SEMESTER – I			
Core I	**Plant Diversity I (Algae, Bryophytes, Fungi and Lichens)**		
Course Code: 21UBOC11	**Hrs / Week: 6**	**Hrs / Sem: 90**	**Credits: 6**

Objectives:

- To have comprehensive idea on primitive plants
- To understand the major groups of lower plants and their characteristics.
- To study the effective utilization of algae, fungi, lichen and bryophytes for the environment and human well being

Course Outcomes:

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	know the general characteristics of algae, fungi, lichen and bryophytes	1	An
CO-2	ennumerate the importance of algae and bryophytes and their role in everyday life and environment.	7	Ev
CO-3	observe adaptive feature of the specified plant groups	3	An
CO-4	compare and contrast algae, fungi and bryophytes	2	Un
CO-5	identify algal, fungal and bryophytes samples	8	Re
CO-6	distinguish life cycle pattern in algae, fungi and bryophytes	7	Ap
CO-7	understand the criteria behind the classification of algae, fungi and bryophytes	1	Un
CO-8	apply the knowledge acquired for self employability	6	Ap

SEMESTER – I			
Core I	**Plant Diversity I (Algae, Bryophytes, Fungi and Lichens)**		
Course Code: 21UBOC11	**Hrs / Week: 6**	**Hrs / Sem: 90**	**Credits: 6**

UNIT I: **Algae**: Introduction - Brief history of Algae, Classification of algae based on Fritsch (1945), Habitat. General characteristics of algae - Range of thallus organization, Methods of reproduction-vegetative, asexual and sexual, Life cycle patterns, Alternation of generation in algae. Algal cytology – cell wall, cytoplasm (algal pigments, reserve food materials), flagella and nucleus. Economic importance of algae: algae as food, SCP, fodder, green manure, role in N_2 fixation, medicine and biofuels. Ecological benefits of algae.

UNIT II: Habitat, thallus structure, reproduction and life cycle of *Oscillatoria, Volvox, Caulerpa, Vaucheria, Sargassum* and *Gracilaria*.

UNIT III: **Bryophytes:** General characteristics of Bryophytes. Classification of Bryophytes by Rothmaler (1951). Habitat, thallus structure, reproduction and life cycle of *Marchantia* and *Polytrichum.* Economic importance of Bryophytes - biological, ecological, medicinal and as potting material. Affinities between algae and bryophytes.

UNIT IV: **Fungi :** Classification of fungi based on Alexopoulus and Mims (1979), General characters. Habitat, somatic structure, asexual reproduction, sexual reproduction and life cycle of *Albugo, Aspergillus, Peziza,* and *Polyporous*. Role of fungi in medicine, industry, food and food products.

UNIT V: **Lichens:** Classification of lichen based on habit, habitat, anatomy, nature of partners, different views on lichen association, organization, process of lichenization. Vegetative propagules - isidia, soredia, cyphellae, cephalodia.Thallus structure and reproduction of *Collema, Parmelia* and *Usnea*. Economic and ecological significance of lichens.

Text Books:

1. Pandey S.N. and Trivedi. P.S. *A Text Book of Botany* Vol. I and II. New Delhi: VikasPublishing House Pvt. Ltd., 2006.
2. Sharma O.P. *Text Book of Algae.* New Delhi: Tata Mc. Graw-Hall Publications, 2006.
3. Johri, R.M., Smeh Lata and Kavitha Tyagi. 2011. *A Text Book of Fungi*, DominantPublishers and Distributors Pvt. Ltd., New Delhi
4. Singh V. Pandey P.C. and Jain D.K.. A *Text Book of Botany*. Meerut: RastogiPublication, 2002

Books for Reference:

1. Fritsch F.E. *The Structure and Reproduction of Algae*. London: Vol.I all II. CambridgeUniveristy Press, 1972.
2. Kamat N.D. *Topics in Algae*. Aurangabad: Sai Kraipa Prakasham, 1982.
3. Parihar N.S. *Bryophyta*. Allahabad: Central Book Depot Publications in Botany, 1967.
4. Robert Edward Lee. *Phycology*: Cambridge University Press, 2009.
5. Vashishta B.R, Sinha A.K. and Singh V.P. *Algae*. New Delhi: S. Chand and Co. Ltd.2007.
6. Vashishta B.R Sinha A.K. and Singh V.P. *Bryophyta*: New Delhi: S. Chand and Co.Ltd., 2006.
7. Ahmadjian V and Hale M.E. *The lichens.* London: Academic Press, 1973.
8. Alexpoulous C.J. Mims C.W. and Blackwell M. *Introductory Mycology.* New Delhi:Wiley Eastern Limited, 1988.
9. Dubey H.C. *An introduction of fungi.* New Delhi: Vikas Publishing House, 2005.
10. Pandey B.P. *Plant Pathology.* New Delhi: S.Chand and Co.Ltd, 2007.
11. Rangasamy G. *Diseases of Crop Plants in India Prenties.* New Delhi. Hall of India,1992.
12. Singh R.S. *Plant Diseases.* New Delhi: Oxford IBH, 1991.

Practicals: Hrs/Week: 2 hrs

- Micropreparation and evaluation of *Oscillatoria, Volvox*, Diatoms, *Vaucheria, Caulerpa,Sargassum, Dictyota, Acanthophora, Gracilaria*
- Micropreparation evaluation of *Riccia, Marchantia* and *Polytrichum*
- Micropreparation evaluation of *Albugo, Aspergillus*, *Peziza* and *Polyporous.*
- Micropreparation evaluation of *Usnea*and*Parmelia*
- Identification of microscopic and macroscopic algae
- Identification of Bryophytes
- Identification of microscopic and macroscopic fungi
- Field visit: No of days: 2 (Collection of seaweeds and bryophytes)
- Submission of specimen (algae/

bryophytes/ fungi/ lichen)Submission:

Record note book

SEMESTER – III			
Core III Plant Diversity II (Pteridophytes, Gymnosperms and Paleobotany)			
Course Code: 21UBOC31	**Hrs / Week:4**	**Hrs / Semester: 60**	**Credits:4**

Objectives:

- To investigate and illustrate the key characteristics of fossil and living pteridophytes and gymnosperms through micropreparation and microscopic observation
- To provide firsthand experience in plant collection, identification preservation and data collection for future studies.
- To impart knowledge on the ecology, economic importance, phylogenic importance of pteridophytes and to infer the evolution of seed habit from pteridophytes.

Course Outcomes:

CO.No.	Upon completion of this programme, students will be able to	PSO addressed	CL
CO-1	summarize the general characters of pteridophytes and gymnosperms and outline the classification of these groups of plants	1,2	Cr
CO-2	specify the criteria of classification and assign the taxonomic hierarchical rank to the taxa	2,3	Re
CO-3	explore the ecological and economic significance of pteridophytes and gymnosperms	1,4	Ev
CO-4	highlight the phenomenon of heterospory in pteridophytes and infer its significance in origin of seed habit	2,4	Un
CO-5	examine microscopically the key characteristics of (morphological, anatomical and ecological) pteridophytes and gymnosperms and make sketches of the same.	4,7	An
CO-6	record the geological time scale and relate the geological era with evolution of plants	7,8	Un
CO-7	identify the types of fossils and discuss the fossilization process and substantiate the importance of fossils evidences in organic evolution.	2,4	Un
CO-8	analyze and justify the idea of evolution of seed plants from pteridophytes	7	Ev

SEMESTER – III			
Core III Plant Diversity II (Pteridophytes, Gymnosperms and Paleobotany)			
Course Code: 21UBOC31	**Hrs / Week:4**	**Hrs / Semester: 60**	**Credits:4**

UNIT I: General Characters of pteridophytes (upto genus level). Classification of pteridophytes: Pteridophyte Phylogeny Group (PPG) by Erics (2016) (upto order level). Stelar Evolution. Heterospory and seed habit. Economic importance: food, fodder, medicine, ecological indicators, ornamental and biofertilizer

UNIT II: Distribution, external structure, internal structure, reproduction, types of gametophyte and life cycle of *Lycopodium* and *Selaginella* (Developmental details not required).

UNIT III: Distribution, external structure, internal structure, reproduction, types of gametophyte and life cycle of *Adiantum* and *Marsilea* (Developmental details not required)

UNIT IV: General characters of gymnosperms, outline the classification of gymnospermsby Chamberlain (1934). Distribution, external structure, internal structure, reproduction and life cycle of *Pinus* and *Gnetum.* (Developmental details not required)

UNIT V: Economic importance of gymnosperms: food, fodder, ornamentals and industrial uses. Fossils: introduction, process of fossilization, theories of fossilization, types of fossils, techniques to study fossils. Geological time scale. Fossil pteridophyte: *Rhynia,* Fossil gymnosperm: *Lyginopteris* constructed plant parts.

Text Book:

1. Pandey S.N., Trivedi P.S. and Misra S.P. *A text Book of Botany Vol. II.*New Delhi:Vikas Publishing House Pvt. Ltd., 2006.

Books for Reference:

1. Rashid A. *An introduction to Pteridophyta*. New Delhi: Vani Educational Books. Vikas Publishing House Pvt. Ltd., 1985.
2. Vashishta P.C., Sinha A.K. and Anil Kumar, *Botany for degree students – pteridophyte.*New Delhi.S. Chand & Co., 2007.
3. Vashishta P.C., Sinha A.K. and Anil Kumar, *Botany for degree students - Gymnosperms.*New Delhi.S. Chand & Co., 2007.
4. Chamberlain C.J., *Gymnosperms* – Structure and evolution. New Delhi: CBS Publishers & Distributors, 1986.

5. Shukla A.C. and Misra S.P. *Essentials of Paleobotany*. New Delhi: Vikas PublishingHouse Pvt. Ltd., 1982.

Practicals:
Hrs/Weel: 2

Pteridophytes

- *Lycopodium* - Habit, section – T.S. of stemPermanent slide: L.S. of cone
- *Selaginella* - Habit, section – T.S of rhizophore, stem and L.S. of cone
- *Adiantum* - Habit, section – T.S. of rachisPermanent slide: L.S. of sporophyll
- *Marsilea*- Habit, section – T.S. of rhizome, petiole and sporocarpPermanent slides: sporocarp at different plane

Gymnosperms:

- *Pinus* - Twig, dwarf shoot, section- T.S. of young stem and needle
  Permanent slides: T.S. of old stem, L.S. of young and mature male, female cone, seedentire
- *Gnetum* - Twig, section – T.S. of stem and leaf, wood showing anomalous secondarythickening
  Permanent slides: L.S. of male and female inflorescence, seed entire

Fossils :

- *Rhynia* (Stem)
- *Lyginopteris*- Constructed plant parts

Field Study

Submission: Record note book

Laboratory manual for reference:

Srivastava H. N. *Practical Botany Volume I.* Jalandhar: Pradeep Publications, 1987

SEMESTER - III			
Skill Based Elective	**Horticulture**		
Course Code: 21UBOS31	**Hrs/week: 2**	**Hrs/Semester: 30**	**Credits: 2**

Objectives:

- To provide knowledge and skills in horticultural techniques.
- To use appropriate horticultural designs based on the geographical region, microclimateand requirement there by maximize its economic and aesthetic value of the produce.
- To effectively adapt plant propagation technique in relation to their environment for income generation.

Course Outcomes:

CO. No.	Upon completion of this course, students will be able to	PSO Addressed	CL
CO-1	explain the various divisions of horticulture and importance.	1	Un
CO-2	design a landscape and interior scope project.	6	Re
CO-3	apply the concept of horticulture science to select, manage, improve plants and their production.	6	An
CO-4	demonstrate employability skills in the field of horticulture	6	Re
CO-5	equip the skill in gardening and floriculture to enhance sense of aesthetic appreciation.	6	Un
CO-6	synthesize and integrate information to solve horticultural problems.	5	Cr
CO-7	apply horticultural principles to the successful growth and production of horticultural plants.	3	An
CO-8	communicate effectively within the discipline and also be able to transmit knowledge and skills to lay- persons in the general public.	6	Ap

SEMESTER - III			
Skill Based Elective	**Horticulture**		
Course Code: 21UBOS31	**Hrs/week: 2**	**Hrs/Semester: 30**	**Credit: 2**

UNIT I: Horticulture : scope and its importance, divisions of horticulture. Garden implements: spade, pick axe, tiller, digging fork, pruning scissors, budding knife, grafting knife, sprayer, water can, making plant growing structure using waste material, pot mixture making.

UNIT II: Methods of propagation - Cutting: leaf cutting, stem cutting: herbaceous stem cutting, soft wood cutting, semi-hard wood cutting, hard wood cutting, root cutting. layering; simple layering, compound layering, air layering, mound layering, tip layering and trench layering.

UNIT III: Grafting: Approach grafting, side grafting, splice grafting, saddle grafting, flat grafting, cleft grafting. budding: 'T' budding, chip, patch budding, vegetative propagules: bulbs, tubers, rhizomes.

UNIT IV: Kitchen garden: selection of site, lay out and choice of plants, designing kitchen garden using Grow Veg software. Storage and preservation of fruits and vegetables.

UNIT V: Gardening: Purpose, plant choice and caring, Design and establishment of hanging basket, rockery, bonsai, flower beds, terrarium Floriculture: cut flowers, flower arrangement: types of flower arrangement-western style, eastern style, components of flower arrangement, arranging the flower in the container.

Text Book:

1. Kumar, N. *Introduction to Horticulture*. India: Rajalakshmi Publications.1997.

Books for Reference:

1. Choudhri D and Amal Metha. D. *Flower crops cultivation and management.* Jaipur:Oxford book company, 2010.
2. Andrew, F.S. and Halfacre, R.G. *Fundamentals of Horticulture.* New Delhi:Tata Mc.GrawHill, 1977.
3. Hartmann & Kester. *Plant propagation Prentice*. New Delhi: Hall India Pvt. Ltd., 1989,
4. Mallikarjuna Reddy and Aparna Rao. *Plant propagation*

*in horticulture.*NewDelhi:Pacific book international, 2010.
5. Randahawa, G.S. *Floriculture in India.* Mumbai:Allied publishers, 1985.
6. Utpal Banerji. *Horticulture.* Jaipur:Mangal Deep Publication, 2008.

SEMESTER III			
Skill Based Elective	**Gardening and Nursery Management**		
Course Code:21UBOS32	**Hrs/week:2**	**Hrs/Semester:30**	**Credit:2**

Objectives:

- To supply elite planting material of the highest possible quality forest abolishment of neworchards.
- To grow plants in an open environment, maintain a good quality of plants and protect the plants from pests and diseases.
- To create awareness about kitchen gardening, to improve skills for growing fresh and safe vegetables without use of any pesticide.

Course Outcomes:

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	recollect scope and basic concepts of gardening	1	Re
CO-2	Understand the different types of gardens and suggest plant choices	2	Un
CO-3	Importance, features and maintenance of commercial gardening.	7	An
CO-4	Acquire knowledge regarding theory and practice of cultural and production techniques and methods.	4	An
CO-5	Equip the skill in landscaping, gardening and floriculture and enhance sense of beautification and aesthetic values	4	Cr
CO-6	Understand the importance, types and establishment of Nursery	5	Un
CO-7	Learn practices like nutrition, water management and pest management	5	Un
CO-8	Develop skills necessary to manage a wholesale nursery	8	Cr

SEMESTER III			
Skill Based Elective	**Gardening and Nursery Management**		
CourseCode:21UBOS32	**Hrs/week:2**	**Hrs/Semester:30**	**Credit:2**

UNIT I: Scope and introduction to gardening. Different types of garden and their suitability.Gardening features, importance of garden and suitable plants for different types of garden. Designing a plan for a commercial garden.

UNIT II: Home garden – suitable plants for home gardening. Detailed aspects ofroof garden, terrace garden and vertical garden. Advantages and limitations of roof, terrace and vertical garden. Plants suitable for different types of gardening. Importance, features and maintenance of commercial gardening.

UNIT III: Different shade loving perennials and flowering trees for commercial/ornamental gardening. Detailed description of potted plants such as outdoor, foliage, flowers, creepers, climbers etc., Introduction to bonsai training, pruning and wiring. Introduction on terrarium technique.

UNIT IV: Introduction, importance, development. Establishment of nursery: Selection ofsite - location, soil and climate for nursery, topography, wind, elevation of nursery place, irrigation and drainage facilities, insects pest and diseases control in nursery. Types ofNursery: multipurpose or mixed nurseries, mono purpose or general nursery, specialized nursery,attached or auxiliary or subsidiary nursery.

UNIT V: Location of nursery: Scientific layout of nursery, collection of mother plantand their management, source of available root stocks and their proper utilization. Use of standardmethods of plant propagation, proper management of seed, arrangement of good selling, propertesting facilities, arrangement of training and demonstration, arrangement of nursery exhibitions.

Text Books:

1. Kumar, N. *Introduction to Horticulture*. Nagercoil,India.Rajalakshmi Publications, 1997.
2. YashwantraoChavanNewDelhi.MaharashtraOpenUniversity,Resource Book on HorticultureNursery Management,ICAR.

Book for Reference:

1. Utpal Banerji. *Horticulture* Jaipur:Mangal Deep Publication, 2008.
2. EdmundSenn-Andrew– Halfacre.*FundamentalsofHorticulture.*TataMc.GrawHill,1977.
3. Randahawa *Floriculture in India.* Alliedpublishers,1985.
4. Mallikarjuna Reddy and Aparna rao *Plant propagation in horticulture.* New Delhi:Pacific book international, 2010.

SEMESTER - III			
NMEI	**Plant Resource Utilization**		
Course Code:21UBON31	**Hrs/week: 2**	**Hrs/Semester:30**	**Credit:2**

Objectives:

- To provide knowledge on distribution, cultivation, harvesting techniques and uses of crop plants
- Toknowthecommercialvaluesofplantsresources
- Toappreciatetherelevanceofcropplantstotheeconomyofthepeople

CourseOutcomes:

CO. No.	Upon completionof thiscourse,studentswillbeableto	PSO addressed	CL
CO-1	comprehend history of agriculture and scope of agricultural crops	3	Re
CO-2	acquiretheknowledge ongeographicalareaofcultivation, productionandmarketing of various foodcrops andtheirfinishedgoods	1	Un
CO-3	graspimportanceoftropicalandtemperate fruitsforhumanwellbeing	3	Ap
CO-4	accessthevalueofspices,condimentsand beverage ininternationaltradesandconfectioneryindustries	3	Ev
CO-5	understandthewealthofcashcropsinIndiaandtheir importanceinimprovingtradeandindustrialgrowth	3	Ev
CO-6	substantiate fibersareanalternativesourceofplastics	5	Un
CO-7	explaintheuseofbeveragesandtheirproduction	6	Un
CO-8	learnaboutthecultivationpracticesandextractionof oilfromoilcrops	6	Cr

SEMESTER - III			
NMEI	**Plant Resource Utilization**		
Course Code:21UBON31	**Hrs/week: 2**	**Hrs/Semester:30**	**Credit:2**

UNIT I: Botanical description, distribution, cultivation, harvesting and economic and nutritional valuesof cereals:rice, wheat, maize.

UNIT II: Botanical description, distribution, cultivation, harvesting and economic and nutritional values of legumes:soyabean ,blackgram, green gram and bengalgram. Vegetables: stem– potato, garlic, herbage– cabbage, cauliflower, fruit-tomato, brinjal.

UNIT III: Botanical description, distribution, cultivation, harvesting and economic and nutritional valuesof fruits: tropical fruits – banana and papaya.

UNIT IV: Botanicaldescription, distribution, cultivation, harvesting and economic and nutritional values of spices and condiments: roots – asafoetida, stem – ginger, bark –cinnamon, leaf – curry leaves, flower bud – clove, fruit – capsicum, coriander and blackpepper.

UNIT V: Beverages: botanical description, distribution, cultivation, harvesting and economic and nutritional values ofteaand wine preparation from fruits. Oil extraction techniques

– lemon grass oil and cinnamon oil.

Textbook:

1. PandeyB.P.EconomicBotany. New Delhi: S. Chand. 1999.

Books forReference:

1. ChrispeelsM.JandSandavaD.*Plants,FoodandPeople*.SanFancisco: W.H.Preeman& Co.,1977.
2. KoccharS.L.*Economic BotanyoftheTropics*. India:MacMillanLtd. Fourthedition, 2012.
3. SammbamurtyA.V.S.S and SubrahmanyamN.S.*AtextbookofModernEconomicBotany*.India: CBSpublishers and Distributors.2008.
4. SharmaO.P.*HillsEconomicBotany*. NewDelhi:Tata Mc Graw Hill.Co.Ltd., 1996.
5. SunidhiMiglani.*TextBookofEconomicBotany*.Delhi: ABSBooks. 2016.
6. SwaminathanMandKocharS.L.*PlantsandSociety*.Macmillan Education., 1989.
7. WickensG.E.*Economic Botany.PrinciplesandPractices*. New York:
8. Springer, Kluer Academic Publishers, 2004.

SEMESTER - IV			
Skill Based Elective	**Organic Farming and Biofertilizer**		
Course Code: 21UBOS41	**Hrs/Week 2**	**Hrs/Semester 30**	**Credits: 2**

Objectives

- To create knowledge on organic farming practices.
- To sensitizes the values and needs of organic farming.
- To develop organic farming management skills.

Course Outcomes:

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	understand overall perspective on organic farming.	7	Un
CO-2	realize the advantages of traditional organic farming over modern system of farming	4 & 7	An
CO-3	identify and formulate mechanical and biological managements of insects/pests/ weeds.	8	An
CO-4	prioritize good water management system, fertilizer choices and application	7	Un
CO-5	recognize the importance of composting and bio fertilizers over chemical fertilizers for soil sustainability	7	Ev
CO-6	understand and implement crop protection techniques of fruits and vegetables	4 & 6	Un
CO-7	know the process of food certification and to assess the socioeconomic benefit of organically grown foods	6	Ap
CO-8	enhance self employability and improve their economy	6	Ap

SEMESTER - IV			
Skill Based Elective	**Organic Farming and Biofertilizer**		
Course code: 21UBOS41	**Hrs/Week 2**	**Hrs/Semester 30**	**Credits: 2**

UNIT I: Introduction: need of organic farming, benefits of organic farming. Organicfertilizers: introduction, need of organic fertilizer, benefits of organic fertilizer.

UNIT II: Preparation of organic fertilizer: Animal waste (bone meal, blood meal, FYM and vermicompost), Plant based fertilizer (seaweed liquid fertilizer, greenmanure and biocompost). Panchakavya.

UNIT III: Organic pesticide: introduction, types and uses. Insecticides: Neem leaf,Onion and Garlic spray, *Chrysanthemum* flower tea.

UNIT IV: Organic weedicides: vinagreen and DIY safe organic weed killer. organicfungicide: organic homemade natural fungicides

UNIT V: Preparation of organic growing structure. Growing medium for plants: coirpeat and vermiculite. Growth hormone from kitchen waste. Guidelines for organic farming certification.

Text Books

1. Arun K Sharma. *Hand book of organic farming*. Jodhpur: Agrobios (India) Publisher,2005.
2. Chandrasekaran B., Annadurai K. and Somasundaram E. *Text book of agronomy*. NewDelhi: New Age International (P) Ltd. Publishers, 2010.

Books for Reference:

1. Fred C. Blank. *Essential aspects of agricultural crop production*. Jodhpur:Agrobios (India) Publisher, 2006.
2. Palaniappan S.P. and Annadurai. *Organic farming-Theory and Practice.* New Delhi:Scientific Publishers Journals Dept., 2010.
3. Sharma J.P. *Organic crop production (Principles and practices Vol-I: Principles andGeneral Aspects)*. New Delhi: KP publisher, 2017.
4. Balasubramanian R., Balakrishnan K. and Sivasubramanian K. *Principles and practicesof organic farming.* New Delhi*:* Satish Serial Publishing House, 2017.

SEMESTER IV			
Skill Based Elective	**Weed Science**		
Course Code: 21UBOS42	**Hrs/week: 2**	**Hrs/semester: 30**	**Credits: 2**

Objectives

- To provide knowledge on ecology of weeds and its dynamic interaction with human activities
- To evaluate herbicides and its long time impact to environment and non-targeted organism
- To identify and survey weeds distribution and apply various weed management techniques

Course Outcomes:

CO.No.	Upon completion of this programme, students will be able to	PSO addressed	CL
CO-1	characterize and classify weeds	1	An
CO-2	recall the harmful and beneficial effects of weeds	7	Ev
CO-3	comment on method of propagation, dispersal mechanism and its perpetuation in its ecological niches	7	Un
CO-4	recognize competition between crop and weed in terms of light, space, moisture and nutrition	4,7	An
CO-5	investigate allelopathic effects between crops in their rhizosphere	1	Un
CO-6	strategies weed control methods	7	Un
CO-7	reveal the mechanism action of herbicides	5	Re
CO-8	understand the importance of herbicides and correlate its long time impact to the environment and non targeted organisms	8	Ap

SEMESTER IV			
Skill Based Elective	**Weed Science**		
Course Code: 21UBOS42	**Hrs/week: 2**	**Hrs/semester: 30**	**Credits: 2**

UNIT I: Weeds**:** Definition, characteristics and classification of weeds. Harmful and beneficial effects of weeds. Biology and ecology of weeds.

UNIT II: Propagation and persistence**:** Propagation, dispersal and persistence of weeds.

UNIT III: Crop - weed competition**:** Crop - weed competition for light, space, moisture and nutrients. Critical period of crop - weed competition. Allopathic effects of weeds on crops.

UNIT IV: Weed management**:** Principles, prevention, eradication and control of weed. Mechanical, cultural, chemical and biological methods of weed control.

UNIT V: Herbicide**:** Definition. Objectives and scope of herbicide application. Formulation. Mechanism of action of herbicides. Toxic symptoms of herbicide in weeds and crops. Effects of herbicide on the environment.

Text Books

1. Grafts A. S. and Robbins W. W. *Weed Control*. New Delhi: Tata-McGraw-Hill, Publishing Co. Ltd., 1973.
2. Zimdahl R. L. *Fundamentals of Weed Science*. U.S.A: Academic Press, 1983.

Books for Reference:

1. Aldrich R.J. *Weed - crop ecology- principles in Weed Management*. Massachusetts, U. S. A.: Breton Publishers, 1984.
2. Fryer J.D. and Makepeace. *Weed Control Handbook Vol. II*. London: Blackwell Scientific Publication, 1978.
3. Hance R.J. and Holy K. *Weed Control Handbook*. Oxford: Blackwell Scientific Publication, 1990.
4. Narwal S. S. *Allelopathy in Crop Production*. Jodhpur: Scientific Publishers, 1994.
5. Gupta O. P. *Scientific Weed Management*. New Delhi: Today & Tomorrow's Printers & Publishers, second revised & enlarged edition, 1984.
6. Gupta O. P. and Lamba P. S. *Modern Weed Science*. New Delhi: Today and Tomorrow's Printers and Publishers, 1978.
7. Rao V. S. *Principles of Weed Science*. New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd., third edition, 1988.
8. Subramanian S., Mohamed Ali A. and Joya Kumar R. *All about Weed Control*. New Delhi: Kalyani Publishers, 1997.

SEMESTER IV			
NME II	**Food Technology**		
Course Code: 21UBON41	**Hrs/week:2**	**Hrs/Semester:30**	**Credit: 2**

Objectives:

- To provide cognizant on the chemistry of food components, microbial interaction with food product and apply scientific methods of food preservation to restrict microbial growth.
- To develop skill in food processing techniques and apply it to their professional accomplishment.
- To encourage collaborative learning and develop skill to introduce novelty in quality improvement and enhancing marketing values.

Course Outcomes:

CO. No.	Upon completion of this programme, students will be able to	PSO addressed	CL
CO-1	discuss basic principles of food preservation methods.	6,8	Un
CO-2	identify and explain nutrients in foods and the specific functions in maintaining health.	6,8	Re
CO-3	commends on causes and deterioration mechanisms of foods and methods to control food spoilage.	6,8	An
CO-4	manufacture a range of simple nutritious and novel food products	6,8	Ap
CO-5	modify recipe for specific purposes such as nutrient enhancement, quality improvement and ingredient substitution.	4	Ap
CO-6	understand the compositional and technological improvement in dairy and bakery industries	6,8	Un
CO-7	learn nutritious values of food and employ technologies in production and preservation	6,8	Ap
CO-8	apply preservation principles in product design	6	Ap

SEMESTER IV			
NME II	**Food Technology**		
Course Code: 21UBON41	**Hrs/week:2**	**Hrs/Semester:30**	**Credit: 2**

UNIT I: Technology of Vegetables**:** Nutritive value of vegetable, storage of vegetable, factors affecting storage life, spoilage of vegetables. Methods of preservation: refrigeration, freezing, canning, drying and dehydration, and chemical preservatives. Preparation - pickles (lemon, mango), soups (mixed vegetables, tomato).

UNIT II: Bakery Technology**:** Ingredients & processes for breads, cakes. Equipments used, product quality characteristics, faults and corrective measures. Different types of icings.

UNIT III: Dairy Technology**:** Milk and dairy products, Pasteurization, sterilization, HTST and UHT processes. Preparation of butter, ghee, ice-cream, paneer.

UNIT IV: Technology of Fruits**: C**omposition and nutritive values of fruits. Spoilage of fruits. Preparation of jam - mixed fruits jam. Fruit juices pineapple and grapes.Squash – lemon. Sauce- tomato.

UNIT V: Technology of millets: Types of millets, nutrient content of millets, health benefits of millets, ways to incorporate millet into diet. Processing - hand pound method and machine method. Preparation of millet bread, millet roti, porridge and laddu.

Text Book:

1. Raina U. Kashyap S. Narula V. Thomas S. Suvira S. and Chopra S. *Basic Food Preparation- A complete Manual*. Hyderabad: Orient Longman Pvt. Ltd., third edition, 2007.

Books for Reference:

1. Dubey S.C. *Basic Baking*. New Delhi: Chanakya Mudrak Pvt. Ltd., fifth edition, 2007.

2. Frazier W.C. and West Holf D.C. *Food Microbiology*. New Delhi: Tata McGraw Hillpublishing Co Ltd., 1995.
3. Kulshrestha S.K. *Food preservation.* New Delhi: Vikas publishing House. 1994.
4. Srivastava R. P. *Preservation of fruits and vegetable products***.** Dehra Dun: Bishen SinghMahendra Pal Singh, 1982.
5. Srivastava R. P. and Kumar S. *Fruit and Vegetable Preservation: Principles andPractices.* Lucknow: International Book Distributing Co., 2002.
6. Swaminathan M. *Handbook of Food Science and Experimental foods*. Banglore: TheBanglore printing and publishing Co. Ltd., 1992.

SEMESTER - III			
Allied I	**Angiosperm Taxonomy and Medicinal Botany**		
18UBOA31	**Hrs / Week: 4**	**Hrs / Semester: 60**	**Credits: 3**

Vision:

- To understand the taxonomy and medicinal values of selected plants

Mission:

- To study the floral characters with an aim to identify the taxa.
- To know the importance of medicinal plant diversity

Course Outcome:

CO.No.	Upon completion of this course, students will be able to	Pos addressed	CL
CO-1	able to recall the botanical names and to recognanise the principles of code of nomenclature	1	Un
CO-2	able to evaluate the distribution, evolution and phylogenetic relationship among plants.	2	Ev
CO-3	able to study the contribution of taxonomist in plant systamatics and	1	Un
CO-4	outline and recall the different systems of classification of angiosperms	2	Re
CO-5	able to acquint the skill of plant collection and herbarium preparation	6	Ap
CO-6	explain the floristic features of families in technical terms	2	An
CO-7	identify medicinal plants and prioritize conservation of medicinal plants	6	Cr
CO-8	apply the practical knowledge of medicinal plants in their day to day life	8	Ap

Unit I Modification of plant parts: root, stem, leaf . Morphology of Inflorescence, flower and fruits.

Unit II Concept of classification – Natural system- Bentham and Hooker. Vegetative , floral characters and economic importance of : Annonaceae, Rutaceae, Caesalpiniaceae.

Unit III Rubiaceae , Asclepiadaceae, Euphorbiaceae, Poaceae.

Unit IV Study of the following plants with reference to the morphology

of the useful parts and their importance: *Aloe vera, Zingiber officinale, Piper nigrum, Gymnema sylvestre.*

Unit V Extraction methods and medicinal uses of *Eucalyptus*, Castor and Lemon grass oil. Conservation of medicinal plants – *in-situ* and *ex-situ* methods

Books for Reference:

1. John Jothi Prakash, E. 2001. Medicinal and Aromatic Plants, JPR Publications, Vallioor.
2. John Jothi Prakash, E., K. Venkataraman, 2001. The science of Medicinal Botany, JPR Publications, Vallioor.
3. Kokate C.F., A. P. Purohit & S.R. Gokhale, 2004. Pharmacognosy. Nirali Prakashan.
4. Pandey, B.P. 2000. Economic Botany, S. Chand & Co., New Delhi.
5. Shukla P. and Misra, S.P. 1997. An introduction to Taxonomy of angiosperms, Vikas Pub. House Ltd., New Delhi.
6. Vashista, P.C. 1985. Taxonomy of Angiosperms. S. Chand & Co., New Delhi.
7. Wallis, T. E. 2000. Test book of Pharmacognosy. CBS Publishers.

Practicals: 2Hrs/week

1. To make dissections and drawing of the floral parts of typical genus belonging to the families prescribed in the syllabus to bring out the salient features (Floral diagram and floral formula are expected).
2. To assign the given plant to its family giving reasons.
3. To identify and to record the medicinal value and morphology of the useful parts of the plant prescribed in the syllabus.
4. To maintain a record note book

Reference

- Gamble J.S. 1997. Flora of Presidency of madras, Volume I to III, Adlard and Son., Ltd., London
- Henry A N , Chitra V and Balakrishnan, NP, 1989. Flora of Tamil Nadu, India, Volume III. Botanical Survey of India, Southern circle Coimbatore.
- Henry AN, Kumari GR and Chitra V 1987. Flora of Tamil Nadu, India, Volume II. Botanical Survey of India.
- Mathew K M, 1981 to 1984. The flora of Tamil Nadu, Carnatic. Volume I to III. Rapinet herbarium, St. Joseph's College, Tiruchirapalli.
- Ashok Bendre and Ashok Kumar. Text Book of Practical Botany II. Rastogi Publications, Meerut.
- Shankar Gopal Joshi, 2008. Medicinal Plants. Oxford and IBH Publishing Company Pvt. Ltd. New Delhi

Semester III		
NME – Plant Resource Utilization		
Code:18UBON31	**Hrs/week:2**	**Credits: 2**

Vision

- To appreciate the relevance of crop plants to the economies of people

Mission

- To know the commercial value of plants resources
- To study the morphology and uses of plants in our day today life

CO		PSO addressed	CL
CO-1	acquire knowledge of useful plant parts	3	Re
CO-2	describe the botanical name, morphology and uses of cereals, millets, legumes, vegetables and fruits.	1	Un
CO-3	know importance of plant and plant products	3	Ap
CO-4	discuss the different types of fruits	3	Ev
CO-5	evaluate the medicinal value of spices and condiments	3	Ev
CO-6	understand the chemical composition of plant products	5	Un
CO-7	explain the use of beverages and their production	6	Un
CO-8	prepare groundnut and eucalyptus oil	6	Cr

Unit I : Cereals: Rice, Wheat, Maize and Oat
Millets: Pearl millet, Italian millet, Finger millet
(Botanical name, Morphology and uses only)

Unit II : Legumes: Soyabean, black gram, green gram and Bengal gram
Vegetables: Stem – Potato, garlic, Herbage – Cabbage, cauliflower, Fruit - Tomato, Brinjal (Botanical name, Morphology and uses only)

Unit III : Fruits: Tropical – Mango, banana, guava and papaya, Temperate – Apple and grape (Botanical name, Morphology and uses only)

Unit IV : Spices and Condiments: Roots – asafetida, stem – ginger, bark – cinnamon, leaf – curry leaves, flower bud –clove, fruit – capsicum, coriander and black pepper.

Unit V : Botanical description and production of beverages - tea and wine
Oil –groundnut, coconut and Eucalyptus oil.

Books for Reference:

1. Chrispeels M.J. and Sandava. D. 1977. Plants, Food and People. San Fancisco.W.H. Preeman &Co.
2. Kocchar S L. 1998. Economic Botany of the Tropics. II Edn. Mac Millan India Ltd.
3. Pandey B. P. 1999. Economic Botany, S. CHAND
4. Sammbamurty A.V.S.S., Subrahmanyam N.S. 2008. A text book of Modern Economic Botany CBS publisher
5. Sharma O. P. 1996. Hills Economic Botany, Tata McGraw Hill. Co. Ltd. New Delhi
6. Sunidhi Miglani, 2016. Text Book of Economic Botany, ABS Books. Delhi
7. Swaminathan M and Kochar S. L. 1989. Plants and Society, Macmillar Publisher. Ltd.
8. Wickens G E 2004. Economic Botany. Principles and Practices, Springer, Kluer Publishers. Dordecht The Netherlands.

Semester III		
Core Skilled Based– Horticulture and Plant breeding		
Code:18UBOS31	**Hrs/week:4 Hrs/Semester : 60**	**Credits : 4**

Vission: This course is aimed at understanding the techniques and our work shall make significant contribution to an efficient and sustainable production of food and industrial products from plants.produce quality seeds.

Mission : To promote, develop and disseminate technologies,through a seamless blend of traditional wisdom and modern scientific knowledge.

Co.No.	Upon completion of this course, students will be able to	PSOs Addressed	CL
CO-1	explain the various divisions of horticulture and importance	4	Un
CO-2	identify the most important medicinal plants based on their chemical constituents.	6	Re
CO-3	analyse and evaluate the purity of the herbal drugs.	6	An
CO-4	formulate medicinal products and apply the knowledge on proper storage and certification.	6	Re
CO-5	elaborate the cultural practices involved in cultivation of important medicinal plants.	6	Un
CO-6	equip the skill in landscaping, gardening and floriculture and enhance sense of beautification and aesthetic values.	7	Cr
CO-7	Assess the marketing opportunities of medicinal plants	6	An
CO-8	describe various selection techniques and methods that can be used in genetic improvement of self and cross pollinated crops	6	Ap

Unit I **:** Horticulture – definition, divisions and importance. Propagation of horticultural crops – cuttage, layerage, graftage and budding. Seedage – characteristics of good seed, and seed treatment for germination – Transplanting of seedling.

Unit II **:** Plant growing structures – objectives and types – green houses, hot beds, cold frames and conservatory. Establishment and cultivation of orchard. Gardening - outdoor garden –types, principles, designing and garden components.

Unit III **:** Indoor gardening. Terrarium, hanging basket and bonsai. Commercial gardening - cut flowers and economic flowers. Kitchen gardening – selection of site, lay out and choice of plants. Storage and preservation of fruits and vegetables.

Unit IV **:** Plant breeding:. Nature and scope of plant breeding; Defining - objectives of crop improvement -high yielding variety-disease resistant crops.hybridization techniques -emasculation-bagging. crossing.labellingand harvesting of hybrid seeds and raising F1

generation. Methods of Breeding self pollinated, cross pollinated and asexually propagsted crops, pure line and mass selection.

Unit V : Development of hybrid cultivars-Evalution of combining ability, prediction of double cross hybrid performance, production of hybrid through the use of cytoplasmic-genetic male-sterility system. Breeding for pest resistance: specific resistance vs general resistance, mechanism of resistance, tolerance, use and development of resistance gene.

Books for Reference:

1. Choudhri D and Amal Metha 2010. Flower crops cultivation and management Oxford book company . Jaipur
2. Edmund Senn - Andrew – Halfacre. 1977. Fundamentals of Horticulture. Tata Mc. Graw Hill.
3. Hartmann & Kester, 1989 – Plant propagation. Prentice – Hall of India Pvt. Ltd. New Delhi.
4. Mallikarjuna Reddy and Aparna rao 2010. Plant propagation in horticulture. Pacific book international. New Delhi.
5. Kumar, N. 1997. Introduction to Horticulture. Rajalakshmi Publications, Nagercoil, India.
6. Randahawa 1985. Floriculture in India. Allied publishers.
7. Utpal Banerji 2008. Horticulture Mangal Deep Publication. Jaipur
8. Principles and practice of plant breeding J.R Sharma.TataMcGraw-Hill Publishing Company Limited New Delhi.
9. Principles of plant breeding R.W.AllardJohn Wiley & Sons, Inc.New York.
10. Plant Breeding Theory and Practice. V.L.Chopra. Oxford and IBH Publishing Co. Pvt.Ltd. New Delhi.
11. Evolution Jay M. Savage. Amerind Publishing Co. Pvt.Ltd.
12. Cytology and Evolution E.N.Willmer.Academic press New York and London.

Reference: Jean Taylor , 1973. Practical flower arranging, The Hamlyn Publishing group Ltd., NewYork

SEMESTER III			
Core Skill Based	**Agricultural Chemistry and Water Management**		
Code :18UCHS31	**Hrs./Week:4**	**Hrs/ Sem : 60**	**Credits:4**

Vision

Facilitate the students to know the basic knowledge about agriculture and soil

Mission

- Realize the importance of agriculture
- Understand the chemistry behind fertilizers and pesticides
- Idea to create vermincompost
- Analyze the quality of drinking water

Course Outcome

CO No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO - 1	understand the importance of soil its constituents, fertility and to promote agriculture.	1, 7	Un
CO - 2	know the preparation and importance of fertilizers in agriculture	1, 7	Re
CO - 3	realize the importance of pesticides and insecticides	1, 7	Ap
CO - 4	understand the water quality standards and water quality parameters.	2, 3, 7	Un
CO - 5	aware of the harmful effects of pollutants Produce vermi compost and gobar gas	2, 3, 8	An,Cr
CO - 6	understand the processes used for purification of municipal water	4	Un
CO - 7	treat waste water by using different methods	4, 7, 8	Cr
CO - 8	estimate the amount of carbonate, chloride, nitrate, phosphate, zinc and calcium present in soil.	4, 7	Ap

SEMESTER III			
Core Skill Based Agricultural Chemistry and Water Management			
Code :18UCHS31	Hrs/Week:4	Hrs/ Sem 60	Credits:4

Unit I Soil Nature and Plant Nutrients

Saline, alkali and acid soils. Buffering capacity of soil - Soil reclamation. Liming of soil – measurement of soil pH - Soil fertility – essential plant nutrients and their functions – deficiency symptoms – macro and micro nutrients & their functions. Natural and synthetic manures-qualities of a good fertilizer- classification of fertilizers – nitrogeneous fertilizers - Preparation and importance of urea, calcium cyanamide - phosphatic fertilizers - preparation and importance of super phosphate, triple super phosphate- potash fertilizers - preparation and importance of potassium chloride and potassium nitrate -complex fertilizers - preparation and importance of DAP, mixed fertilizers (NPK) and human effluent from gobar gas plant as a manure. Vermiculture -vermi compost.

Unit II Pesticides

Pesticides, Insecticides, Repellants, Fungicides- Definition-classification – on the basis of their mode of action, target organisms they control, method of application- environmental hazards - preparation and uses of DDT, BHC, lead arsenate, bordeaux mixture, dithiocarbamates.

Unit III Water Quality Parameters

Water quality standard for drinking water (WHO)- Water quality parameters-pH, EC, alkalinity, Total acidity, hardness, DO, BOD, COD, salinity, nitrate (Methaemoglobinemia), phosphate and fluoride content – Eutrophication- Toxic metals - Heavy metal pollution –Hg, As, and Cd. Case studies (Minamata, arsenic poison in West Bengal, Itai-itai)

Unit IV Water Treatment

Waste water treatment-methods and equipments used-preliminary treatment (screening, skimming) - primary treatment (sedimentation, coagulation) - secondary treatment (trickling filters, oxidation pond, anaerobic digestion)-tertiary treatment (adsorption, ion-exchange, reverse osmosis, electrodialysis, disinfection)-treatment of water of municipal purposes-domestic sewage treatment-industrial waste water treatment.

Unit V LABORATORY WORK (Using Water analyzer and HPLC)

(Internal Evaluation Only)

1. Analysis of carbonate, chloride, nitrate, phosphate, zinc and calcium in soil.
2. Determination of Total Organic Carbon (TOC) in soil.
3. Determination of pH and conductivity of water from different sources.
4. Determination of DO, COD and hardness of water.
5. Samples will be collected from agro ecosystem. Presence of pesticides are recorded / Analysis using HPLC

Industrial Visit

A visit may be made to an industry or a premier institution.

*A report of the industrial visit may be submitted as an assignment.

Text Books

1. Text Book of pharmaceutical chemistry Jayashree Ghosh S.Chand and company, New Delhi 2003

2. K.Bagavathi Sundari, Applied Chemistry , MJP Publishers.2008

Books for Reference

1.B.K.Sharma, Industrial Chemistry, Goel Publishing House, Fifth Edition., 1993-94

2.P.S. Sindhu, Environmental Chemistry, New Age International Publishers.2010

Semester- V			
Core Integral I - Rural Economics			
Code: 18UECI51	**Hours / week :5**	**Hrs / Semester: 75**	**Credits :4**

Vision: Learn rural economic development conceptual frameworks

Mission: Prepare the students for appropriate participation in preparing and implementation of the rural area and agricultural development

Course Outcome:

CO. No	Upon completion of this course, students will be able to	PSO addressed	CL
CO - 1	discuss the importance and Significance of rural development	1, 2	Ap
CO - 2	know the aims and features of National Agricultural Policy.	2	An
CO- 3	apply their knowledge and understanding, and problem-solving abilities, to independently identify rural development issues from a geographical perspective	2, 6	Ap
CO - 4	analyze present problems and provide solutions based on a rural industrial environment.	6	An
CO - 5	identify and analyse specific problems of agricultural labour.	3,6	Cr
CO- 6	describe the current problems of rural marketing & regulate the market structure.	2,3	Ev
CO-7	know the Community Development Programme	2	An
CO-8	understand rural development programme	1,4	Un

SEMESTER- V			
Core Integral I - Rural Economics			
Code: 18UECI51	**Hours / week :5**	**Hrs / Semester: 75**	**Credits :4**

Unit I Nature of Rural Economy **15 Hours**

Concepts and Definition of rural economy- Characteristics of rural economy-Rural Development: Objectives and Scope of rural development- Importance and Significance of rural development in India- Problems of Rural economic development

Unit II Rural Farm Economy **15 Hours**

Importance of agricultural sector in the development of rural economy- Role of agricultural sector in GDP- Problems of Indian agriculture- Main aims and features of National Agricultural Policy - Current scenario of agricultural labour in India

Unit III Rural Non-Farm Economy **15 Hours**

Concepts and definitions of rural industries- needs and economic significance of ruralindustries- rural industries and poverty alleviation- role of KVIC in the development ofrural industries- present problems of rural industries in India – remedies.

Unit IV Rural Marketing **15 Hours**

Introduction to rural products and marketing- nature - importance and significance - 4Ps -recent trends - current problems of rural marketing- suggestion for improving ruralmarketing- meaning of regulated market- objectives-features-benefits-problems and remedies of regulated marketing in India-e-marketing

Unit V Approaches to Rural Development **15 Hours**

Introduction of rural development programmes- Community Development Programmes-Intensive Agricultural District Programme- Employment Guarantee Scheme- TRYSEM--JRY-NABARD programmes etc.

Text Book:

Vasant Desai. *Rural Development in India*, Mumbai: Himalaya Publishing House, 2012.

Books for Reference:

1. Venkata Reddy. K. *Agriculture and Rural Development* Himalaya Publication house,2012.
2. Dutt and Sundaram. *Indian Economy.* New Delhi; S.Chand Publications, 2013-07-02.
3. MishraS.K. and PuriV.K. *Economics of Development and Planning.* Mumbai: HimalayaPublishing House, 2012.
4. Mukundan.N.*Rural Development and Poverty Eradication in India*, 2009.
5. Katar Singh. R*ural Development Principles, Policies and Management, New* Delhi: SagePublications, 1986.

Semester- V			
Core Integral II - Tourism Economics			
Code: 18UECI52	**Hours / week :5**	**Hrs / Semester: 75**	**Credits :4**

Vision: Understand the economic significance of the tourism industry and tourism services

Mission: To create the knowledge in the field of tourism industry and its impacts on the economy

Course Outcome:

CO. No	Upon completion of this course, students will be able to	PSO addressed	CL
CO – 1	know the structure and scope of tourism industry	1,2	An
CO – 2	demonstrating knowledge and understanding of the basic principles of tourism in all its dimensions and areas.	5	Ap
CO – 3	discuss trends in and analyze problems of supply and demand for tourism services	1,2	Ap
CO – 4	planning and management of projects in Tourism	1,2	Ap
CO – 5	understand the travel agency and its functions	1	Un
CO – 6	plan, lead, organize and control resources for effective andefficient tourism operations.	5,8	Ap
CO – 7	develop and evaluate tourism policy and planning initiatives	7, 4	Ev
CO – 8	analyse the effects of economic policies implemented by the government on the overall performance of the economy and on the tourism sector in particular.	6	An

Semester- V			
Core Integral II - Tourism Economics			
Code: 18UECI52	**Hours / week :5**	**Hrs / Semester: 75**	**Credits :4**

Unit I Importance of Tourism **15 Hours**

Definition – Concepts – Scope – Classifications – Challenges -Socio – Economic benefitsof tourism - Factors influencing the growth of Tourism

Unit II Tourism Industry **15 Hours**

Tourism as an Industry – Components of Tourism -Structure of Tourism Industry - Global Status of Tourism Industry - Sustainable Tourism- Indian Tourism Industry -Scope of Tourism in India

Unit III Tourism Product **15 Hours**

Concepts of Tourism product – Characteristics of tourism product - Types -Tourism Demand - Motivation of Tourism Demand - Measuring Tourism Demand- Pattern andCharacteristics of tourism supply - Factors influencing tourism supply.

Unit IV Tourism Planning **15 Hours**

Planning and development of tourism in India – Techniques of tourism planning - Tourism Marketing – Market segmentation and Tourism market mix –Travel documents and procedures - Travel agency andTour operators – Types – Functions of a travel agency

Unit V Tamil Nadu Tourism **15 Hours**

General Performance of the State Tourism Development in Tamil Nadu– Role of Local bodies – Tourism administration – Tourism Policy–Ports – Trade – Commerce - Popular tourist places in Tamilnadu – Promotion of Tourism in Tamilnadu - Environmental Protection measures in Tamil Nadu-Developing tourism potential of local area

Text Book:

Viswanath Ghosh.*Tourism and Travel Management.* New Delhi: Vikas Publishing House, Pvt., Ltd., 2000

Books for Reference:

1. Bhatia A.K. *International Tourism Management.* New Delhi: Sterling Publishers Pvt,Ltd.2001.
2. Cooper, C, Flethor, J.D. and Wanhill, S. *Tourism: Principles and Practices,* London:Pitman. 1993.
3. Johan M. Bryder. *Tourism and Development.* London: Cambridge University Press,1973.
4. Michael Peters. *International Tourism.* London: Hutchinson, 1969.
5. Rajasekara Thangaman. *Tourism Development,* Chennai: Madras art printers, 2003.

Semester- VI			
Core Integral III - International Economics			
Code: 18UECI61	**Hours / week :5**	**Hrs / Semester: 75**	**Credits :4**

Vision:
To understand the theories governing international trade

Mission:
To evaluate the policies pursued by various economic bodies in international economic transactions.

Course Outcome:

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	describing the benefits of international trade and defects	1	Un
CO-2	elaborate the detailed study on balance of trade and balance of payments	4	Un
CO-3	elaborate the procedure to be implemented for GATT, UNCTAD and WTO	1	Ap
CO-4	familiar with the main economic theories and models of international trade.	1	Un
CO-5	aware of the likely distributional consequences of trade and thus of conflicting interests within an economy regarding trade liberalization.	3	Un
CO-6	understand economists' arguments concerning trade policy and its analysis.	4	Un
CO-7	apply economic reasoning to issues of the day surrounding globalization.	6	Ap
CO-8	have an elementary understanding of open-economy macroeconomics and the determinants of exchange rates and the balance of payments.	4	Un

Semester- VI			
Core Integral III-International Economics			
Code: 18UECI61	**Hours / week :5**	**Hrs / Semester: 75**	**Credits :4**

Unit – I Introduction **15 Hours**

Differences between international trade and internal trade - Benefits of international tradeand defects, Free trade: Meaning - Arguments for and against - Protection: Meaning - Arguments for and against – Kinds of Protection and Role of Protection in UDCs

Unit – II Theories of International Trade **15 Hours**

Classical Theory, Comparative Cost Theory, Modern Theory and Factor-Price Equalization Theory

Unit – III Balance of Payments **15 Hours**

Meaning of Balance of trade and Balance of payments – Meaning and Types, Structure ofa Balance of payment, Causes and Remedial measures

Unit–IV Foreign Exchange **15 Hours**

Meaning of Foreign exchange and Exchange Rate, Determination: Mint parity theory – Purchasing power party theory – Balance of payment Theory– Fixed and Flexible Exchange Rate: Merits and Demerits

Unit – V International Financial Institutions **15 Hours**

IMF – Objectives– structure– Functions –World Bank (IBRD) – Objectives – structure – Functions - Trade Agreements: GATT, UNCTAD and WTO-Regional Blocks

Text Book: M.L.Jhingan. *International Economics.* New Delhi: Vrinda Publications P.Ltd -2016.

Books for Reference:

1. D.M. Mithani. *International Economics.* New Delhi:Himalayas Publishing House, 2003
2. Soderston. *International Economics.* London: The Macmillan Press Ltd., 2010
3. Singh & Agarwal. *International Economics.* Meerut: Sanjeeva Prakashan, 2012.
4. Devairakkam. *International Economics*. Tirunelveli: D.S.R.Publications, 2001.
5. Francis Cherunilam. *International Economics*, New Delhi. (Fifth Edition) Tata McGrawHill, 2010

Semester – V			
Part III Core XI (Common Core) Human Resource Management			
Code:18UMCC51	**Hrs/Week: 6**	**Hrs/Sem: 90**	**Credit : 4**

Vision:

To enable students to understand the basic concepts in HRM

Mission:

To familiarize students on the various aspects of HRM

Course Outcome:

CO No.	Upon completion of this course, students will be able to:	PSO addressed	Cognitive Level
CO – 1	gain knowledge on the basic concepts of planning human resource and help them to understand basic techniques of business.	1,2	Un
CO – 2	understand the basic selection process in HR.	1,2,3	Un
CO – 3	know the importance of training and development in HR.	2,3,4	Ap
CO – 4	know about the transfer policies	2,3,5	Un, Re
CO – 5	gain knowledge on compensation methods.	3,4	Un, An
CO – 6	understand the promotional policies in business	3,4	Un, Re
CO – 7	know about the significance and problems in performance appraisal.	3,4,5	Ap
CO – 8	know about the methods of performance appraisal	3,4,5	Ap

Semester V			
Part –III	**Core – XI (Common Core)**	**Human Resource Management**	
Code: 18UMCC51	**Hrs/Week: 6**	**Hrs/Sem: 90**	**Credits: 4**

Unit-I: Introduction **15 Hours**

Human Resource Management: Meaning - Objectives - Nature and Scope - Importance – Functions - and Problems of HRM - Personnel Management Vs. HRM - Qualities and Qualifications of Human Resource Managers.

Unit-II: Human Resource Planning, Recruitment and Selection **20 Hours**

Human Resource Planning: Meaning - Need and Importance - Objective - Problems - Process – Recruitment: Meaning - Factors Influencing Recruitment - Sources of Recruitment - Problems in Recruitment – Selection: Meaning - Factors Affecting Selection Decisions - Selection Policy - Steps in Selection.

Unit-III: Training and Development **20 Hours**

Training: Need and Importance - Objective - Types - Steps in Training Programme – Methods of Training - Evaluation of Training Programmes – Development: Meaning - Concept and Essentials of Management Development Programmes.

Unit-IV: Transfer, Promotion & Compensation **15 Hours**

Transfer: Objective - Transfer Policy - Promotion: Purpose - Promotion Policy – Demotion - Compensation: Objective – Principles.

Unit-V: Performance Appraisal **20 Hours**

Performance Appraisal: Meaning - Need and Importance - Objective - Problems in Performance Appraisal - Factors Influencing Performance Appraisal – Methods of Performance Appraisal.

Text Book:

Chitra,Atmaram, Naik. *Human Resource Management.* Ane Books Pvt., 2016.

Books for Reference:

1. Dr.C.B.Gupta. *Human Resource Management.* New Delhi: Sultan Chand & Sons, 2018.
2. C.P.Memoria, *Personnel Management,* Himalaya Publishing House, 2011
3. L.M.Prasad., *Human Resources Management.* New Delhi: Sultan Chand & Sons,2014.
4. Gary Dessler. *Human Resource Management.* Prentice Hall, 2013.
5. Michael Armstrong. *A Handbook of Human Resource Management Practice.* Kogan Page,2012.

Semester- V			
Core VIII -Macro Economics- I			
Code: 18UECC52	**Hours / week :6**	**Hrs / Semester: 90**	**Credits :4**

Vision: To acquire the knowledge of important concepts of Macro Economics

Mission: To develop and practice economic theories in present life

Course Outcome:

CO. No	**Upon completion of this course, students will be able to**	**PSO addressed**	**CL**
CO - 1	explain what economics is and explain why it is important	1,3,6	An
CO - 2	describe the relationships among GDP, net domestic product, national income, personal income and disposable income.	6	An
CO- 3	identify and differentiate the different types of unemployment	3	Ev
CO-4	identify the strengths and weaknesses of the Keynesian and classical model.	2,3,4	Ev
CO-5	explain and graph the consumption function	1, 6	An
CO-6	explain what would cause the consumption function to grow steeper or flatter or to shift up or down	2, 6	An
CO-7	know the multiplier and identify the leakages of multiplier	1,6,8	An
CO-8	understand the acceleration principles	1	Un

Semester- V			
Core VIII -Macro Economics- I			
Code: 18UECC52	**Hours / week :6**	**Hrs / Semester: 90**	**Credits :4**

Unit – I Introduction and National Income **15 Hours**

Macro Economics vs. Micro Economics, Macro-Economic Problems: Unemployment, Inflation-National Income- meaning – Concepts – methods and problems in measurement

Unit – II Theories of Employment **20 Hours**

Meaning of full employment – Types of unemployment – Classical theory of output and employment – Say's law of market –Criticisms of Classical theory–Keynesian Theory of employment –Comparison of Classical theory with Keynesian theory of employment

Unit – III Consumption Function **20 Hours**

Consumption and income – Average and Marginal propensity to consume and their relationship –Factors determining consumption function - Importance of consumption function – Theories of Consumption Function – Absolute, Relative

Unit – IV Multiplier **20 Hours**

Multiplier – Meaning – Relationship with Marginal propensity to consume and save– Importance – Leakages - Keynes's Investment Multiplier compared with Khan's Employment Multiplier.

Unit – V Accelerator **15 Hours**

Acceleration principle – Meaning – Assumptions – Importance – Limitations – Interaction of Acceleration and Multiplier or leverage effect or Super Multiplier

Text Book:

M.L.Seth. *An Introduction to Keynesian Economics*. Agra: Agarwal Educational Publishers, 1957.

Books for Reference:

1. Ackley. *Macro Economic Theory and Policy.* London, New York : Macmillan, 1978
2. J.M.Keynes. *The General Theory of Employment.* London: Interest and Money, Macmillan, 1936
3. M.Maria John Kennedy. *Macro Economics*, New Delhi: PHI Learning PVT Ltd, 2011

Semester- V			
Core IX -Fiscal Economics			
Code: 18UECC53	**Hours / week :6**	**Hrs / Semester: 90**	**Credits :4**

Vision: Provide the knowledge on basic financial procedure of the government.

Mission: To develop the ability of the students to understand and to make research in finance and economics and the skills to apply those concepts to the making of intelligent decisions for themselves in public sector and business life.

Course Outcome:

CO. No	Upon completion of this course, students will be able to	PSO addressed	CL
CO - 1	differentiate between public finance and private finance	6	Ap
CO - 2	explain tax and non- tax revenue, differentiate between direct and indirect tax, explain shifting of taxation and effects of taxation	1, 2, 6	An
CO- 3	classify the public revenue and its various sources; revenue receipts and non- revenue receipts, understand the tax and non-tax revenue.	1,3	Ev
CO- 4	describe how and in which manner government spends, the causes of increasing public expenditure in the modern economies, explain the varying effects of public expenditure on the economy and role of public expenditure in a developing economy.	2, 3	Ev
CO - 5	identify the measures to reduce public expenditure.	3	Ev
CO - 6	explain the types of public debt and how debt is repaid	1,2,5	An
CO -7	describe the government budget, explain different types of budgets such as balanced and unbalanced budget and know the budgetary procedure.	3	Ev
CO-8	analyse the latest government budget allotment	6,8	An

Semester- V			
Core IX -Fiscal Economics			
Code: 18UECC53	**Hours / week :6**	**Hrs / Semester: 90**	**Credits :4**

Unit I Introduction **15 Hours**

Meaning and Definition of Public finance – Public finance and Private finance Principle of Maximum Social advantage

Unit II Public Revenue **20 Hours**

Tax and non-tax revenues – Canons of Taxation – Types of tax – Direct and indirect taxes – Progressive, Proportional and Regressive taxation, Effects of taxation – Taxable Capacity: Determinants

Unit III Public Expenditure **20 Hours**

Classification of Public Expenditure – Causes and Growth of Public Expenditure – Effects of Public Expenditure on production, employment and distribution – Measures to reduce Public Expenditure in India.

Unit IV Public Debt **15 Hours**

Meaning and Classification – Need for Public Borrowing – Effects of Public Debt on production, consumption and distribution - Burden of Public Debt– Redemption of Public Debt – Growth of Public Debt in India.

Unit V Financial Administration **20 Hours**

Centre state relations –Role of Finance commissions- Meaning and components of Government budget- Revenue and Capital Budget – Characteristics of a sound budget– Budgetary procedure in India - A Review of the latest Union Budget- Local finance

Text Book: B.P.Tyagi. *Public finance* JAI Prakash Nath& Co., 2007

Books for Reference:

1. H.L.Bhatia. *Public Finance.* New Delhi: Vikas Publishing House Pvt. Ltd, 1999
2. R.C. Agarwal. *Public Finance: Theory and Practice.* Agra: Lakshmi Narayan Publications, 2006.
3. Musgrave & Musgrave. *Public Finance -Theory and Practice.* New Delhi: McGraw Hill Book Co.,1981
4. R.Cauvery. *Public Finance.* New Delhi: S. Chand & Company Ltd, 2007

Semester- V			
Core Integral I - Rural Economics			
Code: 18UECI51	**Hours / week :5**	**Hrs / Semester: 75**	**Credits :4**

Vision: Learn rural economic development conceptual frameworks

Mission: Prepare the students for appropriate participation in preparing and implementation of the rural area and agricultural development

Course Outcome:

CO. No	Upon completion of this course, students will be able to	PSO addressed	CL
CO - 1	discuss the importance and Significance of rural development	1, 2	Ap
CO - 2	know the aims and features of National Agricultural Policy.	2	An
CO- 3	apply their knowledge and understanding, and problem-solving abilities, to independently identify rural development issues from a geographical perspective	2, 6	Ap
CO - 4	analyze present problems and provide solutions based on a rural industrial environment.	6	An
CO - 5	identify and analyse specific problems of agricultural labour.	3,6	Cr
CO- 6	describe the current problems of rural marketing & regulate the market structure.	2,3	Ev
CO-7	know the Community Development Programme	2	An
CO-8	understand rural development programme	1,4	Un

SEMESTER- V			
Core Integral I - Rural Economics			
Code: 18UECI51	**Hours / week :5**	**Hrs / Semester: 75**	**Credits :4**

Unit I Nature of Rural Economy **15 Hours**

Concepts and Definition of rural economy- Characteristics of rural economy-Rural Development: Objectives and Scope of rural development- Importance and Significance of rural development in India- Problems of Rural economic development

Unit II Rural Farm Economy **15 Hours**

Importance of agricultural sector in the development of rural economy- Role of agricultural sector in GDP- Problems of Indian agriculture- Main aims and features of National Agricultural Policy - Current scenario of agricultural labour in India

Unit III Rural Non-Farm Economy **15 Hours**

Concepts and definitions of rural industries- needs and economic significance of rural industries- rural industries and poverty alleviation- role of KVIC in the development of rural industries- present problems of rural industries in India – remedies.

Unit IV Rural Marketing **15 Hours**

Introduction to rural products and marketing- nature - importance and significance - 4Ps - recent trends - current problems of rural marketing- suggestion for improving rural marketing- meaning of regulated market- objectives-features-benefits-problems and remedies of regulated marketing in India-e-marketing

Unit V Approaches to Rural Development **15 Hours**

Introduction of rural development programmes- Community Development Programmes- Intensive Agricultural District Programme- Employment Guarantee Scheme- TRYSEM--JRY-NABARD programmes etc.

Text Book:

Vasant Desai. *Rural Development in India,* Mumbai: Himalaya Publishing House, 2012.

Books for Reference:

1. Venkata Reddy. K. *Agriculture and Rural Development* Himalaya Publication house, 2012.
2. Dutt and Sundaram. *Indian Economy.* New Delhi; S.Chand Publications, 2013-07-02.
3. MishraS.K. and PuriV.K. *Economics of Development and Planning.* Mumbai: Himalaya Publishing House, 2012.
4. Mukundan.N.*Rural Development and Poverty Eradication in India*, 2009.
5. Katar Singh. R*ural Development Principles, Policies and Management, New* Delhi: Sage Publications, 1986.

Semester- V			
Core Integral II - Tourism Economics			
Code: 18UECI52	**Hours / week :5**	**Hrs / Semester: 75**	**Credits :4**

Vision: Understand the economic significance of the tourism industry and tourism services

Mission: To create the knowledge in the field of tourism industry and its impacts on the economy

Course Outcome:

CO. No	Upon completion of this course, students will be able to	PSO addressed	CL
CO – 1	know the structure and scope of tourism industry	1,2	An
CO – 2	demonstrating knowledge and understanding of the basic principles of tourism in all its dimensions and areas.	5	Ap
CO – 3	discuss trends in and analyze problems of supply and demand for tourism services	1,2	Ap
CO – 4	planning and management of projects in Tourism	1,2	Ap
CO – 5	understand the travel agency and its functions	1	Un
CO – 6	plan, lead, organize and control resources for effective and efficient tourism operations.	5,8	Ap
CO – 7	develop and evaluate tourism policy and planning initiatives	7, 4	Ev
CO – 8	analyse the effects of economic policies implemented by the government on the overall performance of the economy and on the tourism sector in particular.	6	An

Semester- V			
Core Integral II - Tourism Economics			
Code: 18UECI52	**Hours / week :5**	**Hrs / Semester: 75**	**Credits :4**

Unit I Importance of Tourism **15 Hours**

Definition – Concepts – Scope – Classifications – Challenges -Socio – Economic benefits of tourism - Factors influencing the growth of Tourism

Unit II Tourism Industry **15 Hours**

Tourism as an Industry – Components of Tourism -Structure of Tourism Industry - Global Status of Tourism Industry -Sustainable Tourism- Indian Tourism Industry - Scope of Tourism in India

Unit III Tourism Product **15 Hours**

Concepts of Tourism product – Characteristics of tourism product -Types -Tourism Demand - Motivation of Tourism Demand - Measuring Tourism Demand- Pattern and Characteristics of tourism supply - Factors influencing tourism supply.

Unit IV Tourism Planning **15 Hours**

Planning and development of tourism in India – Techniques of tourism planning - Tourism Marketing – Market segmentation and Tourism market mix –Travel documents and procedures - Travel agency andTour operators – Types – Functions of a travel agency

Unit V Tamil Nadu Tourism **15 Hours**

General Performance of the State Tourism Development in Tamil Nadu– Role of Local bodies – Tourism administration – Tourism Policy–Ports – Trade – Commerce - Popular tourist places in Tamilnadu – Promotion of Tourism in Tamilnadu - Environmental Protection measures in Tamil Nadu-Developing tourism potential of local area

Text Book:

Viswanath Ghosh.*Tourism and Travel Management.* New Delhi: Vikas Publishing House, Pvt., Ltd., 2000

Books for Reference:

1. Bhatia A.K. *International Tourism Management.* New Delhi: Sterling Publishers Pvt,Ltd. 2001.
2. Cooper, C, Flethor, J.D. and Wanhill, S. *Tourism: Principles and Practices,* London: Pitman. 1993.
3. Johan M. Bryder. *Tourism and Development.* London: Cambridge University Press, 1973.
4. Michael Peters. *International Tourism.* London: Hutchinson, 1969.
5. Rajasekara Thangaman. *Tourism Development,* Chennai: Madras art printers, 2003.

Semester- V	
Self-Study or On-line Course (Compulsory)– Economics of Insurance	
Code: 18UECSS3	**Credits :2**

Vision: To know the basic concepts of Insurance.

Mission: To train the students in the field of insurance and auxiliary services thus highly developing efficient and skilled insurance professionals to serve

Course Outcome:

CO. No	Upon completion of this course, students will be able to	PSO addressed	CL
CO – 1	know the importance of insurance	1,2	An
CO – 2	understand the classification of risks	1	Un
CO – 3	identify and apply the insurance policies procedures and benefits with present situation	1,3	Ap
CO – 4	understand the calculation of premium	1	Un
CO – 5	enhance the knowledge of Life and fire insurance.	7	Ap
CO – 6	describe the motor insurance	1, 2	Un
CO – 7	identify the role of insurance in economics	1,3	Ap
CO – 8	understand the IRDA	1	Un

Semester- V	
Self-Study or On-line Course (Compulsory)– Economics of Insurance	
Code: 18UECSS3	**Credits :2**

Unit-I Introduction

The quest for Economic Security - Classification of Risks - Demand for Insurance- Definition and Nature - Evolution and Importance of Insurance

Unit-II Life Insurance

Life Insurance Contract: Nature and Classification of Policies - Selection of Risk - Calculation of premium - Investment of Funds - Surrender Value – Term Insurance

Unit-III Fire Insurance

Fire Insurance: Nature and uses - Kinds of Policies - Policy Conditions - Rate Fixation - Payment of claim - Motor Insurance - Personal Accident - Health and Medical Insurance

Unit-IV Insurance & Economic Development

Insurance in Economic Development: Insurance and Mobilisation of savings - Insurance Institutions as Investment Institutions and their role in capital market -Privatisation of Insurance Sector

Unit-V Insurance & Social Welfare

Insurance as social welfare and security: Insurance - an Investment - Tax and Non - Tax Advantages - Retirement Planning - pension plans - Insurance Regulation and Development Authority (IRDA).

Text Book:

S.Devairakkam. *Insurance Principles and Practice.* Tirunelveli: DSR Publications, 2000

Books for Reference:

1. M.N.Mishra. *Insurance,* New Delhi: S.Chand & Company Ltd, 1999
2. Prof.Muthaya.S. *Life Insurance,* Palayamkottai: Ramalakshmi Publication, 2000.
3. IRDA: *Insurance Regulations and Development.* New Delhi: Authority Regulations.
4. Govt of India: *Old age and Income Security Report (Dave Committee Report)* New Delhi: *Govt of India*,

Semester- VI			
Core –X Macro Economics – II			
Code: 18UECC61	**Hours / week :6**	**Hrs / Semester: 90**	**Credits :4**

Vision:

To enable the students to have basic knowledge on macro-economic theories and policies

Mission:

To interpret the forces that cause fluctuations in capital and investment and to familiarize the issues associated with monetary & fiscal policy**.**

Course Outcome:

CO. No	**Upon completion of this course, students will be able to**	**PSO addressed**	**CL**
CO-1	describe theories of distribution	1	Un
CO-2	evaluate macroeconomic performance using indicators that include output measures and unemployment	1, 4	Ev
CO-3	understand the concepts used, methods to measure and difficulties encountered in the calculation of National Income	1, 3	Un
CO-4	identify, compare, and apply key features of Neoclassical and Keynesian economic models	4	Ap
CO-5	analyse fiscal and monetary policy decisions to counter business cycle swings by using macro-economic models.	6	Un
CO-6	evaluate macroeconomic performance using indicators that include inflation.	1, 2	Ev
CO-7	know about Macroeconomic Policies	1	Un
CO-8	identify the fiscal and monetary policies for internal and external balance	1	Un

Semester- VI			
Core –X Macro Economics – II			
Code: 18UECC61	**Hours / week :6**	**Hrs / Semester: 90**	**Credits :4**

Unit I Theories of Distribution **15 Hours**

Classical Theory of Distribution– Marxian Theory of Income Distribution –Kaldor's Theory of Distribution – Critical appraisal

Unit II Investment Function **20 Hours**

Meaning of Capital and Investment – Types of Investment – Induced Vs Autonomous – Determinants of Investments – Rate of Interest – Marginal Efficiency of Capital (MEC) – Factors influencing MEC

Unit III General Equilibrium **15 Hours**

Concept of Partial Equilibrium – General Equilibrium – Derivation of IS and LM Functions – Shifts in IS and LM Functions

Unit IV Macro Economic Policy **20 Hours**

Macroeconomic Policy – Policy objectives – Conflicts in policy objectives - Fiscal and Monetary Policies for Internal and External Balance

Unit V Monetary & Fiscal Policy **20 Hours**

Monetary Policy –Instruments – Effectiveness - Role of Monetary Policy in Developing Economy – Fiscal Policy – Objectives – Limitations – Fiscal Monetary Policy Mix

Text Book:

M. Maria John Kennedy. *Macro Economics*. New Delhi: PHI Learning PVT Ltd, 2011

Books for Reference:

1. Ackley. *Macro Economic Theory and Policy.* London; Macmillan, 1978
2. M.L.Seth. *An introduction to Keynesian Economics.* Agra: Agarwal, 1974.
3. J.M.Keynes. *The General Theory of Employment, Interest and Money*, London: Macmillan, 1936.

Semester- VI			
Core XI– Development Economics			
Code: 18UECC62	**Hours / week :6**	**Hrs / Semester: 90**	**Credits :4**

Vision:

To relate theoretical concepts in economic development and growth

Mission:

To grasp how the planning contributes to the growth of the Indian Economy.

Course Outcome:

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	understand the concept of economic growth and development	1	Un
CO-2	know about India's stage of Economic Growth	4	Un
CO-3	identify the Achievements and Failures of Five Year plans in India	1	Un
CO-4	describe the nature and meaning of economic development or underdevelopment, both in general, and as applied to people in specific developing countries.	1	An
CO-5	illustrate how economics can be used to create or analyse alternative approaches to promote development.	4	Ap
CO-6	explain the major development problems, choices and opportunities currently faced by developing countries.	6	Un
CO-7	select, assess and justify specific policy choices that developing countries might make to achieve their economic and social objectives.	1	Ev
CO-8	analyse, synthesise and evaluate information drawn from the available data and appropriate theoretical tools, and to express their ideas orally and in writing.	6	An, Ev

Semester- VI			
Core XI– Development Economics			
Code: 18UECC62	**Hours / week :6**	**Hrs / Semester: 90**	**Credits :4**

Unit – I Introduction **20 Hours**

Economic growth and development – Factors affecting Economic Growth – Capital, Labour and Technology - Rostow's stages of Economic Growth –India's stage of Economic Growth

Unit – II Approaches to Economic Development **20 Hours**

Vicious Circle of Poverty, Circular Causation, Unlimited supply of Labour – Big Push Theory, Balanced Growth Theory - Critical minimum effort thesis – Dualism – Technical, Behavioural, Social and Financial

Unit – III Theories of Economic Development **15 Hours**

Classical theory of development – Theory of social changes – crisis in capitalism, Schumpeter and Capitalistic development

Unit – IV Growth Models **20 Hours**

Harrod and Domar Model – Solow – Meade – Mrs. Joan Robinson's- Romer's and Arrow's Models

Unit – V Measures for Economic Development **15 Hours**

Need for Planning – Types – Conditions for successful operation of planning – Planning machinery in India - Achievements and Failures of Five Year plans

Text Book:

M.L.Seth. *Theory and Practice of Economic Planning*, New Delhi: S.Chand & Co., 1969

Books for Reference:

1. M.L.Jhingan. *Economics of Development and Planning.* New Delhi: Vrinda Publications P.Ltd (2016)
2. B.C. Tandon. *Economic Planning: Theory and Practice*, Allahabad: Chaitanya Publishing House, 1971.
3. Misra and Puri. *Economics of Development and Planning*, Himalaya Publishing House, 2014
4. W.A.Lewis. *Development and Planning,* George Allen & Unwin, 1963.
5. Kindleberger. *Economic Development*, New York: McGraw Hill, 1965

Semester- VI			
Core XI I– Labour Economics			
Code: 18UECC63	**Hours / week :6**	**Hrs / Semester: 90**	**Credits :4**

Vision:

To understand labour as a unique factor of production

Mission:

To help students to understand the working of the labour welfare agencies, social security measures in India and to observe the nature of industrial relations in India.

Course Outcome:

CO.No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	describe efficiency of Indian labour	1	An
CO-2	know about characteristics & objectives of trade unions	1	Un
CO-3	elaborate the detailed study on worker's participation in management in India	4	Un
CO-4	explain the relationship of the labour market to other markets.	4	Un
CO-5	understand the basic mechanism of the labour market, in particular with how unemployment, wage and productivity differences can arise as equilibrium phenomena.	1	Re
CO-6	perform supply and demand analysis in the labour market.	2	Ap
CO-7	show the causes and changes in the productivity of labour.	4	Ap
CO-8	analyze the effect of labour unions.	3	An

Semester- VI			
Core XII– Labour Economics			
Code: 18UECC63	**Hours / week :6**	**Hrs / Semester: 90**	**Credits :4**

Unit I Labour as a factor of Production: 15 Hours

Meaning and Definition of Labour - Peculiarities of labour- Factors affecting labour – Migration & absenteeism – causes, effects and remedial measures – Efficiency of Indian labour.-knowledge workers

Unit II Trade Unions: 20 Hours

Trade Unionism – Meaning, Definitions- Types – Characteristics & Objectives of Trade Unions – Functions – Industrial Disputes – Causes – Impact – Suggestions for improving industrial relations - Collective Bargaining – Objectives – Process of Collective Bargaining.

Unit III Workers' Participation in Management 20 Hours

Works Committees – Joint Management Councils – Worker's Participation in Management in India – Worker's Education – Objectives – Worker's Education in India.

Unit IV Labour Welfare 15 Hours

Meaning- Definitions – Features – Concepts –Intra Mural and Extra Mural Labour – Labour Welfare Agencies – Aims and functions of ILO- India and ILO.

Unit V Social Security 20 Hours

Meaning – Definition – Importance – Social Insurance – Social Assistance – Commercial Insurance- Social Security measures in India.

Text Book:

Dr.S.Ramakrishna Moorthy - *Labour Economics,* Tirunelveli: D.S.R.Publications –2002.

Books for Reference:

1. Dr.M.M.Varma and R.K.Aggarwal, *Labour Economics.* New Delhi: – Kings Books publisher –1994.
2. Bhagoliwal T.N. *Economics of Labour and Industrial Relations*, Agra: Sahitya Bhavan, 1983.
3. Reynolds, Lloyd. *Labour Economics and Labour Welfare.* New Delhi: Prentice. Hall of India Pvt. Ltd. 1978.

Semester- VI			
Core Integral III - International Economics			
Code: 18UECI61	**Hours / week :5**	**Hrs / Semester: 75**	**Credits :4**

Vision:

To understand the theories governing international trade

Mission:

To evaluate the policies pursued by various economic bodies in international economic transactions.

Course Outcome:

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	describing the benefits of international trade and defects	1	Un
CO-2	elaborate the detailed study on balance of trade and balance of payments	4	Un
CO-3	elaborate the procedure to be implemented for GATT, UNCTAD and WTO	1	Ap
CO-4	familiar with the main economic theories and models of international trade.	1	Un
CO-5	aware of the likely distributional consequences of trade and thus of conflicting interests within an economy regarding trade liberalization.	3	Un
CO-6	understand economists' arguments concerning trade policy and its analysis.	4	Un
CO-7	apply economic reasoning to issues of the day surrounding globalization.	6	Ap
CO-8	have an elementary understanding of open-economy macroeconomics and the determinants of exchange rates and the balance of payments.	4	Un

Semester- VI			
Core Integral III-International Economics			
Code: 18UECI61	**Hours / week :5**	**Hrs / Semester: 75**	**Credits :4**

Unit – I Introduction **15 Hours**

Differences between international trade and internal trade - Benefits of international trade and defects, Free trade: Meaning - Arguments for and against - Protection: Meaning - Arguments for and against – Kinds of Protection and Role of Protection in UDCs

Unit – II Theories of International Trade **15 Hours**

Classical Theory, Comparative Cost Theory, Modern Theory and Factor-Price Equalization Theory

Unit – III Balance of Payments **15 Hours**

Meaning of Balance of trade and Balance of payments – Meaning and Types, Structure of a Balance of payment, Causes and Remedial measures

Unit–IV Foreign Exchange **15 Hours**

Meaning of Foreign exchange and Exchange Rate, Determination: Mint parity theory – Purchasing power party theory – Balance of payment Theory– Fixed and Flexible Exchange Rate: Merits and Demerits

Unit – V International Financial Institutions **15 Hours**

IMF – Objectives– structure– Functions –World Bank (IBRD) –Objectives – structure – Functions - Trade Agreements: GATT, UNCTAD and WTO-Regional Blocks

Text Book: M.L.Jhingan. *International Economics.* New Delhi: Vrinda Publications P.Ltd - 2016.

Books for Reference:

1. D.M. Mithani. *International Economics.* New Delhi:Himalayas Publishing House, 2003
2. Soderston. *International Economics.* London: The Macmillan Press Ltd., 2010
3. Singh & Agarwal. *International Economics.* Meerut: Sanjeeva Prakashan, 2012.
4. Devairakkam. *International Economics*. Tirunelveli: D.S.R.Publications, 2001.
5. Francis Cherunilam. *International Economics*, New Delhi. (Fifth Edition) Tata McGraw Hill, 2010

Semester- VI			
Core Integral IV-Energy Economics			
Code: 18UECI62	**Hours / week : 7**	**Hrs / Semester: 105**	**Credits :7**

Vision:

To understand the energy and environmental issues

Mission:

To grasp how the energy sector contributes to the growth of the Indian Economy.

Course Outcome:

CO. No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	deliver the importance of nature & scope of Energy Economics	1	Un
CO-2	give sound information on ONGC, OPEC, OAPEC, IEA and World Bank.	3	Un
CO-3	prepare and evaluate energy intensity and elasticity	5	Ap
CO-4	understand the basics of energy resources	1	Un
CO-5	understand the classification and importance of energy resources	3	Un
CO-6	know about the consequences and remedial measures of environmental crisis	1	Un
CO-7	know about the impact of energy consumption on production and environment.	4	Ap
CO-8	understand the usage of energy supply and demand	1	Un

Semester- VI			
Core Integral IV-Energy Economics			
Code: 18UECI62	**Hours / week : 7**	**Hrs / Semester: 105**	**Credits :7**

Unit I Natural Resources **15 Hours**

Classification & Importance of Energy Resources - Types and classification - Emergence of Energy Economics - Its nature & scope

Unit II Institutional Role Of Energy **15 Hours**

Development Role of Energy in Economic Development - Energy intensity and Elasticity - National and International Comparison - Role of Institutions like ONGC, OPEC, OAPEC, IEA and World Bank.

Unit III Environment Energy Crisis **15 Hours**

Energy Crisis: causes - Consequences and Remedial Measures - Environmental Crisis - Causes - Consequences - Impact of Energy consumption on production and on Environment.

Unit IV Indian Energy Sector **15 Hours**

Organisational structure - Energy Supply (Coal & Lignite, Oil & Gas, Hydro, Thermal, Nuclear) Energy Demand (From Agricultural, Industry, Transport, Domestic etc.,)

Unit V Energy Sources **15 Hours**

Renewable (Solar, Wind, Tidal, Wave, Bio-gas, Biomass, Hydrogen etc) Renewable Energy Programmes under 5 year plans - Energy issues and Policy options for India.

Text Book:

Karpagam. M *Environmental economics.* New Delhi: Sterling, 1991

Books for Reference:

1. Agarwal, M.C., and Mongo, J.R. *Economic and Commercial Geography* . New Delhi: (National Publishing House, 1992
2. Agarwal, S.K. *Environment and Natural Resources Economics* London: Scott Foresman & Co., 1985
3. Common, M. *Environmental and Resource Economics.* London: Longman, 1996
4. Paul Stevens (Ed) *The economics of Energy, Vol. 1 and II* . Edward Elgar 2000
5. Raikhy P.S. and Parminder Singh, *Energy Consumption in India.* New Delhi: Patter and Determinants (Deep and Deep, 1990.
6. Richard Eden. *Energy Economic*s. Growth, Resources and Policies London: (Cambridge University Press,1981

Semester- VI			
Core Integral IV–Group Project			
Code: 18UECP61	**Hours / week :7**	**Hrs / Semester: 105**	**Credits :7**

Vision: Facilitate quick understanding of complex data.

Mission: Applies the research strategy in real life situation

Course Outcome:

CO. No	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	understand the research design	4	Un
CO-2	critically assess contributions to the literature.	4, 5	An
CO-3	attain the skills needed to formulate and analyse models used in the particular field of Economics.	5	Ap
CO-4	prepare and present original research papers in the particular field.	4	Cr
CO-5	improve generic skills like oral communication and written communication.	8	Ap
CO-6	perform the interpretation and analysis of data.	3	An
CO-7	originate clarification and present the research report.	4, 5	Ev
CO-8	identify about the universe from a sample	1	Un

Semester- VI			
Core Integral IV–Group Project			
Code: 18UECP61	**Hours / week :7**	**Hrs / Semester: 105**	**Credits :7**

Group Project work submitted by the students would be evaluated by external examiner appointed by the University for Marks of 100; remaining 100 marks would be given by internal examiner as per the rules and regulation of the university.

Guidelines for the project work of the UG programme in Economics

The students are expected to carry out a project work in the last Semester. It is equivalent to a core course. For maintaining uniformity and quality in its preparation, the Board of Studies has prepared clear guidelines.

The scheme and syllabus of the B.A. Programme in Economics under the CBCS suggests that students shall do a final research project for attaining intellectual maturation. The project is a major document that reflects the skills of the student to investigate critically a topic/problem, the ability to gather and analyze information, and to present and discuss the results/investigation concisely and clearly. The guidelines to be followed in the preparation and submission of the project are as given here under.

1. The students may choose any topic from the subject she has studied, including the social and economic issues in the local/regional context.
2. The project work should be supervised by a faculty.
3. The students shall prepare and submit the project report to the Institution
4. The report with around 40 A4 size pages (excluding preliminary pages) with at least 20 lines per page on one side of the paper only. The report should be bound (spiral or other ways).
5. The project report should be submitted to the Department within the date announced by the Controller of Examinations
6. The student shall prepare two copies of the report; one copy for submitting to the Institution and one copy for personal reference.
7. **Structure of the project report**:

- Title page
- Certificate by the students
- Acknowledgements
- Contents
- List of Tables and graphs
- List of Acronyms used
- Chapter 1: Introduction (which includes importance of the study, objectives of the study, methodology and data source, Chapter frame, Concepts used, limitations of the study etc.)
- Chapter II: Review of Literature
- Chapter III: Profile of the study area (Optional)
- Chapter IV: Data Analysis (Core of the report)
- Chapter V: Summary of Findings and Conclusions
- Appendix: Questionnaire/Schedule, other exhibits, case etc.
- Select Bibliography (In referencing and bibliographic preparation, the APA (American Psychological Association) style sheet is recommended.

9. A project work must be the student's own work and must not contain any plagiarized material.

10. Evaluation of the project report: The project report shall be subject to both internal and external evaluation.

11. The internal as well as external evaluation shall be done by the Guide and External Examiners. This component is examined on the basis of the students' awareness in the research process and its methodology. An objective multiple choice Question Bank developed for the course may be used for internal evaluation.

12. The external assessment of the project is based mainly on the written material. Hence, the objective evaluation of it demands clear procedure. Accordingly, the examiners' assessment of the project work will be based on a variety of features. These include amongst others:

- Understanding of the topic
- Methodology used, the standard of presentation
- the adequacy of the literature survey and data search
- Integration with literature; interpretation of data and results
- Ability to explain findings; originality the correct usage of referencing system

SEMESTER- III			
NON MAJOR ELECTIVE- TOURISM AND ECONOMIC DEVELOPMENT			
Code: 18UECN31	**Hours / week :2**	**Hrs / Semester: 30**	**Credits :2**

UNIT I INTRODUCTION **5 Hours**

Meaning and Nature of Tourism -Basic components of Tourism - Elements of Tourism - Factors influencing the growth of Tourism

UNIT II TOURISM DEMAND AND SUPPLY **5 Hours**

Tourism Demand - Motivation of Tourism Demand - Measuring Tourism Demand- Pattern and Characteristics of tourism supply - Factors influencing tourism supply.

UNIT III SIGNIFICANCE OF TOURISM **6 Hours**

Socio-economic importance of Tourism –Revenue Generation- Contribution to GDP- Employment Multiplier- International Agencies

UNIT IV: TRAVEL FORMALITIES **7 Hours**

Passport, Visa, Health requirements, Taxes, Customs, Currency, Travel Insurance, Baggage and Airport information, Passenger Documentation, Baggage Rules.

UNIT V MARKETING OF TOURISM PRODUCT **7 Hours**

Tourism product – Marketing of Tourism product – Visual presentation – Folders – Media advertisement – Image building methods

Text Book

RajasekaraThangaman (2003) – Tourism Development, Madras art printers, Chennai

Books for Reference :

1. Bhatia A.K., (2001) – *International Tourism Management*, Sterling Publishers Pvt, Ltd., New Delhi
2. ViswanathGhosh (2000) – *Tourism and Travel Management*, Vikas Publishing House, Pvt., Ltd., New Delhi.
3. Johan M. Bryder (1973) – *Tourism and Development,* Cambridge University Press, London.
4. Michael Peters (1969) – *International Tourism,* Hutchinson, London.

SEMESTER- III			
NON MAJOR ELECTIVE- TOURISM AND ECONOMIC DEVELOPMENT			
Code: 18UECN31	**Hours / week :2**	**Hrs / Semester: 30**	**Credits :2**

Vision: To make the students aware of the nature and forms of tourism.

Mission: To expose the students regarding the possibilities of employment potential

Course Outcome:

CO. No	Upon completion of this course, students will be able to	PSO addressed	CL
CO – 1	understand the nature of tourism and explore the reasons for the rapid growth of tourism.	1,2	Un
CO – 2	view how the travel motivators promote social tourism, apply the concept to explore the demand, factors influencing tourism	2, 3	Ap
CO – 3	understand and explore maintenance of tourism products in India and abroad	1,7	Un
CO – 4	assert and apply the method to develop an ideal itinerary and function of tour managers.	1,7	Ap
CO – 5	provide information about tour packages	1	Un
CO – 6	plan, lead and organize the effective and efficient operations through tourism formalities	5, 8	An
CO – 7	know and apply innovative structure in present day tourism operations	1, 7	Ap
CO – 8	analyse and develop the market of tourism product	6,7	An

Semester- IV			
Non Major Elective- Tourism and Economic Development II			
Code: 18UECN41	**Hours / week :2**	**Hrs / Sem.: 30**	**Credits : 2**

Vision: Learn about sustainable tourism development for inclusive economic development.

Mission: Understand the importance of Tourism sector and having integrity to achieve economic development through tourism.

Course Outcome:

CO. No	Upon completion of this course, students will be able to	PSO Addressed	CL
CO - 1	recognize and raise awareness for moral issues and dilemmas in tourism.	1	Re
CO - 2	know about various types of tour packages and also about tourism marketing.	2,6	Un
CO- 3	demonstrating knowledge and understanding the basic principles of tourism in all its dimensions and areas.	2,7	Ap
CO-4	identify and evaluate the elements of the tourism system and its interaction with the environment.	1	Ev
CO-5	describing the demand and supply of tourism, cycles and economic growth.	2	An
CO-6	understand the importance of transport and communication in travel tourism and hospitality industry.	1,4	Un
CO-7	understand and disseminate the global code of ethics for tourism	6	Un
CO-8	create an awareness on the economic impact generated by tourism.	1,7	Cr

Semester- IV			
Non Major Elective- Tourism and Economic Development II			
Code: 18UECN41	**Hours / week :2**	**Hrs / Semester: 30**	**Credits :2**

Unit I Nature of Tourism **5 Hours**

Historical development of Tourism – Factors responsible for the growth and development of Tourism over the Years-Sustainable Tourism

UnitII Tourism and Tour Package **6 Hours**

Types ofTourism – Concept of Tourist product – Tour Packages and Type of Package – National and International – Tour itinerary.

Unit III Transport & Tourism **6 Hours**

Evolution of tourist transport system - Importance of transport in tourism - Introduction to transport system: air, road, rail and water transport

Unit IV Hospitality &Communication **7 Hours**

Hospitality Industry -Accommodation types -Relevance of Communication – Communication in Hospitality Industry – Nature of Hospitality Communication

Unit V Tourism Marketing **6 Hours**

Issues in Marketing: Global Marketing - Direct Marketing - Marketing on the Web – GreenMarketing - Social Responsibility and marketing Ethics- Consumerism and Legal Issues

Text Book

A. K. Bhatia, *Tourism Development: Principles and Practice*, Sterling Publishers Pvt. Ltd.,2012

Books for Reference:

1. P.N. Seth, *Successful Tourism Management*,Sterling Publishers Private Limited, 1986.
2. Richard Sharpley, *Travel and Tourism* - SAGE, 2006
3. Manoj Dixit, *Tourism products.* New Royal Book Co., Lucknow, 2009.
4. Richard Sharpley, David J. Telfer, *Tourism and Development: Concepts and Issues* - Channel View Publications, 2002
5. P.N. Seth, *Successful Tourism Management Vol 1 Fundamentals Of Tourism*,Sterling Publishers Private Limited, 2011..

Semester – V			
Part III Core XI (Common Core) Human Resource Management			
Code:18UMCC51	**Hrs/Week: 6**	**Hrs/Sem: 90**	**Credit : 4**

Vision:

To enable students to understand the basic concepts in HRM

Mission:

To familiarize students on the various aspects of HRM

Course Outcome:

CO No.	Upon completion of this course, students will be able to:	PSO addressed	Cognitive Level
CO – 1	gain knowledge on the basic concepts of planning human resource and help them to understand basic techniques of business.	1,2	Un
CO – 2	understand the basic selection process in HR.	1,2,3	Un
CO – 3	know the importance of training and development in HR.	2,3,4	Ap
CO – 4	know about the transfer policies	2,3,5	Un, Re
CO – 5	gain knowledge on compensation methods.	3,4	Un, An
CO – 6	understand the promotional policies in business	3,4	Un, Re
CO – 7	know about the significance and problems in performance appraisal.	3,4,5	Ap
CO – 8	know about the methods of performance appraisal	3,4,5	Ap

Semester V			
Part –III	**Core – XI (Common Core) Human Resource Management**		
Code: 18UMCC51	**Hrs/Week: 6**	**Hrs/Sem: 90**	**Credits: 4**

Unit-I: Introduction **15 Hours**

Human Resource Management: Meaning - Objectives - Nature and Scope - Importance – Functions - and Problems of HRM - Personnel Management Vs. HRM - Qualities and Qualifications of Human Resource Managers.

Unit-II: Human Resource Planning, Recruitment and Selection **20 Hours**

Human Resource Planning: Meaning - Need and Importance - Objective - Problems - Process – Recruitment: Meaning - Factors Influencing Recruitment - Sources of Recruitment - Problems in Recruitment – Selection: Meaning - Factors Affecting Selection Decisions - Selection Policy - Steps in Selection.

Unit-III: Training and Development **20 Hours**

Training: Need and Importance - Objective - Types - Steps in Training Programme – Methods of Training - Evaluation of Training Programmes – Development: Meaning - Concept and Essentials of Management Development Programmes.

Unit IV: Transfer, Promotion and Compensation **15 Hours**

Transfer: Objective - Transfer Policy - Promotion: Purpose - Promotion Policy – Demotion - Compensation: Objective – Principles.

Unit-V: Performance Appraisal **20 Hours**

Performance Appraisal: Meaning - Need and Importance - Objective - Problems in Performance Appraisal - Factors Influencing Performance Appraisal – Methods of Performance Appraisal.

Text Book:

Chitra,Atmaram, Naik. *Human Resource Management.* Ane Books Pvt., 2016.

Books for Reference:

1. Dr.C.B.Gupta. *Human Resource Management.* New Delhi: Sultan Chand & Sons, 2018.
2. C.P.Memoria, *Personnel Management*, Himalaya Publishing House, 2011
3. L.M.Prasad., *Human Resources Management.* New Delhi: Sultan Chand & Sons,2014.
4. Gary Dessler. *Human Resource Management.* Prentice Hall, 2013.
5. Michael Armstrong. *A Handbook of Human Resource*

SEMESTER - I			
Allied – I - Dairy Technology			
Code -18UMIA11	**Hrs/ Week: 4**	**Hrs/ Sem: 60**	**Credits: 3**

Vision:

To provide the leadership, voice and programs for a vibrant dairy industry where farm families, dairy businesses and associated organizations can thrive and be profitable.

Mission:

To create a sustainable environmentally and technologically advanced dairy farm.

Course Outcome :

CO.No.	Upon completion of this course, students will be able to	PSO addressed	C L
CO-1	understand the process involved in production of milk and milk products	1,2	Un
CO -2	classify and explain the different types of milk products	2	Un
CO-3	understand purpose and functions of hygiene in dairy industry	2	Un
CO-4	produce flow chart for the production processes of various milk products	1, 2	Ap
CO-5	explain organization and operations involved in milk processing units	2	Co
CO-6	outline precautions when processing milk and dairy products	2	An
CO-7	organize students to processing of milk and its products	2 ,3,4	Sy
CO-8	analyse the importance of quality control in dairy science	2 ,3,4	An

SEMESTER - I			
Allied – I - Dairy Technology			
Code -18UMIA11	Hrs/ Week: 4	Hrs/ Sem: 60	Credits: 3

Unit I

Clean milk production technique- secretion of milk in the udder- sources of micro organization- cleanliness of the animal- Udder- Utensils- Detergents and Sanitizers- Different micro organisms of milk – Differences between goats, buffaloes and cows milk- Colostrums- Importance of colostrums

Unit II

Importance of milk and its composition properties and nutritive value of milk and milk products- Specific gravity of milk- Lactometer reading- Acidity test estimation of fat, SNF,total solids of milk- Factors that alter the quality andquantities of milk – common adulterants of milk, deduction of adulterants- water adulteration- MBRT- Resazurin Test

Unit III

Chilling – Heat processing – Sterilization pasteurization- test for effective pasteurization – phosphates test – Holding the milk – packing – transport- various types of transports – marketing of fluid milks – special milks- Toned milk, standard milk, UHT milk

Unit IV

Starter culture preparation and their biochemical activities- Methods of manufacture and uses of fermented milk products – Butter, butter milk, curd, yoghurt, ghee, cheese.

Unit V

Methods of manufacture and uses of non-fermented milk products- cream, skim milk, koha, ice cream, ice cream mix powder, condensed milk, powder milk, milk powder.

Text book:

1. Sugumar De. 1997. Outlines of dairy technology, Oxford University press

Books For Reference :

1. Clarence Henry, Heckles, 1957 Milk and Milk products 4th edition Tata Mc Graw Hill Publishing company Ltd., New Delhi.

2. Sugumar D. 1997. Outlines of dairy technology, Oxford University press

3. Ramasamy1996 Hand book of Dairy technologies, International Book distributing and Company, Lucknow.

SEMESTER – IV			
Allied – IV – Mushroom Technology			
Code : 18UMIA41	**Hrs/Week : 4**	**Hrs/Sem : 60**	**Credit : 3**

Vision:

To facilitate the students with wide knowledge about the mushroom technology.

Mission:

To inculcate the deep knowledge on mushroom technology.

Course Outcome:

CO No	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	explain about the detailed information of edible and non – edible mushroom.	4	Un
CO-2	compare the cultivation of various types of mushrooms.	5	Un
CO-3	construct the mushroom house.	6	Cr
CO-4	compare different types of mushroom cultivation techniques and pure culture preparation.	7	An
CO-5	explain about economics of mushroom cultivation and their precaution.	6	Un
CO-6	interpret about the different modes of storage of mushroom.	5	Un
CO-7	illustrate about the various nutrition content present in mushroom.	4	Un
CO-8	make use of various types of foods prepared from mushroom.	6	Ap

SEMESTER – IV			
Allied – IV – Mushroom Technology			
Code : 18UMIA41	**Hrs/Week : 4**	**Hrs/Sem: 60**	**Credit : 3**

Unit – I

Nutritional and medicinal value of mushrooms - Historical account, Cultivation of button mushroom (*Agaricus bisporus*), milky mushroom (*Calocybe indica*), oyster mushroom (*Pleurotus sajor-caju*) and paddy straw mushroom (*Volvariella volvcea*)

Unit - II:

Structure and construction of Mushroom House- Layout of traditional and green house method and spawn lab. Preparation of Pure Culture. Cultivation technology - Substrates, bed preparation, spawning, Mushroom production.

Unit - III

Economics of mushroom cultivation – precautions in mushroom cultivation –area selection, spawn preparation, spawn run, harvesting, pest management.

Unit –IV

Storage and nutrition : Short time storage, Long term storage, Drying , Storage in salt solutions. Nutrition – Proteins , Amino acids , Mineral elements nutritions – Carbohydrate , Vitamins , Crude fibre content.

Unit – V

Value added products - Mushroom - Soup, Pickles, Powders, Jams ,Cutlet, Omelette , Samosa , Curry, mushroom biscuits, mushroom ketchup, mushroom chips, mushroom candy.

Text Books:

1) Marimuthu, T. Krishnamoorthy, A.S. Sivaprakasam, K. and Jayarajan. R, 1991. *Oyster Mushrooms, Department of Plant Pathology,* Tamil Nadu Agricultural University, Coimbatore.
2) Swaminathan, M. 1990. *Food and Nutrition*. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.
3) Nita Bahl, 1988. *Hand book of Mushrooms,* II Edition, Vol. I & Vol. II.

Books for Reference:

1. Biswas S., Datta M. and Ngachan S.V. 2012. *Mushrooms: A Manual for Cultivation,* PHI.
2. Zadrazil F. and Grabbe K. 1983. *Edible Mushroom, Biotechnology* Vol. 3, Weinheim: Verlag Chemie, Berlin
3. Changs T. and Hayanes W.A. (Ed.) 1978. *Biology and Cultivation of Edible Mushrooms.* Academic Press. New York.
4. Tewari, Pankaj Kapoor, S.C., 1988. *Mushroom cultivation*, Mittal Publications, Delhi.

SEMESTER- IV			
Core VI - Agricultural Microbiology			
Code : 18UMIC41	**Hrs/week: 4**	**Hrs/Sem: 60**	**Credit:4**

Vision:

To enhance knowledge of various microbial activities and its impact on the environment and study about various beneficial aspects of soil microbes.

Mission:

To study the plant diseases and to control the pest using bio pesticide related to bacteria, fungi, and viruses.

Course Outcome:

CO No	Upon completion of this course, students will be able to	PSO addressed	CL
CO -1	analyze the soil microorganism and their properties.	1	An
CO- 2	determine the role of microbes on environment.	1	Ev
CO -3	distinguish positive and negative interactions	1	An
CO- 4	outline the interaction between microbes and soil.	4	Un
CO- 5	discuss about the plant diseases such as bacterial, fungal and viral disease.	6	Cr
CO- 6	summarize the causative agents and control measures of the plant disease.	6	Un
CO -7	determine the Biopesticide and Biofertilizer development	2	Ev
CO -8	evaluate the microbes used asBiopesticide and Biofertilizer	4	Ev

SEMESTER- IV			
Core VI - Agricultural Microbiology			
Code : 18UMIC41	**Hrs/week: 4**	**Hrs/sem: 60**	**Credit:4**

Unit-I

Properties of soil - Physical and Chemical - Microbial flora of soil - Bacteria, Fungi, Algae, Actinomycetes and Nematodes) –Factors affecting microbial population.

Unit-II

Biogeochemical cycle- Carbon, Phosphorus, Nitrogen – Biological Nitrogen Fixation – Symbiotic (*Rhizobium*) and Asymbiotic (*Azotobacter*)– Root nodule formation - and Nitrogenase, Hydrogenase.

Unit-III

Microbial interactions between microbes - Mutualism, Commensalism, Competition, Amensalism, Parasitism and Predation.Interaction of microbes and plants – Rhizosphere and Phyllosphere.

Unit-IV

Plant pathology (Etiology, symptoms, disease cycle and control measures) – Bacterial diseases – Blight of rice, Citrus canker – Fungal disease – Red rot of sugarcane, Tikka leaf spot of groundnut – Viral disease – Bunchy top of Banana, Tobacco mosaic.

Unit-V

Biopesticides - Bacterial (*Bacillus thuringiensis*)- Fungal (*Trichoderma viridae*)- Viral (NPV & CPV). Biofertilizer – *Rhizobium*, *Azotobacter*, Cyanobacteria, Azolla – Mass multiplication and crop response.

Text books:

1. Dubey R.C. 2014. *A Text Book of Biotechnology*. Fifth revised Edition. S Chand & Co. New Delhi.
2. Dubey R.C. and D.K. Maheshwari. 2013. *A Text Book of Microbiology*. S. Chand & Co. New Delhi.

Books for Reference:

1. Shiva Aithal. C. 2010. *Mordern approaches in Soil, Agricultural and Environmental Microbiology.* Himalaya Publishers, New Delhi.
2. Atlas,R.M. and Bartha.M. *Microbial Ecology –Fundamentals and applications.* Fourth edition - Benjamin – Cummings, Mento Park, California.
3. Martin Alexander. 1983. *Introduction to Soil Microbiology,* Wiley eastern Ltd., New Delhi.
4. K. VIjaya Ramesh. 2005. *Environmental Microbiology* – MJP Publishers, Chennai
5. SubbaRao. N.S. 1995. *Soil Microorganisms and Plant growth*. Ed,Oxford and IBH Publishing Co, Pvt. Ltd, New Delhi
6. Ravichandra. N. G. 2013. *Fundamentals of plant pathology* – PHI Learning Private Ltd. Delhi.
7. Rangaswamy.G. and Bagyaraj.D.J. 1996. *Agricultural Microbiology*. Second Edition - Prentice- Hall of India Pvt Ltd., New Delhi.

SEMESTER – V			
Core Integral – II- Vermitechnology			
Code:18UMII52	**Hrs/ Week: 4**	**Hrs/ Sem: 60**	**Credit:4**

Vision

To educate the students by ensuring the production of healthy food in a healthy way, we want to contribute to live in a healthy world.

Mission:

To contribute to global ecological economic recovery, profitable and sustainable way to produce high quality organic products and a healthy and positive results in agriculture is to be achieved.

Course Outcome:

CO No	Upon completion of this course, students will be able to	PSO addressed	CL
CO- 1	select from, use and interpret results of descriptive vermi technology methods effectively.	6	Ev
CO -2	demonstrate an understanding the scientific and technological benefits to the rural sector by equipping them with the latest technology and to create the model for the nation	6	Ev
CO- 3	gain knowledge about the various morphology of earthworms	1	An
CO -4	communicate the awareness of field sampling using vermi compost	5	Un
CO- 5	make appropriate awareness of parasites and predators in vermi composting	5	Un
CO- 6	understand the awareness among the present status and importance of composting methods and vermi composting	4	An
CO- 7	understand the waste reduction in vermi composting	4	Un
CO -8	explain the nutrient availability in the vermi compost	6	Ev

SEMESTER – V			
Core Integral – II- Vermitechnology			
Code:18UMII52	**Hrs/ Week: 4**	**Hrs/ Sem: 60**	**Credit:4**

Unit-I:

Earth worm classification – Morphology and Anatomy. Biology of *Lumbricus terrestris*.Vermicomposting - Definition, introduction and scope - The nature of earthworms-soil environment - basic environmental requirements.

Unit-II:

Vermicomposting materials and their classification. Physical, chemical and biological changes brought by earth worm in soil structure-carbon, nitrogen and phosphorous transformations

Unit-III:

Vermicomposting methods - Optimal conditions for Vermiculture - temperature, moisture, pH, soil type, organic matter. Nutrient availability in vermi Compost.

Unit-IV:

Vermicomposting in Homes, Maintenance of vermicomposting beds. Harvesting the worms. Earth worm predators, parasites and pathogens. - Vermi wash. Vermi culture for waste reduction.

Unit-V:

Composting - Vermicomposting - Required conditions - Advantages - Role of vermicompost in plant growth and other applications, Field sampling- passive methods.

Text Book:

Mary Violet Christy. A., 2014, *Vermi Technology* - MJP Publishers, Chennai.

Books for Reference:

1. Edwards, C.A. and Bohlen, P.J. 1996, *Ecology of earthworms*-3rd Edition, Chapman and hall.
2. Jsmail, S.A., 1970, *Vermicology. The Biology of Earthworms.* Orient Longman, London.
3. Lee, K.E., 1985. *Earthworms - Their ecology and relationship with soil and land use,* Academic Press, Sydney.
4. Ranganathan L.S. 2006. *Vermibiotechnology from soil health to human health*.Agrobios India.
5. Gupta P.K. 2008. *Vermicomposting for sustainable Agriculture*. Agrobios. India.

SEMESTER V			
Core Integral I	**Renewable Energy Sources**		
Code :18UPHI51	**Hrs/Week : 4**	**Hrs/Sem : 60**	**Credits : 4**

Vision: To enhance the students to understand about renewable energy sources and their utilisations

Mission: To create awareness among the students about sustainable utilisation and conservation of natural resources

Course Outcome:

CO.No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO –1	construct solar ponds for water desalination, solar cookers and solar green houses	7, 5	Cr
CO –2	assess the working of windmills used for power generation	7	Ev
CO –3	list the renewable energy sources available in surplus	7	Re
CO –4	explain different types of solar water heaters	7,5	Un
CO –5	sketch out the classifications of WEC system	7	Ap
CO –6	recall Green house effect	7	Re
CO –7	discuss Energy audit	7	Un
CO –8	design KVIC plants for bio gas generation	7	Cr

SEMESTER V			
Core Integral I	**Renewable Energy Sources**		
Code :18UPHI51	**Hrs/Week : 4**	**Hrs/Sem : 60**	**Credits : 4**

Unit I: Solar Energy

Introduction – Solar Constant – Solar Radiation at the Earth's Surface : Beam and Diffuse Solar Radiation, Attenuation of Beam Radiation – Solar Radiation Measurements: Pyrheliometers, Pyranometers, Sunshine Recorder – Solar Radiation Data – Solar Energy Collectors: Introduction – Conversion of Solar Radiation into Heat
– Green House Effect – Flat –Plate Collectors: Introduction – Typical Liquid Collector – Advantages of Flat Plate Collectors.

Unit II: Solar Energy Storage and applications

Introduction – Solar Energy Storage Systems: Thermal Storage – Chemical Storage – Solar Pond: Introduction – Principle of Operation and Description of Non-convective Solar Pond –Extraction of Thermal Energy –Applications of Solar Ponds – Applications of Solar energy: Agriculture and Industrial Process heat – Solar Distillation – Solar Cooking: Box type Solar Cooker – Green House effect – Solar Green Houses (Introduction, Types, advantages, parameters for plant growth and Green house environment and control) – Global Warming.

Unit III: Wind Energy

Introduction – Basic Principles of Wind Energy Conversion: The nature of the wind – The power in the wind (only theory) – Wind energy conversion – Wind data and energy estimation – Site selection considerations – Basic components of a WECS (Wind Energy Conversion System) – Classification of WEC systems – Advantages and disadvantages of WECS – Applications of wind energy – Safety systems – Environmental aspects.

Unit IV: Energy Conservation

An Economic Concept of Energy – Principles of Energy Conservation and Energy Audit
– Types of Energy Audit – Energy Conservation Approach: Energy saving devices eligible for higher depreciation – Renewable energy devices eligible for higher depreciation – Co-Generation – Waste Heat Utilization – Heat Recuperators (Definition and Uses) – Heat Regenerators– Instrumentation and control.

Unit V: Other Conventional Energy Sources

Biomass energy – Classification – Biomass conversion Technologies: Wet and Dry Processes – Photosynthesis – Biogas generation – Advantages of Anaerobic Digestion – Factors Affecting Biodigestion – Types of biogas plant (KVIC Digester) – Geothermal energy (Introduction, Applications and advantages) – Ocean Thermal Electric Conversion (OTEC – Basics

principle) – Method and Working Principle of Closed OTEC.

Text Book:

1. G. D. Rai, Non conventional Energy Sources, Khanna Publishers, Reprint 2014.

SEMESTER III			
NME I	**Applied Physics I**		
Code : 18UPHN31	**Hrs/Week : 2**	**Hrs/Sem : 30**	**Credits : 2**

Vision: To transform our students in the field of applied physics

Mission: To train our students in domestic wiring, air conditioning and fibre and laser optics

Course Outcome:

CO.No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO –1	recall the tools used in the home	3	Re
CO –2	discuss the systems of domestic wiring	3	Un
CO –3	explain the principle of Air Conditioning	3	Un
CO –4	sketch the refrigerating cycle	3	Ap
CO –5	describe the function of a compressor	3	Un
CO –6	understand the theory behind the important properties of light such as reflection, refraction , interference and total internal reflection	1,3	Un
CO –7	discuss the types of optical fibers	2,3	Ev
CO –8	list out the applications of lasers	3	Re

SEMESTER III			
NME I	**Applied Physics I**		
Code : 18UPHN31	**Hrs/Week : 2**	**Hrs/Sem : 30**	**Credits : 2**

Unit I: Domestic Wiring

Introduction – Tools – Precautions in handling tools – Wires – Cables – Systems of domestic wiring (CTS wiring, conduit wiring) – Fuses.

Unit II: Electrical Appliances

Electric bell – Electric iron – Electric kettle – Hot plate – Fan – Washing machine.

Unit III: Air Conditioning

Air conditioning – Principle – Refrigerating cycle – Refrigerants – Evaporators – Function of a compressor – Freezers – Ice plant – Water coolers.

Unit IV: Fibre optics

Introduction – Principles of optical fibre – Total internal reflection – Acceptance angle – Numerical aperture – Types of optical fibres – Fibre optic communication system – Advantages.

Unit V: Laser

Basic principle – Concept of laser – Population inversion – Pumping action – Characteristics of laser – Determination of the wavelength of the given laser source of light using grating – Determination of particle size – Application of lasers.

Text Books:

1. G. Jose Robin and A. Ubald Raj, Applied Physics, Indira Publications, Marthandam, 1998
2. P.Mani, A text book of Engineering Physics-I, Dhanam Publications, 2007 Edition.

SEMESTER V			
Core VIII: Animal Physiology			
Code: 18UZOC52	**Hrs/Week: 5**	**Hrs/Sem: 75**	**Credits: 4**

Vision

Understand the physiological processes that regulate body functions and the regulation of organ systems and develop independent thinking skills and written and oral communication abilities

Mission

Apply knowledge of a physiological mechanism to explain how the physiological processes occur in an animal.

Course outcome

CO.No	**Upon completion of this course, students will be able to**	**PSO addressed**	**CL**
CO – 1	compare the structure and functions and co-ordination of organs and organ systems	1	Un
CO – 2	assess the causes, diagnosis, prevention and treatment of illnesses	2	Ev
CO – 3	develop personal healthy life style	6	Cr
CO – 4	demonstrate the different lab experiments	5	Un
CO – 5	experiential learning, analysis and drawing conclusion	4	Cr
CO-6	find way for scientific investigation	6	Ev
CO-7	develop various skills which will be helpful in expressing ideas and views clearly and effectively	7	Ap
CO-8	imbibe ethical, moral and social values in personal and social life leading to highly cultured and civilized personality	8	Cr

SEMESTER V			
Core VIII: Animal Physiology			
Code: 18UZOC52	**Hrs/Week: 5**	**Hrs/Sem: 75**	**Credits: 4**

Unit I **Digestion and Nutrition**

Intracellular and extracellular digestion – role of enzymes in digestion of carbohydrates, proteins and lipids – absorption of digested food materials – malnutrition.

Unit II **Respiration and Circulation**

Respiration: Types of respiratory pigments – transport of respiratory gases – anaerobiosis - Respiratory Quotient.

Circulation: Composition of blood – blood coagulation – structure of human heart – heart beat – origin and conduction – cardiac cycle – blood pressure.

Unit III **Excretion and Homeostasis**

Excretion: Structure and function of nephron – mechanism of urine formation in man – nitrogenous waste products – ammonotelism, ureotelism, uricotelism – ornithine cycle – dialysis. Osmoregulation: in crustaceans and fishes – thermoregulation – mechanisms – ectotherms – endotherms – heterotherms

Unit IV **Muscular, Nervous and Chemical Coordination**

Structure of skeletal muscle and myofibril – molecular organization, mechanism and chemistry of muscle contraction.

Structure of neuron – conduction of nerve impulse - synaptic transmission – neuromuscular junction – reflex action - receptors – photo and phonoreceptors. Endocrine glands: structure and functions of pituitary and pancreas.

Unit V **Reproduction and Behavioural Physiology**

Anatomy of reproductive organs in human – ovary – testis – reproductive cycles – hormonal control of reproduction. Animal behaviour – types – learning and learned behaviour – Biological clock – circadian rhythm – circannual and lunar periodicity.

Text Book

1. Maria Kuttikan, A. and N. Arumugam. 2004. *Animal Physiology.* Saras Publication Kottar, Nagercoil.

Books for Reference

1. Sembulingam, K., Prema Sembulingam. 2008. *Essentials of Medical Physiology*. JaypeeBrothers. New Delhi

2.Rastogi, S.C. 1979. *Essentials of Animal Physiology* – Wiley Eastern Ltd. New Delhi.

3.William S. Hoar. 1987. *General and Comparative Physiology* 3rd Edition. Prentice Hallof India (P) Ltd.

4.Verma, P, Tyagi, S. and V.K. Agarwal. 2002. *Animal Physiology*. S.Chand & CompanyLtd. New Delhi.

5.Prosser, C.L. and F.A Brown. 1984. *Comparative Animal Physiology*. SaundersPhiladelphia.

6.Sambasivah Kamalakara Rao and Agustin Chellappa. 1983. *Animal Physiology* S. Chand and Company.

7.aNagabhrushanam, R., Kodarkar, M.S. and R. Sarojini. 2002. *Text book of Animal – Physiology*, Second Edition, Oxford and IBH Publishing Co, Pvt. Ltd.

SEMESTER VI			
Core XII Ecology and Biodiversity			
Code: 18UZOC63	**Hrs/Week: 4**	**Hrs/Sem: 60**	**Credits:4**

Vision

To support advanced knowledge building in ecological principles and conservation ecology

Mission

To develop knowledge and critical understanding of ecology, conservation and biodiversity science and practice and sustainable use and management of its ecosystem services.

Course Outcome

CO.No	Upon completion of this course, students will be able to	PSO addressed	CL
CO – 1	understand and relate the interactions and the interdependence among environmental factors and living organisms.	1,2	Un
CO – 2	compare the adaptations of the organisms in different habitats	2	Un
CO – 3	analyse the mechanisms regulating the dynamics composition and organization of communities	2	Un,An
CO – 4	explore the interactions between organisms, the dynamics of populations and environment	1,3	Un,An
CO –5	explain different levels of biodiversity	1	Un,
CO – 6	discuss the direct and indirect values of biodiversity	1,3	Cr
CO-7	identify key threats to biodiversity evaluate management options for conserving biodiversity	1,3	Ap,Ev
CO-8	develop skills and competencies for career in eco-conservation and Eco- tourism	7	Ap

SEMESTER VI			
Core XII Ecology and Biodiversity			
Code: 18UZOC63	**Hrs/Week: 4**	**Hrs/Sem: 60**	**Credits:4**

Unit I **Ecological Factors**

Abiotic factors : Basic concepts and biological effects of temperature and light

Biotic factors : Intra and interspecific relationships -mutualism, commensalism and antagonism (antibiosis, parasitism, predation and competition) – Biogeochemical cycles: carbon - nitrogen and phosphorous cycles

Unit II **Population& Community Ecology**

Population - Definition – density and estimation, natality – mortality – age distribution – age pyramids – population growth patterns –population fluctuations- population equilibrium — biotic potential – regulation of population density – dispersal – dispersion – population interaction

Community : concepts and characteristics – diversity – structure – community dominance – community stratification – periodicity – community interdependence Ecotone– Edge effect – ecological niche – Ecological succession

Unit III **Habitat Ecology**

Aquatic - Freshwater – pond

Marine – classification of pelagic and benthic zones ,

Deep sea characteristics , fauna and adaptations .

Terrestrial habitat – desert and cave , characteristics , fauna and adaptations .

Unit IV **Biodiversity**

Definition and levels of Biodiversity (Genetical, Ecological, and Species diversity), values of biodiversity , Threats and loss of biodiversity – causes (natural, and manmade). Hot spots of biodiversity (with special reference to India) IUCN threat categories . Common threatened animal Taxa of India – Red Data Book

Unit V **Biodiversity Conservation and Management**

Conservation of Biodiversity : *In- situ* conservation (Sanctuaries,National parks , Biosphere Reserves, World Heritage sites) Project Tiger – *Ex- situ* conservation (Botanical gardens, gene banks , cryopreservation)

Role of Organizations in conservation: International Union for Conservation of Nature and Natural Resources (IUCN) , Zoological Survey of India (ZSI) , World Wildlife Fund (WWF), National Bureau of Plant Genetic Resources (NBPGR) and Convention on Rio Summit Agenda 21, Biodiversity Act, 2002 .

Text Books

1. Arumugam, N. 2010. *Concepts of Ecology*. Saras Publication, Kottar, Nagercoil.
2. Saha,T.K. 2008. *Ecology and Environmental Biology*. Books and Allied (P) Ltd,Kolkata.

Books for Reference

1. Kumaraswamy, K, AlagappaMoses, A. and Vasanthy, M. 2004. *Environmental Studies* Publication Division.
2. Prabhakar, V.K. 2004. *Environmental Education*. Anmol publications(P) Ltd, New Delhi.
3. Agarwal, K.C. 1999. *Environmental Biology*. AgroBotanica.
4. Verma, P.S. and V.K.Agarwal. 2013. *Cell Biology, Genetics, Molecular Biology, Evolution and Ecology.* S.Chand& Company.
5. Arumugam, N and V.Kumaresan. 2014. *Environmental Studies*, Saras Publication, Nagercoil.
6. Verma and Agarwal. 1985. *Principles of Ecology*. S.Chand& Company Ltd, New Delhi.
7. Veer BalaRastogi and M.S.Jayaraj. 1988. *Animal Ecology and Distribution of Animals*. Kedar Nath& Ram Nath, Delhi
8. Krisnamoorthy, K.V. 2004. *An Advanced Text Book of Biodiversity.* Oxford and IBH, New Delhi

PRACTICALS

Credit - 1

1. Estimation of dissolved O_2 in water sample (pond / sea water)
2. Estimation of alkalinity in water sample (pond / sea water)
3. Estimation of BOD of water samples collected from various sources
4. Detection of transparency of water by Secchi disc
5. Analysis of plankton – fresh water / marine
6. Museum specimens / slides / models and charts
   - Mutualism (Hermit crab & Sea anemone)
   - Commensalism (Echeneis & Shark)
   - Parasitism (Sacculina on crab)
   - Map showing Biosphere Reserves of India
   - Hotspots of India
   - Endangered animals : Greater one horned Rhinoceros , Asiatic lion
   - Endemic animals :Lion tailed Macaque , NilgrisTahr
7. Report on visit to any place of ecological interest – (compulsary).

Books for Reference

1. Jeyasuriya, Arumugam, N. and Dulcy Fatima. 2013. Narayanan L.M *Practical Zoology Vol.3* Saras Publications, Kottar, Nagercoil.
2. Methods in Hydrobiology Manual, *Centre for Advanced Studies in Marine Biology*, Annamalai University.
3. Krisnamoorthy, K.V. 2004. A*n Advanced Text Book of Biodiversity*, Oxford and IBH, New Delhi.

SEMESTER VI			
Core XII Ecology and Biodiversity			
Code: 18UZOC63	**Hrs/Week: 4**	**Hrs/Sem: 60**	**Credits:4**

Vision

To support advanced knowledge building in ecological principles and conservation ecology

Mission

To develop knowledge and critical understanding of ecology, conservation and biodiversity science and practice and sustainable use and management of its ecosystem services.

Course Outcome

CO.No	Upon completion of this course, students will be able to	PSO addressed	CL
CO – 1	understand and relate the interactions and the interdependence among environmental factors and living organisms.	1,2	Un
CO – 2	compare the adaptations of the organisms in different habitats	2	Un
CO – 3	analyse the mechanisms regulating the dynamics composition and organization of communities	2	Un,An
CO – 4	explore the interactions between organisms, the dynamics of populations and environment	1,3	Un,An
CO –5	explain different levels of biodiversity	1	Un,
CO – 6	discuss the direct and indirect values of biodiversity	1,3	Cr
CO-7	identify key threats to biodiversity evaluate management options for conserving biodiversity	1,3	Ap,Ev
CO-8	develop skills and competencies for career in eco-conservation and Eco- tourism	7	Ap

SEMESTER VI			
Core XII Ecology and Biodiversity			
Code: 18UZOC63	**Hrs/Week: 4**	**Hrs/Sem: 60**	**Credits:4**

Unit I **Ecological Factors**

Abiotic factors : Basic concepts and biological effects of temperature and light
Biotic factors : Intra and interspecific relationships -mutualism, commensalism and antagonism (antibiosis, parasitism, predation and competition) – Biogeochemical cycles: carbon - nitrogen and phosphorous cycles

Unit II **Population& Community Ecology**

Population - Definition – density and estimation, natality – mortality – age distribution – age pyramids – population growth patterns –population fluctuations- population equilibrium — biotic potential – regulation of population density – dispersal – dispersion – population interaction
Community : concepts and characteristics – diversity – structure – community dominance – community stratification – periodicity – community interdependence
Ecotone– Edge effect – ecological niche – Ecological succession

Unit III **Habitat Ecology**

Aquatic - Freshwater – pond
Marine – classification of pelagic and benthic zones ,
Deep sea characteristics , fauna and adaptations .
Terrestrial habitat – desert and cave , characteristics , fauna and adaptations .

Unit IV **Biodiversity**

Definition and levels of Biodiversity (Genetical, Ecological, and Species diversity), values of biodiversity , Threats and loss of biodiversity – causes (natural, and manmade). Hot spots of biodiversity (with special reference to India) IUCN threat categories . Common threatened animal Taxa of India – Red Data Book

Unit V **Biodiversity Conservation and Management**

Conservation of Biodiversity : *In- situ* conservation (Sanctuaries,National parks , Biosphere Reserves, World Heritage sites) Project Tiger – *Ex- situ* conservation (Botanical gardens, gene banks , cryopreservation)
Role of Organizations in conservation: International Union for Conservation of Nature and Natural Resources (IUCN) , Zoological Survey of India (ZSI) , World Wildlife Fund (WWF), National Bureau of Plant Genetic Resources (NBPGR) and Convention on Rio Summit Agenda 21, Biodiversity Act, 2002 .

Text Books

1. Arumugam, N. 2010. *Concepts of Ecology*. Saras Publication, Kottar, Nagercoil.
2. Saha,T.K. 2008. *Ecology and Environmental Biology*. Books and Allied (P) Ltd,Kolkata.

Books for Reference

1. Kumaraswamy, K, AlagappaMoses, A. and Vasanthy, M. 2004. *Environmental Studies* Publication Division.
2. Prabhakar, V.K. 2004. *Environmental Education*. Anmol publications(P) Ltd, New Delhi.
3. Agarwal, K.C. 1999. *Environmental Biology*. AgroBotanica.
4. Verma, P.S. and V.K.Agarwal. 2013. *Cell Biology, Genetics, Molecular Biology, Evolution and Ecology.* S.Chand& Company.
5. Arumugam, N and V.Kumaresan. 2014. *Environmental Studies*, Saras Publication, Nagercoil.
6. Verma and Agarwal. 1985. *Principles of Ecology*. S.Chand& Company Ltd, New Delhi.
7. Veer BalaRastogi and M.S.Jayaraj. 1988. *Animal Ecology and Distribution of Animals*. Kedar Nath& Ram Nath, Delhi
8. Krisnamoorthy, K.V. 2004. *An Advanced Text Book of Biodiversity.* Oxford and IBH, New Delhi

PRACTICALS

Credit - 1

1. Estimation of dissolved O_2 in water sample (pond / sea water)
2. Estimation of alkalinity in water sample (pond / sea water)
3. Estimation of BOD of water samples collected from various sources
4. Detection of transparency of water by Secchi disc
5. Analysis of plankton – fresh water / marine
6. Museum specimens / slides / models and charts
   - Mutualism (Hermit crab & Sea anemone)
   - Commensalism (Echeneis & Shark)
   - Parasitism (Sacculina on crab)
   - Map showing Biosphere Reserves of India
   - Hotspots of India
   - Endangered animals : Greater one horned Rhinoceros , Asiatic lion
   - Endemic animals :Lion tailed Macaque , NilgrisTahr
7. Report on visit to any place of ecological interest – (compulsary).

Books for Reference

1. Jeyasuriya, Arumugam, N. and Dulcy Fatima. 2013. Narayanan L.M *Practical Zoology Vol.3* Saras Publications, Kottar, Nagercoil.
2. Methods in Hydrobiology Manual, *Centre for Advanced Studies in Marine Biology*, Annamalai University.
3. Krisnamoorthy, K.V. 2004. A*n Advanced Text Book of Biodiversity*, Oxford and IBH, New Delhi.

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 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.

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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 – 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.

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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

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3. Agarwal, S.C. 1994. *A Hand book of Fish Farming*. Naranda Publishing House, Delhi.
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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.

SEMESTER – III			
Core Skill Based : Fishery Products			
Code : 18UZOS31	**Hrs/Week :4**	**Hrs/Sem : 60**	**Credits: 4**

Vision
Towards proper usage of the products and by-products of the fisheries industry.

Mission
To obtain knowledge on value addition of products of fisheries industry and their preservation processes.

Course Outcome

CO.No.	Upon completion of this course, the graduates will be able to	PSO addressed	CL
CO -1	acquire knowledge on products and by-products of fisheries.	1	Un
CO - 2	interpretation of the various processing and preservation of fisheries products.	7	Ap
CO - 3	attain information on the usage of fish by-products for industrial and domestic purposes.	7	Un
CO - 4	carry out study on seaweeds and their various usages in pharmaceutical and therapeutic industries.	7	Ev
CO - 5	practice the processing and preservation of various fish products.	1	Cr
CO - 6	implementation of sanitation and quality control techniques.	7	Cr
CO - 7	use the knowledge of preservation and processing techniques in day to day life.	7	Ev
CO- 8	comprehend and synthesize advanced knowledge on the outcomes of fisheries.	8	Un

SEMESTER – III			
Core Skill Based : Fishery Products			
Code : 18UZOS31	**Hrs/Week :4**	**Hrs/Sem : 60**	**Credits: 4**

Unit I **Processing and Preservation of Fish products**

Fish pickles and sauce, fish cutlets, fish balls, fish noodles, fish soup powder, fish sausage and fish protein concentrate. Battered and braided products-fish finger, fish cutlet, fish wafer.

Unit II **Processing and Preservation of Fish Byproducts**

Fish glue – isinglass – chitosan – pearl essence – shark fins – fish leather – fish maws.

Unit III **Seaweed Products**

Preparation of agar, algin and carrageenan. Use of seaweeds as food for human consumption and disease treatment –Preparation of therapeutic drugs

Unit IV **Techniques of Preservation and processing**

Freezing - Canning – Smoking – Pickling – Fermentation – Drying – Salting.

Unit V **Quality Control and Sanitation**

Quality control of fish and fishery products – pre-processing control, control during processing and control after processing - Sanitation in processing – Environmental hygiene and personal hygiene in processing.

Text Book

Dr. Surekha Gupta,2010. Textbook of Fishery, Ane Books Pvt. Ltd., New Delhi.

Books for Reference

1. Gopakumar, K. 2002. *A Textbook of Fish Processing Technology.* ICAR, New Delhi.
2. Gupta, S.K. and P.C Gupta. 2006. *General and Applied Ichthyology* [*Fish and fisheries*] S.Chand and Company Ltd.Ram nagar,New Delhi
3. K.R .Ravindranathan 2013. *A Textbook of Economic Zoology.* Wisdom press, New Delhi.
4. Ayyapar, S. 2010. *Handbook of Fisheries and Aquaculture*. ICAR, New Delhi.
5. Srivastava, C.B.L. 2006. *A Textbook of Fishery Science- Indian Fisheries.* KitabMahal, New Delhi.

SEMESTER IV	
Self Study Course – Aquarium Fish Keeping	
Code: 18UZOSS2	**Credits : +2**

Vision

To impart knowledge on fish keeping

Mission

To provide information on setting up and maintenance of of an aquarium

Course Outcome

CO No	Upon completion of this course, the students will be able to	PSO addressed	CL
CO-1	acquire knowledge about home aquarium	1	Un
CO-2	identify common aquarium fishes	1,2	Un
CO-3	explain the different kinds of instruments used in setting up of an aquarium .	6	Un
CO-4	critically analyse the different kinds of fish feed and aquarium plants	5	Un
CO-5	examine the common diseases, symptoms and management of aquarium fishes	7	Ap
CO-6	demonstrate skills in maintenance of water quality parameters	5	An
CO-7	develop the hobby of having an aquarium at home	8	Cr
CO-8	Promote self employment opportunities	8	Ap

SEMESTER IV	
Self Study Course – Aquarium Fish Keeping	
Code: 18UZOSS2	**Credits : +2**

Unit I Construction of Home Aquarium

Construction of home aquarium - materials needed - wooden and metal frames - frameless tanks, sealants and gums - Design and construction

Unit II Setting up of an Aquarium

Setting up an aquarium - requirements - important aquarium fishes - aquarium accessories - hood and light, nets suction tube, aerators, thermostat, heater, filter, gravel, siphon tube and scrapper tool.

Unit III Maintenance of an Aquarium

Maintenance of aquarium - water quality management - pH, temperature - salinity - oxygen - carbon dioxide - waste removal.

Unit IV Fish feed and Aquarium plants

Different kinds of feed - live feed - artificial feed -feeding methods - feeding devices - balanced diet for aquarium fishes. Morphology of aquarium plants - vallisneria, Hydrilla.

Unit- V Fish diseases and Management

Common diseases of aquarium fishes. bacterial diseases, viral diseases, fungal diseases - parasitic diseases - Argulus, lernea and ligula.

Books for Reference

1. Yadav, B.N. 2002. *Fish and Fisheries,* Daya Publishing House – New Delhi
2. Bal, D.V. and K.V. Rao. 1984. *Marine Fisheries of India*. Tata Mc Graw – Hill Publishing Company Limited - New Delhi.
3. Biswas K.P. 2009. *Fishes Around Indian Ocean.* Daya Publishing House – New Delhi.
4. Jayashree, K. V., Thara Devi, C.S. and N. Arumugam. 2015. *Home Aquarium and Ornamental Fish Culture*. Saras Publication. Nagercoil.
5. Jamson, D. and R. Santhanam. 1996. *Manual of ornamental fishes and farming technologies.* Department of Fisheries Environment - Fisheries college and Research department - Tuticorin.

SEMESTER – III	
Self-study – Dairy Management	
Code : 18UZOSS1	**Credits : +2**

Vision

To equip the students to become entrepreneurs .

Mission

To obtain knowledge on different strategies to manage dairy farm.

Course Outcome

CO No	Upon completion of this course, the students will be able to	PSO addressed	CL
CO-1	understand general management of dairy animals.	1	Un
CO-2	explain the various management techniques of breeding and lactating cattle and goat.	1,2	Un
CO-3	analyse the different kinds of feed for dairy animals.	7	An
CO-4	aware of the various feeding practices for dairy animals	1, 2	Un
CO-5	identify the various diseases affecting dairy animals.	6	Ap
CO-6	analyse the nutritive value of milk and factors affecting quality of milk	7	An
CO-7	aware of the importance and types of milk products	2	Un
CO-8	develop skills and acquire knowledge for self employment.	6, 8	Ap

SEMESTER – III	
Self-study – Dairy Management	
Code : 18UZOSS1	**Credit : +2**

Unit I **Dairy Management**

General management practices of dairy animals : Grooming, Drying off, control of bad habits, castration, dehorning, deworming and identifications marks.

Unit II **Cattle and Goat Management**

Calf raising, heifer management, management of pregnant, parturient, lactating and dry cows. Management of lambs and kids - Management of breeding and lactating doe and Ewe.

Unit III **Food and Feeding**

Classification of feeds - balanced food ratio for dairy animals - general feeding practices with regard to management.

Unit IV **Diseases in Dairy Animals**

Diseases of calf : Pneumonia, calf scours, diarrhoea, joint ill, naval ill, worm infestation. Parasitic and protozoan diseases: theilariasis, babesiosis, trypansomiasis, trichomoniasis.

Diseases of Goat: PPR, blue tongue.

Unit V **Dairy Products**

Nutritive value of milk- pasteurization of milk - factors affecting yield of milk. Colostrum-significance. Milk products- butter, cheese, ice cream, condensed and evaporated milk, milk powder.

Books for Reference

1. Banerjee, G.C. 2011. *Textbook of Animal Husbandary.* Eighth edition, Oxford and IBH Publishing Co.Pvt.Ltd, New Delhi.
2. Danjyaganj, *Handbook of Animal Husbandary*. ICAR edition, Sangam Book Depot, New Delhi.
3. Prasad Jayadish, 2016. *Principle and Practices of Dairy Farm*. Kalyani Publisher, New Delhi

SEMESTER-III			
NMEI	**Everyday Chemistry**		
Course Code :21UCHN31	**Hrs/Week:2**	**Hrs/ Sem: 30**	**Credits:2**

Objectives:

- To study the purification process for drinking purpose.
- To classify solid, liquid and gaseous fuels.
- To study the constituents of paints and varnishes.
- To appreciate the manufacture of sugar.
- To know the preparation of candles, toothpowder.

Course Outcome:

CO No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO - 1	understand the biological importance of water.	2	Un
CO -2	aware of the ill effects of water borne diseases and prevention.	2, 5	Ap
CO - 3	know the ignition temperature and flash point of fuels.	1	Re
CO – 4	know the characteristics of solid liquid and gaseous fuels.	1	Re
CO – 5	know the fundamental knowledge about constituents of paints and varnishes and their functions.	2, 5	Re

CO No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-6	aware of fluorescent paints (traffic signal) and fire retardant paints.	2, 5	Ap
CO – 7	understand the recovery of alcohol from molasses and know the chemistry of manufacture of paper.	2, 5	Un, Re
CO – 8	outline the preparation and uses of Candle,ToothPowder,Liquidblues,Blackboard chalk, Moth ballssoap, shampoo, lipstick ..	1, 2,5	Re

UNIT I: Water

Water as universal solvent-Hard and soft water-Purification of water for drinking purpose. Desalination, reverse osmosis, mineral water, pH of water for drinking purpose. Biological importance of water-waterbalance and electrolyte balance in human body. Water borne diseases and prevention.

UNIT II: Fuels

Definition-Classification with examples (solid, liquid and gas)- calorific Value-Ignition temperature-Flash point. Characteristics of solid, liquid, and gaseous fuels and their applications.Nuclear fuels- Rocket fuels- Biofuels.

UNIT III: Surface Coating

Pigments, purpose of surface coating. Constituents of paints and varnishes and their functions. Emulsions.Different kinds of paints-fluorescent paints (traffic signal), fire retardant paints.

UNIT IV: Sugar and Paper Industry

Manufacture of sugar, recovery of alcohol from molasses, fermentation, manufacture of beverages. Bagasse. Paper industry- Manufacture of paper.

UNIT V: Chemicals in Day to Day Use

An Outline of the preparation and uses of the following:

a) Candle b) Tooth Powder c) Liquid blues d) Blackboard chalk e) Moth balls f) Soap

g) Shampoo h) Lipstick i) Phenoyle j) Eyetex k) Cleaning powder l) Face powder

Books for Reference:

1. Jayashree Ghosh. *Fundamental concepts of Applied chemistry*. Edition, New Delhi:S. Chand &company Ltd., 2006.
2. Jain P.C and Monika Jain. *Engineering chemistry.*New Delhi:Dhanpat Rai & Sons, 2020.
3. Prakash Shetty.*Science and Technology of Printing materials.*Chennai: MJP Publishers, 2019.
4. Sharma B.K . *Industrial Chemistry.*Meerut:Goel Publishing House, 2003.

SEMESTER- IV			
NME II Industrial Chemistry			
Course Code :21UCHN41	**Hrs/Week:2**	**Hrs/ Sem: 30**	**Credits:2**

Objectives:

- To know the constituents of petrochemicals.
- To study the importance of reclaimed rubber.
- To know the analysis of fats and oils.
- To identify the nature of artificial and natural food colorants.
- To know the specification and standards in quality control.

Course Outcome:

CO.No.	Upon completion of this course, students will be able to	PSOaddressed	CL
CO-1	know the composition of petroleum and refining of petroleum.	1	Un
CO-2	define and explain the octane number and cetane number.	1	Re, Un
CO-3	employ the manufacture of rubber and Gutta-percha.	1	An
CO-4	know the importance of reclaimed rubber and foam rubber.	1	Un
CO-5	analyze fats and oils.	8	An
CO-6	acquire the knowledge about saponification value and RM value.	5	Un
CO-7	understand the characteristics of food colorants and examine the artificial and natural food colorants.	6, 5, 8	Un,An
CO-8	attain the knowledge of PFA, FPO, FDA, drug licence and aware of essential commodities act, consumer protection act, AGMARK.	2,5	Un Ap

SEMESTER- IV			
NME II	**Industrial Chemistry**		
Course Code :21UCHN41	**Hrs/Week:2**	**Hrs/ Sem: 30**	**Credits:2**

Unit I: Petro Chemicals

Occurrence – composition of petroleum – Refining of petroleum – purification –cracking – types of cracking – catalytic cracking – thermal cracking – knocking andantiknocking properties – octane number – activation. Gasoline – cetane number – flash point –synthetic petrol

Unit II: Rubber Industry and Fibres

Manufacture of rubber, Gutta-percha –properties of rubber – compounding of rubber – vulcanization – properties of vulcanized rubber– synthetic rubber – SBR rubber and Neoprene rubber – Reclaimed rubber and foam rubber –uses.

Fibres – Difference between natural and synthetic fibres

Unit III: Fats, Oils and Waxes

Fats and oils – definition – physical and chemical properties – Analysis of fats and oils–

Saponification value, iodine value, acid value, Reichert-Meissel value– manufacture of vanaspathi or vegetable ghee. Waxes – definition and classification.

Unit IV: Food Additives

Baking soda – food color natural and artificial – intentional food additives – acid base and their salts – antioxidants – stabilizers– bleaching – maturing agents – leavening agents – humectants and preservatives.

Unit V: Quality control

Quality control – Specification and standards : PFA, FPO, FDA, drug licence, WHO standards, IS specification packing and label requirements, essential commodities act, consumer protection act, AGMARK

Books for Reference:

1. Siva Sankar B. *Food processing and preservation*.New Delhi:Prentice — Hall of India Pvt.Ltd., 2002.

2. BagavathiSundari K. .*Applied Chemistry.*Chennai:MJP Publishers, TamilNadu Book House, 2006.

3. Agarwal. *Natural Products Volume II (Organic)*.Meerut: Krishna Prakashan Media P. Ltd 2015.

SEMESTER- III			
Skill Based Elective	**Agricultural Chemistry**		
Course Code : 21UCHS31	**Hrs/Week : 2**	**Hrs/ Sem : 30**	**Credits : 2**

Objectives:

- To facilitate the students to know the basic knowledge about agriculture and soil
- To realize the importance of agriculture
- To understand the chemistry behind fertilizers and pesticides
- To get an idea about vermin composting
- To analyze the quality of drinking water
- To know the various water treatment methods

Course Outcome:

CONo.	**Upon completion of this course, students should be able to**	**PSOaddressed**	**CL**
CO- 1	understand the importance of soil its constituents, fertility and to promote agriculture.	1, 7	Un
CO- 2	have an overview of the macro and micronutrients and their functions	1, 7	Re
CO- 3	know the preparation and importance of fertilizers in agriculture	1, 7	Ap
CO-4	aware of the harmful effects of pollutants Produce vermi compost and gobar gas	2, 3, 8	An,Cr
CO- 5	realize the importance of pesticides and insecticides	1, 7	Ap

CONo.	Upon completion of this course, students should be able to	PSOaddressed	CL
CO-6	rationalise the environmental hazards of pesticides	4, 7	Ap
CO-7	understand the water quality standards and water quality parameters and analyse the case studies of heavy metal pollution like Hg, As, and Cd.	1,4,2, 3, 7	Un
CO-8	understand the processes used for purification of municipal water and treat waste water by using different methods	4,7, 8	Un, Cr

Unit I: Soil Nature and Plant Nutrients

Saline, alkali and acid soils. Buffering capacity of soil - Soil reclamation. Liming of soil – measurement of soil pH - Soil fertility – essential plant nutrients and their functions – deficiency symptoms – macro and micro nutrients& their functions.

Unit II: Fertilisers

Natural and synthetic manures-qualities of a good fertilizer- classification of fertilizers – nitrogeneous fertilizers - Preparation and importance of urea-calcium cyanamide - super phosphate-triple super phosphate- potassium chloride-potassium nitrate - DAP, mixed fertilizers (NPK) and human effluent from gobar gas plant as a manure. Vermiculture -vermi compost.

Unit III: Pesticides

Pesticides, Insecticides, Repellants, Fungicides- Definition-classification – on the basis of their mode of action, target organisms they control, method of application- environmental hazards - preparation and uses ofDDT, BHC, lead arsenate,bordeaux mixture. Biopesticides – definition – examples – applications.

Unit IV: Water Quality Parameters Water quality standard for drinking water (WHO)- Water quality parameters-pH, EC, alkalinity, Total acidity, hardness, DO, BOD, COD,

Methaemoglobinemia) – Eutrophication- Case studies- Hg, As, and Cd. (Minamata, arsenic poison in West Bengal, Itai-itai)

Unit V: Water Treatment Methods

Waste water treatment-methods and equipments used-preliminary treatment (screening, skimming) - primary treatment (sedimentation, coagulation) - secondary treatment (trickling filters, oxidation pond, anaerobic digestion)-tertiary treatment (adsorption, ion-exchange, reverse osmosis, electrodialysis, disinfection)-treatment of water of municipal purposes-domestic sewage treatment-industrial waste water treatment.

Hands on Training:

1. Analysis of carbon, nitrogen, potassium, phosphorous, zinc and calcium in soil using mini lab for soil analysis.

2. Determination of BOD and COD of water samples

3. Determination of pH and conductivity of water from different sources.

4. Determination of DO and hardness of water.

Industrial Visit:

A visit may be made to an industry or a premier institution.

*A report of the industrial visit may be submitted as an assignment.

Text Books:

1. Jayashree Ghosh. *Text Book of Pharmaceutical Chemistry*. NewDelhi:S. Chand and company, 2003.

2. BagavathiSundari K . *Applied Chemistry*. MJP Publishers, 2008.

Books for Reference:

1. Sharma B. K . *Industrial Chemistry*. Goel Publishing House. Fifth Edition, 1993-94.

2. Sindhu P.S. *Environmental Chemistry*. New Age International Publishers, 2010.

3. Dr Joshi. S.R *Biopesticides- A Biotechnological Approach*. New Age International (P)

Ltd., Publishers, 2020.

SEMESTER- IV			
Skill Based Elective I	**Medicinal Chemistry**		
Course Code : 21UCHS41	**Hrs/Week : 2**	**Hrs/ Sem : 30**	**Credits : 2**

Objectives:

- To inculcate the basic knowledge about classification drugs and their mode of action.
- To rationalize the causes and curative measures of common diseases.
- To know about the first aid to be done during emergency.
- To create an awareness about hypertension and cardiovascular drugs.
- To get an idea about diabetes and hypoglycaemic agents.

Course Outcome:

CONo.	**Upon completion of this course, students should be able to**	**PSOaddressed**	**CL**
CO- 1	have an understanding of the classification drugs.	1,3,4	Un
CO- 2	know the importance of drugs and their mode of action.	4	Un
CO- 3	know the causes of common insect borne, air borne and water borne diseases.	3, 4, 7	Re
CO-4	get an idea about the treatment for common diseases.	3, 4, 7	Re
CO- 5	estimate the sugar and cholesterol levels in blood.	4, 5, 7	Ev
CO-6	aware about first aid rules and first aid box.	4, 7	Ap

CO-7	know the types of blood pressure and treatment methods anddescribe about the cardiovascular drugs.	1,2,4	Un
CO-8	know about diabetics and its treatment andget an idea about some anti-convulsant agents.	4, 7	Re

Unit I: Classification and mechanism of drug action

The nature and sources of drugs-Classification of drugs – biological Classification –(drugs acting on central nervous system and peripheral nervous system, Chemotherapeutic drugs, pharamcodynamic agent, metabolic diseases and endocrine function) and chemical classification.

Mechanism of action-actions at extracellular and cellular site-Drug receptors and biological responses-Chemistry of drug receptor binding-covalent bond- hydrogen bond- Van der Waals forces.

Unit II: Causes of common diseases and their treatment by drugs

Common diseases and their treatment: Insect borne diseases-malaria, filariasis, plague, Air borne diseases-diphtheria, whooping cough, influenza, measles, mumps, common cold, tuberculosis (T.B)

Water borne diseases-cholera, typhoid, dysentery, Disorder of digestive system-Jaundice

Unit III: Clinical chemistry cum Hands on Training

Determination of sugar (glucose) in serum-Folin and Wu' s method — -determination of serum cholesterol -Sackett' s method for total cholesterol --tests for cholesterol — estimation of glucose in urine -Benedict's test

Important rules of First aid- First aid for cuts, abrasions and bruises-bleeding-fractures-fainting composition of first aid box — some common poisons and their antidotes

Unit IV: Blood pressure and cardio vascular drugs

Blood pressure-types and treatment -Hypertension-primary and secondary hyper tension treatment, hypo tension.

Functions and uses of the following drugs

Cardiovascular drugs-antiarrhythmic drugs-quinidine-antihypertensive agents- (hypotensive drugs) — clonidine and reserpine.

Definition forAngiogram andAngioplast.

Unit V: Diabetes and hypoglycemic agents

Diabetes types – Diabetes insipidus and diabetes mellitus – control of Diabetes –oral hypoglycemic agents –sulphonyl urease -tolubutamide, chlorpropamide, biguanides-phenformin and metformin.

Text Books:

1. Jayashree Ghosh.*Text Book of Pharmaceutical Chemistry.*New Delhi:S.Chand and company, 2003.

2. BhagavathiSundari. *Applied Chemistry*. MJP Publishers, 2008.

Books for Reference:

1. Jayashree Ghosh.*Fundamental Concepts of Applied chemistry*.New Delhi:S.Chand and Company, 2006.

2. Dr. Abhishek Tiwari, Dr.Biswa Mohan Sahoo, Dr. Rajesh Shukla.*Pharmaceutical Chemistry.*NiraliPrakashan,2021.

3. Ashutosh Kar.*Medicinal Chemistry*.New Delhi: New age International (P) Limited, 2004.

SEMESTER- III			
Core Skill Based	**TOURISM ECONOMICS**- I		
Course Code: 21UECS31	**Hours / week :4**	**Hrs / Sem.: 60**	**Credits :4**

Objectives:

- To understand the impact and challenges in the tourism industry.
- Understand the importance of tourism in the service industry.
- Understand the place of tourism in the service industry.

Course Outcomes:

CO No.	Upon completion of this course, students will be able to	PSO's addressed	CL
CO - 1	understand the nature of tourism and explore the reasons for the rapid growth of tourism.	2, 5	Un
CO - 2	assert and apply the method to develop an ideal itinerary and function of tour managers.	4,6	Ap
CO - 3	plan, lead and organize the effective and efficient operations through tourism formalities	2, 5, 6	Cr
CO - 4	view how the travel motivators promote social tourism, apply the concept to explore the demand, factors influencing tourism	5,6	Ap
CO - 5	Better understanding of Travel and Tourism Industry	4,5	Un
CO - 6	Identify and assess relationships and networks relative to building tourism capacity.	4, 6	Ap
CO - 7	Understand the place of tourism in the service industry.	2,4,7	Un

SEMESTER- III			
Core Skill Based	**TOURISM ECONOMICS- I**		
Course Code: 21UECS31	**Hours / week :4**	**Hrs / Sem.: 60**	**Credits :4**

UNIT-I: Basic Concepts of Tourism **10 Hrs**

Meaning- Definition - Concepts and Types of Tourism - Tourism and economic development - Importance of tourism - Sustainable Tourism

UNIT-II: Tourism Product and Tourism Marketing **10 Hrs**

Tourism products: Attractions, Availability, Accessibility and Amenities - Tourism Marketing – Various types of tourism marketing in India - Impact of Information Technologyin tourism development.

UNIT-III: Tourism Services **10 Hrs**

Hotels - Motels - Resorts - Boating Clubs - Conducted /Organized Tours - Package Tour - Insurance - Guides - Tour Operators - Tour Promoters - Medical Tourism and its importance.

UNIT-IV: Performance of Tourism **15 Hrs**

Tourism status in global and national -Socio, Economic, Cultural and Political Impactsof tourism development in India - Programmes in Tourism Development - Infrastructure Development Programme – Integrated Development of Tourism Circuits, Product infrastructure and Destination Development

UNIT-V: Tourism Organizations **15 Hrs**

Role and Functions: United Nations World Tourism Organizations (WTO), Pacific Asia Travel Association (PATA), World Tourism and Travel Council (WTTC), International Hotel Association (IHA), Ministry of Tourism, Government of India, Indian Tourism Development Corporation (ITDC) and Federation of Hotel and Restaurants Association of India (FHRAI)

Text Book: Sunetra Roday, Archana Biwal & Vandana Joshi. *Tourism: Operations andManagement*. USA: Oxford University Press. Illustrated edition 2009

Books for Reference:

1. D. Leslie & J. Holland. *Tour operators & Operations: Development, Management andResponsibility.* U.K: CABI Publishers. 1st edition 2017.
2. Geetanjali. *Tourism Policy and Planning*. Jaipur: ABD Publishers. 1st edition 2010.
3. Manish Ratti. *Tourism Planning and Development*. New Delhi: Rajat Publications. 1stedition, 2008.
4. R. Shantha Kumar,. *Facts on Tourism*. Chennai: Shantha Publishers. 1stedition 1996.

SEMESTER- IV			
Core Skill Based	**TOURISM ECONOMICS**- II		
Course Code: 21UECS41	**Hours / week :4**	**Hrs / Sem.: 60**	**Credits :4**

Objectives:

- Learn about sustainable tourism development for inclusive economic development.
- Understand the importance of Tourism sector and having integrity to achieve economic development through tourism.

Course Outcome:

CO No.	Upon completion of this course, students will be able to	PSO's Addressed	CL
CO - 1	identify and evaluate the elements of the tourism system and its interaction with the environment.	2,4	Ev
CO - 2	recognize and raise awareness for moral issues and dilemmas in tourism.	4, 5	An
CO - 3	provide information about tour packages	4,5	Un
CO - 4	assert and apply the method to develop an ideal itinerary and function of tour managers.	1, 7	Ap
CO - 5	understand the importance of transport and communication in travel tourism and hospitality industry.	2,4,5	Un
CO - 6	create an awareness on the economic impact generated by tourism.	2,4	Cr

SEMESTER- IV			
Core Skill Based	**Tourism Economics- II**		
Course Code: 21UECS41	**Hours / week :4**	**Hrs / Sem.: 60**	**Credits :4**

UNIT-I: Travel Agency **10 Hrs**

Travel Agents, Tour operators, Function of a travel agent – Travel information, Ticketing,Tour packages, and Type of Package, Tours and excursion -Travel agency commission How to setup a travel agency-Modern mobile application towards in Tourism.

UNIT-II: Personality Developments Of Travel Agent, Tour Operator, Guide 10 Hrs

Introduction: Meaning of Personality, Personality Factors- externa internal. Effective or winning personality, developing a selling personality

UNIT-III: Guiding Concept **15 Hrs**

Meaning, Concepts &Types of Guides: Conceptual meaning of Tourist Guide, duties andresponsibilities. How guides are appointed in tour.

UNIT-IV: Tourism Development **10 Hrs**

Development of tourism in India - New Policy on Tourism Management strategy-Globaland Indian status of Tourism Industry - International Agencies.

UNIT-V: Indian Art & Architecture **15 Hrs**

Indian Art and Sculptures, Archaeological sites – Monuments – Ancient Temples of India -Forts - Palaces and Museums – Buddhist heritage sites of India, Islamic Art & Architecture -UNESCO, World Heritage Sites in India, conservation & Management.

Text Book: A.K.Bhatia, Tourism Development-Principles & Practices, 4th Revised Edition,Sterling Publishers Pvt., Ltd, Uttar Pradesh, 2020.

Books for Reference:

1. S. Subramania Pillai. *Tourism in Tamil Nadu- Growth and Development*. India: MJPPublishers. 1st edition 2021.
2. Rajat Gupta, Nishant Singh, Ishita Kirar& Mahesh Kumar Bairwa. *Hospitality andTourism*. New Delhi: Vikas Publishing House Pvt, Ltd. 1st edition 2015.
3. Satish Chandra Nigam,. *Eco Tourism and Sustainable Development.* New Delhi: RajatPublications. 1st edition 2008.
4. Biswanath Ghosh. *Tourism & Travel Management.* New Delhi: Vikas Publishing HousePvt, Ltd. 2nd edition 2000.

SEMESTER - I			
Allied – I - Dairy Technology			
Course Code -21UMIA11	**Hrs/ Week: 4**	**Hrs/ Sem: 60**	**Credits: 3**

Objectives:

To provide the leadership, voice and programs for a vibrant dairy industry where farm families, dairy businesses and associated organizations can thrive and be profitable.

To create a sustainable environmentally and technologically advanced dairy farm.

Course Outcome:

CO.No.	Upon completion of this course, students will be able to	PSO addressed	C L
CO-1	understand the process involved in production of milk and milk products	1,2	Un
CO-2	classify and explain the different types of milk products	2	Un
CO-3	understand purpose and functions of hygiene in dairy industry	2	Un
CO-4	produce flow chart for the production processes of various milk products	1, 2	Ap
CO-5	explain organization and operations involved in milk processing units	2	Co
CO-6	outline precautions when processing milk and dairy products	2	An
CO-7	organize students to processing of milk and its products	2 ,3,4	Un
CO-8	understand the various agents causing food infection, toxi-infection and intoxication that can be transmitted through consumption of milk and milk products which be immensely useful in preventing the food borne illnesses ensuring the safety of the consumers.	2 ,3,4	Un

SEMESTER – I			
Allied – I - Dairy Technology			
Course Code -21UMIA11	**Hrs/ Week: 4**	**Hrs/ Sem: 60**	**Credits: 3**

Unit I Clean milk production technique

Clean milk production technique- secretion of milk in the udder- sources of micro organisms- cleanliness of the animal- Udder- Utensils- Detergents and Sanitizers- Different micro organisms of milk – Differences between goat's, buffaloe's and cow's milk - Colostrums- Importance of colostrums

Unit II Importance of milk and its composition

Importance of milk and its composition, properties and nutritive value of milk - Specific gravity of milk- Lactometer reading- Acidity test estimation of fat, SNF, total solids of milk- Factors that alter the quality and quantities of milk – common adulterants of milk, detection of adulterants- water adulteration- MBRT- Resazurin Test

Unit III Milk processing

Chilling – Heat processing – Sterilization- pasteurization- test for effective pasteurization – phosphates test – Holding the milk – packing – transport- various types of transports – marketing of fluid milks – special milks- Toned milk, standard milk, UHT milk

Unit IV Starter culture and milk products

Starter culture preparation and their biochemical activities- Methods of manufacture and uses of fermented and non fermented milk products, yoghurt, cheese skim milk, condensed milk.

Unit V Milk borne disease

Milk Borne disease- An Introduction to milk Borne disease, Milk borne infections, *Salmonella* poisoning, bacillary dysentery (Shigellosis). Milk borne intoxication – *Staphylococcal* poisoning, Botulism. Other milk borne diseases- Tuberculosis, Brucellosis

Text book:

1. Sugumar De.. *Outlines of dairy technology*, Oxford University press, 1997.

Books for Reference:

1. Clarence Henry, Heckles, *Milk and Milk products,* New Delhi: Tata. McGraw Hill Publishing company Ltd. 4th edition, 1957.
2. Sugumar D. *Outlines of dairy technology*, Oxford University press. 1997.
3. Ramasamy. *Hand book of Dairy technologies*, International Book distributing and Company, 1996.

SEMESTER – IV			
Allied – IV – Mushroom Technology			
Course Code: 21UMIA41	**Hrs/Week : 4**	**Hrs/Sem : 60**	**Credit : 3**

Objectives

1. To facilitate the students with wide knowledge about the mushroom technology.
2. To inculcate the deep knowledge on mushroom technology.

Course Outcome:

CO N0	**Upon completion of this course, students will be able to**	**PSO addressed**	**CL**
CO-1	explain about the detailed information of edible and non – edible mushroom.	4	Un
CO-2	compare the cultivation of various types of mushrooms.	5	Un
CO-3	construct the mushroom house.	6	Cr
CO-4	compare different types of mushroom cultivation techniques and pure culture preparation.	7	An
CO-5	explain about economics of mushroom cultivation and their precaution.	6	Un
CO-6	interpret about the different modes of storage of mushroom.	5	Un
CO-7	illustrate about the various nutrition content present in mushroom.	4	Un
CO-8	make use of various types of foods prepared from mushroom.	6	Ap

SEMESTER – IV			
Allied – IV – Mushroom Technology			
Course Code: 21UMIA41	**Hrs/Week : 4**	**Hrs/Sem: 60**	**Credit : 3**

Unit – I : Mushroom morphology

Different parts of a typical mushroom & variations in mushroom morphology. Key to differentiate edible from poisonous mushrooms. Button, Oyster and King mushroom (*Ganoderma)*- General morphology, distinguishing characteristics, spore germination and life cycle. Historical account on mushroom cultivation.

Unit - II: Cultivation Technology

Infrastructure, spawn lab, equipments and substrates in mush- room cultivation: Casing; raw material used for casing, preparation of casing material; important sanitation during various stages of mushroom cultivation. Precautions in mushroom cultivation – area selection, spawn preparation, spawn run, harvesting, pest management.

Unit – III: Cultivation of mushrooms

Steps involved in cultivation - Button Mushroom, Oyster mushroom and King mushroom (*Ganoderma)*

Unit –IV: Storage and nutrition

Short time storage, Long term storage, Drying , Storage in salt solutions. Nutrition – Proteins, Amino acids , Mineral elements; Carbohydrate , Vitamins , Crudefibre content.

Unit – V: Health benefits of Mushroom & Value added products

Health benefits of Mushroom: Antiviral value, antibacterial effect, antifungal effect, anti-tumour effect, hematological value cardiovascular & renal effect, in therapeutic diets, adolescence, for aged persons & diabetes mellitus.

Value added products - Mushroom - Soup, Pickles, Powders, Jams ,Cutlet, Omelette , Samosa , Curry, mushroom biscuits, mushroom ketchup, mushroom chips, mushroom candy.

Text Books:

1) Marimuthu, T. Krishnamoorthy, A.S. Sivaprakasam, K. and Jayarajan. R, *Oyster Mushrooms, Department of Plant Pathology,* Coimbatore: Tamil Nadu Agricultural University, 1991.
2) Nita Bahl, *Hand book of Mushrooms,* II Edition, Vol. I & Vol. II: 1988.

Books for Reference:

1. Biswas S., Datta M. and Ngachan S.V. *Mushrooms: A Manual for Cultivation,* PHI. 2012.
2. Zadrazil F. and Grabbe K. *Edible Mushroom, Biotechnology* Vol. 3, Berlin: Wein- heim: Verlag Chemie, 1983.
3. Changs T. and Hayanes W.A. (Ed.) *Biology and Cultivation of Edible Mushrooms.* New York: Academic Press. 1978.
4. Tewari, Pankaj Kapoor, S.C., *Mushroom cultivation*, Delhi: Mittal Publications, 1988.

SEMESTER - II			
Core – II Microbial Diversity			
Course Code : 21UMIC21	**Hrs/ Week: 6**	**Hrs/ Sem: 90**	**Credits: 6**

Objectives:

To illustrate the evolutionary approaches and diversified nature of microorganisms

To demonstrate the students to be aware of ubiquitous nature of micro organisms and their detailed account on taxonomic approaches and survey of prokaryotic phylogeny and phylogenetic groups of eukaryotes.

Course Outcome:

CO .No	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	list out the general classification of microbes.	1,5	Kn
CO -2	distinguish the taxonomic ranks of micro organisms	2	An
CO-3	illustrate the Bergey's manual classification about bacteria	2,4	Co
CO-4	know the Alexopoulous classification of fungi and their general features	1	Kn
CO-5	interpret the general morphological characteristics and the algal diversity	1,2	Co
CO-6	demonstrates the morphology and genetic material of viruses	2	Co
CO-7	know about diversification of microbes	2	Kn
CO-8	analyse the classification, replication, cytocidal effects of plant and animal viruses	2,5	An

SEMESTER - II			
Core – II Microbial Diversity			
Course Code : 21UMIC21	**Hrs/ Week: 6**	**Hrs/ Sem: 90**	**Credits: 6**

Unit-I – Introduction to Taxonomy and classification

General principles of classification. Evolution methods in classification – International codes of nomenclature – Taxonomic approaches and phylogeny.

Unit-II – Bacteria and its classification

General introduction – type study: gram positive bacteria (*Bacillus*), Gram negative bacteria (*E.coli*) – Archaebacteria, Methanogens, Appendage bacteria. Determinative classification of Bergey's manual, cyanobacteria.

Unit-III – Fungi and its classification

– General introduction, morphology, Alexopoulous classification and their general features – Life cycle – filamentous fungi (*Actinomycetes*), molds (*Aspergillus*), macroscopic fungi (*mushroom-Agaricus bisporus*) – unicellular fungi (*Yeast-Saccharomyces cerevisiae*)

Unit- IV – Algae, Protozoa - classification

General characteristics – algal diversity - morphology –classification- General features and Life cycle –blue green algae (*Nostoc*) – Red algae (*Gracilaria*) Protozoa - General introduction –morphology –classification – General features and Life cycle - Sarcodina (*Entamoeba histolytica*) – Mastigophora (*Euglena gracilis*)

Unit- V – Viruses and its classification

Introduction –structure –classification based on morphology and genetic material. Plant virus (TMV) –Animal virus (*Adeno virus*) –Bacteriophage (*T4 phage*).

Text Book:

1. Rajan S., Selvi Christy R., *Essentials of Microbiology*. CBS Publishers and Distributors. 2015

Books for Reference:

1. Stanier, Y. Roger, John L. Ingrahm, Mark L. Wheelis and Page R. Painter. *General Microbiology.* New Jersey: V Ed. MacMillan Press Ltd. 2003.
2. R.C. Dubey. *Text Book of Microbiology* S. Chand and Company Ltd., 2004
3. Pelczar*, Microbiology*, Tata McGraw-Hill Education. 1998.
4. Lansing M. Prescott, John P. Harly and Donald A. Klein. *Microbiology,*. WCB/ McGraw Hill Company. 5th edition, 1999.

SEMESTER – III			
Core– III - Microbial Physiology and Metabolism			
Course Code: 21UMIC31	**Hrs/ Week:4**	**Hrs/ Sem: 60**	**Credits: 4**

Objectives

1. To understand the basic concepts of aerobic and anaerobic metabolic pathway
2. To analyse the role of individual components in overall cell function
3. To provide information on sources of energy and its utilization by microorganisms
4. To study about many different types of metabolic strategies

Course outcome

CO No	Upon completion of this course, students willbe able to	PSO addressed	CL
CO-1	Know the basic knowledge about microbial metabolism	2	Kn
CO-2	Know the applications of the various culture and their pathways	4	Kn
CO-3	Know the process of reporting the reportableDisease	5	Kn
CO-4	Interpret the techniques used in clinical microbiology	2	Co
CO-5	Determine the mechanism of nitrogen fixation by microbes	4	An
CO-6	Demonstrate the mechanism involved in bio-luminescence	1	Co
CO-7	Demonstrate the growth and sporulation process of microbes	4	Co
CO-8	Compare the mechanism of photosystem I & II	2	An

SEMESTER –III			
Core– III-Microbial Physiology and Metabolism			
Course Code :21UMIC31	**Hrs / Week:4**	**Hrs / Sem:60**	**Credits:4**

Unit-I: Introduction to Metabolism

Basic concept of metabolism – Membrane transport system – Passive and Active transport system – Facilitated diffusion, group Translocation – Iron transport – Requirements of growth- Micro & Macro nutrient elements. Role of osmo regulatory proteins

Unit-II: Metabolic pathway

Assimilatory and dissimilatory pathways – Respiratory pathways – Glycolysis, Krebs cycle – ETS – ATP generation – Fermentation pathways- Homo and Hetero lactate fermentation- Ethanol- Fermentation by bacteria and yeast – Mixed acid fermentation- Butanediol, acetate and propionate. Metabolism of protein

Unit-III: Respiration and photosynthesis

Anaerobic respiration: Nitrate, Sulphur, carbonate and methane – Bioluminescence components. Phototrophic metabolism- Historical account of photosynthesis.

Unit-IV: Growth and sporulation

Growth – Batch, continuous– Growth curve – Factors affecting growth – Physical, chemical and biological factors. Endospore – structure and mechanism of sporulation. Regulation of nitrogen assimilation and fixation by bacteria

Unit-V: Nutrition and Phosynthetic pigments

Characteristics and metabolism of autotrophs. – Chemolithotroph – Brief account on Sulphur, Hydrogen and Iron oxidation. Phosynthetic and accessary Pigments –Bacterio chlorophyll, rhodopsin and carotenoids. Energy rich compounds in cell metabolism

Text Book:

1. Meena Kumari S. *Microbial Physiology*.Chennai:1st edition MJP Publishers. 2006.

Books for Reference:

1. Rajapandian K. *Microbial physiology.*Chennai: PBS Book Enterprises India, 2010.
2. Lansing M. Prescott John.P. Harley and Donald A, Klein. *Microbiology.* Newyork: (5thedition). McGraw –Hill Company, 2003.
3. Tortora, Funke Case Addison. Introduction to Microbiology, Newyork: (7thedition)Wesley Longman Inc. 2001.
4. Dubey R.C. and Maheswari, S. *A. Text Book of Microbiology*. New Delhi: S.Chand &Co, 2003.
5. Pelczar Jr., M.J. Chan E.C.S., and Kreig N.R. *Microbiology.* NewYork : McGraw- HillInc,

SEMESTER-III			
NME I - Food Microbiology			
Course Code:21UMIN31	**Hrs/Week:2**	**Hrs/Sem:30**	**Credit:2**

Objectives

To highlight student that microorganisms are importance of food, food hygiene, sanitation and food safety

Course Outcome:

CO. No	Upon completion of this course, students Will be able to	PSO addressed	CL
CO-1	To provide knowledge on the importance of Food microbiology	1,4	Un,An
CO-2	Acquire brief knowledge on food microbes And their importance.	1	Un
CO-3	Acquire knowledge on various types of preservation.	6	Co
CO-4	Provide information about the principles of preservation.	1,6	Un
CO-5	Acquire knowledge on contamination and Spoilage problems	1,6	Un
CO-6	Provide interpretation of laboratory tests in the Diagnosis of infectious diseases.	2	Co
CO-7	To understand the mode of transmission of food Poisoning and food infections	6	Co
CO-8	Provide information about the quality control Principles and importance.	1,2	Un

SEMESTER-III			
NME I-Food Microbiology			
Course Code: 21UMIN31	**Hrs/Week:2**	**Hrs/Sem:30**	**Credit:2**

Unit-I : Food as a substrate for microorganisms

Food as a substrate for microorganisms - factors affecting the growth of microorganism in food. Mold, yeast and bacteria- general characteristics & importance.

Unit-II: Principles of food preservation

Principles of food preservation – Methods of food preservation – asepsis, removal of microorganism anaerobic conditions, high temperature- low temperature, drying and food additives – Canning.

Unit–III: Contamination and spoilage

Contamination and spoilage of milk and milk products, meat and meat products, fish

and fish products, vegetables and fruits and canned food.

Unit-IV: Food Borne diseases

Food Borne diseases: Mode of Transmission –Food Poisoning –Food infection-Bacterial (*Staphylococcal*), Fungal (*Aspergillus*) and Viral infection (*Hepatitis*)

Unit-V: Quality Control

Food Laws and Regulations. Export Act- AGMARK -FPO, FAO-WHO-HACCP- Principles and Importance. intellectual property rights, Introduction to patents

Text Book:

1. Frazier, W.C and Westhoff, D.C *Food microbiology*, 4th edition, New Delhi. Tata Mac Graw Hill, 2008.
2. Adams, M.R and Moss M.O *Food Microbiology* New Age International (p) Limited Publishers. 1995

Books for Reference:

1. Banwart, G.J., Basic *Food Microbiology*, New Delhi. CBS Publishers and Distributors, 2nd Edition 1989.
2. Robinson R.K *Dairy Microbiology*, London. Elsevier Applied science, 1990.
3. Edward Arnold, Hobbs BC Roberts D *Food Poisoning and Food Hygiene*, London., 1993.

SEMESTER–III			
Skill Based Elective - Vermitechnology			
Course Code:21UMIS32	**Hrs/Week:2**	**Hrs/Sem:30**	**Credit:2**

Objectives

1. To get the thorough knowledge on making Vermicomposting and vermiculture.
2. To learn about species used in Vermicomposting and Culture techniques of earthworms
3. To study the Vermicomposting production
4. To encourage the self-employment practice and save the human being by the way of minimizing the use of chemical fertilizers.
5. To understand the interaction of earthworms with other organisms

Course Outcome:

CO No	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	Select from, use and interpret results of descriptive Vermitechnology methods	6	Ev
CO-2	Demonstrate an understanding the scientific and technological benefits to the rural sector by equipping them with the latest technology and to create the model for the nation	6	Ev
CO-3	gain knowledge earthworms about the various morphology	1	An
CO-4	Communicate the awareness of field sampling using Vermicomposting	5	Un
CO-5	Make appropriate awareness of parasites and predators	5	Un
CO-6	Understand the awareness among the present status and importance of composting methods and Vermicomposting	4	An
CO-7	Understand the waste reduction in Vermicomposting	4	Un
CO-8	Explain the nutrient availability in the Vermicomposting	6	Ev

SEMESTER–III			
Skill Based Elective –Vermitechnology			
Course Code:21UMIS32	**Hrs/Week:2**	**Hrs/Sem:30**	**Credit:2**

Unit-I: **Earthworm classification**

Morphology and Anatomy. Biology of *Lumbricus terrestris*. – Digestive system–Excretion – Reproduction and Life cycle – Earthworm as farmer's friend.

Unit-II: Vermicomposting materials and their classification

Vermicomposting materials and their classification. Physical, chemical and biological and environmental changes brought by earth worm in soil structure-carbon, nitrogen and phosphorous transformations.

Unit-III: Vermicomposting production

Requirements – Different methods of Vermicomposting – Heap method – Pot method and Tray method – changes during Vermicomposting. Collection and Preservation of earthworms.

Unit-IV: Vermicomposting in Homes

Vermicomposting in Homes, Maintenance of Vermicomposting beds. Earthworm predators, Parasites and pathogens. - Economics of Vermicomposting and vermiwash production. Vermiculture for waste reduction.

Unit-V: Vermicomposting advantages

Role of in plant growth and other applications, Earthworms as animal feed – Medicinal value of earthworm meal– Role of Earthworms in Solid Waste, and Sewage waste management. Earthworms as bioreactors.

Text Book:

Mary Violet Christy. A. *Vermitechnology*– Chennai: MJP Publishers, 2014.

Books forReference:

1. Edwards,C.A .and Bohlen, P.J., *Ecology of earthworms*. Chapman and hall. 3rdEdition, 1996.
2. Ismail,S.A. *Vermicology. The Biology of Earthworms.* London. Orient Longman, 1970.
3. Lee, K.E. *Earthworms-Their ecology and relationship with soil and land use*, Sydney. Academic Press, 1985.
4. Ranganathan L.S. *Vermibiotechnology from soil health to human health*. India: Agrobios, 2006.
5. GuptaP.K. *Vermicomposting for sustainable Agriculture.* India. Agrobios.2008.

SEMESTER III			
Skill Based Elective	**A. Fishery Products**		
Course Code: 21UZOS31	**Hrs/ Week: 2**	**Hrs/ Sem: 30**	**Credits: 2**

Objectives:

- To obtain knowledge on products of fisheries industry, their processing and preservation process.
- To encourage the students to follow hygiene in fish processing
- To develop entrepreneurial skills in the preparation of sea-food based convenience products in ready-to-eat or ready-to-cook forms

Course Outcome

CO. No.	Upon completion of this course, the graduates will be able to	PSO addressed	CL
CO-1	acquire knowledge on products and by-products of fisheries.	5	Un
CO-2	demonstrate various processing and preservation methods of fishery products	5	Un
CO–3	apply information on processing for the usage of fish by-products for industrial and domestic purposes.	7	Ap
CO–4	carry out study on sea weeds and analyse their usage as food for human consumption	2	An
CO–5	practice the preparation of value added fishery products.	8	Cr
CO–6	implement and discuss sanitation and quality control techniques.	7	Cr
CO–7	update the knowledge of preservation and processing techniques and recommend their use in day to day life.	7	Ev
CO-8	develop advanced techniques on fishery products.	8	Un, Cr

Unit I **Value Added Fishery Products**

Fish pickles, fish sauce, fish cutlets, fish balls, fish soup powder and fish sausage. Battered and braided products-fish finger, fish wafer.

Unit II **Fishery By Products**

Fishery by products - fish oil – isinglass – chitosan – pearl essence – shark fins

Unit III **Seaweed Products**

Uses of agar, algin and carrageenan. Use of sea weeds as food for human consumption.

Unit IV **Techniques of Preservation and Processing**

Freezing - quick, slow freezing; freezer - horizontal plate freezer, tunnel air blast freezer - cryogenic freezing; canning; smoking - hot, cold, electrostatic smoking; pickling; drying – natural, artificial; salting - dry, wet and mixed salting.

Unit V **Quality Control and Sanitation**

Sanitation in processing – environmental hygiene and personal hygiene in processing. Fishery guidelines for HACCP and FSSAI on fish and fish products.

Text Book

1. Dr. Surekha Gupta. *Textbook of Fishery*. New Delhi: Ane Books Pvt. Ltd. 2010

Books for Reference

1. Gopakumar, K. *A Textbook of Fish Processing Technology.* New Delhi: ICAR. 2002.
2. Gupta, S.K. and P.C Gupta. *General and Applied Ichthyology* [*Fish and fisheries*]. Ramnagar New Delhi: Chand and Company Ltd. 2006
3. K.R. Ravindranathan. *A Text book of Economic Zoology*. New Delhi*:* Wisdom Press. 2013.
4. Ayyapar, S. *Handbook of Fisheries and Aquaculture*. New Delhi: 2010
5. Srivastava, C.B.L. *A Text book of Fishery Science – Indian Fisheries.* New Delhi: Kitab Mahal. 2006.

Semester VI			
Core X	**Plant Physiology**		
Code: 18UBOC61	**Hrs/week: 5**	**Hrs/ Semester: 75**	**Credit : 4**

Vision:

- To provide knowledge on orderly metabolic activities in plant to sustain life

Mission:

- To understand the plant functions such as transpiration, photosynthesis and respiration.
- To recognize the intermediary metabolism of plants.

Course Outcome

CO.No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	understand the water relation and root structure and functions that influence the transfer of inorganic nutrients from the soil into the plants	2,3	Un
CO-2	assess the symptom specific nutritional deficiencies and discuss the need of fertilisers for crop improvement	2	An,Ap
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,Cr
CO-6	investigate plant's functions and adaptations under altered environmental conditions	2	Cr
CO-7	comment on the hormone controlled and light mediated morphogenetic events in plants	2	An
CO-8	design and conduct scientific experiments and analyse the data critically	4,8	Cr

Semester VI			
Core X	**Plant Physiology**		
Code: 18UBOC61	**Hrs/week: 5**	**Hrs/ Semester: 75**	**Credit : 4**

Unit I : **Plant - Water Relations:** Importance of water to plant life. **Physical properties of water:** Imbibition, Diffusion, Osmosis, Plasmolysis and Water potential. **Absorption and transport of water:** active and passive absorption, ascent of sap – path and mechanism (Dixon's cohesion theory). **Transpiration:** types, mechanism of stomatal movement (starch- sugar interconversion theory and proton transport and hormonal regulation theory), factors affecting transpiration, importance of transpiration

Unit II : **Solute relations: Mineral nutrition** – role of essential macro elements in plant nutrition, deficiency and toxicity symptoms. **Translocation of organic solutes:** mechanism of phloem transport, source-sink relationship, factors affecting translocation. **Nitrogen metabolism:** Nitrogen fixation: symbiotic fixation - importance of nitrate reductase and its regulations - ammonia assimilation.

Unit III : **Photosynthesis:** photosynthetic apparatus, pigment systems, red drop and Emerson enhancement effect. **Photochemical reaction:** cyclic and non cyclic photophosphorylation. **CO_2 fixation:** C_3 and C_4 cycles. Factors affecting photosynthesis.

Unit IV : **Respiration:** Respiratory substrates, **types of respiration:** aerobic – glycolysis, Krebs cycle, ETC and oxidative phosphorylation. **Anaerobic respiration:** lactic acid fermentation, alcohol fermentation. Pentose Phosphate Pathway (PPP).Factors affecting respiration.

Unit V : **Growth:** definition, phases of growth- factors affecting growth. **Plant growth regulators:** occurrence, physiological effects and practical applications of auxin, gibberellin and cytokinin. **Physioloy of flowering:**Photoperiodism and vernalization. **Seed dormancy:** causes and methods of seed dormancy, physiology of seed germination.

Text Book:

1. Jain, V.K. 2004. *Fundamentals of Plant Physiology*. S. Chand & Company Ltd. NewDelhi.

Books for Reference:

1. Noggle, G. R. and G. J. Fritz, 2008. *Introductory Plant Physiology*. Prentice Hall of India, Pvt. Ltd., New Delhi.
2. Pandey, K.K. and B.K. Sinha, 2005. *Plant Physiology*. Vikas publications, New Delhi.
3. Salisbury, F.B. and C.W. Ross 2007. *Plant physiology*. Thompson. Asia. Pvt. Ltd. Singapore.

Practical Hrs per Week: 2

- Imbibition by direct weight method
- Determination of water potential by Chardakov's method
- Determination of differential transpiration of leaf surface using cobalt chloride method
- Estimation of magenisum in plant tissue
- Determination of effect of light intensity on photosynthesis
- Rate of photosynthesis in different concentration of bi-carbonate (bubble count method)
- Extraction and separation of chloroplast pigments by ascending paper chromatography
- Demonstration of aerobic respiration by Retort's method
- Demonstration on fermentation
- Determination of growth curve by leaf area method
- Estimation of auxin

Submission: Record note book

Books for Reference: Francis H Witham, David F Blaydes and Robert N Devlin, 1970.
Experiments in Plant Physiology.VanmostrandRainhold Company, New Delhi

SEMESTER VI			
Core XI	**Marine Botany**		
Code:18UBOC62	**Hrs/week: 5**	**Hrs/semester: 75**	**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	understand the marine environment and classify them	7	Un
CO-3	able to signify the characteristic feature of sandy shore and sand dunes and their economic importance	1	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 marine plants 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 VI			
Core XI	**Marine Botany**		
Code: 18UBOC62	**Hrs/week: 5**	**Hrs/semester: 75**	**Credits: 4**

Unit I : Marine environment- classification, physical and chemical properties of sea water, characteristics and adaptations of pelagic (planktonic), benthic (littoral and deep sea) organisms.

Unit II : Introduction to marine plants - Phytoplankton – sea weeds and sea grasses - introduction, adaptation, biology, ecology, economic and medicinal significances.

Unit III : Coastal vegetation – sandy shore and sand dunes - introduction, adaptation, biology, ecology, economic and medicinal significances.

Unit IV : Coastal shore vegetation – salt marshes and mangroves - introduction, adaptation, biology, ecology, economic and medicinal significances.

Unit V : Laboratory culture of marine algae, commercial cultivation of seaweeds – general methods – *Gracilaria* and *Porphyra*. Economic importance of marine algae – in food and agriculture. Phycocolloids – agar agar, algin, alginate, carrageenan – commercial production, properties and uses, diatomite, antibiotics and vitamins. Conservation of coastal ecosystem with special reference to coral reef and mangroves.

Text Books:

1. Bilgrami, K.S. and L.C. Saha, 2004. *Textbook of Algae.* CBS publishers & Distributors, New Delhi.
2. Tait, 1978. *Elements of marine ecology*. Butterworth & Co. (Publishers) Ltd. London.

Books for Reference:

1. Boaden P.J.S. and R. Seed 1985. *An Introduction to coastal ecology.* Thomas Press Limited, New Delhi.
2. Chapman, V.J. and Chapman, 1980. *Seaweeds and their uses* – Chapman and Hall, London.
3. Dawes, C.J. 1981. *Marine Botany*. John Wiley & Sons, New york.
4. Lobban, C.S. and M. J. Wynne. 1981. *The biology of Seaweeds*. Blackwell Scientific publications. Oxford, London.
5. Newell and Newell.1977. *Marine Plankton a practical guide.* Hutchinson and Co. Ltd.
6. Sinha, P. C. 1998. *Marine pollution*, Anmol publications Pvt. Ltd. New Delhi.
7. Sverdrup H.U. 1972. *The Oceans* – Modern Asia Edition.
8. Venkataraman, G.S. 1969. *The cultivation of algae*, IARI.

Practical Hrs per week: 2

- Phytoplanktons - Collection and identification
- Culture of micro algae
- Seaweeds- *Ulva, Sargassum, Hypnea* and *Gracilaria*
- Study of sand dune, salt marsh and mangrove vegetation in their natural habitat,
- Submission of photographs and field report for internal evaluation.

Books for Reference:

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

Semester VI			
Core XII	**Ecology and Phytogeography**		
Code;18UBOC63	**hrs/week:4**	**Hrs/semester: 60**	**Credit : 4**

Vision:

- To learn about the interconnectedness of life with the environment

Mission:

- To understand the structure and function of ecosystem
- To analyze the different types of vegetation and their distribution pattern.

Course Outcome

CO. No	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	reveal the range of plant diversity in terms of structure, function and their environmental relationships.	5	Un
CO-2	describe the climatic and edaphic factors and ecological succession	5	Un
CO-3	categorize the plants based on adaptation	3	An
CO-4	address the global environment crisis and the strategies applicable for environmental problem mitigation	7	Ev
CO-5	learn the global level environmental summit organized that focused for sustainable future	7	Cr
CO-6	know the importance of remote sensing in finding the current status of global health	7	Cr
CO-7	recognize the causes of environmental problems	7	Un
CO-8	discuss ecological issues and concept	5	Re

Semester VI			
Core XII	**Ecology and Phytogeography**		
Code:18UBOC63	**hrs/week:4**	**Hrs/semester: 60**	**Credit : 4**

Unit I : Introduction. Ecological factors: Climatic factor – light, temperature, wind, precipitation and humidity. Biotic factors – Interaction between plants and animals, interaction between plants growing in a community and interaction between plants and microorganisms. Edaphic factors – soil temperature, soil nutrients and soil organisms.

Unit II : Plant adaptations – morphological, anatomical and physiological adaptations of hydrophytes, xerophytes and halophytes.

Unit III : Plat communities – Characteristic features, methods of analysis- quadrats and transect methods, units of vegetation.

Unit IV : Plant succession - types, causes, processes. Hydrosere and xerosers. Climax and its concepts.

Unit V : Geographical regions of India. Vegetational types of Tamil Nadu. Structure and distribution of evergrren and deciduous forests, mangroves, scrub jungle and grassland, Endemism.

Text Books:

1. Sharma, P.D1999.*Elements of ecology*. Rastogi Publications, Shivaji Road, Meerut.
2. Shukla, R.S. and Chandal, S.S 1991. *Plant Ecology*. S, Chandal and Co. New Delhi

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. Trivedi P.R, P.L Sharma and KN Sundarshan 1994. *Natural environment and Constitution of India*, Efficient offset printers, New Delhi.
6. Tyller Miller G., 2004. *Environment Science* Thompson Brooks/Cole. Singapore.
7. Varshney C.K 1989. *Water pollution and management*, S.P. Printers, Noida.

Practical Hrs per 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

Books for Reference : Murugesan A.G. and Rajakumari 2005.Environmental Science andBiotechnology and Biotechnology, Theory and Techniques, MJP Publishers