VIRUDHUNAGAR HINDU NADARS' SENTHIKUMARA NADAR COLLEGE
(An Autonomous Institution Affiliated to Madurai Kamaraj University)
[Re-accredited with 'A' Grade by NAAC]
Virudhunagar – 626 001.

Course Name: Bachelor of Science
Discipline: Botany
(For those who join in 2022 and after)
Eligibility for admission

Higher secondary students with Biology as Background

Duration of the course: Three years
Course Scheme:

Semester	Part	Subject	Hours	Credit	Int+Ext =Tot	Local	Regional	National	Global	Professional Ethics	Gender	Human Values	Environment & Sustainability	Employability	Entrepreneurship	Skill Development	Subject Code	Revised/ New/ No Change/ Interchanged. (If revised % of change)
I	Part 1	Tamil /Hindi	6	3	25+75=100		✔					✔					**U22PT11**	
	Part 2	English	6	3	25+75=100				✔	✓		✓					**U22PE11**	
	Core I	Core- I Algae and Bryophytes	6	4	25+75=100	✔		✔	✔							✓	**U22BYC11**	Revised 10%
	Core II-LAB - I	Core- LAB I: Algae and Bryophytes	2	1	40+60=100	✔		✔	✔							✓	**U22BYCP11**	Revised 10%
	SBE I - LAB	SBE 1:LAB-Horticulture	2	2	40+60=100	✔		✔	✔					✓	✓	✓	**U22BYSP11**	Revised 100%
	SBE II	SBE 2: Embryology of Angiosperms	2	2	25+75=100												**U22BYS11**	Revised 10%
	Allied	Anc.: General Chemistry I	4	3	25+75=100												**U22CHAY11** /U3CHA1Y	
	Allied	Anc.:LAB: Volumetric Analysis	2	-	-												---	----
	Part IV SLC*	Value Education	-	3	-												**U22VE11**	

II	Part 1	Tamil /Hindi	6	3	25+75=100		✔					✔					**U22PT21**	
	Part 2	English	6	3	25+75=100				✔	✓		✓					**U22PE11**	
	Core III	Core - III - Herbal Technology	6	4	25+75=100				✔					✓	✓	✓	**U22BYC21**	Revised 5%
	Core IV-	Core -LAB II: Herbal Technology	2	1	40+60=100				✔					✓	✓	✓	**U22BYCP21**	Revised 10%
	SBE III	SBE III: Plant Ecology and Phytogeography	2	2	25+75=100				✔						✔	✓	**U22BYS21**	Revised 10%
	SBE IV	SBE IV: LAB: Techniques in Cell Biology	2	2	40+60=100				✔					✓		✓	**U22BYSP21**	Revised 10%
	Allied	Anc.: General Chemistry II	4	3	25+75=100												**U22CHAY21** / U3CHA2Y	
	Allied Lab	Anc.: LAB: Volumetric Analysis	2	2	40+60=100												**U22CHAYP21** /U2CHA2YP	
	Part IV SLC*	Environmental Studies	-	2	25+75=100				✔								**U22ES21**	

Year	Part	Subject	Credit	Int=Total	Code
I & II	Part V	NSS/ NCC/ Physical Education - Sports/YRC/RRC	3	100=100	U2NS4/ U2NC4/ U2PS4/ U1YR4/ **U22RR4**

SEMESTER - I

Course Title : Core - I -ALGAE AND BRYOPHYTES	**Total Hours :90**
Course Code : U22BYC11	**Total Credits : 4**

Course Outcomes

COs	CO Statement
CO1	Provide basic knowledge and expose to the habit of algae
CO2	Know the systematics, morphology and structure of Algae.
CO3	Understand the life cycle pattern and uses of Algae.
CO4	Understand the morphological diversity of Bryophytes.
CO5	Familiarize the economic importance of the Bryophytes

Unit I **18-Hours**

Classification of algae by Fritsch; General characters of Algae; Pigmentation in Algae; Economic importance of Algae. Life cycle patterns (Haplontic and Diplontic) in Algae.

Unit II **18- Hours**

Study of the distribution, structure, reproduction and life history of the following Genera:

i) *Oscillatoria*
ii) *Caulerpa*
iii) *Vaucheria*

Unit III **18- Hours**

Study of the distribution, structure, reproduction and life history of the following Genera:

i) Pennate Diatoms
ii) *Sargassum*
iii) *Polysiphonia*

Unit IV **18- Hours**

General characters of Bryophytes; Classification of Bryophytes by Rothmaler (1951); Morphology, reproduction and structure of Gametophyte and Sporophyte of *Marchantia*

Unit V **18- Hours**

Morphology, reproduction and structure of Gametophyte and Sporophyte of the following Genera

i) *Anthoceros* ii) *Polytrichum;* Economic importance of Bryophytes.

Text Books:

1. Vasishta, B.R. Algae - S.Chand& Co. Ltd, New Delhi,
2. Pandey, B.P. College Botany - Algae, Fungi and Bryophyta Vol.1 S.Chand& Co. Ltd, Ram Nagar, New Delhi.
3. Vasishta B.R. et al, Bryophyta - S Chand & Co., Ltd, New Delhi, 2010.

Reference Books:

1. Fritsch, F.E, - The Structure and Reproduction of the Algae Vol.1 & II Vikas Publication, New Delhi,1956.
2. Bhatia, K.N, Treatise on algae - S.Chand& Co. Ltd, New Delhi, 1975.
3. Chopra, G.L, - A text book of algae, S.Nagin& Co, New Delhi, 1969.
4. Gupta,J.S, - A text book of algae, S.Nagin& Co, New Delhi, 1987.
5. Sharma, O.P., Text book of algae, Tata MvGraw - Hill publishing company Ltd, New Delhi, 2008.

6. Smith, G.M., Cryptogamic Botany Vol.11, Tata MvGraw - Hill publishing company Ltd, New Delhi, 1958.
7. Parihar N.S., An Introduction to Bryophytes Vol.1, Central book Depot, Allahabad, 1985.

E RESOURCES

1. https://www.biologydiscussion.com/algae/algae-definition-characteristics-and-structure-with-diagram/46727
2. https://www.onlinebiologynotes.com/algae-general-characteristics-classification/
3. https://www.easybiologyclass.com/characteristics-of-bryophytes-life-cycle-and-reproduction-of-phylum-bryophyta/

QUESTION BANK

1. Explain the different types of asexual reproduction in algae.
2. Briefly describe the economic importance of algae.
3. Write a short note on movement of trichome and vegetative reproduction of *Oscillatoria.*
4. Explain the internal structure of *Caulerpa* thallus and draw diagram
5. Give an account on the structure of diatoms.
6. Explain the internal structure of stipe and leaf of *Sargassum.*
7. Write an account on the outline classification of bryophytes by Rothmaler.
8. Describe the mature sporophyte of *Marchantia* and draw L.S.diagram.
9. Explain the vegetative reproduction of *Anthoceros*.
10. Describe the internal structure of *Polytrichum* aerial stem and draw diagram.
11. Describe the outline classification of algae proposed by Fritsch.
12. Write an essay on the life cycle of *Vaucheria.*
13. Briefly describe the life cycle of *Polysiphonia*.
14. Write an account on the internal structure of *Marchantia* thallus and draw diagram.
15. Describe the structure of mature *Polytrichum* capsule and draw L.S.

Core Paper – I – LAB: ALGAE AND BRYOPHYTES

Hours: 2 hrs / week **Subject Code: U22BYCP11** /U2BYC1P **Credit: 1**

Course Outcomes

COs	CO Statement
CO1	Develop skill in the micro preparations of the thallus of Algae and Bryophytes and make sketches of it
CO2	Understand the the thallus variations among Algae
CO3	Identify the reproductive structures among algae
CO4	Acquires knowledge on the morphological diversity of Bryophytes.
CO5	Compare and contrast the reproductive structures among Bryophytes

Algae: To study the external and internal structure of the thallus and the reproductive structure of the following groups:
Cyanophyceae – *Oscillatoria*.
Chlorophyceae – *Caulerpa*
Xanthophyceae – *Vaucheria*
Bacillariophyceae – Pennate diatom
Phaeophyceae – *Sargassum*
Rhodophyceae -*Polysiphonia.*

Bryophytes: Study of the external and internal structure of the Gametophyte and the structure of Sporophyte of the following groups:.

Hepaticopsida - *Marchantia*
Anthocerotopsida – *Anthoceros*
Bryopsida–*Polytrichum*

Practical Question Pattern

Time: 3 hours **Total marks: 60**

1. To make suitable temporary micro preparation of 'A' and 'B' Mount it in glycerin and submit the slides for valuation.
   Draw diagrams, identify and give reasons (2 X 15 = 30 Marks)
2. Write critical notes on C.D.E & F (4 X 5 - 20 Marks)
3. Submission of record note books (10 Marks)

Course Title : SKILL BASED I – LAB: HORTICULTURE	**Total Hours :30**
Course Code : U22BYSP11	**Total Credits : 2**

Course Outcomes

COs	CO Statement
CO1	Understand the usefulness of garden tools and implements in various horticultural operations.
CO2	Acquire sufficient knowledge in raising the nursery beds and horticultural operations of seeds raised in pots.
CO3	Expertise in vegetative propagation methods of important horticultural plants.
CO4	Self-reliant in the preparation of Farm yard Manure.
CO5	Development of skills in raising Indoor Garden plants.

List of Practical's

1. Study of garden tools and implements.
2. Preparation of seed bed /nursery bed.
3. Study of pots, potting, depotting and repotting.
4. Study on propagation of horticultural plants by cutting.
5. Study on propagation by horticultural plants by layering.
6. Study on propagation of horticultural plants by grafting.
7. Study on propagation of horticultural plants by budding.
8. Study on the layout of orchard
9. Preparation of hanging pots for vertical garden.
10. Preparation of farm-yard manure.
11. Study of Indoor plants.
12. Raising the kitchen garden.
13. Study of Bonsai plants.

Text books:

Kumar.N, Introduction to Horticulture, Rohini Agency, Nagercoil, 1990.
S.K. Pandey and C.S. Pandey ,Practical Manual on Fundamentals of Horticulture, Department of Horticulture, College of Agriculture, Jawaharlal Nehru KrishiVishwaVidyalaya, Jabalpur, MP,2018.

Reference Books:

1. Edmond et al., Fundamentals of Horticulture, Tata Mc Grew Hill Publishing Co., Mumbai, 1977.
2. GopalaSwamiIyyengar K.S, Complete Gardening, v.
3. Percy Lancaster, Gardening in India, Rakha Printers, New Delhi, 1977.
4. Hidson T. Hartmann & Dale E.Kester, Plant Propagation, Principles and Practices Prentice Hall of India., Delhi, 1976 .

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1.	https://agritech.tnau.ac.in/horticulture/horti_TNAU_techvideos.html
2	https://swayam.gov.in/nd2_cec20_ag11/preview
3	https://swayam.gov.in/nd2_cec20_bt13/preview
4	https://swayam.gov.in/nd1_noc20_ce11/preview
5	https://swayam.gov.in/nd1_noc19_ag04/preview
6	http://ugcmoocs.inflibnet.ac.in/ugcmoocs/view_module_ug.php/50
7	https://nptel.ac.in/courses/126/105/126105009/

Practical Question Pattern

Duration : 3 Hours Max.Marks : 60

1. Identify the Garden tool 'A' and 'B'(draw diagrams and write notes.) 2 x5 = 10
2. Write a procedure for raising nursery beds 10
3. Draw a layout of kitchen garden/ Orchard and write notes on it, 1 x10 = 10
4. Demonstrate any two vegetative propagation methods (cutting/layering/grafting/budding) 2 x 5 =10
5. Identify and write critical notes on 'C' and 'D'. 2 x 5 = 10
6. Submission of Record note 10 Marks

Key and Scheme of Evaluation

1. Any two frequently used Garden tools 2×5=10 marks
2. Nursery bed: Objective-1 mark, Materials required-1 mark, Types of nursery bed-2 marks, soil treatment-3 marks, seed bed treatment, seed treatment, sowing seeds-1 mark, care and handling of seedlings, potting, hardening, sale-3 marks
3. Lay out -5 marks; Notes-5 marks
4. Demonstration 2×5=10 marks
5. For C and D, (Identification 1 marks, notes-4 marks)
6. Submission of Record note 10 Marks

Course Title : SKILL BASED II: EMBRYOLOGY OF ANGIOSPERMS	**Total Hours :30**
Course Code : U22BYS11	**Total Credits : 2**

Course Outcomes

COs	CO Statement
CO1	Appreciate the Structure and development of microsporangium.
CO2	Understand the differences between monosporic, bisporic and tetrasporic embryo sac development.
CO3	Gain knowledge about double fertilization and endosperm types.
CO4	Get an insight about the Structure and development of dicot and monocot embryos.

CO5	Acquire basic knowledge about tissue culture and their significance.

Unit I **6-Hours**

Microsporangium structure; Tapetum- Types and functions; Microsporogenesis; Male gametophyte development (a brief account).

Unit II **6-Hours**

Megasporangium structure; Types of ovules; Megasporogenesis; Megagametogenesis– *Polygonum* type (Monosporic), *Allium* type (Bisporic) and *Fritellaria* type (Tetrasporic).

Unit III **6-Hours**

Fertilization; Path of pollen tube – types; Double fertilization; Endosperm types -Nuclear, cellular and helobial (a brief account).

Unit IV **6-Hours**

Structure of monocot and dicot embryo; Development of Dicot embryo (*Capsella*)and Monocot embryo (Luzula); Apomixis types.

Unit V **6-Hours**

Experimental Embryology: *In vitro* culture of embryo and anther; Polyembryony - causes, types and significance.

Text Books

1. Bhojwani S and S.P. Bhatnagar, The Embryology of Angiosperms, Vikas Publishing House (P) Ltd, 1998.
2. Maheswari P., Introduction to Embryology of Angiosperms, Mac Graw Hill, New York, 1985.

Reference Books

1. Davis C.L., Systematic Embryology of Angiosperms, John Wiley, New York, 1965.
2. Eames M.S., Morphology of Angiosperms, Mc Graw Hill New York, 1960.
3. Johri B.D., Embryology of Angiosperms, Springer - Verlag, Berlin, 1984.

e- Resources

1. https://en.wikipedia.org/wiki/Microsporangia
2.https://www.britannica.com/science/microsporangium
3.https://www.vedantu.com/question-answer/the-megasporangium-proper-of-an-angiosperm-ovule-class-11-biology-cbse-5fc7befc1474a12252736480
4. https://www.youtube.com/watch?v=xBoxtvCJ1_o
5.https://www.youtube.com/watch?v=GSYClHTgcIA
6.https://pubmed.ncbi.nlm.nih.gov/11337398/

Question bank

1. Describe the developmental stages of microsporogenesis.
2. Discuss the structure of the tapetum.
3. Give short notes on the development of the dicot embryo.
4. Write an account on development of bisporic embryo sac.
5. Write an essay on types of ovule.
6. Explain the types of endosperm.
7. Write an essay on anther culture.

8. Describe the structure of Megasporangium.
9. Write about the development of microsporangium in detail.
10. Write about triple fusion.

Part III — **Allied** Subject — **GENERAL CHEMISTRY-I for Biological Science**
Hours per week: 4 Subject Code: **U22CHAY11** /U3CHA1Y Credits: 3

Course Outcomes

CO1: Understand fundamental ideas about organic chemistry and isomerism

CO2: Preparation properties of hydrogen isotopes

CO3: Know the various types of colloids

CO4: Become professionally trained in the area of petrochemicals products and fertilizers

CO5: Understand importance of polymers in our daily life

Unit I: Basic concepts of organic chemistry **12 Hours**

Organic compounds — general properties and classification of organic compounds — functional groups — homologous series. Isomerism — structural isomerism and stereoisomerism — examples — Types of organic reactions: substitution, addition and elimination with examples.

Unit II: Hydrogen, Hydrides and Oxides **12 Hours**

Hydrogen:

Isotopes of hydrogen — preparation, properties and uses of heavy hydrogen — ortho and para hydrogen.

Hydrides:

Definition — classification of hydrides (Saline hydrides, Metallic hydrides, Molecular hydrides and Polymeric hydrides.) — Nature of hydrides and position of hydrogen in the periodic table.

Oxides:

Definition — classification — examples.

Unit III: Colloids **12 Hours**

Colloidal state of matter — various types — classification. Sols — dialysis — electroosmosis- electrophorosis — stability of colloids — protective action — Hardy Schulze law — gold number.

Emulsion: types of emulsion — emulsifier.

Gels: Classification, preparation — application of colloids.

Unit IV: Petroleum and fertilizers **12 Hours**

Refining of petroleum — composition and uses of petroleum fractions — thermal and catalytic cracking — octane number, cetane number — antiknocking agents - unleaded petroleum — petrochemicals — synthetic petrol.

Fertilizers — classification — important manures — manufacture and uses of urea — super phosphate — calcium ammonium nitrate (CAN) fertilizer.

Unit V: Polymers **12 Hours**

Polymers — general characteristics — plastics — elastomers and fibres — thermoplastics and thermosetting plastics - methods of polymerization — bulk — suspension and solution polymerization. Uses of polycarbonates — polyurethanes — epoxy resins and teflons (PTFE).

Text Books

Unit I

1. B.S.Bah1 and Arun Bah1, Advanced Organic Chemistry, S.Chand & Co., Ltd., 2008.

Unit II & III

1. B.R.Puri, L.R.Sharma and K.C.Kalia, Principles of Inorganic Chemistry, Villabh Publishing , 2003.

Unit-IV & V

1. M.K. Jain and S.C.Sharma, Modern Organic Chemistry, Vishal Publishing Co., 2011.

Reference Books

Unit I

1. M.K. Jain and S.C.Sharma, Modern Organic Chemistry, Vishal Publishing Co., 2011.

Unit II

1. R.D.Madan, Satya Prakash's Modern Inorganic Chemistry, S.Chand & Co., Ltd., 2008.
2. P.L.Soni and Mohan Katiyal, Textbook of Inorganic Chemistry, Sultan Chand & Sons, 2008.

Unit III

1. P.L.Soni, Textbook of Physical Chemistry, Sultan Chand & Sons, 2008.

Unit IV

1. K.S.Tewari, N.K.Vishnoi and S.N.Mehrota, A Text book of Organic Chemistry, 2nd revised edition, Vikas publishing house PVT LTD, New Delhi, 2005.

Unit V

1. P.L.Soni, Textbook of Physical Chemistry, Sultan Chand & Sons, 2008.

e-Resources:

1. https://www.priyamstudycentre.com/chemistry/organic-compound
2. https://youtu.be/XklMKuEAWdU
3. https://www.adichemistry.com/inorganic/hydrogen/H2/hydrogen.html
4. https://en.m.wikipedia.org/wiki/Isotopes_of_hydrogen
5. https://byjus.com/jee/colloids/
6. https://youtu.be/QAH-cCK1bS8
7. https://en.m.wikipedia.org/wiki/Petroleum_refining_processes
8. https://youtu.be/Dmn1X_z985A
9. https://www.britannica.com/science/polymer/Synthetic-polymers
10. https://youtu.be/t9UtS70GR44

SEMESTER - II

Course Title : Core - III - HERBAL TECHNOLOGY	**Total Hours : 90**
Course Code : U22BYC21	**Total Credits : 4**

Course Outcomes

COs	CO Statement
CO1	Impart knowledge on herbal medicine.
CO2	Develop a scientific attitude towards the study of herbal medicines.
CO3	Expose the students to different pharmaceutical industries and research institutes.
CO4	Develop skill in experiments and usage of equipments in herbal products preparation and their utilization.
CO5	Understand the ethical principles in herbal medicine research.

Unit I:
Introduction and scope of Ethnobotany and Ethnomedicine; Collection of Herbal products; Identification and authentication of herbs; Different dosage forms of crude drugs; Evaluation of different dosage forms; Drug Adulteration; Detection of Adulterants in crude drugs (Turmeric and Pepper).

Unit-II:
Herbal Care Products: Hair care - Formulation of Shampoos, Conditioners, Setting lotion, Hair creams, Hair dyes; Skin Care - Formulation of skin cleansers, moisturizers, acne products; Dental products - Oral rinses, Tooth powder and paste.

Unit-III
Preparation of Herbal medicine/ Products - Herbal Tea, Herbal Infusion, Herbal Tincture and Ointments, Eucalyptus oil, *Aloe vera* gel and Triphala Churna.

Unit IV
Organoleptic properties of crude drugs; Endomorphological characters of crude drugs: Trichomes, Various types of Stomata and their frequency, stomatal index, Vein islet and Vein termination number; Simple permanent tissues and Complex tissues.

Unit V
Pharmacognostical standardization of the following plants with special reference to anatomical features.
Stem- *Achyranthes aspera*, *Andrographis paniculata* and *Begonia malabarica*
Root –*Vetiveria zizanioides*
Leaf – *Piper betle*

Reference Books:
1. G.E.TreesenadW.C.Evans, Text book of Pharmacognosy, 15thedn, W.B. Saunders Edenburg, NewYork.
2. C.K.Kokate, Purohit, Ghokhale, Text book of Pharmacognosy, 5thednNiraliPrakassan. 1996.
3. Pharmacognosy, Phytochemistry, Medicinal Plants by Jean Bruneton, 2nd Revised

edition
4. Varro E. Tyler, Lynn R. Brady, James E. Robbers, Pharmacognosy,Intercept Ltd; Edward Praegner Claus.
5. Pulok K. Mukherjee, Quality Control and Evaluation of Herbal Drugs: Evaluating Natural Products and Traditional Medicine, Elsevier Science, United States, 2019.
6. Anil K. Sharma, Raj K. Keservani, Surya Prakash Gautam, Herbal Product Development: Formulation and Applications, Apple Academic Press, United States, 2020.

Course Title : LAB II- HERBAL TECHNOLOGY	**Total Hours : 30**
Course Code : U22BYCP21	**Total Credits : 1**

Course Outcomes

COs	CO Statement
CO1	Acquire knowledge on identification of. crude drug.
CO2	Understands the anatomical traits of the crude drugs.
CO3	Get trained in the preparations of herbal formulations
CO4	Develop skill in experiments and usage of equipments in herbal products preparation and their utilization.
CO5	Gain hands on training in pharmacognostic standardization of herbal drugs.

Practical Syllabus

1. Preliminary phytochemical screening of secondary metabolites (Alkaloids, Flavonoids, Phenols and Steroids).
2. Determination of ash values of drugs.
3. Study of stomatal frequency and index
4. Study of Vein termination number and vein islet number
5. Organoleptic properties of crude drugs
6. Determination of adulterants of selected crude drugs by Fluorescent analysis
7. Preparation of selected herbal based formulations
   i) Shampoos
   ii) Tooth powder
   iii)Hair oil
   iv) Bath powder
   vii) Decoction (Kasayam)
   viii) Churnam

8. Pharmacognostical standardization of the following plants with special reference to anatomical features.

Stem- *Achyranthes aspera, Andrographis paniculata* and *Begonia malabarica*
Root –*Vetiveria* sp.
Leaf – *Piper betle*

A field study / trip or research institute / universities / industrial visit should be carried out for atleast Three days.

HERBAL TECHNOLOGY

Duration - 3 Hrs **Practical Question Pattern** **Max.Marks = 60**

1. Study the Pharmacognostic features of given sample **A** 1 x 10 = 10
2. Identify the drug, observing the organoleptic properties for the given samples **B and C** 2 x 5 = 10
3. Detection of adulterants in the sample **D** by fluorescent analysis method 1 x 10 = 10
4. Preparation of any one herbal formulations as in the lot **E** 1x5 =5
5. Spot at sight F ,G and H 3x5 = 15
6. Submission of herbal product 5 Marks
7. Submission of Record note. 5 Marks

Key and Scheme of Valuation

1. Section -3 Marks Identification – 1 Marks, Diagram – 3 Marks, Notes – 3 Marks
2. Identification – 2 Marks, Notes – 3 Marks
3. Methodology – 5 Marks,Explanation – 5 Marks
4. Materials required - 1Mark, procedure – 4 marks
5. Identification – 1 Mark, Notes – 4 Marks
6. Submission of herbal products – 5 Marks
7. Submission of record – 5 Marks

Course Title : SKILL BASED III - PLANT ECOLOGY AND PHYTOGEOGRAPHY	**Total Hours :30 Hours**
Course Code : U22BYS21	**Total Credits : 2**

Course Outcomes

COs	CO Statement
CO1	Know about the biotic and abiotic components of ecosystems.
CO2	Understand the importance of biogeochemical cycles and flow of energy among various trophic levels.
CO3	Learn about the adaptations exhibited by the flora of various geographical areas
CO4	Know about the Ecological succession and its types.
CO5	Understand the phytogeographical regions of India.

Unit I **6-Hours**

Ecosystem: Components - Biotic and Abiotic; Types of ecosystem – Pond, forest and grassland.

Unit II **6- Hours**

Biogeochemical cycles –Carbon, Nitrogen and Phosphorus cycle; Food chain and food web; Ecological Pyramids - Pyramid of number, biomass and energy.

Unit III **6- Hours**

Study of the following groups with special reference to their morphological and anatomical adaptations - Hydrophytes, Xerophytes and Halophytes.

Unit IV **6- Hours**

Ecological succession – Primary and Secondary Succession; Types of Seres - Hydrosere and Xerosere; Global warming, Ozone depletion and acid rain.

Unit V **6- Hours**

Phytogeographic regions of India, Principles of Phytogeography. Age and area hypothesis; Alfred Wegener theory of Continental drift; Endemism.

Text Book:

1. Shukla, R.S. and P.S. Chandel, Plant Ecology and soil science, S.Chand& Co. Ltd. 1991.
2 Sharma P.D. Plant Ecology And Phytogeography, Rastogi Publications, 2019.

Reference Books:

1. Stanly, A. Claim, F. Fundamentals of Plant Geography. Harper and Brother, New York. 1859.
2. Odum, E.P. Fundamental of Ecology, W.B. SaunderColondon. 1959.
3. Ambast, R.S. A text book of Plant Ecology, Students Friends &C.Varanashi. 1969.
4. Bhatia and Sharma, Atreaties on Plant Ecology, Pradeep Publication, Jalendhur. 2005.

e- Resources

1. https://www.canr.msu.edu/resources/biotic-abiotic
2. https://www.britannica.com/science/biogeochemical-cycle
3. https://www.biologydiscussion.com/plants/morphological-and-physiological adaptations-of-hydrophytes/4583
4. https://biologydictionary.net/ecological-succession/
5.https://ccelms.ap.gov.in/adminassets/docs/26062020030446 phytogeographical_zones_in_india_notes.pdf

Question Bank

1. Explain the physiological adaptation of halophytes.
2. Enumerate the morphological adaptations of xerophytes.
3. Explain the morphological adaptations of hydrophytes
4. Write an essay on Xerophytes.
5. Describe the anatomical adaptations of Hydrophytes.
6. Give an account on halophytes.
7. Explain the succession on bare rocks.
8. Briefly explain the stages of Hydrosere.

Course Title : SKILL BASED IV – LAB: TECHNIQUES IN CELL BIOLOGY	**Total Hours :30 Hours**
Course Code : U22BYSP21	**Total Credits : 2**

Course Outcomes

COs	CO Statement
CO1	Know about the principles and working of microscopes
CO2	Develop skill to measure the objects and count the cells viewed under microscope.
CO3	Know the various structures present in the plants
CO4	Develop skill to preserve the plant material sections
CO5	Understand the various stages of cell division

List of Practicals

1. Study of Structure and working principles of Dissecting microscope, Compound microscope and Phase contrast microscope.
2. Study of Principles and calibrations of Ocular micrometer, Stage micrometer, Haemocytometer and Photomicrograph.
3. Identification of epidermal appendages - Glands, trichomes and stomatal types.
4. Study of simple and complex tissues through Maceration technique.
5. Study on ergastic substances – starch grains, raphides, druses and cystolith.
6. Histochemical localization of starch and lipid.
7. Staining (Hydrilla stem and Casuarina cladode).
8. Observation of stages in Mitosis and Meiosis.

Reference

1. Singh Dinesh, Tools and Techniques of Cell Biology Hardcover, Kalyani Publishers, New Delhi (2018).
2. Bruce Alberts *et al.* Molecular Biology of the Cell.4th Edition, Garland United States, (2004).
3. Hawes and Jeunemaitre,Plant Cell Biology: A Practical Approach, 2nd edition, Oxford University Press (2001).
4. Harris, N. and Oparka K. J. ,Plant Cell Biology (A Practical Approach),Oxford University Press, (1994).
5. Ambrose, E.J and Dorothy, M.E. , Cell Biology, ELBS CAMLOT Press, (1970).

Techniques in Cell Biology
Practical Question Pattern

Duration : 3 Hours **Max.Marks : 60**

1. Identify the type of epidermal appendage in the given material **'A' and 'B'** 2x5=10
   (Identify, draw diagrams and give reasons.)
2. Identify the type of stomata in the given material **'C'** 1 x 5 = 5
   (Identify, draw diagrams and give reasons.)
3. Carry out the maceration technique for given material **'D'** and identify any two types of cells of complex tissue. Give the procedure in flow chart, submit the slides for valuation. 1 x15 = 15
4. Make temporary preparation for **'E' and 'F'.** Identify and give critical notes on the type of ergastic substance present in it. Submit the slides for valuation. 2 x5=10
5. Identify and write critical notes on **'G' and 'H'**. 2 x 5 = 10
6. Submission of Record note 10 Marks

Key and Scheme of Evaluation

1. Any leaf/stem 'A' and 'B' 2x5=10 marks
(Identification – 1, diagram – 2, reasons – 2)
2. Any leaf'C' 1 x 5 = 5 marks
(Slide - 3, Identification – 1, diagram – 2, reason – 2)
3. Stem - Maceration technique for 'D' 15 marks
(Procedure – 5, Slide – 5, Identification – 5 (2x2 1/2)
4. Leaf/ Stem/grains 'E' and 'F' 2 x 5= 10 marks
(Identification – 1, slide – 2, notes – 2)
5. Microscopes/Ocular micrometer/Stage micrometer/ Haemocytometer - 'G' and 'H'.
(Identification – 1, Notes – 4) 2 x5 =10marks
6. Submission of Observation book 10 marks

SEMESTER II

Part III — Allied subject II — GENERAL CHEMISTRY —II for Biological science

Hours per week: 4 **Credits:** 3 **Subject Code: U22CHAY21/ U3CHA2Y**

Course Outcome:

Co1: Understand various chromatography technique

Co2: Know about proteins and Vitamins

Co3: Understand the importance of significant numbers and various methods for expressing

Co4: Concentration of the solution.

Co5: Comprehend the method of estimation carbon, hydrogen, sulphur and halogens.

Co6: Ability to draw the structure and explain the applications of dyes**.**

Unit I: Chromatography **12 Hours**

Basic principles of common types of chromatography — Paper chromatography — thin layer chromatography — column chromatography — Ion exchange chromatography. Applications of each technique.

Unit II: Protein, Nucleic acids, Hormones and vitamins **12 Hours**

Definition — classification of proteins — colour reaction of proteins — Nucleic acids — nucleoside — nucleotides and general structure of DNA. Hormones — classification — structure of some sex hormones — oestrone and testosterone. Vitamins — classification of vitamins — sources and deficiencies of Vitamins A, B1, C, D, E and K (structural elucidation not required).

Unit III: Basic chemical calculation **12 Hours**

Significant numbers — SI Units— calculation of formula weight–understanding Avogadro number — mole concept — mole fraction of the solvent and solute — conversion of grams into moles and moles into grams — stoichiometric equations.

Methods of expressing concentration of the solution: normality, molarity and molality — calculations based on principle of volumetric analysis.

Unit IV: Detection and estimation of elements **12 hours**

Detection of nitrogen, halogens and sulphur (Lassaigne's test) — estimation of carbon and hydrogen (Liebig's method), sulphur and halogens (Carius method) — Determination of empirical and molecular formula — structural formula.

Unit V: Dyes **12 Hours**

Dyes - colour and constitutions — chromophore - auxochrome theory - classification of dyes by structure and methods of applications - preparation of methyl red, Bismarck brown, Malachite green, Indigo and Congo red.

Text Books

Unit – I

1. B.R.Puri, L.R.Sharma and S.Pathania, Principles of Physical Chemistry, Vishal Publishing Co., 2004.

Unit – II

1. M.K. Jain and S.C.Sharma, Modern Organic Chemistry, Vishal Publishing Co., 2011.

Unit – III

1. P.L.Soni and Mohan Katiyal, Textbook of Inorganic Chemistry, Sultan Chand &Sons, 2008.

Unit – IV

1. P.L.Soni, Textbook of Organic Chemistry, Sultan Chand & Sons, 2008.

Unit – V

1. M.K. Jain and S.C.Sharma, Modern Organic Chemistry, Vishal Publishing Co., 2011
2. B.S.Bahl and Arun Bahl, Advanced Organic Chemistry, S.Chand & Co., Ltd., 2008.

Reference Books

Unit - I

1. B.R.Puri, L.R.Sharma and S.Pathania, Principles of Physical Chemistry, Vishal Publishing Co., 2004.

Unit - II

1. P.L.Soni, Textbook of Organic Chemistry, Sultan Chand & Sons, 2008.

Unit - III

1. K.S.Tewari, N.K.Vishnoi and S.N.Mehrotra, textbook of organic Chemistry,Vikas house PVT Ltd, New Delhi, 1998.

Unit - IV

1. B.S.Bah1 and Arun Bah1, Advanced Organic Chemistry, S.Chand & Co., Ltd., 2008.

Unit - V

1. R.D.Madan, Satya Prakash's Modern Inorganic Chemistry, S.Chand & Co., Ltd., 2008.

e-Resoursces

1. https://microbenotes.com/chromatography-principle-types-and-applications/
2. https://youtu.be/8m7CeObsTIk
3. https://youtu.be/AUMJwjLXh1M
4. https://simple.m.wikipedia.org/wiki/Vitamin
5. https://en.m.wikipedia.org/wiki/Significant_figures
6. https://chemistryonline.guru/normality-molarity-molality-3/
7. https://youtu.be/aH-Cjyn8V_Y
8. https://www.adichemistry.com/organic/basics/analysis/lassaignes/lassaignes- test.html
9. https://youtu.be/MhBEj32wZqE
10. https://www.britannica.com/technology/dye

Part III — Allied Chemistry Lab I — LAB: VOLUMETRIC ANALYSIS
Hours per week: 2 Subject Code: U22CHAYP21 /U2CHA2YP **Credits: 2**

Course Outcome:

Upon completion of this lab, the students will be able

CO1: Understand the apparatus used in volumetric analysis

CO2: The precautions to using equipment

CO3: Acquire the knowledge about the standard solutions

CO4: Prepare standard solutions

CO5: Acquire the knowledge about strength of the solutions

(Exam to be conducted at the end of even Semester)

A double titration involving making up of the solution to be estimated or single titration involving making up of the solution to be estimated and the preparation of standard solution.

(a) Acidimetry and alkalimetry

Standard solutions

1. Titration between a strong acid and strong base.
2. Titration between a strong acid and weak base.
3. Titration between a weak acid and strong base.

(b) Permanganometry

1. Titrations between potassium permanganate and oxalic acid, ferrous sulphate and ferrous ammonium sulphate.

(c) Iodometry

1. Titrations between sodium thiosulphate with potassium permanganate and potassium dichromate (demonstration only)

VIRUDHUNAGAR HINDU NADARS' SENTHIKUMARA NADAR COLLEGE

(An Autonomous Institution Affiliated to Madurai Kamaraj University)

[Re-accredited with 'A' Grade by NAAC]

Virudhunagar – 626 001.

Course Name: Bachelor of Science

Discipline : Botany

CHOICE BASED CREDIT SYSTEM

(For those who joined in June 2018 and after)

Course scheme

Semester	Part	Subject	Hours	Credit	Int+Ext=Tot	Local	Regional	National	Global	Professional Ethics	Gender	Human Values	Environment & Sustainability	Employability	Entrepreneurship	Skill Development	Subject Code	**R**evised / **N**ew / No **C**hange / **I**nterchanged & Percentage of revision
III	Part I	Tamil / Hindi	6	3	25+75=100		✔					✔					U3PT3/ U1PH3	Revised / 60%
	Part II	English	6	3	25+75=100				✔	✓		✓					U3PE3	Revised / 90%
	Core - III	Fungi, Lichens and Plant pathology	4	4	25+75=100				✔							✓	U3BYC3	Revised / 20%
	Core Practical - III	LAB: Fungi, Lichens and Plant Pathology	2	**1**	40+60=100				✔								U3BYC3P	Revised / 20%
	Allied (a) – III	General Chemistry-III	4	4	25+75=100				✔								U2CHA3Y	No – Change
	Allied (a) – Practical III	LAB: Organic Qualitative Analysis	2	-	-				✔								---	
	Allied (b) – I	Invertebrata	4	4	25+75=100												U3ZYA3X1	No Change
	Allied (b) – Practical I	LAB: Invertebrata and Chordata	2	-	-												---	
IV	Part I	Tamil /Hindi	6	3	25+75=100		✔					✔					U2PT4/ U1PH4	Revised / 60%
	Part II	English	6	3	25+75=100				✔	✓		✓					U3PE4	Revised / 65

	Core – IV	Pteridophytes and Gymnosperms	4	4	25+75=100				✔							✓	U2BYC4	Revised / 20%
	Core Practical – IV	LAB: Pteridophytes and Gymnosperms	2	1	40+60=100				✔								U2BYC4P	No-Change
	Allied (a) – IV	General Chemistry-IV	4	4	25+75=100												U2CHA4Y	No Change
	Allied (a) - Practical IV	LAB: Organic Qualitative Analysis	2	2	40+60=100												U2CHA4YP	No Change
	Allied (b) - II	Chordata	4	4	25+75=100											✓	U3ZYA4X2	Revised / 5 %
	Allied (b) - Practical II	LAB: Invertebrata and Chordata	2	2	40+60=100											✓	U3ZYA4PX	Revised / 10 %

Year	Part	Subject	Hour	Credit	Int=Total	Code
I & II	Part V	NSS/ NCC/ Physical Education – Sports/YRC/RRC	-	1	100=100	U2NS4/ U2NC4/ U2PS4/ U1YR4/ U1RR4

Self-Learning Courses:

Subject	Semester	Credit	Ext =Tot	Subject Code
Human Rights	IV	5	100 = 100	U1CSL41

Third Semester

CORE - III - Fungi, Lichens and Plant Pathology

Hours/week: 4 **Subject Code:** U3BYC3 **Credit: 4**

Course Objectives:

- To study the morphology and reproduction of major classes of fungi.
- To study the fungal, bacterial and viral diseases and control measures in plants.
- To know about the classification of fungi and lichens.
- To acquire knowledge about the role of fungi.
- To make the students know about the types, structure and reproduction in lichens.

UNIT - I **(12-hours)**

Fungi

General characters and Classification of fungi based on Alexopoulos(1962). Contributions of Edwin John Butler & C.V.Subramaniyan. Role of fungi as food, medicine, growth regulators and in industries. Vesicular arbuscular mycorrhiza (VAM) in agriculture.

UNIT - II **(12-hours)**

Occurrence, structure, reproduction and life cycle of the following:

a) Phycomycetes - *Rhizopus*
b) Oomycetes - *Albugo*
c) Basidiomycetes - *Agaricus*
d) Deuteromycetes - *Alternaria.*

UNIT - III **(12-hours)**

Lichens

General characters, types – crustose, foliose and fruticose. Somatic structures – Soredia and isidia. Structure and reproduction of *Usnea.* Economic importance of Lichens.

Unit - IV **(12-hours)**

Plant Pathology

Classification of plant diseases. Symptoms of plant diseases - bacterial, fungal and viral. Plant protection - Principles , Physical, Chemical and Biological methods.

UNIT - V **(12-hours)**

Study of the Etiology, symptoms and control measures of the following diseases:

a) Citrus canker
b) Tikka disease of Groundnut
c) Red rot of Sugarcane
d) Sheath blight disease of Paddy.
e) Bunchy top of Banana.

- **A field study/trip or research institute/Universities/Industrial visit should be carried out for atleast two days.**

Text Books:

- Text book of Fungi O P Sharma, 1998. Tata McGrew Hill Publishing Co. New Delhi.
- Plant Pathology - B P Pandey, 2001. S. Chand & Company.

Reference Books:

- Dubey, R.C. and Maheswari, D.K. 2000. A Text Book of Microbiology. S.Chand & Co Ltd. New Delhi.

- Kumar, H.D. and Swati Kumar, 1999. Modern Concepts of Microbiology. Vikas Publishing House Pvt, Ltd. New Delhi.
- Mehrotra, R.S. 2000. Plant Pathology. Tata McGrew Hill Publishing Co. New Delhi.
- Rangaswamy, G. 1992. Disease of crop plants in India. Prentice Hall of India, New Delhi.
- Vashishta, P C and Gill, P C. 1998. Plant Pathology. Pradeep Publications, Jalandhar.
- Introductory Mycology - C.J Alexopoulos, Charles W. Mims, M.Blackwell,2002. 4th Edition. Wiley India Pvt. Ltd. New Delhi.
- Plant Pathology - R.S Mehrotra, 2nd Edition, 2003. Tata McGrew Hill Publishing Co. New Delhi

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Core Practical - III- LAB: Fungi, Lichens and Plant Pathology

Hours/week: 2 **Subject Code:** U3BYC3P

Credit: 1

Practical Syllabus

- Observation of slides - *Rhizopus, Albugo, Agaricus, Alternaria.*
- Study of external and internal structure of basidiocarp of *Agaricus.*
- Study of the infected region of the *Arachis hypogea* leaves and *Amaranthus* leaves.
- Study of external and internal morphology of *Usnea* thallus.
- Study of the etiology of bacterial, fungal and viral disease prescribed in the syllabus

A field study / trip or research institute / Universities / Industrial visit should be carried out for atleast two days.

Part III – Allied Paper III – General Chemistry-III

Hours per week: 4 **Credits: 4** **Subject Code: U2CHA3Y**

Objectives:

- To gain basic knowledge of photochemistry and nuclear chemistry.
- To understand the concept data analysis.
- To acquire basic knowledge in water quality parameters.
- To study the versatility of insecticides

Unit – I Photochemistry (12 Hours)

Introduction to photochemistry – Difference between thermal and photochemical reactions – Laws of photochemistry (Grotthus – Draper & Stark-Einstein) Quantum yield – Photosynthesis, Photophysical process (Fluorescence & Phosphorescence) – Photosensitization – Definition and examples for chemiluminescence and Bioluminescence –

Unit-II Nuclear chemistry (12 Hours)

Composition of the nucleus – Nuclear forces – mass defect – binding energy – Nuclear stability – Law of radioactive disintegration: Soddy's group displacement law. Nuclear fission – nuclear fusion – Principle of atom bomb and hydrogen bomb. Applications of radioactive isotopes in medicinal, agriculture, industry and Carbon dating.

Unit-III Error analysis (12 Hours)

Evaluation of analytical data: Idea of significant figures – its importance. Accuracy – methods of expressing accuracy. Error analysis – types of errors – minimizing errors. Precision –

methods of expressing precision: Mean, Median, Mean deviation, Standard deviation and Confidence limit. Method of least squares.

Unit-IV Water quality parameters and their determination (12 Hours)

Physical, chemical and biological standards – significance of the contaminants over the quality and their determinations - Electrical conductivity - turbidity - pH, total solids, TDS - alkalinity - hardness - chlorides – Dissolved oxygen (DO) – Biochemical oxygen demand (BOD)- Chemical oxygen demand (COD) – Total organic carbon (TOC) - nitrate – sulphate, fluoride.

Unit-V Insecticides (12 Hours)

Introduction - Classification of insecticides - Inorganic insecticides- Organic insecticides: Natural (Nicotine, Pyrethrum & Rotenone) and synthetic Insecticides (o-dichlorobenzene, DDT, DDD, DDE & BHC) – Common insecticides (Baygon & Mesurol) – Insect attractants and repellents.

Reference Books

Unit-I

1. K.K.Rohatgi Mukherjee, Fundamentals of Photochemistry, New Age International private limited, 2000.
2. N.J. Turro, Modern Molecular Photochemistry, Benjamin Cummings, 1965.

Unit-II

1. R.D.Madan, Satya Prakash's Modern Inorganic Chemistry, S.Chand & Co. Ltd., New Delhi, 2008.
2. Puri, Sharma and Kalia, Principles of Inorganic Chemistry, S.Chand & Co., 2008.
3. P.L. Soni, Textbook of Inorganic Chemistry, Sultan Chand & Sons, 2008.

Unit-III

1. R.D.Madan, Satya Prakash's Modern Inorganic Chemistry, S.Chand & Co. Ltd., New Delhi, 2008.
2. Puri, Sharma and Kalia, Principles of Inorganic Chemistry, S.Chand & Co., 2008.

Unit-IV

1. A.K.De, Environmental Chemistry (seventh edition), New age International Publishers New Delhi 2010.
2. M.M.Uppal, A Text Book of Engineering Chemistry, Khanna Publishers, New Delhi 1988.

Unit-V

1. K.S.Tewari, N.K.Vishnol and S.N. Mehrotra A Text Book of Organic Chemistry, 2nd revised edition.
1. P.L.Soni and H.M.Chawla, Text Book of Organic Chemistry, Sultan Chand & Sons, New Delhi, 2007.

INVERTEBRATA

ALLIED I: 1 **CREDITS: 4** **Subject Code: U3ZYA3X1**

Contact hours per Week – 4 hours
Contact hours per Semester – 60 hours

Course Outcome:

CO 1: The outcome of the course 'Invertebrata' is to understand the systemic position and classification principles of various groups of animals.

CO 2: To impart knowledge about general characteristics of various Phyla belongs to Invertebrata.

CO 3: To acquire knowledge about single cell animals and sponges, understand the structure, reproduction and life cycle of Obelia, realize the Coral reef role in the marine environment.

CO 4: To build up the familiarity among the students regarding earthworm morphology and anatomical system.

CO 5: To Pass on information about Structure of Pila and know about the torsion in Mollusk.

UNIT – I (12 hours)

Taxonomy

Levels of organization: grades, symmetry and body cavity- General characters of invertebrates – principles of classification– Binomial nomenclature- Rules of nomenclature.

UNIT – II (12 hours)

Protozoa & Porifera

Protozoa:

General characters– *Paramecium*- General organization and Conjugation- Protozoan parasites and their control (*Plasmodium* Life cycle in detail)

Porifera:

General characters- *Olynthus*– General organization- Economic importance of sponges.

UNIT – III (12 hours)

Coelenterata & Helminthes

Coelenterata:

General characters - *Obelia* – Structure of Obelia colony, Medusa and Nematocyst-
-Coral reefs –types, formation and significance

Helminthes:

General characters- *Taenia solium* (Tape worm) – External characters, Excretory system, Reproductive system- parasitic adaptations.

UNIT – IV (12 hours)

Annelida & Arthropoda

Annelida:

General characters- Earthworm– morphology- Setae, Excretion, Nervous system and Reproductive system- Metamerism in Annelids.

Arthropoda:

General characters- *Penaeus monodon* (Marine Prawn)– Appendages- Economic importance of insects (beneficial insect: Honeybee - Harmful insect: mosquito).

UNIT – V **(12 hours)**

Mollusca & Echinodermata

Mollusca:

General characters- *Pila globosa*– morphology, Respiratory system, Sense organs: osphradium and statocysts - Torsion in Gastropods - Process and advantages.

Echinodermata:

General characters- Star fish– morphology, Water vascular system- Larval forms of Star fish.

Text book:

1. N.C. Nair, S. Leelavathy, N. Soundarapandian, T. Murugan and N. Arumugam A Text Book of Invertebrates- Saras publications, Nagercoil, 2015.

Reference books:

1. T.C. Majupuria, Invertebrate zoology, Pradeep Publications, Jalandar, 2001.
2. M. Ekambaranatha Iyer and T.N. Ananthakrishna, A Manual of zoology, S. Viswanathan Publishers, Chennai, 2003.
3. E. L. Jordon and P.S. Verma S., Invertebrate Zoology, Chand and Company Ltd., New Delhi, 2005.
4. R. L. Kotpal, Invertebrare Zoology, Third Edition, Rastogi Publications, Meerut. 2005.
5. P.S. Dhami and J.K. Dhami R., Invertebrate Zoology, Chand and Company, New Delhi, 2003.

Fourth Semester

Core-IV Pteridophytes and Gymnosperms

Hours/week: 4 **Subject Code:** U2BYC4 **Credit: 4**

Course objectives:

- To understand the salient features and the importance of Pteridophytes and Gymnosperms
- To provide knowledge about the structure and reproduction in Pteridophytes and Gymnosperms.
- To know about the types and methods of fossilization.
- To impart knowledge about the fossil ferns and Gymnosperms.

Unit - I **(12-hours)**

Pteridophytes

General characters, Classification of Pteridophytes (G.M Smith). Economic importance of Pteridophytes.

Structure and reproduction of the following: (Except developmental stages)

a) Psilotales - *Psilotum*
b) Lycopodiales - *Lycopodium*

Unit - II **(12-hours)**

Structure and reproduction of the following: (Except developmental stages)

a) Equisetales - *Equisetum*
b) Gleicheniales - *Gleichenia*
c) Marsiliales - *Marsilea*

Unit - III **(12-hours)**

Gymnosperms

Classification of Gymnosperms by C.J. Chamberlain (1935). Structure and reproduction of *Pinus* (Except developmental stages)

Unit - IV **(12-hours)**

Structure and reproduction of *Gnetum* (Except developmental stages)
Economic Importance of Gymnosperms.

Unit - V

Paleobotany **(12-hours)**

General classification of geological time scale - Contributions of Birbal Sahni - Fossilization and types of fossils.

Brief study of the following

a) Psilotales - *Rhynia*
b) Cycadofilicales - *Lyginopteris*
c) Lepidodendrales - *Lepidodendron*

A field study / trip or research institute / Universities / Industrial visit should be carried out for atleast two days.

Text Books:

- Pandey B.P(2006). A text book of Botany (Bryophyta, Pteridophyta & Gymnosperms)
- Parihar, N.S(1965) - An Introduction to Embryophyta Vol II (Pteridophytes)
- Vashishta.P.C,1999,Gymnosperms. S.Chand & Company Ltd,New Delhi.
- Vashishta.P.C,1999,Pteridophytes. S.Chand & Company Ltd,New Delhi.

Reference Books:

- Sporne. K.R (1975) - Morphology of Pteridophytes.
- Chopra, G.L (1992) - Gymnosperms.
- Sporne K.R (1965) - The Morphology of Gymnosperms.
- Shukla and Misra (1986) - Essentials of Paleobotany.

Core Practical - IV - LAB: Pteridophytes and Gymnosperms

Hours/week: 2 **Subject Code:** U2BYC4P **Credit: 1**

1. Study the external morphology and internal structure of - *Psilotum, Lycopodium , Equisetum, Gleichenia, Marsilea*
2. Study the external morphology and internal structure of - *Pinus* and *Gnetum*
3. Prepare permanent slides (two)
4. Observe the fossil slides prescribed in the syllabus.

- ***A field study / trip or research institute / Universities / Industrial visit should be carried out for atleast two days***.

Allied Paper IV – General Chemistry – IV

Hours per week: 4 **Credits:4** **Subject Code: U2CHA4Y**

Objectives:

- To study the mode of action of drugs.
- To learn some chemicals day to day life utility.
- To acquire basic idea about the alkaloids and Terpenoids.

- To gain knowledge about the soil chemistry.
- To study the role of catalyst in chemical reactions.

Unit-I Drugs (12 Hours)

Chemotherapy –Anaesthetics – General anaesthetics and local anasethetics (definition and example only). Sulpha drugs (Sulphonamides) - Synthesis and applications of sulpha drugs (sulphanilamide, sulphapyridine - sulphathiazole and sulphadiazine) – Mode of action of sulpha drugs. Antibiotics: Penicillin –Streptomycin- Chloramphenicol (Chloromycetin) – Structure and mode of action of these drugs (synthesis not required).

Unit-II Chemistry of some useful compounds (12 Hours)

Preparation and uses of CH_2Cl_2, $CHCl_3$, CCl_4, CF_2Cl_2, Bleaching powder, Phenyl, Talcum powder, Shampoo, Shave lotion, Soaps and Detergents.

Unit-III Alkaloids & Terpenoids (12 Hours)

Alkaloids: Definition, sources, classification, structure (structural elucidation not required) and biological activities of coniine, piperine, quinine and morphine.

Terpenoids: Classification – Isoprene rule - Structure of geraniol, citral, menthol and limonene (Structural elucidation not required)

Unit-IV Soil chemistry (12 Hours)

Introduction – Modern system of soil classification – Properties of soils (soil texture) - Soil water – Types of soil water, soil temperature – Soil colloids (Silicate Clay, Oxide Clay and Humus)- Soil minerals (Primary and secondary minerals, Feldspar, Mica, Silica, Carbonates and Phosphates)- Soil pH, acidity and alkalinity- Effect of pH on plants.

Unit-V Adsorption & Catalysis (12 Hours)

Adsorption

Definition of various terms (adsorption, absorption, adsorbent, adsorbate, sorption & desorption) – Difference between adsorption and absorption – Factors influencing adsorption of gases on solids – Physical and chemical adsorption – Adsorption isotherm - Langmuir & Freundlich adsorption isotherm (derivation not required) – Application of adsorption.

Catalysis

Definition – Characteristics of catalyst – Promoters and poisons – Enzyme catalysis – Acid- base catalysis and Autocatalysis – Applications of catalysis.

Unit-I

1. B.S.Bahl and Arun Bahl, A Text Book of Organic Chemistry, S.Chand & Company Ltd, Ram Nagar, New Delhi,16th edition, 2002.
2. K.S.Tewari, N.K.Vishnol and S.N. Mehrotra A Text Book of Organic Chemistry, 3rd revised edition, 2006.
3. P.L.Soni and H.M.Chawla, Textbook of Organic Chemistry, Sultan Chand & Sons, New Delhi, 2007.

Unit-II

1. R.D.Madan, Satya Prakash's Modern Inorganic Chemistry, S.Chand & Co. Ltd., New Delhi, 2008.
2. Puri, Sharma and Kalia, Principles of Inorganic Chemistry, S.Chand & Co., 2008.
3. P.L. Soni, Textbook of Inorganic Chemistry, Sultan Chand & Sons, 2008.
4. P.K.Chattopadhyay, Modern Technology of Soaps, Detergents and Toiletries, 2nd edition, 2005.
5. B.K.Sharma, Industrial Chemistry, Goel Publishing House, 6th edition, 1994.

Unit-III

1. B.S.Bahl and Arun Bahl, A text book of Organic Chemistry, S.Chand & Company Ltd, Ram Nagar, New Delhi,16th edition, 2002.
2. K.S.Tewari, N.K.Vishnol and S.N. Mehrotra A Text Book of Organic Chemistry, 3rd revised edition, 2006.
3. P.L.Soni and H.M.Chawla, Textbook of Organic Chemistry, Sultan Chand & Sons, New Delhi, 2007.

Unit-IV

1. Jaya shree Ghosh, Fundamental Concept of Applied Chemistry S.Chand & Company LTD, 2008.

Unit-V

1. Arun Bahl, B.S. Bahl and G.D. Tuli, Essentials of Physical Chemistry, S.Chand & Co., 2004.
2. Puri, Sharma and Pathania, Principles of Physical Chemistry, Vishal Publishing Co., 2005.

LAB: Organic Qualitative Analysis

Hours per week: 2 **Credits: 2** **Subject Code: U2CHA4YP**

Objectives:

- To gain the fundamental knowledge about organic analysis

Organic analysis

Analysis of an organic compound containing one or two functional groups and confirmation by the preparation of solid derivative / colour reaction – acids, phenols, aldehydes, ketones, esters, nitro compounds, primary amines, amides, anilides, aliphatic diamide and monosaccharides.

CHORDATA

ALLIED I: 2 **CREDITS: 4** **Subject Code: U3ZYA4X2**

Contact hours per Week – 4 hours

Contact hours per Semester – 60 hours

Course Outcome:

CO 1: To understand the basis of chordates and their evolutionary importance.

CO 2: To gain knowledge about the reproductive and respiratory mechanisms and their regulations.

CO 3: To discuss the importance of identification of poisonous and nonpoisonous snakes and their classification system.

CO 4: To explain the mechanisms of adaptation of flight of birds and their taxonomic importance.

CO 5: To highlight the mechanism of reproduction in mammals and adaptation of aquatic mammals.

UNIT – I **(12 hours)**

Prochordates and Chordates

General characters of Prochordates and Chordates– classification of chordates upto class level - Amphioxus: External morphology, feeding, Digestive and excretory system.

UNIT – II **(12 hours)**

Pisces and Amphibia

General characters of Pisces - Shark - morphology, Digestive and reproductive system- Accessory respiratory organ in fishes.

General characters of Amphibia- Frog- respiratory system- Parental care in Amphibia.

UNIT – III **(12 hours)**

Reptilia

General Characters of Reptiles– Calotes: External morphology and digestive system - Identification of Poisonous and non-poisonous snakes- biting Mechanism, First aid - Non-poisonous snakes: Natrix and Dryophis– Poisonous snakes: Indian Cobra, Krait.

UNIT – IV **(12 hours)**

Aves

General characters of class Aves – Pigeon: External morphology - Flightless Birds and their distribution- Migration of birds- Flight adaptations of birds.

Unit – V **(12 hours)**

Mammalia

General characters of mammals – Rabbit: morphology, Reproductive System, Sense organs (eye)- Dentition in mammals - Adaptation of aquatic mammals.

Text Books:

1. Ekambaranatha Ayyar, M., and Ananthakrishna, T.N. A manual of Zoology. Volume II, Chordata; S. Visvanathan (Printers and Publishers) Pvt Ltd. Chennai. (2005)
2. Kotpal, R.L –Modern text book of Zoology Vertebrates. Third Edition, Rastogi Publlishers, Ganapathi Shivaji road, Meerut. (2005)

Reference Books:

1. The Chordates –II International Edition, Alexander, R. MCN. Cambridge University press, New Delhi. (1981).
2. Chordate Zoology. E.L. Jordon and P.S. Verma – S. Chand and Company Ltd, New Delhi. (2006).

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LAB: INVERTEBRATA AND CHORDATA

(To be done at the end of the II semester)

ALLIED I LAB: 1 **CREDITS: 2** **Subject Code: U3ZYA4PX**

Contact hours per week 2 hours.
Contact hours per semester 30hours

DISSECTION

Earthworm: Nerve ring and nerve cord, Body Setae mounting (Demonstration)

MOUNTING

Honey Bee: Mounting of mouth parts and sting of honey bee, mosquito

SPOTTERS

INVERTEBRATES

Protozoa **:** Amoeba, Paramaceium, Euglena and Plasmodium.

Coelenterata: Obelia colony, Obelia medusa, Jelly fish, Sea anemone.
Helminthes : Tape worm, Liver fluke, Redia and cercaria larva.
Nematodes : Ascaris and Wuchereria
Annelida : Earthworm, Nereis, Leech
Arthropoda : Prawn, Zoea larva, Mysis larva, Centipede.
Mollusca : Pila, Pearl oyster
Echinodermata: Star fish oral and aboral view

CHORDATES

Prochordata: Amphioxus, Balanoglossus
Pisces : Echeneis, Hippocampus, Eel, Catla, Tilapia.
Amphibia : **B**ufo, Rhacophorus, Salamander.
Reptilia : Cobra, Krait and Viper, Dryophis and Ptyas.
Aves : Pigeon, Archaeopteryx.
Mammalia : Bat, Loris.

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Program Name: Bachelor of Science
Discipline : Botany
CHOICE BASED CREDIT SYSTEM
(For those who joined in June 2018 and after)
Course scheme

Semester	Part	Subject	Hour	Credit	Int+Ext= Total	Local	Regional	National	Global	Professional Ethics	Gender	Human Values	Environment & Sustainability	Employability	Entrepreneurship	Skill Development	Subject Code	Revised/ New/ No Change/ Interchanged If Revised % of Change
V	Core V	Biochemistry and Biotechniques	5	5	25+75=100				✔							✔	U3BYC51	5 %
	Core VI	Genetics and Plant Breeding	5	5	25+75=100				✔							✔	U3BYC52	10 %
	Core VII	Taxonomy of Angiosperms	4	4	25+75=100				✔							✔	U3BYC53	25 %
	Core Practical V	Lab: Biochemistry and Biotechniques, Genetics and Plant Breeding & Taxonomy of Angiosperms	6	3	40+60=100				✔							✔	U3BYC5P	15 %
	Allied (b) - III	Cell Biology, Developmental Biology, Physiology, Immunology and Evolution	4	4	25+75=100				✔								U3ZYA5X3	Revised / 40%
	Allied (b) – Practical III	LAB: Cell biology, Developmental biology, Physiology, Immunology and evolution & Commercial Zoology	2	-	----				✔								---	
	Skill V – General Studies	Employability Skills	2	2	25+75=100									✔			U1PS51	No change
	NME I	Plant Resources and Utilization	2	2	25+75=100				✔					✔	✔		U3BYN51	10 %

VI	Core VIII	Plant Physiology	5	5	25+75=100				✔							✔	U3BYC61	5 %
	Core IX	Microbiology and Biotechnology	5	5	25+75=100				✔					✔		✔	U3BYC62	New Paper
	Core X	Organic Farming	4	4	25+75=100				✔					✔	✔	✔	U3BYC63	New Paper
	Core Practical VI	Lab: Plant Physiology, Microbiology & Biotechnology and Organic Farming	6	4	40+60=100				✔					✔	✔	✔	U3BYC6P	New Paper
	Allied (b) - IV	Commercial Zoology (Vermiculture, Apiculture, Aquaculture and Poultry Science and Dairy Farming)	4	4	25+75=100												U3ZYA6X4	Revised / 20%
	Allied (b) - Practical IV	LAB: Cell biology, Developmental biology, Physiology, Immunology and evolution & Commercial Zoology	2	2	40+60=100												U3ZYA6PX	Revised / 20%
	Skill VI	Project work	2	2	50+50=100				✔					✔	✔	✔	U1BY6PR	New Paper
	NME II	Mushroom Cultivation	2	2	25+75=100				✔					✔	✔		U3BYN61	2%

Self-Learning Course:

Subject	Semester	Credit	Ext =Tot	Subject Code
Food science and Nutrition	IV	5	100 = 100	U1BYSL51

SEMESTER - V
Core V - BIOCHEMISTRY AND BIOTECHNIQUES

Contact Hours per week: 5 hrs **Sub code: U3BYC51**
Contact Hours per Semester: 60 hrs **Credit: 5**

Course Outcomes:
Students, after successful completion of the course, will be able to

- Gain knowledge on fundamental biochemical principles such as bonding structure and function of biomolecules.
- Get insight about biomolecules.
- Acquaintance with basics of enzymes, classification and mechanism of enzyme action.
- Gain proficiency in handling basic instruments and laboratory techniques.

Unit I **12 Hrs**

Basic concepts of atoms, Bonding in biomolecules (Covalent and non-covalent interactions, Hydrogen bond, Electrostatic interactions, Hydrophobic interactions, Vander Waal's forces and their significance); Isomerism and its types; structure and properties of water and its biological significance; Henderson-Hasselbalch equation, Buffers (inorganic and organic) and their importance.

Unit II **12 Hrs**

Carbohydrates – classification, structure, properties and significance of mono, di and polysaccharides. Glucose, Sucrose, Starch and Cellulose - structure and function. Lipids - fatty acids (saturated and unsaturated fatty acids); Classification of lipids (simple, compound and derived lipids) and biological role of lipids.

Unit III **12 Hrs**

Amino acids - classification (based on polarity) - physical and chemical properties. Protein structure (primary, secondary, tertiary and quaternary structures), Protein classification (based on structure), properties and functions of protein.

Unit IV **12 Hrs**

Enzymes – classification, properties, mechanism of enzyme action, factors affecting enzyme action, enzyme inhibition (reversible;competitive and non-competitive;irreversible) – Co-enzymes and iso-enzymes, Enzyme regulation. Vitamins – classification (fat-soluble and water-soluble) and its deficiencies.

Unit V **12 Hrs**

Colorimeter: Working principle (Beer Law and Lambert's law) and applications; pH meter – Working Principle and application, Chromatography and its principle – Paper chromatography , Thin layer chromatography and Column chromatography and its application. Centrifuge – principle (sedimentation coefficient – Svedberg's unit), types of centrifuge and their uses.

Text Books:

- Jain, J. L. 2000. Fundamentals of Biochemistry. S. Chand & Co. Ltd., New Delhi.
- Satyanarayana, U. and U. Chakrapani, 2013. Biochemistry. Elsevier Co-published with Books and Allied Press, New Delhi
- Lea, P.J and Leegood, R.C. 2001. Plant Biochemistry and Molecular Biology, 2nd Ed. John Wiley and Sons Ltd., England.

Reference Books:

- Conn, E.E., Stump, P.K., Bruening and Doi, R.H. (2001).Outlines of Biochemistry, John Wiley & Sons, New York
- Nelson, D. L. and M. M. Cox. 2008. Lehninger Principles of Biochemistry. W. H. Freeman Publishers, New York.
- Berg, *J. M., J. L.* Tymoczko and L. *Stryer*, 2010. Biochemistry, W. H. Freeman Publishers, New York.

Core VI - GENETICS AND PLANT BREEDING

Contact Hours per week: 5 hrs **Sub code: U3BYC52**
Contact Hours per Semester: 60 hrs **Credit: 5**

Course Outcomes:

Students, after successful completion of the course ,will be able to

- Understand the natural hereditary mechanisms in living organism
- Impart knowledge in basic concepts at molecular level of organism
- Learn the principles and practices in plant breeding techniques.

Unit I **12 Hrs**

Mendel's law of inheritance. Monohybrid and Dihybrid cross- test cross- Interaction of gene- Incomplete dominance , Codominance. Complementary gene, Epistasis: dominant and recessive, Multiple alleles (ABO blood group), Polygenic inheritance.

Unit II **12 Hrs**

Linkage and crossing over – significance- linkage in maize, molecular mechanism of crossing over. Types of sex determination in plants. Extra chromosomal inheritance (plastid inheritance in *Mirabilis*). Gene mutation- induced and spontaneous – molecular basis- mutagens

Unit III **12 Hrs**

DNA as genetic material- structure of DNA and types of DNA - DNA replication (three types). RNA- types, structure and functions. Prokaryotic transcription and translation. Operon concept.- Lac operon

Unit IV **12 Hrs**

Eukaryotic genome organization–Genetic recombination in bacteria – Transformation, Transduction and conjugation.

Unit V **12 Hrs**

Principles of Plant breeding-Selfing and crossing techniques, Hybridization. Methods of selection - Mass, Pedigree, Bulk and back cross. Polyploidy and its applications, Heterosis. Mutation breeding-, applications of mutation breeding.

Institutional Visit to Sugarcane breeding institute, Tamilnadu Agricultural University, IFGTB,Coimbatore /any research institute.

Text Books:

- Veer Bala Rastogi. A Textbook of Genetics. Published by Kedar Nath and Ram Nath.
- Verma P.S and V.K Agarwal 1991.Cytology (Cell Biology and Molecular Biology). S. Chand & Co, New Delhi.
- B.D.Singh, Plant Breeding: Principles and Methods, Kalyani Publishers,2009.

Reference Books:

- Burns, G.W.1980 – The Science of Genetics, Collier acillan, New York
- Gardnet, E.J Simmons and Snustad, D.P 1985 – principles of Genetics. Edition 8, John Wiley & Sons, New York.
- Strickberger, M.W. 1999. Genetics. Prentice hall of India Pvt Ltd, New Delhi.
- Singh P.D 2000 Fundamentals of genetics. Kalyani Publishers, New Delhi.
- Gupta, P.K 2002. Genetics. Rastogi Publishers, Meerut.
- Mirta,S. 1994. Genetics. Rastogi publishers, Meerut.

Core –VII TAXONOMY OF ANGIOSPERMS

Contact Hours per week: 4 hrs **Subject Code: U3BYC53**
Contact Hours per semester: 60 hrs **Credit: 4**

Course outcomes:

Students, after successful completion of the course,will be able to

- Get interest in admiring the variations in the vegetative and floral morphology of Angiosperms.
- Understand the importance of herbarium and BSI.
- Understand the floral arrangement to identify the plant species.
- Gain knowledge on the economic importance of Angiospermic plants.

UNIT I **12 Hours**

Importance of Taxonomy, Classification – Linnaeus classification, Bentham and Hooker'sclassification & Engler and Prantl classification – APG system of classification (In brief) – Herbarium techniques, BSI ; Botanical nomenclature - ICBN Principles and rules.

UNIT II **12 Hours**

Vegetative morphology: Leaves – Phyllotaxy, simple and compound, Shape, Venation and its types, Stipules. Reproductive morphology - Inflorescence types: Racemose, Cymose and Special types. Perianth, Calyx, Corolla (arrangement and aestivation) Androecium (cohesion and adhesion) , Gynoecium (structure and placentation types). Types of fruits.

UNIT III **12 Hours**

Study of the following families with special reference to morphology and economic importance – Annonaceae, Nymphaeaceae, Malvaceae, Meliaceae, Caesalpiniaceae,.

Unit IV **12 Hours**

Study of the following families with special reference to morphology and economic importance – Rubiaceae, Asteraceae, Apocynaceae, Acanthaceae, Verbenaceae

UNIT V **12 Hours**

Study of the following families with special reference to morphology and economic importance – Nyctaginaceae, Euphorbiaceae, Amaryllidaceae, Arecaceae, Poaceae

***A minimum of three days Field trip to Hill stations / Research Institutes**

Text Books:

- Dutta A.C (2008) Botany for degree students (6th edition). Oxford university press
- Pandey, S.N and Misra, S.P (2008) Taxonomy of Angiosperms. Ane books India, New Delhi.

Reference Books:

- George H.M. Lawrence (1964) Taxonomy of vascular plants, Oxford and IBM publishing co. New Delhi.
- Michael G.Simpson (2019) Plant Systematics (third edition),Academic Press
- Vasishta P.C (2001) Taxonomy of Angiosperms. S.Chand & company, New Delhi
- Pandey, B.P (2001) Taxonomy of Angiosperms. S.Chand & company, New Delhi

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LAB - V: BIOCHEMISTRY and BIOTECHNIQUES, GENETICS and PLANT BREEDING & TAXONOMY OF ANGIOSPERMS

Sub code: U3BYC5P **Credit: 3** **Hours/week=6**

PRACTICAL SYLLABUS

Course Outcomes:

- Gain proficiency in handling basic instruments and laboratory techniques.
- Understand the natural hereditary mechanisms in living organisms.
- Learn the principles and practices in plant breeding techniques.
- Understand the floral variations among plant species

BIOCHEMISTRY and BIOTECHNIQUES

- Determination of the pH of different solutions
- Titration of weak acid with a strong base
- Determination of Rf value of amino acids by paper chromatography
- Verification of Beer's and Lambert's law
- Estimation of starch in plant tissue by gravimetric method
- Estimation of amino acid by Ninhydrin method
- Estimation of protein by Lowry et al method method
- Qualitative tests for carbohydrates, proteins, amino acids and lipids

GENETICS AND PLANT BREEDING

- Solving Problems related to Monohybrid, Dihybrid crosses, Test cross, Incomplete dominance, co-dominance
- Problem related to complementary gene, epistasis,
- Study of polygenic inheritance for quantitative traits in plants such as length of pods and leaves, number of seeds in fruits
- Emasculation techniques, various breeding experiments.

TAXONOMY OF ANGIOSPERMS

Refer angiosperm plants to their respective families giving reasons.

- Describe the plant in technical terms. (Draw labelled diagrams of the floral parts including longitudinal sections of the flower, construct the floral diagram and give the floral formula.)
- Identify the local angiosperms / from the herbarium collected during the field study.
- Preparation of Herbarium. (15 plants)
- **Go for field study under supervision for minimum of three days to acquaint with the flora of Hills.**

Botany Major Practical Question

BIOCHEMISTRY AND BIOTECHNIQUES, GENETICS AND PLANT BREEDING & TAXONOMY OF ANGIOSPERMS

Time: 3 hours Max marks: 60

1.	Taking a lot from the set of experiments, submit the procedure, tabulate and interpret the results.	10 marks
2.	Solve the given genetic problems **A** & **B** (2X5=10)	10 marks
3.	Refer specimen **C** to its respective family giving reasons (sketches not required)	5 marks
4.	Describe specimen D in technical terms; draw labeled sketches of floral parts including L.S of the flower. Construct the floral diagram and write the floral formula	8 marks
5.	Write genus and family of the given specimen **E**	2 marks
6.	Identify, draw diagrams and write notes on **F, G** and **H**	3X 5 = 15marks
7.	Submission of Record note books	10 marks

Key & Scheme of Valuation

1. Biochemistry experiments: Procedure 4 marks, Table, Interpretation of results 6 marks. 10 marks
2. Genetics problems: value as whole (5 marks) 2 x 5 = 10 marks
3. C - Taxonomy: family identification - 1 mark, reasoning - 4 marks 5 marks
4. D - Taxonomy: Technical description of flower - 3 marks, L.S flower diagram - 2 marks, floral diagram - 2 marks and floral formula - 1 mark 8 marks

5. E - Taxonomy: Genus - 1 mark, family - 1 mark 2 marks
6. Spotters : F – from Biochemistry & Bio-techniques
   G & H – from Genetics & Plant Breeding
   Identification - 1 mark, Diagrams - 2 marks, Notes - 2 marks 3 X 5 = 15 marks

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CELLBIOLOGY, DEVELOPMENTAL BIOLOGY, PHYSIOLOGY, IMMUNOLOGYAND EVOLUTION

Contact hours per Week – 4 hours **Subject Code: U3ZYA5X3**
Contact hours per Semester – 60 hours **Credits: 4**

Objectives

- To understand various structure and functions cell and organelles
- To Study about the development and function of various organs in animal body
- To find out ancestral development in earth

Unit I (**12 hours)**

Cell Biology

Structure and functions of animal Cell- cell membrane- cell organelles- mitochondria, endoplasmic reticulum, Golgi complex, ribosomes. Cancer- site of infection- types- causes – treatment.

Unit II (**12 hours)**

Developmental Biology

Structure of sperm and ovum in frog- Gametogenesis-cleavage, blastulation and gastrulation. Human reproductive system, birth control –Test tube baby.

Unit III **(12 hours)**

Physiology

Digestion and absorption of Carbohydrates, proteins and lipids- Structure of Nephron. Neuron and conduction of Nerve impulse.

Unit IV (**12 hours)**

Immunology

Types of immunity (Innate and Acquired immunity) - Lymphoid organs (Primary and Secondary)– Immunoglobulin-IgG- Antigen antibody reactions.

Unit V (**12 hours)**

Evolution

Paleontological evidences for evolution- Lamarckism- Darwinism- Modern synthetic theory, Allopatric and sympatric speciation- cultural evolution of man.

Text Books

1. Cell Biology, Molecular biology, Genetics, Immunology, And Biotechnology, Arumugam. N. (2007), Saras publication, Nagercoil.
2. Physiology, Developmental biology, Biochemistry, Microbiology and Evolution, Arumugam. N., (2007), Saras publication, Nagercoil.

Reference Books

1. Chordate embryology, PS Verma & VK .Agarwal, (2012), Chand Publication
2. Fundamentals of biochemistry for medical students, Ambika Shanmugam (2007),
3. Evolution, Veera bala Rastogi-.
4. Animal Physiology, Rastogi-
5. Immunology –Ivan Roitt

SBE- EMPLOYABILITY SKILLS

Contact Hours per week: 2 **Subject Code: U1PS51**
Contact Hours per Semester: 30 **Credits: 2**

Course Outcomes :

Students, after successful completion of the course ,will be able to

- Enrich the Employability Skills by imparting Reasoning skills, Aptitude skills and General Knowledge.

Unit I : Quantitative Aptitude – Averages, Percentage, Profit & Loss, Ratio & Proportion, Time & Work, Time & Distance, Clock. **6 hours**

Unit II : Quantitative Aptitude –Problems on Ages, Boat & Stream, Simple Interest, Compound Interest, Area, Partnerships. **6 hours**

Unit III: Reasoning **6 hours**

Verbal Reasoning - Analogy, Classification, Series, Coding & Decoding, Blood Relations, Direction Sense Test.

Unit IV: Reasoning **6 hours**

Verbal Reasoning - Number Test, Ranking & Time sequence Test, Alphabet Test, Logical Venn Diagrams.

Unit V: General Knowledge **6 hours**

Abbreviations, Acronyms, Famous Personalities, Important Days, Capital Cities, Currencies, Books and Authors, Inventions.

Reference Books:

1. Verbal & Non Verbal Reasoning - R.S.Aggarwal
2. Quantitative Aptitude - R.S.Aggarwal
3. Subjective & Objective Quantitative Aptitude - R.S.Aggarwal
4. Malayala Manorama Year Book, 2014

NME - PLANT RESOURCES AND UTILIZATION

Contact Hours per week: 2 hrs **Sub code: U3BYN51**
Contact Hours per Semester: 30 hrs **Credit-2**

Course outcomes:
Students, after successful completion of the course,will be able to

- Develop their understanding on Plants morphology and Uses.
- Increase the awareness and appreciation of plants & plant products encountered in everyday life.
- Develop a basic knowledge of taxonomic diversity of plants and its economic importance.
- Understand core concepts of Economic importance of Plants and their value added processing plants in human use.

Unit I **6 Hrs**

Brief Study of the following economic produces with special reference to botanical name, family, morphology of the useful parts and uses; Cereals – Paddy, Wheat; Pulses - Red gram, Black gram; Fruits - Banana, Mango.

Unit II **6 Hrs**

Brief Study of the following economic produces with special reference to botanical name, family, morphology of the useful parts and uses. Spices and Condiments: Garlic, Cardamom, Pepper and Ginger; Dyes – Indigo; Nuts – Cashew and Almond

Unit III **6 Hrs**

Brief Study of the following economic produces with special reference to source, family, morphology and uses Latex - rubber, Oil- Gingelly, Coconut; Tannins - Myrobalan, Resins and gums - Oleoresin, Canada balsam and Turpentine

Unit IV **6 Hrs**

Brief Study of the following economic produces with special reference to botanical name, family, morphology and uses: Essential oil- Lemon grass oil, sandalwood oil; Wood -Teak wood, neem and rose wood; Medicinal- Common periwinkle and Amla

Unit V **6 Hrs**

Methods of Processing: Tea, Coffee, Extraction of Eucalyptus oil, preparation of Aloe gel; Importance of Ethnobotany in Indian context.

Text books: H.D.Kumar .Economic Botany.2003.Macmath Publications.New Delhi

Reference Books: Dr.V.Singh .C.Pandey• &J.K.Jain. Economic Botany.2012.Rastogi publications. New Delhi.

Semester – VI

CORE VIII - PLANT PHYSIOLOGY

Contact Hours per week: 5 hrs **Sub code: U3BYC61**
Contact Hours per Semester: 60 hrs **Credit-5**

Course Outcomes:

Students, after successful completion of the course, will be able to

- Impact an insight into the various plant water relations.
- Understand the mechanism of various metabolic processes in plants.
- Acquire basic knowledge about growth and development in plants.
- Equip students with skills and techniques related to plant physiology so that they can design their own experiments.
- Take students to higher levels of learning about the mineral nutrition in plants.

Unit I **12 Hrs**

Absorption of water – imbibition, diffusion, osmosis, plasmolysis. Mechanism of water absorption – active and passive. Ascent of sap – path of ascent of sap, mechanism of ascent of sap, physical force theories. Transpiration –Types - stomatal,cuticular and lenticular. Mechanism of stomatal movement,Transpiration a necessary evil. Factors affecting transpiration. Guttation

Unit II **12 Hrs**

Mineral nutrition – Macro (N,P,K &Mg) and micro(Bo,Cu &Zn) its physiological role and its deficiency symptoms. Sand culture, Hydroponics, and Aeroponics. Photosynthesis – photosynthetic unit. Site of photosynthesis. Light reaction – two photosystems, Electron transport ,Photophosphorylation – cyclic and non-cyclic. Dark reaction – Calvin cycle, Hatch and Slack pathway, C_2 cycle.

Unit III **12 Hrs**

Respiration – types of respiration – aerobic and anaerobic, site of respiration, respiratory substrates. Mechanism of respiration – Glycolysis, Kreb's cycle, Electron transport and oxidative phosphorylation. Nitrogen fixation – symbiotic and asymbiotic

Unit IV **12 Hrs**

Physiology of flowering – Photoperiodism, cryptochrome, Phytochrome. Vernalization. Plant growth hormones – physiological effects of auxins, gibberellins, cytokinins and ethylene. Seed dormancy – Factors affecting seed dormancy. Methods of breaking seed dormancy.

Unit V **12 Hrs**

Plant movements : Autonomic – ciliary, amoeboid, cyclosis Paratonic – phototaxis, chemotaxis, thermotaxis and thigmotaxis. Tropic movements – phototropism, geotropism, hydrotropism. Movement of Curvature – nutation and nastic movement (nyctinastic, seismonastic, thigmonastic)

Text Books:

- S.N. Pandey and B.K. Sinha, Plant physiology –Vikas Publishing house 1999.
- Subash chandra dutta ,Plant physiology- New Age International (P) Limited, Publishers; First edition (2007)
- S.K.Verma, Text Book of Plant Physiology –S.Chand and company,New Delhi, 2003.

Reference Books:

- R.K. Sinha , Modern Plant physiology –Narosa Publishing house New Delhi, 2004.
- Devlin and Witham, Plant Physiology – CBS Publishers and Distributors, 1999
- Salisbury and Ross ,Plant Physiology –CBS Publishers and distributors ,Delhi 1995.

CORE-1X MICROBIOLOGY AND BIOTECHNOLOGY

Contact Hours per week : 5 hrs **Sub code: U3BYC62**
Contact Hours per Semester : 60 hrs **Credit : 5**

Course Outcomes:

Students, after successful completion of the course ,will be able to

- Develop their knowledge about microbes.
- Create awareness on sewage water treatment, preservation of food products and antibiotics
- Build up the knowledge on tissue culture and its applications.
- Understand the multidisciplinary approaches in the field of biotechnology.

Unit I **12 Hrs**

Historical background of Microbiology - Bergey's classification of Bacteria - General and morphological characteristics of Bacteria – Ultra structure of bacterial cell. Reproduction in Bacteria, Growth curve, Methods of measurement of bacterial growth, Nutritional types of bacteria.

Unit II **12 Hrs**

Viruses - Characteristics, Classification of virus based on Symmetry and Nucleic acids. Structure of TMV. Structure and reproduction of Bacteriophage -T_4 Phage.

Unit III **12 Hrs**

Sewage treatment – oxidation pond and trickling filter. Spoilage of food (Perishable and non perishable)and preservation techniques, Microbiology of milk and milk products, Pasteurization of milk. Disinfectants. Structure and mode of action of Antibiotics - Penicillin, Streptomycin and Tetracycline.

Unit IV **12 Hrs**

Scope – definition, multidisciplinary approach of biotechnology, Introduction to gene cloning, Vectors: Plasmids – pBR322: Bacteriophage vectors- M13.Ti plasmid based vectors Restriction endonucleases, DNA ligases, DNA Polymerase (Taq), Reverse Transcriptase. Blotting techniques. – southern and western. Tissue culture: Protoplast culture, micro propagation, embryo culture. Artificial seeds. Application of Tissue culture.

Unit V **12 Hrs**

Methods of gene delivery - direct gene transfer using PEG, Electroporation, Biolistics, Microinjection and Liposome mediated. Identification of recombinants - Insertional inactivation of antibiotic resistance marker gene-Inactivation of Lac Z gene, Selection of recombinant phages, Colony Hybridization.

Text books:

- Powar, C.B and M.E. Daginawala – General Microbiology Vol- 1 and Vol-II 2011
- A.S Rao. Introduction to Microbiology. 2012
- P.D Sharma – Microbiology and Plant pathology. 2009
- R.C. Dubey, 2006A text Book of Biotechnology , - S. Chand & Company Ltd, Ram Nagar, New Delhi.
- Kalyan Kumar De., 1992 .Plant tissue culture, - New central book Agency P .Ltd, Calcutta.
- Shanmugavel,P.2005.Principles of Bioinformatics. Pointer Publishers,Jaipur,India

References books:

- Pelczar, M.J. Chan, E.C.S. and Krieg, N.R. 1993 – Microbiology- Concepts and application. Mc Grew Hill, Inc. New York.
- R.C Dubey and D.K. Maheshwari. A text book of Microbiology- S.Chand &Company Ltd, New Delhi.
- Kumar, H.D. and Swati Kumar, 1999. Modern Concepts of Microbiology. Vikas Publishing House Pvt.Ltd. New Delhi.
- Brown, C.M, Campbell, I. and Priest, F.G, 1990. Introduction to Biotechnology. Blackwell Scientific publications Oxford, London.
- Brown, T.A, 1999. Genomes. John Wiley & Sons. Newyork.
- Chawla, H.S. 2000. Introduction to plant biotechnology. Oxford & IBH Publishing Co. Pvt.Ltd. New Delhi.
- Dixon, R.A and Gonzales, R.A (Eds.) 1994. Plant Cell Culture- A Practical Approach. Oxford University Press, Newyork.

Core X - ORGANIC FARMING

Contact Hours per week : 4 hrs **Sub code: U3BYC63**
Contact Hours per Semester : 60 hrs **Credit : 4**

Course Outcomes:
Students, after successful completion of the course, will be able to

- Know the values of organic waste and their utilization by adopting different technologies.
- Assess the nutritive value of organic products.
- Get awareness on organic agriculture.

Unit I **12 Hrs**

Farming, organic farming, concept and development of organic farming. Principles of organic farming & Need for organic farming, Agencies and institutions related to organic agriculture, Types of organic farming, Biodynamic farming, Benefits of organic farming. Differences between Conventional farming v/s organic farming.

Unit II **12 Hrs**

Manures and Fertilizers – definition, differences, classification – major nutrient fertilizers – N,P, K fertilizers – secondary and micronutrient fertilizers – complex and mixed fertilizers – losses of nutrients from soil – biofertilizers – plant growth regulators – Preparation of Enriched farm yard manure and micro nutrient mixtures.

Unit III **12 Hrs**

Erection of Vermicompost unit, Drainage arrangement and collection of the liquid, Raising leguminous crops around the pit, Collection of raw materials & Processing, introducing active worms (specific sps.) and processed raw materials in the pit, Collection of final product . Vermi wash.

Unit IV **12 Hrs**

Some Other forms of Organic Management and Inputs: Biodynamic Agriculture, Rishi Krishi, Panchgavya Krishi, Natural farming, Natueco Farming, Homa Farming, Effective microorganism Technology

Unit V **12 Hrs**

Organic Management: Developing organic farm, Conversion of soil to organic, Multiple cropping and crop rotation, Crop rotation, Seed/ Planting material Treatment, Manuring and soil enrichment, Use of Biofertilizers and microbial cultures, Some important formulations for soil enrichment, Management of Temperature, Protection to all life forms, Pest management

Text Books

- A.K. Sharma, A hand book of organic farming –Agrobios publication.

- A.K Yadav Organic Agriculture (Concept, Scenario, Principals and Practices) Director National Centre of Organic Farming, Ghaziabad

Reference Books

- A.K. Dahama, Organic farming for sustainable Agriculture –Agrobios.
- Rana S.S 2011, Organic Farming - Department of Agronomy, College of Agriculture, CSK Himachal Pradesh KrishiVishvavidyalaya, Palampur.

PRACTICAL SYLLABUS

LAB: PLANT PHYSIOLOGY, MICROBIOLOGY AND BIOTECHNOLOGY & ORGANIC FARMING

Sub code: U3BYC6P **Credit:4** **Hours/week=6**

Course Outcomes:

Students, after successful completion of the course, will be able to

- Understand the mechanism of various metabolic processes in plants.
- Acquire basic knowledge about growth and development in plants.
- Create awareness on sewage water treatment, preservation of food products and antibiotics
- Build up the knowledge on tissue culture and its applications.
- Impart Knowledge on organic waste and their utilization by adapting different technologies.
- Assess the nutritive value of organic products.
- Know the importance of organic agriculture.

PLANT PHYSIOLOGY

To carry out the following experiments and explain the working principle, observation, Results & Interpretations.

- Imbibition – Direct weight method.
- Osmotic pressure – Plasmolytic method.
- Rate of transpiration – Farmer's Potometer.
- Rate of Photosynthesis – Test tube Funnel method.
- Separation of photosynthetic pigments- Paper chromatography method.
- Demonstrate the Physiological Experiment set up.
- Potato osmoscope.
- Bell – jar experime nt
- Ganong's Potometer
- Kuhne's fermentation
- Ganong's Light screen
- Mohl's half leaf experiment.
- Measurement of growth using Lever Auxanometer.
- Geotropism
- Phototropism.

- Hormones

MICROBIOLOGY AND BIOTECHNOLOGY

- Basic equipments used in Microbiology Laboratory.
- Sterilization of glass wares and culture media
- Motility of Bacteria – Hanging drop method.
- Gram staining of bacteria
- Preparation of culture media – Nutrient Broth, Nutrient Agar, Potato Dextrose Agar.
- Isolation of microorganisms from environment.
- Isolation of DNA from tender coconut endosperm.
- Quantitative estimation of DNA.
- Agarose gel electrophoresis - Demonstration
- Blotting techniques.
- Plant tissue culture - Demonstration

ORGANIC FARMING

- Demonstration of Vermi compost preparation.
- Preparation of Panchagavya Krishi
- Biofertilizer.

Industrial Visits and Educational Institutional visits for a minimum of two days

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V.H.N.SENTHIKUMARA NADAR COLLEGE (AUTONOMOUS)
DEPARTMENT OF BOTANY
B.SC PRACTICAL SEMESTER EXAMINATION
PRACTICAL QUESTION
Plant Physiology, Microbiology And Biotechnology & Organic Farming

Duration : 3 Hrs **Max marks=60**

1. By taking lot, write the procedure, do the physiology experiment, and interpret the results 15 Marks
2. Comment on the physiology set up "A" 5 Marks
3. Prepare the Hanging Drop for "B" & submit the slide for valuation. 5 Marks
4. By taking a lot, do the experiment and interpret the result 10 Marks
5. Write critical notes on C, D & E (3X5) 15 Marks
6. Submission of record note books 10 Marks

Key & Scheme of Valuation

1. Physiology experiment - Procedure- 15 Marks
2. Physiology set up A- Diagram-2, Comments-3. 5 Marks
3. B - Hanging Drop 5 Marks
4. Organic farming - Experiment-4, Procedure-3, interpretation- 3 10 Marks
5. C- Plant Physiology, D- Microbiology and Biotechnology, E-Organic farming Identification -1 diagram-2 Notes-2 (3X5) =15 Marks
6. Submission of record note books 10 Marks

COMMERCIAL ZOOLOGY
(VERMICULTURE, APICULTURE, AQUACULTURE AND POULTRY SCIENCE AND DAIRY FARMING)

Contact hours per Week – 4 hours **Subject Code: U3ZYA6X4**
Contact hours per Semester – 60 hours **Credits: 4**

Objectives

- To understand the concepts of maintain animals like earthworms, honey bees, fishes, chicks and cattle.
- To develop the students as entrepreneur of the zoology

Unit I **12 hours**

Vermiculture

Cultivatable species of earthworms-*Eisenia fetita, Endrilus eugeniae, Perionyx excavates* and *Lampito mauritti* - Vermicomposting methods (Pit, Heap, Tray and Bed methods) -conditions required for vermicomposting- vermicast- vermiwash.

Unit II **12 hours**

Apiculture-Life history of honey bee, kinds of honey bee-types of hives-newton's hive and other appliances, enemines (Bee wax moth and Wasps) and diseases of honey bee (*Nosema* and *Acarine* deseases) –Medicinal values of honey.

Unit III **12 hours**

Aquaculture –scope of aquaculture –aquaculture in India-Culturable organisms (Cata, Rohu and Mrigal) - construction of fish pond-Culture of Indian major carps, induced breeding-prawn culture- pearl culture.

Unit IV **12 hours**

Poultry science

Breeds of fowls-poultry industry in India-Choosing of parents- sexing of day old chick construction of poultry house- deep litter system- Cage system-Rearing of layers and broilers-

nutritive value of egg-poultry diseases (common diseases like Raniket diseases, coryza, fowl pox, polyneuritis, coccidiosis, curled toe)

Unit V **12 hours**

Dairy farming

Importance of dairy farming, dairy animals-cattle cow –buffalo-goat (any one example to each)-management of a model dairy farm-live stock diseases- foot and mouth diseases, udder diseases, Rinder pest – nutritive values of milk and milk products.

Text Books

1. Arumugam .n, Murugan.T,Johnson Rajeswar.J,Ram Prabhu.R, 2009 Applied zoology,saras publication,Nagarkovil

Reference Books

1. Sharma, Bee Keeping in India, ICAR Publications.
2. Ganamani.M.R., 2010 Modern aspects of Commercial poultry keeping, Giri Publications, Madurai
3. Sulthan Ismail,Vermitechnology, Chennai
4. Jamson and Santhanakumar, Concepts of Aquaculture,

LAB: CELLBIOLOGY, DEVELOPMENTAL BIOLOGY, PHYSIOLOGY, IMMUNOLOGYAND EVOLUTION & COMMERCIAL ZOOLOGY

(To be done at the end of the Sixth semester)

Contact hours per week 2 hours. **Subject Code: U3ZYA6PX**
Contact hours per semester 30hours **CREDITS: 2**

List of Practical

1. Preparation of Onion root tip and observe the Mitotic stages.
2. Preparation of Squamous epitheilial cells.
3. Qualitative test for Ammonia, Urea and Uric acid.
4. Qualitative test for Protein, Carbohydrate and lipids.
5. Mounting of mouth parts , sting of Honey bees- Demo only

List of Spotters

1 Mitochondria , Golgi Body , Endoplasmic reticulum, lysosome and Ribosome
2 Mitosis –Stages identification
3 Meiosis -stages identification
4 Following stages of frog embryo i)Egg ii)Sperm iii)Blastula iv) Gastrula
5 Primary lymphoid organ – Thymus.
6 Secondary lymphoid organ – Spleen.
7 Paper cutting of Giraffe neck growth to explain Lamarckism
8 Identification of Catla ,Roghu, Mrigal
9 Model fish pond
10 Vermicompost
11 Newton's hive
12 Poultry feeds, feeder and waterers
13 Milk and their by products.

PROJECT

Hours/week-2 Sub code: U1BY6PR Credit-2

Objectives:

- To train the student in various spears of learning skills like critical thinking, creativity, synthesis of knowledge, analyzing capacity, instrument basics and handling and scientific report writing.
- To introduce the frontiers areas of research in botany among students
- To understand the scope of research programme in Botany
- The project work (field/ lab work) is to inculcate students to learn adequate knowledge on research methodology in the subject and prepare them for pursuing research in experimental areas of the subject.

Project will be carried out by the final year students in the sixth semester under the guidance of respective guides. The Project work or Field Study is to be undertaken under the guidance of a Teacher of the Department. Projects will be carried out in groups (with maximum of 5 students per group). For projects internal marks (max 50) will be awarded by the respective guide and external marks (max 50) will be awarded by the external examiner during summative practical examination.

Non Major Elective - MUSHROOM CULTIVATION

Contact hours per Week – 2 hours **Subject Code: U3BYN61**
Contact hours per Semester – 30 hours **Credits: 2**

Course Outcomes:

Students, after successful completion of the course ,will be able to

- Explore mushroom cultivation and its economic importance.
- Understand about mushroom spawn preparation for mushroom cultivation and mushroom marketing

Unit I **6 Hrs**

History of Mushroom Cultivation, General Characters of Mushroom-Morphology of Common edible and Poisonous Mushrooms.

Unit II **6 Hrs**

Spawn & Spawning – Different kinds of Spawn (Virgin Spawn, Flake spawn, Brick spawn, Grain Spawn) – Grain spawn production - Advantages of grain spawn- Factors determining spawn production – Methods of spawning, Storage of Spawn.

Unit III **6 Hrs**

Mushroom Cultivation & Harvesting - Paddy straw mushroom, Button Mushroom, and Oyster mushroom, post harvesting technology of Mushrooms

Unit IV **6 Hrs**

Disease of Mushrooms – Bacterial, Fungal, Insect Pest and Nematodes.

Unit V **6 Hrs**

Food and Medicinal value of edible mushrooms, Economic importance of mushrooms, Recipes of Mushroom, Packing and marketing of mushroom.

Text book:

- Nita bahl 2009. Handbook on Mushrooms. Oxford & IBH Publishers, New Delhi

Reference books:

- Tripathi.D.P 2005. Mushroom Cultivation. Oxford & IBH Publishers, New Delhi
- Muthusamy. A.D & Yesuraja.I 1999. Mushrooms Culture, TNAU Publishers, New Delhi

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Program Name: Bachelor of Science
Discipline : Botany

Self-Learning Course:

Subject	Semester	Credit	Ext =Tot	Subject Code
Food science and Nutrition	IV	5	100 = 100	U1BYSL51

Self-Learning
Food science and Nutrition

TOTAL MARKS : 100 **Credit: 5** **Subject Code: U1BYSL51**

Objectives

1. To have a broad outline of the methodology of food science
2. To enable students to apply scientific methods independently
3. To understand the nature of unit operations in the food industry.

Unit I

Food pyramid, functions, classification, conservation of nutrients, cooking methods, meal planning for different age & income groups, food adulteration of food safety and Weaning foods – meaning, importance and preparation.

Unit II

Nutrition – Definition of nutrients, components, requirements, metabolism – carbohydrate, protein and fat, Normal and therapeutic nutrition, nutritional deficiency.

Unit III

Art in food service - Design, selection, structural and decorative, design and their application in food service institutions. a) Colour - Colour schemes. b) Flower arrangements - Types and styles c) Table service - Styles - Indian, Western and oriental.

Unit IV

Preservation of Food – Milk Based; Millet Based preparation of canned food; Fermented Food; Colouring and preservative agents and its disadvantage.

Unit V

Concept of Extension – Principles and scope; Science and technology, health promotion, environmental sanitation; programme planning for women and children and transaction, ICDS programme and role of different functionaries.

REFERENCES:

1. Potter, N.N. Food Science 5th edition. CBS publishers and distributors, New Delhi. 1996.
2. Kroger, M and Shapiro, R. Changing food technology. (Vol. 1-3) Technomic publishing Co. Inc, USA. 1987.
3. Raj, G.D. Encyclopaedia of Food Science. (Vol 1-3). Anmol publications Pvt. Ltd, New Delhi. 1997.
4. Kumar, A and Meenakshi, N. Marketing management. Vikas publishing house Pvt. Ltd. 2006.
5. Srilakshmi, B. Nutrition Science, New age International (P) Ltd publishers, New Delhi. 2006.

Course Name : **Bachelor of Science**
Discipline : **Botany**
(Those who joined in 2018 and after)
COURSE SCHEME:

VALUE ADDED COURSES

Course Name	**Internal Mark = Total Mark**	**Subject Code**
Bioresources for Human Welfare	100=100	V1BY1
Mushroom Culture Technology	100=100	V1BY2

Value Added Course

Bioresources for Human Welfare

(For B.Sc students) Subject Code: V1BY1 Hours (30)

Unit-I: Bacterial resources: Plant growth promoting rhizobacteria(PGPR) -*Pseudomonas*; Biocontrol agent-*Bacillus thuringiensis*; Antibiotic sources-Bacteriocin, Streptomycin; Probiotics **6 Hrs**

Unit-II Algal resources: Nutrient supplements obtained from algae; single cell protein (*Spirulina*) - Diatomaceous earth - Agar-agar, Carageenin - Sea weed manure - Biofuel from algae **6 Hrs**

Unit-III: Fungal resources: Role of fungi in food: Mushrooms, Beer, Cheese, Bread; in Medicine - *Ganoderma*, Shitake, *Penicillium*; Fungi as bio-control agent- *T. viridae* **6 Hrs**

Unit- IV: Plant resources: Distribution, Systematic position, parts used and method of use of the following

i. Spices and condiments - *Crocus sativus, Piper nigrum, Zingiber officinale*
ii. Beverages - *Camellia sinensis, Vitis vinifera*
iii. Fibers - *Chorchorus capsularis, Cocos nucifera*
iv. Timbers - *Tectona grandis , Dalbergia sissoo , Terminalia arjuna* **6 Hrs**

Unit-V Plant medicinal resources: Distribution, Systematic position, parts used and method of use of the following

i. Anodynes - *Atropa belladona, Zingiber officinale*
ii. Laxatives - *Aloe vera , Plantago ovata*
iii. Aromatic oils - *Thymus serpyllum , Lavandula angustifolia*
iv. Anti-cancerous - *Taxus baccata* subsp. *wallichiana, Linum usitatissimum* **6 Hrs**

Reference:

- Sharma, O.P. (2001). Hill's Economic Botany, Tata McGraw-Hill Pub. Ltd.
- Sharma, Ramniwas. (2006). Growth and Development of Agriculture. Biotech Book
- Chattopadhyay, P.K., (2008). Herbal cosmetics and Ayurvedic medicines
- Panda, H(2004), Herbal cosmetic Handbook, Asia Pacific Business Press, Delhi

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MUSHROOM CULTURE TECHNOLOGY

(For M.Sc Students)

Subject Code: V1BY2

Course Objectives: 30 hours

- To impart the knowledge about Mushroom cultivation and its nutritional value
- To generate trained manpower for the promotion of mushroom production in the country
- To empower the student communities with entrepreneurial skills through the production and sale of mushrooms

Unit I - Mushroom Morphology **6 hrs**

Morphology of mushroom - General characters of Mushroom – edible and poisonous mushrooms, Types of edible mushrooms in India – Mushroom classification (Based on Natural habitat - Humicolous, Lignicolous & Coprophilous, Based on colour of spores)

Unit II - Nutrient Profile of Mushroom **6 hrs**

protein, aminoacids, calorific values, carbohydrates , fats, vitamins & minerals - medicinal values of mushroom – Recipes of mushrooms

Unit III - Spawn Preparation **6 hrs**

Different kinds of spawn – Methods of grain spawn preparation – Factors determining spawn production – Methods of spawning – Storage of spawn

Unit – IV Oyster Mushroom & Milky Mushroom Cultivation **6 hrs**

Farm design - Methods of Substrate preparation – Cultivation Technology – Spawn & spawning – casing for milky mushroom cultivation, Oyster mushroom cultivation, *Ganoderma* cultivation, harvest and packing. Factors affecting the mushroom bed preparation.

Unit – V Post–harvest Handling And Processing **6 hrs**

Short term storage – Long term storage – Different methods of storage – canning of mushrooms – freeze drying methods – packing of mushroom.

Text books:

- Nita bahl 2009. Hand book on Mushrooms, Oxford & IBH Publishers New Delhi.
- Tripathi.D.P 2005. Murshroom cultivation, Oxford & IBH Publishers New Delhi.
