, Janpath, New Delhi.
2. Dinabandhu Sahoo, S.Z. Qasim. 2009. *Sustainable Aquaculture*. A.P.H Publishing Co, NewDelhi.
3. Agarwal, S.C. 1994. *A Hand book of Fish Farming*. Naranda Publishing House, Delhi.
4. Chaudhuri, A.B. 2009. *Aquaculture Resurgence Birth of Blue Revolution*. Daya Publishing House, Delhi.
5. Sailendra Ghosh. 2009. *Fisheries and Aquaculture Management*. Adhyayan Publisher & Distributors, New Delhi.
6. Santhanam,R., N. Ramanathan and G. Jegathesan 1990. *Coastal Aquaculture in India.* First Edition, CBS Publishers, New Delhi.

SEMESTER – VI			
Core Integral III – Sericulture			
Code : 18UZOI61	**Hrs/Week : 4**	**Hrs/Sem : 60**	**Credits : 4**

Vision

Towards exploring the scope of various techniques involved in sericulture and moriculture for self employment.

Mission

To impart knowledge and technical skills in various aspects of sericulture and moriculture.

Course Outcome

CO.No	Upon completion of this course, students will be able to	PSO addressed	CL
CO - 1	acknowledge various organizations involved in the welfare of sericulture.	7	Un
CO - 2	interpret the practices of Moriculture.	3	Un
CO -3	attain information on the various diseases and pests affecting mulberry and its control measures.	1	Ev
CO - 4	develop skills on various silkworm rearing processes and operations.	8	Ap
CO - 5	use the knowledge of cocoon mounting and harvesting.	7	Ap
CO - 6	enumerate silkworm diseases and its control measures.	7	Un
CO - 7	involve in cocoon stifling, deflossing and reeling.	8	Ap
CO - 8	understand the uses of the products and byproducts of sericulture.	7	Un

SEMESTER – VI			
Core Integral III – Sericulture			
Code : 18UZOI61	Hrs/Week : 4	Hrs/Sem : 60	Credits : 4

Unit I **Introduction**

Introduction to sericulture – sericulture in India and world – role of Central Silk Board(CSB), Central Sericultural Research and Training Institute(CSRTI) –

Unit II **Moriculture**

Commercial varieties of mulberry – mulberry cultivation – cultivation practices – biofertilizers – foliar spray for mulberry – bacterial – viral – fungal –nematode and deficiency diseases – pests of mulberry – symptoms and control measures.

Unit III **Silkworm Rearing**

Mulberry silkworm –Popular silkworm breeds and hybrids in India- morphology– silk gland. Silk worm rearing – rearing house – rearing appliances – rearing operations – chawki rearing – rearing of late age worms – application of sampoorna.

Unit IV **Cocoon Mounting and Marketing**

Mountages – mounting methods – harvesting of cocoons – transport of cocoons – defective cocoons – cocoon markets. Silkworm diseases – bacterial, fungal and viral diseases – pest (Uzifly) symptoms and control measures.

Unit V **Silk Reeling.**

Cocoon stifling – methods of stifling – storage of cocoons – deflossing cocoon cooking – reeling operations. reeling appliances – cottage basin – filature units – uses of silk.

Text Book

1. Ganga, G. and J. Sulochana Chetty. 1991. *An Introduction to sericulture*. Oxford & Publishing Co Pvt. Ltd. New Delhi

Books for Reference

1. Krishnaswamy S. 1990. *New Technology of Silkworm Rearing.* Published by Central Silk Board, Bangalore.
2. Hisao Aruga. 1990. *Principles of Sericulture*. Published by Oxford & IBH Publishing Co. Pvt.Ltd., New Delhi.
3. Tammanna N. Sonwalker. 1993. *Hand Book of Silk Technology*. Published by Wiley Eastern Ltd, Madras.
4. Manjeet S. Jolly. 1987. *Appropriate Sericulture Techniques*. Published by Director, International Centre for Training and Research in Tropical Sericulture, Mysore.
5. Kamal Jaiswal, Sunil, P., Trivedi, B., Pandey, V. and P.N. Pandey 2009. *Indian Sericulture*. ALFA Publication, New Delhi.