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

Objectives

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

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

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

Unit II **Characteristics of Sea Water**

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

Unit III **Marine Ecosystems**

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

Unit I V **Marine Pollution**

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

Unit V **Wealth of the sea**

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

Books for Reference

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

PRACTICALS

Hrs / Week : 2

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

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

Objectives:

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

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

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

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

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

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

Books for Reference:

1. Colin Rattledge and K. Bjon, 2001. Basic biotechnology. Cambridge University
2. Dubey, R.C. 2005. Textbook of Biotechnology. S. Chand & Co. New Delhi
3. George, E.F. and P.D. Sherrington, 1984. Plant propagation by tissue culture. Exegetic Ltd. London.
4. Gupta, P.K. 2000. Elements of Biotechnology. Rastogi publication, Meerut.
5. Kalyan Kumar De. 2004. An Introduction to Plant Tissue Culture. New Central Book Agency, Calcutta.
6. Kumar, H.D. 1993.Molecular biology and Biotechnology. Vikas publishers, New Delhi.
7. Mahesh, 2008. Paddy molecular Biotechnology, New age international, publishers. (p) Limited.
8. Mukhopadhyay S.N, prabhakar Sharma, and Rabindra Narain, 2011. A text book of DNA recombinant technology. Wisdom press. New Delhi.
9. Ramavat, K. G., 2000. Plant Biotechnology, S. Chand & Co., New Delhi
10. Reinort, J and M.M. Yeoman, 1983. Plant cell and tissue culture. Narosa publishing house Delhi.
11. Satyanarayana U. 2006. Biotechnology. Books and Allied (P) Ltd. Kolkatta.
12. Singh, B.D.2005. Biotechnology- Expanding Horizons. Kalyani Publishers, New Delhi.

Practical
Hrs /week: 2
Practical

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

Set up / pictures / photographs/ demonstration

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

Submission - Record Note Book

Semester II			
Core V	**Horticulture , Plant breeding and Evolution**		
19PBOC21	**Hrs/week:5**	**Hrs/Semester : 75**	**Credits : 4**

Vision:

- To promote, develop and disseminate horticultural and plant breeding technologies through the blend of traditional wisdom and modern scientific knowledge.

Mission :

- To understand the techniques and make significant contribution to an efficient and sustainable production of crops
- To understand the concept of plant breeding and evolution

Course Outcome

CO. No	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	use the garden implements using in horticultural techniques	4	An
CO-2	identify good and healthy plants and seeds for propagation and develop skill in propagation of useful vegetable, fruit and garden plants.	4	Ap
CO-3	understand basic concepts of gardening and able to layout different types of gardens and suggest plant choices	4	Un
CO-4	understand the use of modern technologies on raising horticultural plants for economic benefits and adapt modern methods of irrigation system in order to conserve water	4, 7	Un
CO-5	equip knowledge on disease management, improved production, storage strategies and business practices.	7	An
CO-6	describe various selection techniques and methods that can be used in genetic improvement of self and cross pollinated crops	6	Ap
CO-7	describe various molecular breeding technique and method that could be used for genetic improvements of crops	2	Ap
CO-8	understand the genetic basis of evolution and evolutionary process	1	Ap

Semester II			
Core V	**Horticulture , Plant breeding and Evolution**		
19PBOC21	**Hrs/week:5**	**Hrs/Semester : 75**	**Credits : 4**

Unit I

Horticulture – definition, divisions and importance. Plant growing structures – objectives and types – green houses, hot beds, cold frames and conservatory - green house production system. Plant growth environment- Physical environment, Pest management- chemical and biological. Establishment and cultivation of orchard. Gardening - outdoor garden –types, principles, designing and garden components.

Unit II

Parameters associated with sexual propagation. Asexual reproducion - Natural, artificial methods. Seedage – characteristics of good seed, and seed treatment for germination – Transplanting of seedling. Propagation of horticultural crops – cuttage, layerage, graftage and budding.

Unit III

Indoor gardening - Purpose, plant choices, caring, potting media, disease and pest management of growing succulents, Terrarium, hanging basket. Bonsai -types and training of 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 goals of plant breeding; Methods of Breeding self pollinated, cross pollinated and asexually propagated crops, pure line and mass selection. Plant transformation and genetically modified organisms in Agriculture: Role of *A.tumefaciens* in GMO development. Engineering of plasmids. Molecular marker and their role in plant breeding: RFLP's, AFLP's, SSR's and SNP's.

Unit V

Evolution: Introduction, Evolution and life, The genetic basis of evolution. Evolutionary process: Elemental forces, sources of variation, Role of natural selection and genetic Drift. Evolutionary Divergence: Races, species and isolating Mechanisms. The Origin of species Evolution above the species level.

Books for Reference:

1. AllardJohn, R.W. *Principles of plant breeding* Wiley & Sons, Inc.New York.
2. Chopra, V.L *Plant Breeding Theory and Practice*. Oxford and IBH Publishing Co. Pvt.Ltd. New Delhi.
3. Choudhri D and Amal Metha 2010. *Flower crops cultivation and management* Oxford book company . Jaipur
4. Edmund Senn - Andrew – Halfacre. 1977. *Fundamentals of Horticulture*. Tata Mc. Graw Hill.

5. Hartmann & Kester, 1989 – *Plant propagation*. Prentice – Hall of India Pvt. Ltd. New Delhi.
6. Kumar, N. 1997. *Introduction to Horticulture*. Rajalakshmi Publications, Nagercoil, India.
7. Mallikarjuna Reddy and Aparna rao 2010. *Plant propagation in horticulture*. Pacific book international. New Delhi.
8. Randahawa 1985. *Floriculture in India*. Allied publishers.
9. Sharma, J.R *Principles and practice of plant breeding* TataMcGraw-Hill Publishing Company Limited New Delhi.
10. Utpal Banerji 2008. *Horticulture* Mangal Deep Publication. Jaipur

Practical-
Hrs / Week: 2
Horticulture:

- Knowledge of garden implements and tools - Spade, Sprayer, Water can, Pruning scissor, Tiller, Digging fork, Pickaxe, Budding and Grafting Knife,
- Preparation of nursery and seed bed.
- Propagation -stem, leaf and root cutting.
- Propagation - air layering, budding and grafting technique.
- Designing kitchen garden, Rockery, Hanging basket, terrarium
- Flower arrangement and vegetable carving
- Preparation of potting mixture for different types of garden
- Preparation of natural rooting hormones/ foliage boosters/flowering boosters.

Plant breeding:

- Emasculation, bagging and crossing methods.Demonstration - Molecular breeding
- **Submission -** Record Note Book

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

SEMESTER II			
Core VIII	**Biostatistics and Bioinformatics**		
19PBOC24	**Hrs / week: 4**	**Hrs/Semester : 60**	**Credits: 4**

Vision:

- To familiarize in collection of data and analysis of data for scientific solution
- To apply advanced bioinformatics tools in the field of biology

Mission:

- To make them analyze the biological data.
- To introduce the students to the explorations of advanced sciences.

Course Outcome

CO.No.	Upon completion of this course, students will be able to	PSO Addressed	CL
CO-1	understand the fundamentals of statistics and statistical analysis	4	Un
CO-2	apply the learned procedure for collecting data, analyzing and representation of the same	4	Ap
CO-3	calculate the central tendency and dispersion in collected data	4	An
CO-4	do statistical analysis and communicate the results of statistical analyses accurately and effectively	6	Ap
CO-5	apply knowledge of the most important bioinformatics databases and able to identify what information they contain?	4	Re
CO-6	analyze concepts and approaches in bioinformatics and its application in various biological fields	4	An
CO-7	explain the major steps and principles for doing different types of sequence alignments	6	Ap
CO-8	demonstrate the use of bioinformatics tools in biological research	6	Ap

SEMESTER II			
Core X – Biostatistics and Bioinformatics			
Code: 19PBOC24	**Hrs / week: 4**	**Hrs/Semester : 60**	**Credits: 4**

Unit I

Biostatistics: Introduction, collection, classification and presentation of data. **Descriptive statistics:** Introduction. **Measures of central tendency**: Definition, Types (simple arithmetic mean, median and mode) - **Measures of dispersion**: standard deviation, coefficient of variation and standard error (merits and demerits).

Problems: raw data, discrete data, continuous data – direct method only

Unit II

Inferential Statistics: Introduction. **Test of significance:** Chi-square analysis (goodness of fit, test of independence, test of homogencity). Student's t test (estimation of population mean, matched pair data analysis, comparison of means of two small groups). ANOVA: (one way and two way).

Problems: chi-square, student t test, ANOVA

Unit III

Correlation: Definition. Relationship (mutual dependence, cause and effect relationship), types. Methods of correlation: scatter diagram, correlation graph, Karl Pearson's coefficient of correlation. **Regression**: definition, regression equations, properties of regression lines, difference between correlation and regression.

Problems: Karl Pearson's coefficient of correlation, regression coefficient.

Unit IV

Bioinformatics: definition, scope. **Biological databases:** Nucleotide databases – NCBI, EMBL, Genbank and DDBJ. Protein databases – PDB, SWISS PROT. **Bioinformatics tools** – BLAST, FASTA.

Unit V

DNA sequence analysis: Global alignment, local alignment, gap penalty alignment, affine gap penalty alignment. Pairwise sequence alignment – dot matrix. Scoring matrices - PAM and BLOSUM. Multiple sequence alignment – sum of pairs method and progressive method.

Books for Reference:

1. Attwood T.K and D. J. Pary Smith. 2006. *Introduction to Bioinformatics* Pearson Education, Ltd.
2. Gurumani N. 2005. *An Introduction to Biostatistics.* 2nd edition. M.J.P. Publishers, Chennai.
3. Jin Xiong, 2006. *Essential Bioinformatics*. Cambridge University Press.
4. Rastogi, S.C., Namita Mendriata and Parag Rastogi, 2005. *Bioinformatics methods and applications*. 4th edition. PHI learning Pvt Ltd.
5. Satguru Prasad, 2003. *Fundamentals of Biostatistics*. 4th edition. Emkay Publications.
6. Veera Bala Rastogi, 2009. *Fundamentals of Biostatistics*. 2nd e dition. Ane Books Pvt. Ltd. Chennai.

Practical
Hrs / week:2
Biostatistics using excel

- **Descriptive statistics:** mean, median, mode, standard deviation, standard error, confidence interval.
- **Graphing data:** scatter graphs, bar graphs, error bars, lines
- **Association statistics:** Pearson coefficient, linear regression
- **Comparative statistics:** paired and unpaired t-test, Mann-Whitney U-test ANOVA
- **Frequency statistics:** χ^2 – test, χ^2 – test of association

Bioinformatics

- **W**eb browsing
- Retrieving data from biological database
- Bibliographic searching
- Sequence alignment and similarity searching
- Gene finding
- Protein prediction
- Structural Visualization of DNA, Proteins by using rcsb website.

Submission - Record Note Book

Books for Reference

1. Palanisamy, S. and M. Manoharan, 1994. *Statistical methods for biologists.* II Edition. Palani paramount publishers.
2. Murthy C.S. V. 2004. *Bioinformatics*. 1st edition. Himalaya Publishing House.

SEMESTER-I			
Core IV	**Histology, Embryology and Morphogenesis**		
19PBOCI4	**Hrs/week:5**	**Hrs/Semester : 75**	**Credits :4**

Vision: To have comprehensive idea on histology, reproductive biology and morphogenetic events in Angiosperms.

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Mission: This course is aimed at understanding the structure and functions of reproductive organs associated with seed development and the internal morphology of Angiosperms

Course Outcome

CO.No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	classify the shoot and root apical meristems	1,2	Ev
CO-2	explain the function and types of epidermal tissue systems	1,2	Ap
CO-3	Identify different types of cells through micro preparation and microscopic observation	4	An
CO-4	Give illustrious explanation and differentiate the primary and secondary structure of plant.	1,2	Un
CO-5	understand the mode of development of reproductive structures identify the different stages of dicot and monocot embryo	3,6	Ap
CO-6	explain the fertilization process including pollen pistil interaction and self incompatibility	1	Ev
CO-7	recognize different types of endosperm and their role in seed development	4	Re
CO-8	identify the different stages of dicot and monocot embryo	4	Ap

SEMESTER-I			
Core IV – Histology, Embryology and Morphogenesis			
Code:19PBOCI4	**Hrs/week:5**	**Hrs/Semester : 75**	**Credits :4**

Unit: I

Meristem- classification, shoot apical meristem and root apical meristem. Simple permanent tissues- parenchyma, collenchyma and sclerenchyma. Epidermal tissue system- Functions and types: Anomocytic, anisocytic, diacytic and paracytic. Trichomes - Stinging hairs, glandular hairs and peltate hair.

Unit: II

Complex permanent tissues- Components of xylem - Tracheids, Fibres, vessels, parenchyma. Wood anatomy: Xylem- Primary xylem, secondary xylem. tyloses-reaction wood, heart wood and sap wood, growth rings. Phloem- components, sieve elements, fibres, parenchyma. Cambium - origin, structure and function-seasonal activity of the cambium.

Unit: III

Secondary growth in dicot stem- *Polyalthia, Boerhaavia, Achyranthus, Antigonan,* dicot root - *Azadirachta.* Aerial root - *Tinospora* and *Vanda.* Dicot leaf - Dorsiventral and isobilateral leaf and monocot leaf.

Unit: IV

Microsporogenesis - Pollen wall, Pollen development Pollen storage, Pollen allergy,Megasporogenesis. Fertilization - barriers of fertilization. Endosperm - Types and haustoria. Organogenesis of dicot and monocot embryo. Apomixis and Polyembryony

Unit: V

Plant Morphogenesis - Definition – Polarity - as expressed in external and internal structures and in isolated cells. Symmetry - types. Differentiation as expressed in structure- effect of environment on differentiation - Factors controlling morphogenesis.

Books for Reference:

1. Bhojwani S S, S. P. Bhatnagar 2000. *The Embryology of Angiosperms* McGraw Hill
2. Catherine Easu, 1972, *Plant Anatomy*. 2nd Edition . Wiley Eastern Private ltd.
3. Chandurkar P. 1977. *Plant Anatomy* Oxford and IBH
4. Cutter, E.G. 1978.*Plant Anatomy*, Edward Arnold Publishers Ltd; London
5. Elezabeth G. Cutter, 1978- 2d ed., *Plant Anatomy*, Reading, Mass: Addison - Wesley Pub.Co.
6. Fahn A. 1990. *Plant Anatomy* Pergamon Press
7. Maheshwari P 1971 *An introduction to the Embryology of Angiosperms* Tata McGraw Hill Publishing Co New Delhi
8. Pandey B P 1978 *Plant Anatomy* S Chand Co
9. Pandey S N A Chadha. 2009. *Plant Anatomy and Embryology* Sangam Books Ltd

Practical
Hrs / week: 2
Anatomy

- Examination of different cells and tissue types
- Examination of Structural detail and identification of wood of some common Indian timbers (any four)
- Anomalous activity of cambium in *Polyalthia, Boerhaavia, Achyranthus, Antigonan,* dicot root -*Azadirachta.* Aerial root - *Tinospora* and *Vanda.*
- Double staining technique to study the stem and root prescribed in the syllabus.
- Study of leaf anatomy.

Microsporogenesis

- Pollen germination and pollen tube growth.
- Dissection of dicot embryo (globular, cordate and mature stage).
- endosperm haustorium from suitable seed.

Submission - Record Note Book

Books for Reference:

- Lamesh Rao and K E S Juneja, 1971. *Field Identification of fifty important timbers of India*, The manager of publications.

- Dnyansagar V R, 1986. *Cytology and Genetics*, Tata McGraw – Hill Publishing Company Ltd., New Delhi

Semester I			
Core IV	**Phytochemistry and Pharmacognosy**		
Course Code: 21PBOC14	**Hrs/week: 5**	**Hrs/Semester: 75**	**Credits: 4**

Objectives:

- Exploring the plant resources as pharmaceuticals and nutraceuticals.
- To acquire knowledge on identification, extraction and utilization of phytochemicalconstituents through teaching and training.

Course Outcomes:

CO. No.	Upon completion of this course, students will be able to	PSO's addressed	CL
CO-1	confirm the promising role of the phytoconstituents as cytotoxicity and substantiate them for the treatment of fatal diseases	8	Re
CO-2	understand the importance of secondary metabolites and relate them in treating the ailments	6	Un
CO-3	identify and categorize medicinal potential of herbs based on their chemical constituents and therapeutic applications	1	Un
CO-4	associate the medicinal compounds with their natural resources	2	An
CO-5	analyse of qualitative and quantitative medicinal compounds in herbal drug preparation.	2	An
CO-6	extract essential oils from natural resources and utilize them effectively as pharamaceuticals and cosmeticals	7,8	Av
CO-7	evaluate the purity of the drugs and able to detect adulterations and substitutions	2,4	Ev
CO-8	screen and elucidate various pharmacologically important phytoconstituents to ascertain its medical quality	5	Ev

Semester I			
Core IV	**Phytochemistry and Pharmacognosy**		
Course Code:21PBOC14	**Hrs/week: 5**	**Hrs/Semester: 75**	**Credits: 4**

UNIT I: Phytochemistry, Histochemistry, Biosynthetic pathway for secondary metabolites. Secondary metabolites - definition, classification, preliminary phytochemical screening. Glycosides: Definition, properties, classification, natural sources, pharmacological and toxicological effects of glycosides. Terpenoids- β-Sitosterol, Glycyrrhizin. Phenolics - Coumarins and Tannins. Steroids and alkaloids.

UNIT II: Flavonoids: Definition, properties, classification, natural sources and therapeutic applications offlavonoids. Medicinal uses of resins.

UNIT III: Extraction methods – Maceration, infusion, percolation, Decoction, soxlet extraction, supercritical fluid extraction, distillation, Counter-current Extraction, and cold extraction. Volatile oils - source, constituents, properties, extraction and utilization of Lemon grass oil, Vetiver oil, Clove oil and Eucalyptus oil. Intellectual property rights and trade of medicinal plants.

UNIT IV: Pharmacognosy: Definition, scope and applications of herbal medicine. Classification (morphological, therapeutic, chemical. and chemotaxonomic classifications): Collection and processing of crude drugs - adulteration of crude drugs. Pharmacognostical standards, synergy and polyvalent action of secondary metabolites.

UNIT V: Evaluation of crude drugs – Physico-chemical, organoleptic analysis. Botanical name, family, useful part, chemical constituents, adulterants and uses of the following drug Glycosides – Senna, Aloe, Digitalis, Liquorice; Terpenoids – Coriander, Fennel, Cinnamom; Alkaloids – Datura, Vinca, Pepper; Lipids - Castor, Neem, Sesame oil.

Books for Reference:

1. Agarwal S.S. and Paridhavi M. *Crude Drug Technology*, Hyderabad: Universities Press, 2007.
2. Evens W.C. *Pharmacognosy Medicinal and Aromatic Crops*, Singapore:Harcourt Brace and company Asian Pvt. Ltd., Universities press, 1987.
3. Farooqui A.A and B.S.Sreeramu B.S. *Cultivation of medicinal and aromatic crops*,Pune: Universities press, 2001.
4. Gurdeep Chatwal. *Organic Chemistry of Natural Products*, Mumbai: Himalaya ` Publishing house,1983.

5. Kokate C.K. Purohit A.P. and Gokhale S.R, *Pharmacognosy,* Pune: Nirali PrakshanPublishing House Ltd., 2004.
6. Tewari K.S, Vishogi N.K and Mehrotra S.N. *Text Book of Organic Chemistry* ,Uttaarpradesh:VikasPublishing House Ltd., 1998.
7. Trivedi P.C. *Medicinal Plant conservation and utilization,* Jaipur: Aavishkarpublishers,2004.
8. Trivedi P.C and Sharma N.K. *Ethomedicinal Plants,* Jaipur: Pointer Publishers , 2004
9. Wallis. *Text Book of Pharmacognosy*, New Delhi: CBS Publishers, 2003.
10. Yohanarasimban S.N. *Medicinal plants of India*, Jodhpur: 2004.

Practical: Hrs/Week: 2

- Morphology, histology and Powder characteristics, extraction and detection ofCinnamon,Clove, Fennel and Coriander.
- Isolation and detection of active principles:Caffeine from Tea dust Sennosides from Senna Curcumin from Turmeric
- Analysis of crude drugs by chemical tests for the detection of Glycosides - Senna, *Aloe*, LiquoriceTerpenoids – Coriander, Fennel, Cinnamom Alkaloids – *Datura, Vinca*, Pepper Lipids - Castor, Neem, Sesame, Groundnut oilResin – Ginger, Asafoetida. Volatile oil – Lemon and clove
- Distillation of Volatile oils and detection of phytoconstituents by TLS Jasmine and *Eucalyptus*

Books for Reference:

1. Kokate K.C and Gokhale S.B. Practical Pharmacognosy, Pune: 2008.
2. Chauhan M.G. and Pillai A.P.G, Microscopic Profile of Powdered Drugs Used in IndianSystems of Medicine. Jamnagar: *Institute of Ayurvedic Medicinal Plant Sciences*, 2005.

SEMESTER - IV			
Core Elective	**Entrepreneurship Botany**		
Course Code: 21PBOE41	**Hrs / Week: 4**	**Hrs /Semester: 60**	**Credits: 4**

Objectives:

- To able to understand the available natural resources and explore the greatest opportunity to increase and achieve sustainable competitive business advantage.
- To introduce organizations and agencies that can backup entrepreneurial initiatives.
- To expose students to various business opportunities emerging from the plant resources.

Course Outcomes:

CO.No.	Upon completion of this course, students will be able to	PSO addressed	C L
CO-1	adapt the methods of preservation of vegetables and fruits and identify the industrial scope of these resources	6	Un
CO-2	determine the quality of oil and prepare aesthetic product to find out good marketing capacity	6	Ap
CO-3	understand contemporary opportunities in business situations of value added products and develop skills needed to successfully convert them into entrepreneurial ventures	6	Un
CO-4	explore how the value added products can enhance the profitability of local farmers	6	Un
CO-5	acquire knowledge on primary forest product, wood products and secondary wood products and infer wood industries are major sector in many economy	2,6	Un
CO-6	able to differentiate natural and synthetic wood able to dictate the their pros and cons	3	Un
CO-7	develop ideas that will lead them to start their own business and enable them to be professionally competent	6	Ap
CO-8	able to start entrepreneurship (small scale/medium scale industries) , extract the financial support available and manage the targeted customers to enhance profitability	6	Re

SEMESTER - IV			
Core Elective	**Entrepreneurship Botany**		
Course Code: 21PBOE41	**Hrs / Week: 4**	**Hrs / Semester: 60**	**Credits: 4**

UNIT I: **Fruits and Vegetables preservation:** Fruits and vegetables preservation methods: Dehydrating, canning, salting, pickling and freezing. Fruits and Vegetables Products: tutti frutti, health drink, mango pulp, pickle, jam, jelly, amla candy and raisin. Factors influencing the growth of microorganisms in food. Sources of contamination of fruits. Types of spoilage.

UNIT II: **Bioventure:** Industry, overview of *Spirulina*, *Pleurotus* sajor-caju, *Ganoderma*, *Lentinus edodes*, drumstick and coconut. Straight Vegetable Oil (SVO) and Pure Plant Oil (PPO): methods and marketing. Fresh and dry flowers for aesthetics.,

UNIT III: **Value added plant based products:** Mushroom recipes (soup, omelette, pakoda and briyani). Preparation of - Coco peat, Banana products, Palm products, fiber products; Packing techniques – low, trans wrap, deep drawing, doy, sachet, top seal, vacuum: Cost management and estimation.

UNIT IV: **Commercial Wood products:** Natural durability of wood. Wood preservation: Nonpressure processes, Pressure process, Chemical processing of wood. Commercial wood species and identification, Synthetic woods, Marine plywood, Fuel wood, pulp and paper making woods, matchstickwood. Economic importance of pulp and wood

UNIT V: **Marketing and trade :** Steps for starting a small scale industry. Registration as SSI. Role of SIDBI. Advantages and problems of SSI. Government Schemes for SSI: NABARD, NCDC, MSME, NSIC. Marketing and entrepreneurship: different types of marketing, identification of types of consumer and their needs, building consumer relationship. FSSAI, FAO, ICDS, import and export businessdevelopment and strategies.

Text Books:

1. Bahi N. *Hand Book on Mushrooms*. New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd. Print, Fourth edition, 2015.
2. Desrosier N.W. and Desrosier J.N. *The Technology of Food Preservation*. New Delhi: CBS Publishers & Distributors. Fourth edition, 1987.
3. Narayanaswami R.V. and Rao K.N. *Outlines of Botany*, Chennai: India: Esvee Press, 1976.

Books for Reference

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