

**NALLAMUTHU GOUNDER MAHALINGAM
COLLEGE (AUTONOMOUS)
POLLACHI – 642 001.**

M.Sc., BOTANY

**SYLLABUS
&
SCHEME OF EXAMINATION**

OUTCOME BASED EDUCATION (OBE)

**[FOR THE STUDENTS ADMITTED DURING THE
ACADEMIC YEAR 2018-2020 BATCH &
ONWARDS]**

**(PASSED ON THE BOARD OF STUDIES
HELD ON FEBRUARY 2018)**

NGM COLLEGE (AUTONOMOUS)

Vision

Our dream is to make the College an Institution of Excellence at the national level by imparting quality education of global standards to make students academically superior, socially committed, ethically strong and culturally rich citizens to contribute to the holistic development of the self and society.

Mission

Training students to become role models in academic arena by strengthening infrastructure, upgrading extension through an enlightened management and committed faculty who ensure knowledge transfer, instil research aptitude and infuse ethical and cultural values to transform students into disciplined citizens in order to improve quality of life.

PG AND RESEARCH DEPARTMENT OF BOTANY

Vision

Our vision is to conduct innovative research, teaching and outreach on the patterns and process of life with a focus on plants and their environments.

Mission

Our mission is to foster an environment of excellence by attracting and supporting the outstanding students, faculty and staff needed to sustain our vision.

SCHEME OF EXAMINATION

Sem	Course Code	Course Title	Class hours /Week	Exam Hrs	Maximum marks			Credits
					Internal	External	Total	
I	18PBY101	Core - 1 Microbiology	5	3	25	75	100	4
I	18PBY102	Core - 2 Phycology, Mycology, Lichenology and Bryology	5	3	25	75	100	4
I	18PBY103	Core - 3 Pteridophytes, Gymnosperms and Palaeobotany	5	3	25	75	100	4
I	18PBY104	Core - 4 Core Practical-I (for core papers)	9	4	40	60	100	4
I	18PBY1E1	Elective -1 Ecology and Phytogeography	5	3	25	75	100	5
II	18PBY205	Core - 5 Anatomy and Embryology	5	3	25	75	100	4
II	18PBY206	Core - 6 Plant physiology	5	3	25	75	100	4
II	18PBY207	Core - 7 Cytogenetics and Plant Breeding	5	3	25	75	100	4
II	18PBY208	Core - 8 Core Practical- II (for core papers 5,6,7)	9	4	40	60	100	4
II	18PBY2E2	Elective-2 Horticulture	4	3	25	75	100	5
II	18PBY2N1	Non- Major Elective Mushroom cultivation	1	3	-	100	100	2
III	18PBY309	Core - 9 Plant Systematics	5	3	25	75	100	5
III	18PBY310	Core -10 Plant Biochemistry and Biophysics	5	3	25	75	100	4
III	18PBY311	Core -11 Research Methodology and Biostatistics	4	3	25	75	100	4
III	18PBY3E3	Elective -3 Forestry	4	3	25	75	100	5
III	18PBY312	Core - 12 Core Practical- III (Plant Systematics)	6	4	40	60	100	4
III	18PBY313	Core - 13 Core Practical –IV (Plant Biochemistry & Research methodology)	6	4	40	60	100	4
IV	18PBY414	Core - 14 Molecular Biology and Plant Biotechnology	5	3	25	75	100	5
IV	18PBY415	Core - 15 Bioinformatics and Cyber Security	5	3	25	75	100	4
IV	18PBY416	Core - 16 Core Practical -V (for core papers 14. 15)	6	4	40	60	100	4
IV	18PBY4P1	Core - 17 Project Work and Viva -Voce	14	-	40	160	200	8
Total							2200	90

Bloom's Taxonomy Based Assessment Pattern

K1-Remember ; K2- Understanding ; K3- Apply ; K4-Analyze ; K5- Evaluate

1. Part I,II & III--Theory: 75 Marks

(i) TEST- I & II and ESE:

Knowledge Level	Section	Marks	Description	Total
K1	A(Answer all)	10x1=10	MCQ/Define	75
K2	B (Either or pattern)	5x5=25	Short Answers	
K3 & K4	C (Answer 4 out of 6)	4x10=40	Descriptive/ Detailed	

2. Part IV--Theory: 50 Marks

Knowledge Level	Section	Marks	Description	Total
K1	A(Answer all)	10x1=10	MCQ/Define	50
K2, K3 & K4	B (Answer 5 out of 8)	5 x 8=40	Descriptive/ Detailed	

3. Practical Examinations:

Knowledge Level	Section	Marks	Total
K3	Practicals & Record work	60	100
K4		40	
K5			

Components of Continuous Assessment

Components		Calculation	CIA Total
Test 1	75	$\frac{75+75+25}{7}$	25
Test 2	75		
Assignment/Seminar	25		

Programme Objectives

1. To bring out the scientific potentialities
2. To inculcate the teaching and technical skills in the subject
3. To create awareness in research and development.

Programme Outcomes

- PO1** To be self confidence, mastery in life sciences and ability to do practically every experiments by applying various biological instruments and techniques
- PO2** To get employability in the core industry and also form a bridge for research and higher education

Programme Specific Outcomes

- PSO1** A source of knowledge of botanical terms, facts, concepts and principles
- PSO2** Way to become a good academician/ researcher
- PSO3** Opportunity to lead as a successful entrepreneur
- PSO4** Chance to get awareness in advanced research in plant sciences
- PSO5** Creating a technically skilled individual to practice modern agricultural techniques.

Programme code	M.Sc.	Programme Title : Master of Science in Botany		
Course Code: 18PBY101		Title: Core - 1 Microbiology	Batch	2018 - 20
			Semester	I
Hrs/Week:	5		Credits	4

Course Objective

To introduce the microbial techniques and its role in the plant and human welfare

Course Outcomes (CO)

K1	CO1	Students will recollect the basics of microbiology
K2	CO2	One can understand the interaction of microorganism with the environment and food
K3	CO3	Apply the microbial culture in the manufacturing of value added products
K4	CO4	Analyze the plant diseases commonly occurring in crops

Unit	Content	Hrs
Unit I	Microbiology: Scope of Microbiology; Microbial diversity [Bacteria, Fungi, Algae, Viruses and Protozoa] - a general account, classification, growth and reproduction.	13
Unit II	Microbiological Media: Types, preparation, methods of sterilization- enumeration of microorganisms in soil, water and air- isolation of microorganisms from infected plant tissue- techniques of pure culture- maintenance and preservation of microbes- staining techniques - <i>*bacterial growth curve - nutritional types of microorganisms.</i>	13
Unit III	Pathology: General account of plant pathogens - pathogen attack and defense mechanism - physical, physiological, biochemical and molecular aspects- concepts in epidemiology- development of disease in plant population- monocyclic and polycyclic pathogens- role of environment and meteorological factors in the development of plant disease epidemics - plant diseases: symptoms, causative organisms and control measures of following diseases: Blast disease of Paddy - Red rot of Sugar cane - Late blight of Potato - Bunchy top of Banana	13
Unit IV	Food Microbiology: Single cell protein- Fermented foods (pickles, silage, sausages and bread) - microbial spoilage of foods (fresh & canned foods) - food borne infections & intoxication - preservation of foods - preservation of milk and milk products by physical (irradiation) and chemical agents - <i>* Food adulteration- identification of adulteration in foods.</i>	13
Unit V	Industrial Microbiology: Fermenters, batch fermentation vs continuous fermentation - Industrial production of enzymes (cellulase, amylase and protease), amino acids (glutamic acid and L-Lysine), organic acids (lactic and citric acid) and biofuels (ethanol) - methods of cell and enzyme immobilization - applications of immobilized cells and enzymes.	13

**Self study topics*

Power point presentations, Seminar and Assignment

Text Books:

1. Joanne Willey, Linda Sherwood and Chris Woolverton, 2013. Prescott's Microbiology, 9th edition, McGraw-Hill Companies.
2. Gangulee and Kar, 1970. College Botany Vol. II. New Central Book Agency, New Delhi.
3. Rangaswamy, G. and Mahadevan, A. (1999). Diseases of crop plant in India 4th Edition.

Reference Books:

1. Power, C.B. and H.F. Dagainawala. (1982), General Microbiology.
2. Michael, J. Pelczar, Jr. E.C.S. chan and N.R. Krief. (1995). Microbiology. Tata McGraw-Hill (Ed), New Delhi.
3. Alexopoulos, C.J. and Mims, C.W.1979. Introductory Mycology. Wiley Eastern Ltd, New Delhi.
4. Steindraus, K.H. (ed.) 1983. Hand Book of Indigenous Fermented Food, Parcel Dekker Inc., New York.
5. Sharma, P.D. 2006. Plant Pathology. Narso Publishing House, New Delhi.
6. Das Gupta M.K. (1958). Principles of Plant Pathology
7. Webster, J. 1970. Introduction to Fungi. Cambridge University Press, UK.
8. Smith, K.M. (1974). Viruses, Cambridge University Press.

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	S	M	M	S
CO2	M	S	H	M	H
CO3	M	M	S	S	H
CO4	M	H	M	L	S

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr. R. Rakkimuthu	Name: Dr. R. Rakkimuthu	Name: Dr. M. Durairaju	Name: Dr. R. Muthukumaran
Signature:	Signature:	Signature:	Signature:

Programme code	M.Sc.	Programme Title : Master of Science in Botany		
Course Code: 18PBY102		Title: Core - 2 Phycology, Mycology, Lichenology and Bryology	Batch	2018 - 20
Hrs/Week:	5		Semester	I
			Credits	4

Course Objective

To know the diversity and the chrematistic features of the non-flowering group of plants

Course Outcomes (CO)

K1	CO1	Remembering the values of lower plant forms and its diversity
K2	CO2	Will get an idea on evolution of lower plants and its architectural specialization in cells
K3	CO3	Apply economic values of lower plants to manufacture value added products
K4	CO4	Review the developmental stages of lower group of plant diversity

Unit	Content	Hrs
Unit I	PHYCOLOGY: Algae in diverse habitats (Terrestrial, Fresh water, Marine) - Thallus organization (range of thallus) and reproduction (vegetative, asexual, sexual) - Ultra structure of cell, Flagella, Chloroplast, Pyrenoids and Eye Spot in major groups of algae - principles of classification, classification of Fritsch - Life cycle patterns in Algae and Algal blooms - <i>*Economic importance of Algae as food - bio-fuels - source of chemicals and drugs - Algal bioinoculants.</i>	13
Unit II	Comparative study of classes of Cyanophyceae, Chlorophyceae, Xanthophyceae, Bacillariophyceae, Phaeophyceae and Rhodophyceae with reference to - Range of structure of plant body including - Ultra structure - Methods of reproduction and Variations in life cycles - Life histories of <i>Nostoc, Bulbochaete, Vaucheria, Diatoms, Padina</i> and <i>Gelidium</i> .	13
Unit III	MYCOLOGY: General Characteristics of Fungi - Range of thallus Organization - The architecture of fungal cells, cell walls, cell membrane, cell organelles and cytoskeleton - Nutrition and growth in fungi including factors affecting fungal growth - Types of reproduction in fungi - Fungal Classification (Alexopoulos, 1971) - Diagnostic features of different classes of fungi - Structure and Life-histories of <i>Plasmodiophora, Penicillium, Neurospora, Fusarium</i> and <i>Cercospora Pleurotus</i> .	13
Unit IV	Fungal genetic variation and evolution - Heterothallism, Heterokaryosis and Parasexual cycle - Saprotrophs and Ecosystems - Fungi as Parasitic and Mutualistic Symbionts - VAM Ecto and Endophytic mycorrhiza - <i>*Economic Importance of Fungi.</i> LICHENOLOGY: General characteristics & classification of lichens (Hale, 1969) - occurrence and interrelationship of phycobionts and mycobionts, structure and reproduction - lichens as indicators of pollution - economic importance of lichens.	13

Unit V	BRYOLOGY: Classification of Bryophytes - Origin of Bryophyta - evolution (Proskauer, 1957), structural organization of gametophyte and sporophyte in different classes of Bryophytes - life histories of <i>Marchantia</i> , <i>Porella</i> , <i>Fossombronia</i> , <i>Anthoceros</i> and <i>Polytrichum</i> - * <i>Bryophytes as pollution indicators</i> .	13
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*Self study topics

Power point presentations, Group discussions, Seminar, Quiz and Assignment.

Text Books

1. Gangulee and Kar, 1970. College Botany Vol. II. New Central Book Agency, New Delhi.
2. Smith, G.M. 1938. Cryptogamic Botany. Vol., I. McGraw Hill Book Co., New York.
3. Tridevi, P.C. 2001. Algal Biotechnology, Point Publisher, Jaipur, India.
4. Text Book of Algae O.P. Sharma .Tata McGraw Hill Publication 1986.
5. The Ecology of Algae F.E. Round Cambridge University Press.1981

Reference Books

1. Alexopoulos, C.J. and Mims, C.W. 1979. Introductory Mycology. Wiley Eastern Ltd, New Delhi.
2. Singh, S.K. 2006. Text Book of Bryophyta, Campus Books, New Delhi.
3. Fritsch, F.F. 1972. The Structure and Reproduction of the Algae Vol. II. Cambridge University Press, UK.
4. Kumar, H.D. 1988. Introductory Phycology. Affiliated East-West Press Ltd. New Delhi.
5. Morris, I. 1986. An introduction to the Algae. Cambridge University Press, UK.
6. Beaker, S.W. 1994. Micro Algae Biotechnology and Microbiology. Cambridge University Press.
7. Venkataraman, G.S. 1972. Algal Biofertilizers and rice cultivation. Today and Tomorrows Printers and Publishers, New Delhi.
8. Webster, J. 1970. Introduction to Fungi. Cambridge University Press, UK.

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	L	M
CO2	H	S	L	H	M
CO3	M	H	S	H	M
CO4	H	S	L	H	M

S-Strong; H-High; M-Medium; L-Low

Course Designed by Name and Signature	Verified by HOD Name and Signature	Checked by CDC	Approved by COE
Name: Dr. A. M. Anandakumar Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Dr. M. Durairaju Signature:	Name: Dr. R. Muthukumaran Signature:

Programme code	M.Sc.	Programme Title : Master of Science in Botany		
Course Code: 18PBY103		Title : Core - 3 Pteridophytes, Gymnosperms and Paleobotany	Batch	2018 - 20
			Semester	I
Hrs/Week:			5	Credits

Course Objective

To know the various dynamics and characteristic features of lower vascular plants

Course Outcomes (CO)

K1	CO1	Remember the diverse forms of plants in the plant kingdom
K2	CO2	Will understand the vascular plants and fossils
K3	CO3	Apply the economic value of Pteridophytes and Gymnosperms
K4	CO4	Review the evolutionary idea of fossil diversity

Unit	Content	Hrs
Unit I	PTERIDOPHYTES: Introduction - classification of Pteridophytes (Sporne, 1970) - characteristic features and types of life cycles in Pteridophytes - comparative account of sporophytes, gametophytes and embryogeny in Psilotopsida, Lycopsida and Sphenopsida.	13
Unit II	Comparative account of sporophytes - gametophytes and embryogeny in Pteropsida - types of steles and their evolution in Pteridophytes - heterospory and seed habit - apospory, apogamy and parthenogenesis - <i>*economic importance of Pteridophytes - origin and evolution of Pteridophytes.</i>	13
Unit III	GYMNOSPERMS: Introduction - classification of Gymnosperms (Sporne, 1965); characteristic features and life cycles of Gymnosperms. Comparative study of morphology, anatomy, reproduction and phylogeny of Ephedrales, Pteridospermales, Bennettitales, Pentoxylales and Cycadales.	13
Unit IV	Comparative study of morphology, anatomy, reproduction and phylogeny of Coniferales, Ginkgoales and Gnetales - <i>*economic importance of Gymnosperms. Affinities of Gymnosperms with Angiosperms and Pteridophytes.</i>	13
Unit V	PALAEOBOTANY: Geological time scale, fossils and fossilization-types of fossils - Nomenclature of fossil plants - Indian contribution towards fossil resources - Radiocarbon dating - Contribution of Prof. Birbal Sahni in the field of palaeobotany.	13

**Self study topics*

Power point Presentations, Group discussions, Seminar, Quiz and Assignment.

Text Books

1. Gangulee and Kar, 1970. College Botany Vol. II. New Central Book Agency, New Delhi.
2. Vashishta, P.C. 2006. Gymnosperms. S. Chand & Company Ltd., Ram Nagar, New Delhi.
3. Vashishta, P.C. 1991. Vascular Cryptogams. S. Chand & Company Ltd., Ram Nagar, New Delhi.

Reference Books

1. Arnold, C.A. 2013. An Introduction to Paleobotany. Academic Press, New York and London
2. Biswas, C. and Johrc, B.M. 1977. The Gymnosperms. Narosa publishing House, New Delhi.
3. Bower, F.O. 1923-28. The ferns. Vol., 1-3; Cambridge University Press, London.
4. Eames, A.J. 1936. Morphology of Vascular Plants. Lower groups, New York and London.
5. Meyen, S.V. 1987. Fundamentals of Paleobotany. Chapman and Hall, New York.
6. Sporne, K.R. 1965. The Morphology of Pteridophytes. Hutchinson & Co., London
7. Sporne, K.R. 1967. The Morphology of Gymnosperms. Hutchinson & Co., London.

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	L	H	M
CO2	S	H	M	H	L
CO3	H	H	S	H	M
CO4	H	H	L	M	M

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Ms. D. Sowmiya	Name: Dr. R. Rakkimuthu	Name: Dr. M. Durairaju	Name: Dr. R. Muthukumaran
Signature:	Signature:	Signature:	Signature:

Programme code	M.Sc.	Programme Title : Master of Science in Botany		
Course Code: 18PBY104	9	Title : Core - 4 Practical - I (Microbiology, Phycology, Mycology, Lichenology and Bryology, Pteridophytes, Gymnosperms and Palaeobotany)	Batch	2018 - 20
Hrs/Week:			Semester	I
			Credits	4

Course Objective

To understand the organization of plant forms and get hands on experience on microbial and algal culture techniques

Course Outcomes (CO)

K3	CO1	Execute the culture techniques in laboratories
K4	CO2	Understand the morphological and anatomical features of lower plants.
K5	CO3	Manufacturing of value added products from microbes and lower plants

Unit	Content	Hrs
Unit I	MICROBIOLOGY 1. Preparation of Basic medium - solid agar and broth 2. Preparation of agar plates, agar slants and agar deep tubes. 3. Simple staining of bacteria. 4. Gram's staining of bacteria. 5. Isolation of Bacteria, Fungi, Actinomycetes from soil and water 6. Isolation of microorganisms from the infected plant tissues. 7. Subculture, pure culture and maintenance of culture. 8. Bacterial growth curve 9. Biochemical tests for bacteria	23
Unit II	10. Production of Alcohol. 11. Effect of antibiotics on pathogenic microorganism by Kerby - Bayer method. 12. Testing the milk quality - Methylene Blue Reduction Test (MBRT) 13. Identification of adulteration in foods 14. Pathology Submission of herbarium of infected plant specimens (not less than five)	23
Unit III	PHYCOLOGY, MYCOLOGY, LICHENOLOGY AND BRYOLOGY 1. Range of thallus structures in algae 2. Reproductive structures in algae 3. Collection of microalgae using phytoplankton net 4. Culturing of microalgae	24

	5. Culturing of macro algae/seaweed (demo only) 6. Commercial products from macroalgae	
Unit IV	7. Vegetative and reproductive structures of <i>Rhizopus</i> , <i>Ascobolus</i> , <i>Pleurotus</i> and <i>Cercospora</i> 8. Fungal spore count using Haemocytometer. 9. Slide culture technique 10. Lichen - <i>Usnea</i> sp. 11. Morphological and anatomical study of bryophytes with reference to the following genera: <i>Marchantia</i> , <i>Anthoceros</i> , <i>Sphagnum</i> , <i>Funaria</i> and <i>Polytrichum</i> . 12. Field trip for lower plant collection and submission of reports.	24
Unit V	PTERIDOPHYTES, GYMNOSPERMS AND PALAEOBOTANY Study of morphology, anatomy and reproductive structures of the following genera: 1.Pteridophytes: <i>Selaginella</i> , <i>Equisetum</i> , <i>Ophioglossum</i> , <i>Adiantum</i> and <i>Marsilea</i> . 2.Gymnosperms: <i>Ephedra</i> , <i>Pinus</i> , <i>Araucaria</i> and <i>Gingko</i> . 3.Paleobotany : <i>Rhynia</i> , <i>Lepidodendron</i> , <i>Lepidocarpon</i> , <i>Williamsonia</i> , <i>Lagenostoma</i> , <i>Lyngiopteris</i> .	23

Power point presentation, Specimen observation, Sectioning, Field/Industrial visit, Experience discussion, and Case study

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	H	M
CO2	H	S	H	M	H
CO3	H	S	S	M	M

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr. R. Rakkimuthu	Name: Dr. R. Rakkimuthu	Name: Dr. M. Durairaju	Name: Dr. R. Muthukumaran
Signature:	Signature:	Signature:	Signature:

Programme code	M.Sc.	Programme Title : Master of Science in Botany		
Course Code:	18PBY1E1	Title : Elective -1 Ecology and Phytogeography	Batch	2018 - 20
Hrs/Week:	6		Semester	I
			Credits	5

Course Objective

To create awareness about the environmental problems and their consequences

Course Outcomes (CO)

K1	CO1	Students will keep in mind the ecosystem concepts and functions
K2	CO2	Able to understand the importance of biodiversity
K3	CO3	They can execute the remedies of pollution in the environment
K4	CO4	Evaluate the geographical distribution of plants

Unit	Content	Hrs
Unit I	History and Scope of Ecology. Concept of Ecosystem, its structure and function, Ecological factors; Edaphic, Climatic, Topographic, Biotic and Abiotic factors. Adaptation of plants, Energetics: Productivity.	15
Unit II	Ecological succession - Seral and Climax communities - Hydrosere, Xerosere. Bog succession, sand dune succession. Plant indicators. Terrestrial ecosystems, Fresh water ecosystem, Marine ecosystem. Biodiversity and Conservation Biology: Types, benefits, and conservation of Biodiversity, * <i>Biodiversity Hotspots</i> .	16
Unit III	Environmental pollution - Air, Water, Soil, Thermal, Radiation, Noise, E-waste and solid waste; Cumulative effect of Pollution on global environment; * <i>Global warming</i> , climate change and its consequences.	15
Unit IV	Environmental Impact Assessment (EIA). Scope, importance and application of EIA process - eco-restoration/remediation- ecological foot prints - carbon foot print - ecolabeling - environmental auditing.	15
Unit V	Phytogeography - Principles and importance of plant geography- Phytogeographic regions of India. Theories of present day distribution of plants- Continental drift hypothesis-Factors involved in distribution - Endemism, Age and Area hypothesis; Dispersal and Migration and their aims and methods.	17

*Self study topics

Power point Presentations, Group discussions, Seminar ,Quiz, Assignment, Case study

Text Books:

1. Krishnamoorthy, K.V. 2003. An Advanced Text book on Biodiversity, Oxford & IBH Book Company, New Delhi.
2. Odum, E.P. 1971. Fundamentals of ecology, W.B. Saunders & Co., Philadelphia, USA.
3. P. D. Sharma, 2005. Ecology And Environment, Rastogi Publications, India.
4. Trivedi, R.K. and Goel, P.K. 1986. Chemical and Biological methods for water pollution studies, Environmental publication, India.

Reference Books:

1. Ambasht, R.S. 1974. A text book of plant ecology (3rd ed.), Students’ Friends. & Co., Varanasi, India.
2. Chapman, J.L. and Reiss, M.J. 1999. Ecology; Principles and Applications. I Ed. Cambridge University Press. New York.
3. Chiras, D. D., 2009. Environmental Science, 8th edition, Jones and Bartlett Publishers, Sudbury, Massachusetts (www.jbpub.com).
4. Groombridge, B. (Ed.) 1994. Global Biodiversity status of the Earth’s livng resources. Chapman & Hall, London.
5. Melchias, G. 2001. Biodiversity and Conservation. Oxford IBH. New Delhi. 236Pp.

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	M	H	M
CO2	H	S	L	M	M
CO3	H	M	M	M	M
CO4	H	S	M	H	H

S-Strong; H-High; M-Medium; L-Low

Course Designed by Name and Signature	Verified by HOD Name and Signature	Checked by CDC	Approved by COE
Name: Dr. P. Sathishkumar Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Dr. M. Durairaju Signature:	Name: Dr. R. Muthukumaran Signature:

Programme code	M.Sc.	Programme Title : Master of Science in Botany		
Course Code: 18PBY205		Title: Core - 5 Anatomy and Embryology	Batch	2018 - 20
			Semester	II
Hrs/Week:	6		Credits	4

Course Objective

To acquire knowledge on the anatomical structure and reproductive phase of Angiosperms

Course Outcomes (CO)

K1	CO1	Keep in mind the basic terminologies in anatomy of plants
K2	CO2	Understand the vascular system and cellular developmental
K3	CO3	Implement the techniques for <i>in vitro</i> culture by understanding the ontogeny
K4	CO4	Review the applications of growth hormones in crops.

Unit	Content	Hrs
Unit I	ANATOMY: General account and theories of organization of shoot apex and root apex - quiescent centre and modern concept on meristems - structural diversity, functional complexity and phylogenetic trends in specialization of complex permanent tissues (xylem and phloem) - cambium - origin - structure, storied and non-storied types - formation of cork cambium, and periderm - <i>*Anomalous secondary growth in dicot and monocot.</i>	16
Unit II	Vascular differentiation in primary and secondary structure of root and stem in dicot and monocot - origin of lateral roots - root stem transition - anatomy of dicot and monocot leaves - stomatal types - nodal anatomy - petiole anatomy - trichomes - glands - secretory tissues - nectaries - laticifers and their significance.	16
Unit III	EMBRYOLOGY: Microsporangium - microsporogenesis - microspores - arrangement - morphology - ultra structure - microgametogenesis - pollen - stigma - incompatibility - methods to overcome incompatibility - Palynology .	15
Unit IV	Classification, structure and development of megasporangium, megasporogenesis, female gametophyte - types, ultra structure, and haustorial behavior - Nutrition of embryo sac - double fertilization and triple fusion - endosperm - types and functions of endosperm. <i>*Embryogeny: classification, development of monocot (grass) and dicot (crucifer) embryos.</i>	15
Unit V	Polyembryony - types - classification - causes - induction and practical application. Apomixis and its significance - seed and fruit development and role of growth substances - parthenocarpy and its importance - polyembryony - apomixis - apospory.	16

**Self study topics*

Power point Presentations, Group discussions, Seminars and Assignment.

Text Books

1. Bhojwani, S.S. and Bhatnagar, S.P. 2009. The Embryology and Angiosperms. Vikas publishing house pvt. Ltd, New Delhi.
2. Easu, K. 1985. Plant Anatomy, Wiley Eastern Pvt. Ltd., New Delhi.
3. Johri, B.M. (ed.) 1983. Embryology of Angiosperms, Springer-Verlag, New York.
4. Pandey, B.P. 1993. Plant anatomy, S. Chand & Co, New Delhi.

Reference Books

1. Bierhorst, D.W. 1971. Morphology of vascular plants. Macmillan publishers, New York.
2. Maheshwari, P. 1963. Recent Advances in Embryology of Angiosperms. Intl. Soc. Plant Morphologists, New Delhi.
3. Pullaiah, T., Lakshiminarayana, K. and Hanumantha Rao, B. 2006. Text book of Embryology of Angiosperms. Regency Publications, New Delhi.
4. Swanson, P. and Webster, P. 1977. The Cell. Prentice Hall, Inc. Englewood Cliffs, New Jersey, USA.

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	M	M	H
CO2	M	H	H	H	M
CO3	H	S	L	M	H
CO4	M	M	H	H	H

S-Strong; H-High; M-Medium; L-Low

Course Designed by Name and Signature	Verified by HOD Name and Signature	Checked by CDC	Approved by COE
Name: Dr. A.M Anandakumar Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Dr. M. Durairaju Signature:	Name: Dr. R. Muthukumaran Signature:

Programme code	M.Sc.	Programme Title : Master of Science in Botany		
Course Code: 18PBY206		Title: Core - 6 Plant Physiology	Batch	2018 - 20
			Semester	II
Hrs/Week:	6		Credits	4

Course Objective

To understand the metabolic components involved in the functioning of plants.

Course Outcomes (CO)

K1	CO1	Remember the basic metabolism in plants
K2	CO2	Deduce the biological pathways
K3	CO3	Execute the molecular based modification of metabolism in plants
K4	CO4	Interpret the physiological processes and apply in agriculture.

Unit	Content	Hrs
Unit I	Plant- water relations: diffusion and osmosis - water potential and chemical potential - absorption of water - water transport through xylem - transpiration and its significance - factors affecting transpiration - physiology of stomatal movement - transport of photosynthate - source-sink relationship - the mechanism of translocation in the phloem, assimilate partitioning.	16
Unit II	Signal transduction: overview - receptors and G-proteins - phospholipid signaling, role of cyclic nucleotides - Calcium- cadmium cascade. Mineral nutrition: Criteria of essentiality of elements; macro and micro-nutrients; <i>*role of essential elements; mineral deficiency symptoms and plant disorders</i> , nutrient uptake and transport mechanism, role of cell membrane, ion pump carrier.	16
Unit III	Photosynthesis: Historical background and significance - photosynthetic pigments - accessory pigments and photoprotective carotenoids - reaction center complexes - photochemical reactions - electron transport pathways in chloroplast membrane - photo phosphorylations - Calvin cycle - the C4 carbon cycle - crassulacean acid metabolism- photorespiration.	15
Unit IV	Respiration: Glycolysis - TCA cycle and its regulation - aerobic and anaerobic respiration - electron transport in mitochondria - redox potential - oxidative phosphorylations - pentose phosphate pathway. Nitrogen metabolism: Importance of Nitrogen to plants - Nitrogen cycle - biological nitrogen fixation - nif gene - nitrate assimilation GDH and GS/GOGAT pathway - Integration of Nitrogen and Carbohydrate metabolisms.	15
Unit V	Growth and development: Kinetics of growth - seed dormancy - seed germination and influencing factors of their regulation - the concept of	

	photoperiodism - physiology of flowering - florigen concept - vernalization - biological clocks - physiology of senescence - fruit ripening. Plant hormones - auxins, gibberellins, cytokinins, abscisic acid ethylene, history of their discovery, role and mechanism of action. Photomorphogenesis: phytochromes and cytochromes, their discovery - physiological role and mechanism of action. * <i>Stress physiology: Plant responses to biotic and abiotic stress</i> , mechanism of biotic and abiotic stress tolerance.	16
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*Self study topics

Power point Presentations, Group discussions, Seminar, Quiz and Assignment.

TEXT BOOKS

1. Jain, V.K. 2000. Fundamentals of Plant Physiology (5th ed.), S. Chand & Co Ltd; New Delhi.
2. Pandey, S.N. and Sinha, B.K. 2010. Plant Physiology, Vikas Publishing, New Delhi.
3. Steward, F.C. 2012 Plant Physiology Academic Press, US

REFERENCE BOOKS

1. Devlin, R.M. and Baker, N.R. 1973. Photosynthesis, Reinhold Affiliated East-West Press Pvt. Ltd, New Delhi.
2. Moore, T.C. 1979. Biochemistry and physiology of plant hormones. Narosa book Distributors, New Delhi.
3. Roberts, E.A. 1987. Plant growth regulators. Kluwer Academic publishers, London.

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	S	L	H	S
CO2	H	S	M	S	H
CO3	S	H	M	S	H
CO4	H	S	M	S	H

S-Strong; H-High; M-Medium; L-Low

Course Designed by Name and Signature	Verified by HOD Name and Signature	Checked by CDC	Approved by COE
Name: Ms. D. Sowmiya Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Dr. M. Durairaju Signature:	Name: Dr. R. Muthukumaran Signature:

Programme code	M.Sc.	Programme Title: Master of Science in Botany		
Course Code: 18PBY207		Title : Core - 7 Cytogenetics and Plant Breeding	Batch	2018 - 19
Hrs/Week: 6			Semester	II
			Credits	4

Course Objective

To acquire knowledge on genetic traits and breeding techniques in plants

Course Outcomes (CO)

K1	CO1	Remember the principles of genetics
K2	CO2	Understand the role of genes in expression of characters
K3	CO3	Execute the molecular techniques for mapping of genes
K4	CO4	Review the innovative techniques in plant breeding

Unit	Content	Hrs
Unit I	Cytogenetics: Chromosome: Structure, types and nomenclature, centromere and telomere- Chromosome labeling and cell cycle analysis - overview of mitosis and meiosis - chromosomal aberrations- applications of molecular cytogenetics.	15
Unit II	Mendel's laws of inheritance – Monohybrid ratio, dihybrid ratio, Incomplete dominance - deviation of mendel's laws – interaction of genes, complementary genes, Reversions, Epistasis, multiple factor inheritance - Sex-linked inheritance – theories of sex determination - Sex determination in plants– Linkage and crossing over.	16
Unit III	Classification of mutations - gene mutations - spontaneous and induced mutations – physical and chemical mutagens - molecular basis of gene mutation - point and frame shift and suppressor mutation- epigenetics - DNA as a genetic material. - gene regulatory mechanisms (prokaryotes & eukaryotes)	15
Unit IV	Plant Breeding: Introduction to breeding of cultivated plants - objectives of breeding - polyploidy and haploids in plant breeding –Selection – mass selection: pureline selection, clonal selection merits and demerits - <i>*Improvement of crop plants by pedigree method, bulk method, backcross method</i>	16
Unit V	Intervarietal, interspecific and intergeneric hybridization - heterosis - hybrid vigour - marker assisted breeding - <i>*national and international organizations for crop improvement</i> - Protection of Plant Varieties & Farmers' Rights Authority, India - Dus - Germplasm - The role of IBPGR and NBPGR - germplasm conservation (Rice and Sugarcane).	16

**Self study topics*

Text Books:

1. Gardener, E.J. 1975. Principles of Genetics (5th ed.), John wiley, New York.
2. Gupta, P.K. 1994. Genetics, Rashtogi Publication, Meerut, India
3. Singh, E.D. 1990. Plant Breeding. Kalyani Publishers, New Delhi.
4. Sinha, U. and Sunita Sinha 1998. Cytogenetics, Plant breeding and evolution. Vikas Publishing House Private, Limited.

Reference Books:

1. Allard, R.W. 1960. Principles of Plant Breeding, John Wiley and Sons, Inc. New York.
2. Gilber, N.W. 1978. Organellar heredity, Revan press, New York.
3. King, R.C. 1975. A Hand book of Genetics, Plenum Press, New York.
4. Simmonds, N.W. 1979. Principles of Crop improvement. Longman, London.
5. Strickberger, M.V. 1977. Genetics, Macmillan publishers, New York.

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	M	H	M
CO2	H	M	L	S	M
CO3	S	H	H	H	S
CO4	S	H	H	H	S

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr. R. Rakkimuthu	Name: Dr. R. Rakkimuthu	Name: Dr. M. Durairaju	Name: Dr. R. Muthukumaran
Signature:	Signature:	Signature:	Signature:

Programme code	M.Sc.	Programme Title: Master of Science in Botany		
Course Code: 18PBY208	9	Title : Core - 8 Practical - II (Anatomy, Embryology, Plant physiology, Cytogenetics and plant breeding)	Batch	2018 - 20
Hrs/Week:			Semester	II
	Credits		4	

Course Objective

To experimentally study the anatomical, physiological and breeding techniques in plants

Course Outcomes (CO)

K3	CO1	Applying the plant anatomical characters in techno based designing
K4	CO2	Estimate the physiological carbon transition forms in plants and carbon budgeting
K5	CO3	Validate the scientific hypothesis by using various experiments

Unit	Content	Hrs
Unit I	ANATOMY 1. Staining of various plant tissues 2. Primary structure of dicot and monocot stem (<i>Helianthus annuus</i> , <i>Zea mays</i>) 3. Normal secondary thickening of dicot stem 4. Anomalous secondary thickening Multiple and successive cambial rings - <i>Boerhaavia</i> Included or interxylary phloem - <i>Achyranthes</i> Intraxylary phloem/Ridged xylem - <i>Bignonia</i> Inverted cortical bundles - <i>Nyctanthes</i> 5. Secondary growth in monocot stem - <i>Dracaena</i>	24
Unit II	1. Stomatal types 2. T.S of dicot leaf - dorsiventral & isobilateral (<i>Nerium</i>) 3. T. S. of monocot leaf - Bamboo 4. Maceration of plant tissues 5. Microtomy 6. Slide submission (Permanemt slide submission)	23
Unit III	EMBRYOLOGY 1. Study of pollen morphology 2. Pollen germination 3. Test for pollen viability 4. Types of ovules 5. Mature embryo sac 6. Observation of endosperm types 7. Dissection of embryos – dicot, monocot and polyembryony	23
Unit IV	PLANT PHYSIOLOGY 1. Determination of DPD of plant tissues by plasmolytic method	

	<ol style="list-style-type: none"> 2. Extraction and estimation of chlorophyll. 3. Separation of chlorophyll pigments using paper chromatography. 4. Determination of stomatal frequency and stomatal index. 5. Effect of light intensity on the rate of photosynthesis. 6. Effect of quality of light on the rate of photosynthesis. 7. Effect of varying concentrations of CO₂ on the rate of photosynthesis. 8. Measurement of respiration by simple respiroscope. 9. Hill reaction by isolated chloroplasts (demonstration). 10. Rate of transpiration under varying climatic factors 	24
Unit V	CYTOGENETICS AND PLANT BREEDING <ol style="list-style-type: none"> 1. Mitosis and meiosis 2. Problems in Mendelian and non - Mendelian inheritance 3. Mutation 4. Charts on plant breeding techniques 	24

Ultrasopic images, Group discussions, Sectioning, Experimental setups and Genetic problems

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	S	M	H	H
CO2	H	S	M	H	M
CO3	S	H	M	H	M

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr. A. M. Anandakumar	Name: Dr. R. Rakkimuthu	Name: Dr. M. Durairaju	Name: Dr. R. Muthukumaran
Signature:	Signature:	Signature:	Signature:

Programme code	M.Sc.	Programme Title : Master of Science in Botany		
Course Code: 18PBY4E3		Title : Elective -3 Horticulture	Batch	2018 - 20
Hrs/Week: 6			Semester	II
			Credits	4

Course Objective

To understand the principles, aspects of horticulture

Course Outcomes (CO)

K1	CO1	Remember the importance of horticultural crops
K2	CO2	Understand the propagation methods of commercially important crops
K3	CO3	Apply the horticultural techniques in self employment
K4	CO4	Figure out the principles of various types of landscaping

Unit	Content	Hrs
Unit I	Definition; Brief history; Scope and importance and divisions of Horticulture; Classification of horticultural plants; Plant growth Environment: Biotic and Abiotic factors.	16
Unit II	Primary and Secondary nutrients and their functions; Organic matter; Fertilizers - organic, inorganic and potting media; Bioinoculants; methods of fertilizer application; Directing plant growth - pruning and thinning.	15
Unit III	Plant propagation: Seeds - advantages, viability, mechanism of dormancy and dormancy breaking: Methods of direct and indirect seedling production in nurseries and transplantation - Medicinal plant cultivation - adaptive cultivation.	15
Unit IV	Propagation through specialized underground structures - Corm, Tuber, Sucker, Bulb, Bulbil, Rhizome; Vegetative propagation - Cutting, Layering, Grafting and Budding. Soil-less production of Horticultural crops - Hydroponics, sand culture, gravel culture, terrace garden, rockery, vertical garden.	16
Unit V	Esthetics of Horticulture - Design; Elements and principles of design; Flower arrangement - cut flowers - Significance of cut flower industry in India; Terrarium culture; Bonsai; Growing plants indoors; Turf production; Landscaping- Principles, Types of parks; Xeriscaping. Post-harvest handling of Horticultural products - Harvesting; *Storage; Processing; *Elements of Marketing.	16

**Self study topics*

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Field study
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Text Books :

1. Adams, C.R. and M. P. Early. 2004. Principles of horticulture. Butterworth –Heinemam, Oxford University Press.
2. Bansil. P.C. 2008. Horticulture in India. CBS Publishers and Distributors, New Delhi.
3. Kumar, N.1997. Introduction to Horticulture, Rajalakshmi Publication, Nagercoil.

Reference Books:

1. Bose T. K and Yadav L. P Commercial Flowers Naya Prokash
2. Bose, T.K., Maiti, R.G., Dhua, R.S. and Das, P. 1999. Floriculture and Landscaping. Naya Prokash, Calcutta.
3. Denisen, E.L. 1979. Principles of Horticulture. MacMillan Publishing co, Inc. New York.
4. Janik, J. 1972. Horticultural Science. W.H. Freeman & Company, San Francisco.
5. Kumar, N. 1994. Introduction to Horticulture, Rajalakshmi Publication, India.
6. Tolanus, S. 2006. Soil fertility, Fertilizer and Integrated Nutrient management. International Book Distributory Co.

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	H	H
CO2	H	H	H	M	S
CO3	H	H	S	M	H
CO4	H	H	S	M	M

S-Strong; H-High; M-Medium; L-Low

Course Designed by Name and Signature	Verified by HOD Name and Signature	Checked by CDC	Approved by COE
Name: Dr. P. Sathishkumar Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Dr. M. Durairaju Signature:	Name: Dr. R. Muthukumaran Signature:

Programme code	M.Sc.	Programme Title : Master of Science in Botany		
Course Code: 18PBY2N1		Title : Non Major Elective - 1 A Mushroom Cultivation	Batch	2018 - 20
Hrs/Week: 1			Semester	II
			Credits	2

Course Objective

To impart mushroom cultivation skills and to promote entrepreneurship

Course Outcomes (CO)

K1	CO1	Keep in mind about the health benefits of mushroom
K2	CO2	Get the idea of the intricacies of mushroom cultivation
K3	CO3	Apply the mushroom cultivation technique in improving the economic status of society
K4	CO4	Evaluate the commercially significant mushroom production

Unit	Content	Hrs
Unit I	Introduction - morphology - types of mushroom - identification of edible and poisonous mushroom - nutritive and medicinal values - life cycle of common edible mushrooms.	3
Unit II	Methods of mushroom cultivation (Hanging bag, bed and rack method) - prospects and scope of mushroom cultivation in small scale industry.	3
Unit III	Life cycle of <i>Pleurotus</i> , <i>Agaricus</i> , <i>Volvariella</i> , <i>Calocybe</i> and <i>Lentinus</i> - breeding and genetic improvement of mushroom strains.	2
Unit IV	Cultivation - conditions for tropical and temperate countries, isolation - spawn production - growth media - spawn running and harvesting of mushrooms.	2
Unit V	Diseases and post harvest technology - harvesting - freezing, dry freezing, drying, <i>*packaging and marketing</i> - <i>*recipes from mushrooms</i> .	2

**Self study topics*

Power point Presentations, Group discussions, Seminar, Quiz, Assignment and Field visit

Text Books:

1. Hand book of mushroom cultivation, 1999, TNAU publication.
2. Nita Bhal. (2000). Handbook on Mushrooms. 2nd ed. Vol. I and II. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Tripathi, D. P. (2005). Mushroom Cultivation. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Reference Books:

1. Alice, D., Muthusamy and Yesuraja, M. (1999). Mushroom Culture. Agricultural College, Research Institute Publications, Madurai.
2. Pathak, V. N. and Yadav, N. (1998). Mushroom Production and Processing Technology. Agrobios, Jodhpur.
3. Tewari Pankaj Kapoor, S. C. (1988). Mushroom Cultivation. Mittal Publication, New Delhi.

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	S	H	H	H
CO2	H	H	H	S	M
CO3	M	H	H	M	H
CO4	M	M	H	S	S

S-Strong; H-High; M-Medium; L-Low

Course Designed by Name and Signature	Verified by HOD Name and Signature	Checked by CDC	Approved by COE
Name: Dr. P. Sathishkumar Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Dr. M. Durairaju Signature:	Name: Dr. R. Muthukumaran Signature:

Programme code	M.Sc.	Programme Title : Master of Science in Botany		
Course Code:18PBY309		Title : Core - 9 Plant Systematics	Batch	2018 - 20
			Semester	III
Hrs/Week:	5		Credits	5

Course Objective

To learn the systems of nomenclature in plants and its economic value

Course Outcomes (CO)

K1	CO1	Remember the methods and principles of classification and plant nomenclature
K2	CO2	Understand the patterns in the evolution of seed plants
K3	CO3	Execute the distribution of seed plant diversity
K4	CO4	Evaluate the economic uses of plants

Unit	Content	Hrs
Unit I	History of classification - Detailed study of Bentham & Hooker, Engler & Prantl and Hutchinson - Merits and demerits of the systems - ICBN - typification, principles of priority, effective and valid publication, citation, and retention - APG System of classification.	13
Unit II	Biosystematics - aim and scope - biosystematic categories - phenotypic plasticity - Herbarium technique, <i>*major herbaria in India and World,floras, *monograph and revision.</i>	13
Unit III	Vegetative, floral characters and economic importance of the following families: Polypetalae: Magnoliaceae, Portulacaceae, Caryophyllaceae, Zygophyllaceae, Oxalidaceae, Tiliaceae, Aizoaceae, Lythraceae, Rhamnaceae, Sapindaceae and Combretaceae.	13
Unit IV	Gamopetalae: Oleaceae, Verbenaceae, Gentianaceae, Boraginaceae, Pedaliaceae and Bignoniaceae. Monochlamydeae: Moraceae, Loranthaceae, Nyctaginaceae and Chenopodiaceae. Monocots: Commelinaceae, Liliaceae, Aroideae and Cyperaceae.	13
Unit V	Modern trends in taxonomy: Anatomical, embryological, cytological, chemical characters and their use in taxonomy. Molecular taxonomy and its applications - numerical taxonomy. Computer aided taxonomy - taxonomy softwares - DELTA, GRIN, IPNI. Biodiversity portal. GIS in taxonomy.	13

**Self study topics*

Power point Presentations, Group discussions, Seminar ,Quiz, Assignment, Case study

Text Books:

1. A classification of flowering plants Vol. I & II Rendle A.R. Cambridge University press.
2. Taxonomy of vascular plants. Lawrance. H.M. Mac Millan& Co.
3. Principles of Numerical Taxonomy. Sokal, S.R and Sneath P.H, N.H Fremen& co.
4. Taxonomy of Angiosperms. Pandey, S. N. and S. P. Misra, 2009. Ane Books Pvt. Ltd, New Delhi.

Reference Books:

1. New concepts in flowering plants taxonomy. Heslop. J. Herrison.
2. An introduction to plant Nomenclature. S.S.R. Bennet international Book distribution India.
3. Principles of angiosperm Taxonomy. Devis& Hey wood Krieger publication Co.
4. A hand book of field and Herbarium methods Jain S.K. and Rao R.R. Today and Tomorrow Publications.
5. An update of the Angiosperm Phylogeny Group Classification for the Orders and Families of Flowering Plants: APG III. Bot. J. Linn. Soc. 161: 105-121.

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	H	H	M
CO2	H	S	L	H	L
CO3	S	H	H	S	M
CO4	S	H	H	H	M

S-Strong; H-High; M-Medium; L-Low

Course Designed by Name and Signature	Verified by HOD Name and Signature	Checked by CDC	Approved by COE
Name: Dr. P. Sathishkumar Signature:	Name: Dr. R.Rakkimuthu Signature:	Name: Dr. M. Durairaju Signature:	Name: Dr. R. Muthukumaran Signature:

Programme code	M.Sc.	Programme Title : Master of Science in Botany		
Course Code: 18PBY310		Title: Core - 10 Plant Biochemistry and Biophysics	Batch	2018 - 20
Hrs/Week: 5			Semester	III
			Credits	4

Course Objective

To understand the biomolecular basis of life

Course Outcomes (CO)

K1	CO1	Remember the fundamentals of biochemistry
K2	CO2	Get the idea on Biochemical pathways and its significance
K3	CO3	Execute the biophysical laws
K4	CO4	Analyze and apply the biomolecular techniques

Unit	Content	Hrs
Unit I	PHYTOCHEMISTRY: pH and its significance - pH scale - Henderson-Hasselbalch equation - isoelectric point - buffers - definition, chemical composition, characteristics of buffer, buffer action, buffer capacity - <i>*biological role of buffer system.</i>	13
Unit II	Plant secondary metabolites: Shikimate, acetate and mevalonate pathway of secondary metabolites - Structure, classification and biological significances of alkaloids, terpenoids and polyphenolic compounds - extraction, isolation and identification of alkaloids, phenols, flavonoids, polysaccharides and terpenoids.	13
Unit III	Enzymes: Nomenclature, classification and properties. Mechanism of enzyme action (Lock and key & induced fit model) and factors affecting enzyme activity (substrate, pH and temperature) - Michaelis - Menton kinetics - enzyme inhibition and its types - enzyme utilization in industry - enzymes and rDNA technology- <i>* enzymes applications in medicine.</i>	13
Unit IV	BIOPHYSICS: Chemical bonds - ionic bond - covalent bond, Vander Vaal's forces, hydrogen bonding and hydrophobic interactions - Energy flow - Laws of thermodynamics - concept of free energy - energy transfer and redox potential - Radio labeling techniques: properties of different types of radioisotopes normally used in biology, their detection and measurement- incorporation of radioisotopes in biological tissues and cells, molecular imaging of radioactive material safety guidelines	13
Unit V	Analysis of biomolecules using electrophoresis - AGE, NATIVE PAGE, SDS PAGE - UV visible spectrophotometer- principle and biological	

	applications of chromatography: paper chromatography, column chromatography, TLC, HPLC, GCMS, LCMS - NMR and Ramachandran plot, Southern blotting and Northern blotting.	13
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**Self study topics*

Power point Presentations, Seminar and Assignment

Text Books:

1. Satyanarayana, U. 2005. Biochemistry. Books and Allied (P) Ltd. Calcutta.
2. Satyanarayana, U. and chakrapani, U. 2005 Biochemistry, Books and Allied (P) Ltd. Calcutta.
3. Lehninger, A.I. 1987. Biochemistry, Kalyani Publishers, New Delhi
4. Veerakumari, I. 2004. Biochemistry, MJP Publishers, Chennai.

Reference Books:

1. Campbell, M.K. 1999. Biochemistry, Saunders College Publishing, New York. Harborne, J.B. 1999. Plant Biochemistry. Chapman & Hall, New Delhi. Jain, J.L. 2005. Fundamentals of Biochemistry. S. Chand & Co. New Delhi.
2. Plummer, D.T. 1996. An introduction to practical biochemistry. McGraw Hill.
3. Conn E.E. and P.K. Stumpf. 1987. - Outlines of Biochemistry, Wiley Eastern Ltd, Chennai.
4. Lubert Stryer. 1986. Biochemistry, CBS Publishers, New Delhi.

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	H	M	H	M
CO2	S	M	M	S	H
CO3	H	S	M	H	M
CO4	S	H	H	H	H

S-Strong; H-High; M-Medium; L-Low

Course Designed by Name and Signature	Verified by HOD Name and Signature	Checked by CDC	Approved by COE
Name: Dr. R. Rakkimuthu Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Dr. M. Durairaju Signature:	Name: Dr. R. Muthukumaran Signature:

Programme code	M.Sc.	Programme Title : Master of Science in Botany		
Course Code: 18PBY414		Title: Core - 11 Research Methodology & Biostatistics	Batch	2018 - 19
Hrs/Week: 5			Semester	III
			Credits	4

Course Objective

To provide the knowledge on research and interpretation

Course Outcomes (CO)

K1	CO1	Remember the basic knowledge on research
K2	CO2	Get the idea in the developing strong hypothesis and methodology for research
K3	CO3	Execute the basic research activities using biophysical instruments
K4	CO4	Evaluate scientific findings through various statistical tools

Unit	Content	Hrs
Unit I	RESEARCH METHODOLOGY: Research - introduction, objectives, types (fundamental, applied, qualitative and quantitative) and significance - selecting research problem - research design - introduction, needs and feature of a good design - Basic principles of experimental designs.	13
Unit II	Literature collection and citation: Bibliography - bibliometrics (scientometrics): definition-laws - citations and bibliography - <i>*biblioscape - plagiarism</i> - Project proposal writing - Dissertation writing – <i>paper presentation (oral/poster)</i> - Monograph - introduction and writing- Monograph for <i>Aloe vera</i> and <i>Ocimum sanctum</i> and SOP – introduction and preparation.	13
Unit III	BIOSTATISTICS: General description and theories of various biostatistical methods: Data collection & representation: graph and tabulation - measures of central tendency - mean (arithmetic) - median and mode - measures of dispersion: standard deviation - standard error - coefficient of variation.	13
Unit IV	Tools and application of Excel: Measures of significance: Chi-Square test - F-test - t-test - correlation - scatter diagram - Spearman's rank correlation coefficient - regression coefficients - lines of regression & their properties - analysis of variance (ANOVA-single factor).	13
Unit V	Tools and applications of SPSS: measures of central tendency and dispersion - measures of significance - analysis of variance (ANOVA-single factor) - multivariate analysis - probability of distribution (binomial, poisson and normal) - Cluster analysis.	13

**Self study topics*

Text Books

1. Mount, D. W. 2004. *Bioinformatics: Sequence and genome analysis. Cold Spring Harbour Laboratory Press.*
2. Kothari, C.R. and Gaurav Garg, 2014. *Research Methodology: Methods and Techniques (3rd revised edition). New Age International publisher, New Delhi.*

Reference Books

1. M.H. Cordon and R. Macrae, 1987. *Instrumental analysis in the Biological Science, Blackie and Son Limited, London.*
2. Sadasivan and Manickam, *Biochemical Methods.*
3. Jayaraman, J. *Laboratory Manual of Biochemistry.*
4. Harborne, *Phytochemical methods.*
5. Prasad and Prasad, *Micro technique.*
6. Rajiv, K. Sinha and Shweta Sinha, 2005. *Ethno biology, Surabi Publications, Jaipur.*
7. Garry D Christian, James E O'reilvy (1986). *Instrumentation analysis. Alien and Bacon, Inc.*
8. Wilson, K. and Walker, J. 2006. *Principles and techniques of Biochemistry and molecular Biology, Cambridge University Press, Cambridge, UK.*
9. Sadasivam, S. and Manickam, A. 2008. *Biochemical Methods. New Age International Publishers, New Delhi.*
10. Khan, I.A. and Khannum, A. 1994. *Fundamentals of Biostatistics. Vikas Publishing, Hyderabad.*

Journals:

1. *Journal of Mixed Methods Research.*
2. *Journal of Research Methods and Methodological Issues.*

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	S	L	H	L
CO2	H	S	M	S	M
CO3	H	H	M	H	M
CO4	H	H	H	M	M

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Ms. D. Sowmiya	Name: Dr. R. Rakkimuthu	Name: Dr. M. Durairaju	Name: Dr. R. Muthukumaran
Signature:	Signature:	Signature:	Signature:

Programme code	M.Sc.	Programme Title : Master of Science in Botany		
Course Code: 18PBY312		Title : Core - 12 Practical - III (Plant Systematics)	Batch	2018 - 20
			Semester	III
Hrs/Week:	4		Credits	4

Course Objective

To acquire practical skills in plant identification

Course Outcomes (CO)

K3	CO1	Identify salient features of families
K4	CO2	Understand the key characters for identification of plants
K5	CO3	Apply techniques to conserve importance of forests

Unit	Content	Hrs
Unit I	PLANT SYSTEMATICS 1. Terminologies related to taxonomy. 2. Identification and description of families belongs to Polypetalae (Magnoliaceae, Portulacaceae, Caryophyllaceae, Zygophyllaceae, Oxalidaceae, Tiliaceae, Aizoaceae, Lythraceae, Rhamnaceae, Sapindaceae and Combretaceae) 3. Identification and description of families belongs to Gamopetalae (Oleaceae, Verbenaceae, Gentianaceae, Boraginaceae, Pedaliaceae and Bignoniaceae).	12
Unit II	1. Identification and description of families belongs to Monochlamydeae (Moraceae, Loranthaceae, Nyctaginaceae and Chenopodiaceae) 2. Identification and description of families for Monocots (Commelinaceae, Liliaceae, Aroideae and Cyperaceae)	10
Unit III	1. Preparation of artificial keys at family, generic and species level by locating key characters. 2. Field identification of plants	10
Unit IV	1. Economic importance of all the families given in the theory 2. Herbarium techniques	10
Unit V	3. Preparation of herbarium sheets - 50 minimum. 4. Botanical tour to any vegetation rich places.	10

Power point Presentations, Group discussions, Floral dissection, Field visit and Case study

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	L	M
CO2	H	S	H	M	M
CO3	H	H	M	M	M

S-Strong; H-High; M-Medium; L-Low

Course Designed by Name and Signature	Verified by HOD Name and Signature	Checked by CDC	Approved by COE
Name: Dr. P. Sathishkumar Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Dr. M. Durairaju Signature:	Name: Dr. R. Muthukumaran Signature:

Programme code	M.Sc.	Programme Title: Master of Science in Botany		
Course Code:18PBY313		Title : Core - 13 Practical - IV (Plant Biochemistry and Research methodology)	Batch	2018 - 20
Hrs/Week:			Semester	III
	5		Credits	4

Course Objective

To get a hands on experience biomolecular and plant tissue culture techniques

Course Outcomes (CO)

K3	CO1	Understand the nature of bio molecules in plants
K4	CO2	Analyze the plants for its biochemical components
K5	CO3	Access recent techniques in molecular biology

Unit	Content	Hrs
Unit I	PLANT BIOCHEMISTRY: 1. Estimation of Carbohydrates (Anthrone method) 2. Estimation of Proteins (Lowry & Bradford). 3. Quantification of total free amino acids. 4. Estimation of free fatty acids. 5. Separation of plant pigments by column chromatography.	13
Unit II	1. Plant extraction by soxhelt apparatus. 2. Phytochemical screening of plant extract 3. Qualitative and quantitative estimation of phenols, flavonoids and alkaloids. 4. Determination of enzyme activities - catalase, ascorbic acid oxidase and polyphenoloxidase.	13
Unit III	BIOPHYSICS 1. Protein separation by SDS-PAGE 2. Agarose gel electrophoresis 3. Qualitative and quantitative analysis of plant genomic DNA using spectrophotometer	13
Unit IV	RESEARCH METHODOLOGY 1. Research process 2. Hypothesis development 3. Research writing 3.1. How to write a research proposal? 3.2. How to write a research report? 3.3. Dissertation writing 3.4. Manuscript preparation using LATEX software	13

	4. Bibliometrics 5. Citation index & Citation 6. Bibliography and biblioscope	
Unit V	BIOSTATISTICS 1. Collection, analysis and graphical representation of data 2. Measures of central tendency - mean, median and mode 3. Measures of dispersion: range, standard deviation, coefficient of variation correlation 4. Test of significance - Chi-square test and Student 't' test. 5. Simple exercises in MS- Word 6. Presentation in MS-Powerpoint 7. Statistical calculations and chart preparation in MS-Excel and SPSS. 8. Creation of database in MS-Access.	13

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	S	M	H	M
CO2	H	H	H	S	H
CO3	H	S	S	H	H

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr. R. Rakkimuthu	Name: Dr. R. Rakkimuthu	Name: Dr. M. Durairaju	Name: Dr. R. Muthukumaran
Signature:	Signature:	Signature:	Signature:

Programme code	M.Sc.	Programme Title : Master of Science in Botany		
Course Code: 18PBY3E3		Title: Elective - 3 Forestry	Batch	2018 - 20
			Semester	III
Hrs/Week:	5		Credits	4

Course Objective

To understand the components and role of forest ecosystem

Course outcomes (CO)

K1	CO1	Recollect the importance of forests
K2	CO2	Understand various forests types and to impart conservation strategy
K3	CO3	Apply the forest units in the manufacturing of value added products
K4	CO4	Review the laws for the protection of forest and its resources

Unit	Content	Hrs
Unit I	General introduction to forests - Natural and Manmade; Tropical, temperate, evergreen, semi evergreen, deciduous; Monoculture, multipurpose, social and industrial. Forest and gene conservation; * <i>Forest types in South India with special emphasis to Tamil Nadu</i> . IUCN red listed categories.	13
Unit II	Silviculture - regeneration of forests. Clear felling, uniform shelter, wood selection, coppice and conservation systems. Silviculture of some of the economically important species <i>Azadirachta indica</i> , <i>Tectona grandis</i> , <i>Eucalyptus</i> , Mahogany (<i>Swietenia mahagoni</i>), <i>Dalbergia sissoo</i> , <i>Santalum album</i> , <i>Madhuca longifolia</i> , Rubber (<i>Hevea brasiliensis</i>), Sal (<i>Shorea robusta</i>) and Padauk (<i>Pterocarpus</i>). Barks - Nature and types, Wood: Morphology - Anatomy - Types - homogenous and heterogenous - spring and autumn wood- porous and non porous wood- heart and sap wood.	13
Unit III	Social and agro forestry: Selection of species and role of multipurpose trees. Food, fodder and energy- Social forestry - Avenue plantation - Sacred groves- definition, status and importance - Seed dormancy - Types of dormancy, physical and chemical methods to overcome seed dormancy. Forest laws- necessity, General principles, Indian forest act 1927 and their amendment.	13
Unit IV	Forest resources and utilization: timber, pulp wood, secondary timbers, non timber forest products (NTFPs). Origin of cultivated plants, Vavilov's centres of origin- Plants as sources for food, fodder, fibres, spices, beverages, drugs, narcotics, insecticides, timber, gums, resins and dyes- Latex, cellulose Starch and their products- Perfumery- Forest conservation and management - strategies for conservation - <i>In situ</i> - <i>ex situ</i> - laws - the	13

	biological diversity act (2002 in force) - World Conservation Strategy (WCS) and National Biodiversity Strategy and Action Plan (NBSAP).	
Unit V	Origin and History, Botanical description, Cultivation, Harvesting and uses of spices and condiments - beverages - fibres and timbers - oils - medicinal plants. Ethnobotany - definition - sub divisions - methodology - major tribes in Southern India - regional studies - ethnobotany in human welfare - food - medicine. Importance of Ethnobotany in Indian context. Role of tribes in medicinal plants conservation - <i>role of NMPB, FRLHT, AYUSH in medicinal plant conservation*</i> - MPCA sites.	13

**Self study topics*

Power point Presentations, Group discussions, Seminar, Quiz and Assignment.

Text Books

1. Dhiman, A.K. 2003. Sacred plants and their medicinal uses. Daya publishing house, New Delhi.
2. Kocchar S.L. 2009. Economic botany in the tropics, Macmillan publishers, Chennai
3. Jain S.K. Mudgal V. 1999. A Handbook of Ethnobotany. BSMPS, Dehradun.
4. Avery, T.E. 1967. Forest Measurements. Mc Grand Hill Book Company, Newyork.
5. Ramprakash (1986). Forest management. IBD Publishers, Debra Dun.
6. Chundawat, B.S. and Gautham, S.K. 1996. Text book of Agroforestry. Oxford and IBH publisher, New Delhi
7. Rao, K.R. and Juneja, J.D. 1971. A handbook for field identification of fifty important timbers of India. The Manager of Publications, Govt. of India, New Delhi.
8. WWF. 2007. Timber identification manual. TRAFFIC, New Delhi.

Reference Book

1. Jain S.K., Philipps R.D. 1991. Medicinal Plants of India. Ref. Publ. Algonac, U.S.A. Vol. 2 1-849.
2. Saklani A., Jain S.K.1994. Cross Cultural Ethnobotany of Northeast India. Deep Publ. Delhi 1-453
3. Sagreiya, K.P. Forests and Forestry, 1997. National Book Trust India.
4. Mehta, T. 1981. A handbook of forest utilization. Periodical Expert Book Agency, Delhi. 298 p.
5. Rao, K.R. and Juneja, K.B.S. 1992. Field identification of 50 important timbers of India. ICFRE Publi. Dehradun 123 p.
6. Gupta, T. and Guleria, A. 1982. Non-wood forest products in India: Economic potential. Oxford and IBH Publication, New Delhi. 147 p.
7. Sagreiya, K.P. 1994. Forests and Forestry (Revised by S.S. Negi). National Book Trust. New Delhi.

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	S	M	S	H
CO2	S	H	M	M	M
CO3	S	M	H	M	M
CO4	S	M	M	M	M

S-Strong; H-High; M-Medium; L-Low

Course Designed by Name and Signature	Verified by HOD Name and Signature	Checked by CDC	Approved by COE
Name: Dr. A.M. Anandakumar Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Dr. M. Durairaju Signature:	Name: Dr. R. Muthukumaran Signature:

Programme code	M.Sc.	Programme Title: Master of Science in Botany		
Course Code: 18PBY311		Title: Core - 14 Molecular Biology and Plant Biotechnology	Batch	2018 - 20
Hrs/Week: 5			Semester	IV
			Credits	5

Course Objective

To acquire knowledge on molecular basis of life and applications of plant biotechnology

Course Outcomes (CO)

K1	CO1	Students will keep in mind the knowledge on techniques in plant tissue culture
K2	CO2	Understand the fundamentals of gene regulation
K3	CO3	Execute knowledge on molecular achievements in environmental stress management in plants
K4	CO4	Analyze and apply the important of nanoparticles in plant diversity

Unit	Content	Hrs
Unit I	Essential Plant biology concepts for plant biotechnology: Genome organization- Mitochondrial genome organization- Chloroplast genome organization- Nuclear genome organization.- protein targeting- protein targeting to nuclear, mitochondria and chloroplast - important biochemical pathways in plants - Glucose metabolism, Respiration, over view of biosynthesis for small and macromolecules, anaerobic and autotrophic metabolism- molecular markers in plants.	13
Unit II	Replication of Eukaryotic chromosome: Replication origin, replication fork, terminals, replication apparatus - replication of RNA genome (replicase and reverse transcriptase) - semi conservative mode of DNA replication - Transcription: RNA polymerase - signals - chemistry and process, translation - mechanism of initiation - elongation and termination of protein synthesis.	13
Unit III	PLANT TISSUE CULTURE: History, Laboratory organization, Sterilization methods - media preparation - micropropagation - meristem culture - callus culture - suspension culture- organogenesis - somatic embryogenesis - artificial seed preparation- cryopreservation. Haploid production - protoplast isolation and culture- somatic hybridization - cybrids - somoclonal variation.	13
Unit IV	Development of plant transformation cassettes - Structure and function of Ti plasmid of <i>Agrobacterium</i> - mechanism of T-DNA transfer to plants - Ti plasmid vectors for plant transformation - promoter and marker genes in	13

	plant transformation - <i>*physical , chemical and biological method for plant gene transfer</i> - transgenic plants for viral resistance - herbicide tolerance - delay of fruit ripening - resistance to insects, pests and pathogens - ethics in plant biotechnology - IPR	
Unit V	Types of nanomaterials: nano rods, nanowires, nanoparticles, nanocapsules, nano membranes, nano meshe, nano fibres, nano catalysts, and carbon nano tubes - methods of preparation of nanomaterial: top down and bottom up approaches- emulsifiers, homogenizers, MOCVD etc. Environmental applications: Nano clays, nano adsorbents, zeolites, release of nutrients and pesticides, biosensors - green technologies - <i>*treatment of industrial waste waters using nano-particles.</i>	13

**Self study topics*

Power point Presentations, Seminar and Assignment

Text Books:

1. Slater A. Scott N. and Fowler M. 2008. Plant Biotechnology: The Genetic Manipulation of Plants. Oxford University Press Inc.
2. Satyanarayanan U. 2007. Biotechnology. Books and Allied (P) Ltd., Kolkata.

Reference Books:

1. Lea, P.J, Leegood, R.C. 1993. Plant Biochemistry and Molecular Biology. eds. John Wiley and Sons, Chichester and New York.
2. Mahesh S. 2008 Plant Molecular Biotechnology. New Age International Publishers.
3. Ramavat K.G. 2006 Plant Biotechnology S. Chand and Co. Ltd., New Delhi
4. Trivedi P.C. 2000 Plant Biotechnology – Recent Advances. Panima Publication Corporation, New Delhi
5. Ignacimuthu S. 1998 Plant Biotechnology. Oxford and IBH
6. Reynolds P.H.S 1999. Inducible Gene Expression in Plants. CABI Publishing, U.K.

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	S	H	H	S
CO2	H	S	M	S	H
CO3	H	S	S	H	H
CO4	S	H	H	H	H

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr. R. Rakkimuthu	Name: Dr. R. Rakkimuthu	Name: Dr. M. Durairaju	Name: Dr. R. Muthukumaran
Signature:	Signature:	Signature:	Signature:

Programme code	M.Sc.	Programme Title : Master of Science in Botany		
Course Code: 18PBY415		Title : Core - 15 Bioinformatics and Cyber security	Batch	2018 - 20
Hrs/Week: 5			Semester	IV
			Credits	5

Course Objective

To provide an *insilico* platform for biomolecular study.

Course Outcomes (CO)

K1	CO1	Keep in mind the threats to cyber security and related social issues
K2	CO2	Apprehend the ideas on molecular biology
K3	CO3	Apply various tools for genomic and proteomic studies
K4	CO4	Figure out the characteristics of biomolecules <i>insilico</i>

Unit	Content	Hrs
Unit I	BIOINFORMATICS: Definition and Scope. Biological databases - Primary and secondary. Genomics: Definition - Gen Bank, DDBJ - Sequence and molecular file formats. Biological information portal: NCBI and EMB net. BLAST- An overview of BLAST tools available with NCBI - conserved domains - CpG islands.	13
Unit II	Gene prediction methods (Homology, <i>ab initio</i> , and comparative method). Pair wise and multiple sequence alignment, scoring matrices (PAM and BLOSUM). Molecular phylogeny (Cladistics and phenetic methods) CLUSTAL and PHYLIP.	13
Unit III	Proteomics: Definition, Levels of protein structure, Protein secondary structure prediction (SOPMA and JPRED). Molecular visualization tool - Rasmol and Swiss PDB Viewer. Protein modeling methods - Comparative and <i>De novo</i> methods. Model refinement and evaluation of model. Over view of SWISS PROT. Outline of computer aided drug designing. * <i>Systems biology - concept and applications.</i>	13
Unit IV	CYBERSECURITY: Overview of cyber security - confidentiality, integrity and availability - Threats - malicious software (viruses, Trojans, rootkits, worms, botnets) - memory exploits (buffer overflow, heap overflow. Integer overflow, format string) - cryptography - authentication - password system - windows security.	13
Unit V	Network security - network intrusion detection and prevention systems - firewalls - software security - vulnerability auditing, penetration testing, sandboxing, control flow integrity - web security - user authentication - legal and ethical issues - cyber crime, * <i>intellectual property rights, copyright, patent, trade secret, hacking and intrusion, privacy, identity threat.</i>	13

**Self study topics* (Study material for cyber security is available in college website in the form of e-book)

Power point Presentations, Group discussions, Seminar, Assignment and online demonstration.

Text Books

1. Arthur Conklin W.M., and Greg White, Principles of computer security. TMH.
2. Rastogi, S. C., N. Mendiratta, and P. Rastogi (2008), Bioinformatics - Methods and applications, Genomics, Proteomics and Drug discovery, PHI Learning pvt Ltd., New Delhi.
3. Baxevanis and Quellette (1998). Bioinformatics. A practical guide to analysis of genes and proteins.
4. Arthur M. Lesk (2002) Introduction to Bioinformatics.

Reference Books

1. Stuart M. Brown. 2000. Bioinformatics: A biologist's guide to biocomputing and the internet.
2. T. K. Attwood and Parry-Smith, 1999. Introduction to Bioinformatics.
3. S. Sundararajan and R. Balaji, 2002. Introduction to Bioinformatics.
4. David W. Mount, 2001. Bioinformatics: Sequence and genome analysis. SEM.IV
5. Chwan-Hwa (John) Wu, J. David Irwin, Computer networks and cyber security. 2016. CRC press.
6. Mike O'Leary, Cyber O. 2016. Apress publications.
7. Matt Bishop, Computer security art and science, second edn., Pearson/PHI.
8. Atul Kahate, Cryptography and Network security. Mc Graw Hill, 2nd edn.
9. Yang Xiao. Frank H Li, Hui Chen. Handbook of security networks, World scientific.

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	S	M	M	L
CO2	S	H	M	S	H
CO3	H	H	H	H	H
CO4	H	H	H	S	M

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr. A.M. Anandakumar	Name: Dr. R. Rakkimuthu	Name: Dr. M. Durairaju	Name: Dr. R. Muthukumaran
Signature:	Signature:	Signature:	Signature:

Programme code	M.Sc.	Programme Title: Master of Science in Botany		
Course Code: 18PBY416		Title: Core - 16 Practical - V (Molecular Biology and Plant Biotechnology and Bioinformatics & Cyber security)	Batch	2018 - 19
			Semester	IV
Hrs/Week:	6		Credits	4

Course Objective

To provide hands on experience on biomolecular *insilico* analysis and to enrich the research analysis and interpretation skills

Course Outcomes (CO)

K3	CO1	Implement research execution, data interpretation and thesis writing
K4	CO2	Evaluate the principles and techniques for conducting research
K5	CO3	Validate the experimental results using statistical tools

Unit	Content	Hrs
Unit I	MOLECULAR BIOLOGY AND PLANT BIOTECHNOLOGY 1. DNA Replication, protein targeting, structure of m - RNA charts 2. Isolation of plasmid DNA from bacteria 3. Isolation of genomic DNA from plants 4. Estimation of RNA by orcinol method 5. Amplification of a plant gene using PCR 6. Synthesis of silver nano particles from plant extracts	16
Unit II	1. Preparation of MS Medium 2. Meristem culture 3. Callus induction 4. Organogenesis 5. Somatic embryogenesis 6. Anther culture 7. Synthetic seeds 8. Hardening	15
Unit III	BIOINFORMATICS & CYBER SECURITY 1. Observation and analysis of biological databases 2. Data mining -sequence and structure retrieval 3. FASTA format 4. Pair wise alignment using BLAST 5. Multiple sequence alignment using CLUSTAL X 6. Construction of phylogenetic tree using CLUSTAL W and PHYLIP 7. Gene finding using Gen Mark Hmm.	15
Unit IV	1. Conserved domain search 2. Motifs search	15

	3. CpG islands	
Unit V	4. Protein primary structure prediction using PROTPARAM 5. Protein secondary structure prediction using GOR 6. Protein translation using TRANSLATE 7. Protein structure visualization with Rasmol and Swiss PDB Viewer	17

Power point presentations, group discussions, online demonstration and field visit

CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	S	H	H	M
CO2	H	H	M	S	M
CO3	H	S	H	M	M

S-Strong; H-High; M-Medium; L-Low

Course Designed by	Verified by HOD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr. A.M. Anandakumar	Name: Dr. R. Rakkimuthu	Name: Dr. M. Durairaju	Name: Dr. R. Muthukumaran
Signature:	Signature:	Signature:	Signature:

Department	Botany	
Course	M.Sc., Botany	Effective from the Year: 2018
	Subject Code : 17PBY4P1 Title : PROJECT	Semester:IV
Hrs/Week :	14	Credits: 4

Course Objective

To identify innovative modules in research and to develop the thesis writing skills

Course Outcomes (CO)

K3	CO1	Execute the advanced research areas
K4	CO2	Apply the methodology for the development of societal needs in the present scenario
K5	CO3	Validate the research process.

Unit	Content	Hrs
Unit I	1. Selection of title 2. Literature collection	20
Unit II	Experimental techniques	21
Unit III	Observations and results	22
Unit IV	Summarizing and conclusion of project	20
Unit V	Preparation of thesis and presentation for project viva voce	21

Power point presentations, Group discussions, Experience discussion and Wet lab experiments.
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CO \ PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	H	S
CO2	H	S	M	H	H
CO3	H	H	S	S	S

S-Strong; H-High; M-Medium; L-Low

Course Designed by Name and Signature	Verified by HOD Name and Signature	Checked by CDC	Approved by COE
Name: Dr. R. Rakkimuthu Signature:	Name: Dr. R. Rakkimuthu Signature:	Name: Dr. M. Durairaju Signature:	Name: Dr. R. Muthukumaran Signature: