Estd: 1966

SARASWATHI NARAYANAN COLLEGE
(An Autonomous Institution Affiliated to Madurai Kamaraj University)
(Reaccredited with Grade 'B' by NAAC)
Perungudi, MADURAI – 625 022.
Website : www.sncollegemadurai. org
E.mail: sncollegemdu@yahoo.com
Ph.: 0452 2690635 Fax: 0452 2690635

DEPARTMENT OF BOTANY

Choice Based Credit System (CBCS)
Learning Outcomes-based Curriculum Framework (LOCF)

M.Sc. Botany Programme
(For those who join in June 2022)

PRINCIPAL

Dr. M. Kannan M.A., M.Phil., Ph.D.

DEPARTMENT OF BOTANY

1. Dr. N.Vasudevan, M.Sc., B.Ed., M.Phil., Ph.D.

-Associate Professor and Head

2. Dr. D. Kathiresan, M.Sc., B.Ed., M.Phil., Ph.D

- Associate Professor

3. Dr. S. Rajendran., M.Sc. M.Phil., Ph.D

- Associate Professor

4. Dr. S. Sankaralingam, M.Sc., B.Ed., M.Phil., Ph.D.

- Assistant Professor

5. Dr. K.Suresh, M.Sc., M.Phil., Ph.D

- Assistant Professor

6. Dr. S. Prakash, M.Sc., Ph.D.

- Assistant Professor

7. Dr. T. Athiperumalsami, M.Sc., M.Phil., Ph.D.

- Assistant Professor

7. Dr. A. Saravanakumar, M.Sc., M.Phil., PMCPGE.,Ph.D.
- Assistant Professor

8. Dr. P.Packiyaraj, M.Sc., M.Phil., PGDCA., Ph.D

- Assistant Professor

9. Dr. S. Karthickkumaran, M.Sc.(Biotech), M.B.A., M.Sc.(Bot)., M.Phil., Ph.D.

- Assistant Professor

PROFILE OF THE COLLEGE

Thiru. L. Narayanan Chettiar, a renowned philanthropist founded Saraswathi Narayanan College at Perungudi near Madurai Airport in the year 1966. The college is a prestigious academic powerhouse catering to the educational needs of students hailing from economically weaker and socially oppressed section of our society. It imparts education of the highest quality to students irrespective of caste, creed and religion. The guiding principles of our college are duty, devotion and distinction. The institution has proved an innovative leader and a catalyst in the best educational, cultural and economic interests of students. It is committed to make the students morally upright, intellectually resourceful, socially advantaged and globally competent. It is devoted to teaching, research and extension activities with equal importance.

The college set off its academic journey with Pre-University Courses in the year 1966 – 67. The Institution started offering UG programmes from the academic year 1968 – 69. It was upgraded as Post-Graduate Institution in 1979 – 80 and as Research Institution in 1984 – 85. The co-educational system was introduced for M.Phil. programmes in the academic year 2001 – 02 and for PG programmes in the year 2002 – 03 with the noble objective of promoting higher education among girls in rural areas. Girls have been enrolled in UG programmes also since the academic year 2010 – 11.

The green campus of 66 acres has a built-up area of 1,70,059 sq.ft. A new library housed at Silver Jubilee building was built at the cost of Rs.25,00,000/- and it was inaugurated by His Excellency Dr. M. Chenna Reddy, then the Governor of Tamilnadu on 04.04.1994. The library was dedicated to the memory of Achi. The major donor of this building was Tmt. Saraswathi Narayanan, the better half of the Founder President Thiru. L. Narayanan Chettiar. Sri Vidhya Ganapathi Temple was built and consecrated on 27.08.2015.

The Departments of Botany, Mathematics, Commerce, English, Economics and Chemistry have been upgraded as university recognized research centres to carryout M.Phil and Ph.D research programmes in the college. NAAC accredited the college with grade B+ in the year 2005. UGC accorded the status of Autonomy to our institution in the year 2007. NAAC re-accredited the college with grade B (CGPA of 2.78) in the year 2016. UGC extended the Status of Autonomy to the institution for another period of five years from the academic year 2016 – 17.

SARASWATHI NARAYANAN COLLEGE
(An Autonomous Institution Affiliated to Madurai Kamaraj University)
(Reaccredited with Grade 'B' by NAAC)
Perungudi, MADURAI – 625 022.

M.Sc. BOTANY COURSE STRUCTURE

SEMESTER – I

Course Type	Title of the course	Course code	H/W	Credit	A.C	Exam hours	CIA	Ext
CC1	Plant Diversity –I (Algae, Fungi, Bryophytes)	LPBYCT11	5	4	-	3	25	75
CC2	Ecology and Biodiversity	LPBYCT12	5	4	-	3	25	75
CC3	Developmental Botany and Internal Morphology	LPBYCT13	5	4	-	3	25	75
CC4	Plant diversity-I (Algae, Fungi, Bryophytes)	LPBYCL11	5	2	-	3	40	60
CC5	Ecology and Biodiversity, Developmental Botany and Internal Morphology	LPBYCL12	5	2	-	3	40	60
DSE-1	Applied Botany	LPBYDS11	5	4	-	3	25	75
	Forestry	LPBYDS12						
Ad.Cr.Co:I	MOOC		-	-	-	-	-	-
			30	**20**	**2**			
SEMESTER – II								
CC6	Plant Diversity –II (Pteridophytes, Gymnosperm and Paleobotany)	LPBYCT21	5	4	-	3	25	75
CC7	Genetics and Evolution	LPBYCT22	5	4	-	3	25	75
CC8	Theory VI- Cell and Molecular biology	LPBYCT23	5	4	-	3	25	75
CC9	Plant diversity-II	LPBYCL21	5	2	-	3	40	60

	(Pteridophytes, Gymnosperm and Paleobotany)							
CC10	Genetics and Evolution & Cell and Molecular biology	LPBYCL22	5	2	-	3	40	60
DSE-2	Plant Pathology	LPBYDS21	3	3	-	3	25	75
	Genomics and Proteomics	LPBYDS22						
AEC-1	Pharmaceutical technology	LPBYAE21	2	2	-	3	25	75
SLC-1	Ethnobotany	LPBYSC21	-	-	2	3	100	-
	Field Methods for Vegetation Mapping	LPBYSC22						
Ad.cr.co:11	MOOC		-	-	-	-	-	-
			30	**21**	**2**			
SEMESTER – III								
CC11	Plant Systematics	LPBYCT31	5	5	-	3	25	75
CC12	Plant Biotechnology	LPBYCT32	5	5	-	3	25	75
CC13	Bioinstrumentation	LPBYCT33	5	5	-	3	25	75
CC14	Plant systematics, Plant Biotechnology, Bioinstrumentation	LPBYCL31	4	2	-	3	40	60
CC15	Project/Dissertation	LPBYPJ41	4	-	-	-	-	-
GEC-1 NME	Plants and Human welfare	LPBYNM31	5	4	-	3	25	75
AEC-2	SET/NET/CSIR-UGC General paper Preparation	LPBYAE31	2	2	-	3	25	75
		LPBYAE32						
SLC-2	Conservation of Natural Resources and Policies	LPBYSC31	-	-	2	3	100	-
	Forensic Botany	LPBYSC32						
Ad.cr.co:11	MOOC				-	-	-	-
			30	**23**	**2**			

SEMESTER –IV								
CC16	Plant Physiology	LPBYCT41	5	5	-	3	25	75
CC17	Plant Biochemistry and Metabolism	LPBYCT42	5	5	-	3	25	75
CC18	Microbiology and Immunology	LPBYCT43	5	5	-	3	25	75
CC19	Plant Physiology, Plant Biochemistry and Metabolism, Microbiology	LPBYCT44	5	2	-	3	40	60
CC15	Project/Dissertation	LPBYPJ41	4	4	-	-	50	50
DSE-3	Intellectual Property Right	LPBYDS41	4	3	-	3	25	75
	Computational Biology	LPBYDS42						
SEC-1	Biostatistics	LPBYSE41	2	2	-	3	25	75
		LPBYSE42						
Ad.Cr.Co:11	MOOC		-	-	-	-	-	-
			30	**26**	**2**			

SARASWATHI NARAYANAN COLLEGE
(An Autonomous Institution Affiliated to Madurai Kamaraj University)
(Reaccredited with Grade 'B' by NAAC)
Perungudi, MADURAI – 625 022.

DEPARTMENT OF BOTANY – PG – CBCS - LOCF

(For those who join in June 2022)

Title of the Course: Plant Diversity – I		**Semester: I**
(Algae, Fungi and Bryophytes**)**		
Course Code:LPBYCT11	**Contact hours: 5hrs/w**	**Credit: 4**

Course Learning Outcomes:

On completion of the course, the students are able to

- derive knowledge on plant diversity and its distribution.
- get more information about algae and its existence.
- gather knowledge on diversity of fungi and its general characters.
- get more information on various fungal species.
- acquire knowledge about bryophytes and its ecological relationship as well as vegetative reproductions of various genera.

Pre-required knowledge:

- Thallus organization
- Sex hormones
- Fossil Bryophytes

Unit I: Algae

General characters of algae including similarities and diversities; Classification of algae by Chapman and Chapman (1960). General features- vegetative, asexual and sexual; reproduction in Algae.Life cycle patterns and alternation of generations– Occurrence, structure (Thallus organization) reproduction and life cycle of Cyanophyta and Chlorophyta (at class level).

Unit II:Reproduction of Algae

Occurrence, habit, structure, reproduction and life cycle of Xanthophyta, Bacillariophyta, Phaeophyta and Rhodophyta and Fossil forms. Economic importance. Role of algae in soil fertility; Algal blooms; symbiotic associations, pollution indicators and Single Cell Protein.

Unit III: Fungi

General characters of Fungi; classification of fungi proposed by Alexopoulous and Mims (1979). An overview and life history of Myxomycetes, Oomycetes, Zygomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes.

Unit IV: Classes of Fungi

Homothalism and Heterothalism in Fungi; Parasexuality in Fungi, Sex hormones in Fungi, Economic importance of Fungi.

Unit V: Bryophytes

Classification by G.M.Smith (1938), Distribution, morphological and anatomical features, structural variations and evolution of Gametophytes and Sporophytes in Bryopsida, Anthoceropsida and Thalophyta. Economic importance. Vegetative reproduction in Bryophytes. Fossil Bryophytes. Ecology of Bryophytes.

Suggested Topics for Seminar/Presentation/Group Discussion

Thallus organization

Economic importance of algae

Homothalism and Heterothalism in Fungi

An overview and life history of Myxomycetes

Ecology of Bryophytes

Suggested Readings:

i)Text Books:

1. Fritsch. F.E. The structure and reproduction of Algae – Volume I & II, Vikas Publication, New Delhi, 1965.

2. Vashishta,B.E., Sinha,A.K. and Singh, V.P. Algae – 9th Revised Edition, 2002.
3. Sharma, O.P. Text Book of Algae. Tata McGraw – Hill publishing Co.,Ltd., New Delhi, 1986.
4. Vashishta, B.R.Sinha. A.K. and Singh,V.P. Fungi – S. Chand & Ltd., New Delhi, 2002.

ii)Reference Books:

1. Chapman, V.J.and Chapaman,D.J. The Algae, ELBS & MacMillan, London, 1960.
2. Prescott.G.W. The Algae – a Review, Bishen Singh & Mahendra Pal Singh. Dehra Dun. 1969.
3. Smith.G.M. Cryptogamic Botany Vol.II. Tata McGraw Hill.New Delhi, 1955.
4. Alexopoulos.J and Mims, W. Introductory Mycology, Wiley Eastern Limited. New Delhi, 1985.

iii)Web Sources:

1. https://www.britannica.com/science/algae
2. https://en.wikipedia.org/wiki/Bryophyte
3. https://www.britannica.com/plant/bryophyte/Ecology-and-habits
4. https://www.livescience.com/53618-fungus.html.

DEPARTMENT OF BOTANY - PG - CBCS - LOCF

Title of the Course: Ecology and Biodiversity		**Semester: I**
Course Code:LPBYCT12	**Contact hours: 5hrs/w**	**Credit:4**

Course Learning Outcomes:

On completion of the course, the students are able to

- appraise upon the scope and importance of population ecology, plant communities and ecosystem ecology.
- understand the importance of resource ecology, climate change and waste management.
- acquire knowledge and understand the values and conservation of biodiversity.

- recognise the botanical regions of India and vegetation types of Tamil Nadu.
- classify phytogeographical zones of India and Tamil Nadu.

Pre-required knowledge

- Environmental Ecology
- Climate Change
- Need of conservation

Unit I: Ecology

Introduction – History, scope, concepts. Terminology and main sub-divisions. Concepts of Population Ecology – Describing a Population: population size, density, dispersion,age, structure, natality, mortality, life tables – population dynamics – Regulation of populationdensity. Concepts of community – characteristics, composition, structure, origin anddevelopment – community dynamics – trends of succession.

Unit II: Ecosystem Ecology

Introduction – kinds – major types – functional aspects of Ecosystem: Food chain and food web, energy flow, laws of thermodynamics. Productivity – primary and secondary productivity – GPP & BPP – Methods of measurement.

Unit III: Resource Ecology

Resource Ecology: Energy resources; renewable and non-renewable. Soil:-formation, types andprofile - erosion and conservation water resources – conservation and management.Environment Deterioration: Climate change-Greenhouse effect and global warming, ozonedepletion and acid rain. Waste management - recycling of solid waste and e-waste.

Unit IV: Biodiversity

Definition, types and values - Hot spots& Endemism- Threats - Habitat loss. Poaching of wild life – Invasion of exotic species, man and wild lifeconflicts - endangered and endemic plant species of India - Biotechnology assisted plant

Conservation- *in situ* and *ex situ* methods. Ecological genetics: Ecotypes, Ecads and Ecolines.

Unit V: Phytogeography

Phytogeographical Zones - Vegetation types of India and Tamil Nadu, Distribution: Continuous, discontinuousand Disjunct. Theories of Discontinuous Distribution: Continental Drift, Age and Area hypothesis - IUCN – society; committee; convention - Red listed plants, Red Data Book, Threatened plants and animals of India.

Suggested Topics for Seminar/Presentation/Group Discussion

- Plant Ecology
- Ecosystem Ecology
- Resource Ecology
- Plant Biodiversity
- Phytogeographical Zones

Suggested Readings:

Text Books:

1. Shukla, R.S.and Chandel, P.S. (2006). The Text Book of Plant Ecology, *S. Chand & Co. Ltd., New Delhi*.
2. Odum, E. and Barett, G. (2005). Fundamentals of Ecology. Thomson Brooks/Cole.
3. Odum.E.P (1996) Fundamentals Plant Ecology, Nataraj Publishers, New Delhi.
4. Subramaniyam, N.S. and Sambamurthy, A.V.S.S (2000). Ecology. Narosa Publishing House, New Delhi.
5. Sharma,P.D. (2002). Ecology and Environment. Rastogi Publications, Meerut.

Reference Books:

1. Chapman, J.L. and Reiss, M.J. (1998). Ecology: Principles and applications. Cambridge University Press.
2. Jase Fitzgerald.(2017). Biodiversity: *An Introduction*. Larsen and Keller Education. ISBN: 978- 1635490428

3. Primack, R. B. (2012). *A Primer of* Conservation Biology. Oxford University Press; 5th edition.
4. Anne E. Magurran, Brian J. McGill (2011) Biological Diversity: *Frontiers in Measurement and Assessment*. Oxford University Press. ISBN: 978-0199580675.

Web Sources:

1. Zubaida Yousaf and Habiba Ramazan (2017) Introductory Chapter: Plant Ecology. IntechOpen https://www.intechopen.com/chapters/56171 DOI: 10.5772/intechopen.69926
2. Malpas, J., "Donald Davidson", Biodiversity (2021). The Stanford Encyclopedia of Philosophy (Winter 2012 Edition), Edward N. Zalta (ed.), https://plato.stanford.edu/entries/biodiversity/
3. Bolger, James. (2021) "Four Types of Biodiversity" sciencing.com, https://sciencing.com/four-types-biodiversity-8714.html.
4. https://www.iaea.org/topics/plant-biodiversity-and-genetic-resources
5. http://www.bsienvis.nic.in/Database/Status_of_Plant_Diversity_in_India_17566.aspx

---

Title of the Course: Developmental Botany & Internal Morphology **Semester: II**

Course Code:LPBYCT13 **Contact hours: 5hrs/w** **Credit: 4**

Course Learning Outcomes:

On completion of the course, the students are able to

- develop an understanding of concepts and fundamentals of internal organization of plants.
- explain the developmental process in plants and also apply knowledge on developmental sequences on secondary organization.

- differentiate the structure and development of microsporangium and megasorangium.
- differentiate the types of pollination - types of fertilization– endosperm types.
- understand the role of hormones, genes and the molecular basis of development of embryo, shoot, root and flower.

Pre-required knowledge:

- Tissue types
- Developmental stages of plants
- Primary growth of plants

Unit I: Meristems

Organization of shoot and root apical meristems – Development of shoot and root. Combined effect of hormone in shoots and root differentiation. Polarity and Symmetry - leaf development and Phyllotaxy; Transition to flowering, floral meristems and floral development in *Arabidopsis* and *Antirrhinum*.

Unit II: Secondary tissues

Vascular cambium: origin, types and structure. Division of fusiform and ray initials – seasonal activity of cambium – wound healing – normal and anomalous behavior – Bark cambium (periderm, polyderm, bark, Lenticel, rhytidome)

Secondary xylem: components, structure, arrangements – sap wood, heart wood, growth rings, reaction wood and wood seasoning.

Secondary phloem: components, structure – companion cells and fibres - P&S type of plastids, Kranz anatomy, transfer cell.

Unit III: Embryology

Microsporangium: Development and structure – microsporogenesis – male gametophyte – pollen wall stratification – importance of palynology and palyontology.

Megasporangium: Development and structure – megasporogenesis. Ovule and its types, ultra-structure of female gametophyte and its types.

Pollen pistil interaction: Compatibility and non-compatibility

Unit IV: Fertilization, Endosperm and Embryo

Fertilization:Histochemical and physiological aspects. Endosperm – development, types, haustorial behavior and cytology. Embryo development and classification – Apomixis and polyembryony.

Embryo: Development of Dicot and Monocot embryo - seed development – fruit development - biochemical changes.

Unit V: Molecular basis of development

Embryogenesis and seedling development - Root, shoot and leaf development – Gene expression during transition to flowering - Development of flower, seed coat and fruit wall.

Suggested Topics for Seminar/Presentation/Group Discussion

- Meristems and their classification
- Pollen and pistil interaction.
- Gene expression during transition to flower development
- Development of Dicot and Monocot embryo
- Molecular basis of development of plants

Suggested Readings:

Text Books:

1. Bhojwani, S.S. and S.P. Bhatnagar. (2010). The Embryology of Angiosperms, 5th Revised Edition.Vikas Publishing House Pvt Ltd. Noida.
2. Maheswari, P. (1971). An introduction to Embryology.Tata McGraw Hill Publications, New Delhi,
3. Katerine Esau. (2010). Anatomy of Seed Plants, 2nd Edition. Wiley India Pvt., Ltd., New Delhi.
4. Fahn.A. (1989).Plant Anatomy.Pergomon Press, London.

5. Sharma, H.P. (2009), Plant Embryology: Classical and Experimental. Narosa Book Distributors Pvt. Ltd., New Delhi.
6. Pullaiah,T., Naidu, K.C., Lakshminarayana, K., and Hanumantha Rao, B. (2007). Plant. Development. Regency Publications, New Delhi.
7. Pandey, B.P. (2011). Plant Anatomy, 21st Edition. S. Chand & Company Ltd., New Delhi.

Reference Books:

1. Eames. A.J. and Mac Daniales, H.L. (1972). Introduction to Plant Anatomy.Tata McGraw Hill Publications, New Delhi.
2. Johri, B.M.(1984). Embryology of Angiosperms. Springer-Verlag Publishers, Berlin.
3. Mani. M.S. (1998). Plant Morphogenesis.McGraw Publishers, New Yark.
4. Shivanna. K.R and Johri, B.M. (1985). The Angiosperm Pollen Structure and Function. Wiley Eastern Ltd, New Delhi.
5. Howell, S.H. (1998). Molecular Genetics of Plant Development. Cambridge University Press, Cambridge.
6. Lyndon, R.F. (1990). Plant Development.The Cellular Basis.Unnin Hyman, London.

Web Sources:

1. https://faculty.etsu.edu/liuc/plant_anatomy_sites.htm
2. http://aryacollegeludhiana.in/E_BOOK/Botany/plant_anatomy.pdf
3. https://www.uou.ac.in/sites/default/files/slm/BSCBO-202.pdf
4. http://greenlab.cirad.fr/GLUVED/html/P1_Prelim/Bota/Bota_typo_014.html
5. http://libgen.li/

Title of the Course: Plant Diversity -I **Semester: I**

(Practical- Algae, Fungi and Bryophytes)

Course Code:LPBYCL11 **Contact hours: 5hrs/w** **Credit: 2**

Course Learning Outcomes:

On completion of the course, the students are able to

- understand the habit, cellular organization of lower groups of plants both externally and internally.
- realize the range of structural variations among all type specimens.
- apply knowledge on various diseases to recognize and diagnose different symptoms
- develop skill on geographical distribution of specimens in various habitats and to identify the individual species
- gain the information on anatomy of Bryophytes.

List of Experiments:

ALGAE:

1. To document the local algal flora – Study of their morphology & structure
2. Algal culture:Media preparation, inoculation and biomass estimation
3. Study of morphology and structure of the following types:

Scendesmus, Pediastrum, Ulva, Chaetomorpha, Stegioclonium, Bulbochaetae, Closterium, Cosmarium, Codium, Valonia, Halimeda, Acetabularia, Diatoms, Dictyota, Padina, Turbinaria, Liagora, Champia, Ceramium, Gracilaria, Nostoc and Oscillatoria.

4. Field and Herbarium technique – Algal collection tour (not exceeding four days) 5 herbarium sheets to be submitted – submission of album of seaweeds (5 specimens)

FUNGI:

1. Isolation of fungi from soil phylloplane and rhizosphere
2. Pure culture of fungi in PDA

3. Cultivation of mushroom in lab
4. Study of following genera of fungi.

a) Myxomyctes: *Physarum*

b) Phycomycetes: Saprolegnia, Albugo, Pernospora, Mucor, Rhizopus, Pilobolus

c) Ascomycetes: Yeast, Neurospora, Xylaria, Penicillium, Aspergillus, Peziza.

d) Basidiomycetes: Puccinia, Polyporus, Pleurotus, Agaricus, Podoxis, Lycoperdon

e) Deuteromycetes: Curvularia, Alternaria, Fusarium.

BRYOPHYTES:

Critical study of the following taxa: a) *Targionia* b) *Plagiochasma* c) *Reboulia*, d) *Porella* e) *Polytrichum*

Suggested Readings:

Text Books:

1. Vashishta,B.E., Sinha,A.K. and Singh, V.P. Algae – 9th Revised Edition, 2002.
2. Vashishta, B.R,Sinha.A.K.and Singh, V.P., Bryophytes – 9th Revised Edition.S.Chand & Co., Ltd., New Delhi, 2002.
3. Sharma, O.P. Text Book of Algae. Tata McGraw – Hill publishing Co.,Ltd., New Delhi, 1986.
4. Vashishta, B.R.Sinha. A.K. and Singh,V.P. Fungi – S. Chand & Ltd., New Delhi, 2002.

Reference Books:

1. Chapman, V.J.and Chapaman,D.J. The Algae, ELBS & MacMillan, London,1960.
2. Prescott.G.W. The Algae – a Review, Bishen Singh & Mahendra Pal Singh. Dehra Dun. 1969.
3. Smith.G.M. Cryptogamic Botany Vol.II. Tata McGraw Hill.New Delhi, 1955.
4. Sporne.KR. Morphology of Pteridophytes. Hutchinson & Co., London, 1985.

5. Alexopoulos.J and Mims, W. Introductory Mycology, Wiley Eastern Limited. New Delhi, 1985.

Title of the Course: Practical - II **Semester: I**

(Ecology & Biodiversity and Development Botany & Internal Morphology)

Course Code: LPBYCL12 Contact hours: 5hrs/w Credit:2

Course Learning Outcomes:

On completion of the course, the students are able to

- lay out Quadrat and Line transect methods of vegetation study
- understand the need of total carbonate, bicarbonate and dissolved oxygen in water
- ecology, biodiversity and phytogeography will help the students to understand plants inrelation to environment
- know about wood anatomical structures and also learn primary secondary growth of the plants
- learn about the basic internal structure and differentiate the monocot and dicotyledon

List of experiments

Methods of studying vegetation:

a) Determination of quadrat method for the study of herbaceous vegetation in the college campus, by species area curve method (species to be listed).

b) Quadrat method - Measurement of diversity – IVI, species diversity index, dominance index, evenness index of campus communities.

Analysis of water samples:

1) Estimation of carbonate.
2) Estimation of bicarbonate.
3) Estimation of chloride.
4) Determination of dissolved oxygen

Ecology:

1) Conservation programmes
2) Age distribution in different type of population

3) S-shaped growth curve of population increase.
4) Histogram showing Raunkier normal frequency diagram
5) Food web
6) Wind mill
7) Greenhouse effect
8) Acid rain
9) Ozone depletion

Biodiversity:

1) World - Hot spots
2) National parks
3) Biosphere reserves
4) Types of forest

Every student has to undertake a trip to nearby forest at least for 3 days to study the vegetation and submit a report. Visit to a forest patch/ wetland / coast to study communities, data collection, report preparation and submit photography copies.

Internal Morphology:

1) Wood anatomy; study of the following woods (TS, TLS & RLS):
   a) *Dalbergia*b) *Thespesia*c)*Tectona*d) *Artocarpus*e) *Bombax*f) *Azadirachta*
2) Study of anomalous secondary growth of the following:
   a) *Achyranthcs*b) *Bougainvillea*c) *Aristolochia*d) *Dracaena*e)*Boerhaavia*
3) Study of stages in microsporogensis – *Datura* Stamen
4) Study of pollen grain: *Hibiscus*, *Ocimum*, and grass
5) Types of ovules – permanent slide study
6) Stylar anatomy study
7) Embryo dissection in *Tridax*
8) Endosperm study *Artobotrys*, *Polyalthia* and Cucumber
9) Seed coat anatomy of cotton and *Cicer*

10) Study of different types of galls. Submission of five different plant galls photos.

11) Preparation and submission of 15 permanent slides (TS, TLS & RLS).

Suggested Readings:

Reference Books:

1. APHA, De, A K. (2005). Standard methods for the examination of water and wastewater (21st edition).
2. Husch B, Beers TW and Kershaw JA. (2003). Forest mensuration. John Willey & Sons Inc,.
3. Brewer, R. and McCann, M.T. (1982). Laboratory and field manual of ecology, Saunders College Publishing.
4. Mueller-Dombois, D and Ellenberg, H. (1974). Aims and methods of vegetation ecology.
5. John Wiley and Sons, New York.
6. Carlquist S. (2001). Cambial Variants (Anomalous Secondary Growth). In: *Comparative Wood Anatomy*. Springer Series in Wood Science. Springer, Berlin, Heidelberg.
7. Fritz Hans Schweingruber, Annett Börner, Ernst-Detlef Schulze Secondary Growth: Advantages and Risks. (2008). In: *Atlas of Woody Plant Stems*. Springer, Berlin, Heidelberg.
8. Chadha and Pandey. (1997). Plant Anatomy and Embryology. Vikas Publishing.

Title of the Course: Applied Botany **Semester: I**

Course Code: LPBYDS11 Contact hours: 5hrs/w Credit: 4

Course Learning Outcomes:

On completion of the course, the students are able to

- classify the horticultural crops and use of technology.
- evaluate the importance of propagation techniques.
- develop conceptual understanding of plant genetic resources, plant breeding, gene bank and gene pool.

- familiarize with economic value of Plants.
- recognize about the different type forest and their conservation strategies.

Pre-required Knowledge:

- Vegetative Propagation Methods
- Garden Management
- Hybridization Techniques

Unit I: Horticulture

Horticulture: Aims and objectives of horticulture, importance and divisions of horticulture. – Pomology, Olericulture, Floriculture. Basic propagation methods: cuttage, graftage, layerage. Horticultural techniques – pruning and training.

Unit II: Garden Types (Indoor & Outdoor)

Gardening – types of gardens, components of ornamental garden – lawns, hedges, edges, flower beds, garden path, water garden, rockery and Landscaping. Indoor gardening – hanging pots, bottle garden, terrarium and bonsai. Home garden – Kitchen garden – growing vegetables for processing, value addition to raw materials.

Unit III: Plant Breeding Methods

Objective and importance of plant breeding – methods of crop improvement:Plant introduction, Selection – mass, pure line and clonal selection – advantages, disadvantages and achievements.Hybridization types and techniques – definition, objectives and achievements – procedure, advantages and disadvantages. Heterosis –hybrid vigour, causes and achievements. Mutation breeding and its applications.Cytoplasmic male sterility.

Unit IV: Economic Botany

Origin of cultivated plants. Vavilov's center of origin – plants as sources for food – fodder – fiber –spices- beverages – drugs – narcotics – insecticides – timber – gums – resins – dyes - Latex - cellulose – starch and their products.

Unit V: **Forest Types and its Management**

Forest and its ecological significance – types of forests in India – status of forest wealth of the world. Indian Forest Policy and acts – Social Forestry – Agro forestry – major and minor forest produces; causes and consequences of deforestation. Forest Management – The present programme for the development of forestry and wild life – Afforestation – Sacred groves – Role of biotechnology in conservation of forest ecosystems.

Suggested Topics for Seminar/Presentation/Group Discussion

- Division of horticulture
- Vavilov's center of origin
- Pure line selection
- Heterosis
- Forest types

Suggested Readings:

Text Books:

1. Kumar,N. 1997. Introduction to Horticulture, Rajalakshmi Publications.
2. Singh, B.D. 2012. Plant Breeding: Principles and Methods. Kalyani Publishers. 9th edition.
3. Pandey., B. P. 1999. Economic Botany. S. Chand Limited.

Reference Books:

1. ICAR Publication. 1979 Hand book of Agriculture. Ministry of Agriculture. New Delhi.
2. Sadhu.M.K.1989. Plat Propagation. Wiley Eastern Publications, New Delhi.
3. Chowdhary,R.C.1982. Introduction to Plant Breeding. Oxford and IBH Publishing Company,New Delhi.
4. Chaudhri,R.K.1976. Elementary principles of Plant Breeding. Oxford and IBH Publishing Company,New Delhi.
5. Poehlman,J.M.1987. Breeding field crops. 3rd Editions. AVI Publishing Company, Inc, West Post.

6. Balakathiresan. S.1986. Essentials of Forest Management. Natraj Publishers, Dehradun.

Web Sources:

1. https://www.tnhorticulture.tn.gov.in/
2. http://ifs.nic.in/
3. http://ecoursesonline.iasri.res.in/mod/page/view.php?id=12278

Title of the Course: Forestry **Semester: I**

Course Code: LUBYDS12 Contact hours: 5hrs/w Credit: 4

Course Learning Outcomes:

On completion of the course, the students are able to

- know the basic facts about forests and recognize diseases of commercial forestry
- evaluate the marketing channels, costs, margins and price spread and its applications.
- explain the role of public and private agencies in marketing of forest
- interpret total and relative growth rate of forests and assess international trade in timber and non-timber forestry
- classify forest market according to its structure and determine the methods of forest

Pre-required knowledge:

- Social forestry
- Communal forestry
- Growth rate

Unit- I: Basics of forests

Forestry, Characteristics, Types of forest, Production and Commercial Forestry techniques, Trees for commercial forestry, Growth rate- Total and Relative Growth rate, History of commercial forestry in India, Diseases of commercial forestry, maintenance of forests, Protection form fire, illicit felling, Measurement of Trees- Height, girth, wood density, wood quality, clear and selective felling.

Unit II: Nature and scope of marketing

Approaches to marketing and the study of marketing functions with special reference to forestry. Classification of market, market structure and conduct of important timber and non-timber markets. Marketing channels, costs, margins and price spread - concepts and applications.

Unit –III: Concepts of market integration and marketing efficiency

Role of public and private agencies in marketing of forest produce. Market inefficiencies in the trade of forest produce and measures to check the same.

Unit-IV: Fundamentals of international trade

Domestic and international trade in timber and nontimber forestry output, Demand forecasts - concept and methods: WTO - background, structure, functions and decision making process. IPRs and their implications for forestry and allied sectors in the country.

Unit -V: Forest and its ecological significance

Types of forests in India – status of forest wealth of the world. Indian Forest Policy and acts – Social Forestry – Agro forestry – major and minor forest produces; causes and consequences of deforestation. Forest Management – The present programme for the development of forestry and wild life – Afforestation – Sacred groves – Role of biotechnology in conservation of forest ecosystems.

Suggested Topics for Seminar/Presentation/Group Discussion

- Types of forest and their significance
- Production and commercial forestry techniques
- Role of public and private agencies in marketing of forest produce
- Domestic and international trade in timber and nontimber forestry output

- Role of biotechnology in conservation of forest ecosystems.

Suggested readings:

Text books:

1. ICAR Publication. 1979 Hand book of Agriculture. Ministry of Agriculture. New Delhi.
2. Kumar,N.1997. Introduction to Horticulture, Rajalakshmi Publications.
3. Sadhu.M.K.1989. Plat Propagation. Wiley Eastern Publications, New Delhi.
4. Chowdhary,R.C.1982. Introduction to Plant Breeding. Oxford and IBH Publishing Company,New Delhi.
5. Chaudhri,R.K.1976. Elementary principles of Plant Breeding. Oxford and IBH Publishing Company,New Delhi.
6. Poehlman,J.M.1987. Breeding field crops. 3rd Editions. AVI Publishing Company, Inc, West Post.
7. Balakathiresan. S.1986. Essentials of Forest Management. Natraj Publishers, Dehradun.
8. Agarwala, V.P. 1990. Forests in India, Environmental and Protection Frontiers. Oxford IBH Publishing Co., New Delhi.

References books:

1. Belcher, B.M. (1998). A production-to-consumption systems approach: Lessons from the bamboo and rattan sectors in Asia. In: Wollenberg, E and A. Ingles (eds.). Incomes from the forest: methods for the development and conservation of forest products for local communities. Center for International Forestry Research (CIFOR), Bogor, Indonesia.
2. Chomitz, K.M., with P. Buys, G. De Luca, T. S. Thomas, and S. WertzKanounnikoff. (2007). Incentives and constraints shape forest outcomes. In: At loggerheads? Agricultural expansion, poverty reduction and

environment in tropical forests. The World Bank, Washington, DC.

3. Mosse, D. (2001). 'People's knowledge', participation and patronage: operations and representations in rural development. In: Cook, B & Kothari, U (eds), Participation the new tyranny? Zed Press.
4. Ong, C.K. & Huxley, P.K. (1996). Tree Crop Interactions – A Physiological Approach. ICRAF.

Web Sources:

1. http://wwwwds.worldbank.org/external/default/WDS ContentServer/WDSP/IB/2006/1 0/19/00 0112742_2006 1019150049/Rendered/PDF/367890Loggerheads0Report .pdf.
2. https://www.britannica.com/science/forestry
3. https://en.wikipedia.org/wiki/Forestry.
4. https://www.biologydiscussion.com/forest/essay-forest-importance.major-products-and-its-conservation/25119
5. https://www.sciencedirect.com/topics/agriculture-and-biological-science-forest-product.

Title of the Course: Plant Diversity – II (Pteridophytes, Gymnosperms and Paleobotany) **Semester: II**

Course Code:LPBYCT21 **Contact hours: 5hrs/w** **Credit: 4**

Course Learning Outcomes:

On completion of the course, the students are able to

- derive knowledge on diversity and distribution of pteridophytes and gymnosperms.
- realize the phylogenetic attributes of pteridophytes with other plant forms.
- understand the characteristic features of lower vascular plants.
- comprehend the economic importance of pteridophytes and gymnosperms.

- acquire knowledge on fossilization and understand features of various fossil type forms of pteridophytes and gymnosperms.

Pre-required knowledge:

- Habitats and Habits of non-vascular and vascular plants
- Alternation of generation during the life cycle of plants
- Geological eras and fossil plants

Unit I: Characteristics and classification of Pteridophytes

General characters. Affinities of characters with Bryophytes and Gymnosperms. Classification of Pteridophytes by Sporne (1975). Telome theory-basis, elementary proves- origin of sporophylls in Lycopsida, Sphenopsida and Pteropsida-origin of root- merits and demerits of telome theory.Evolution of Stele.Economic importance. Contributions of Indian Pteridologists.

Unit II: Evolution of Pteridophytes:

Occurrence, structure, reproduction and life cycle: Psilopsida, Lycopsida, Sphenopsida and Pteropsida. Evolutionary trends in the gametophytes. Origin and evolution. Evolution of Sporangium-Eusporangium and Leptosporangium. Apogamy and Apospory. Homosporous and heterosporous pteridophytes. Heterospory and seed habit. Evolution of Sorus in ferns.

Unit III: Characteristics and classification of Gymnosperms

General characters. Origin and phylogeny. Advanced features, classification by Bierhorst (1971). Distribution of gymnosperms in India. Comparative study of Gymnosperms and Angiosperms. Economic importance.

Unit IV: Type studies of Gymnosperms

External and internal structures of vegetative parts, structure of male and female strobili, male and female gametophytes of Cycadales-*Cycas*; Coniferales-*Pinus*, *Cupressus*, *Podocarpus*, *Araucaria*; Gingkoales-*Ginkgo* and Gnetales-*Gnetum*.

Unit V: Paleobotany

Geological Time Scale – Process of Fossilization – methods of determination of age of fossils and radio carbon dating. Detailed study of fossil forms of pteridophytes: *Lepidodendron* - (Lepidodendrales), *Calamitus* – (Calamitales) and *Sphenophyllum* – (Sphenophyllales). Detailed study of fossil forms of gymnosperms: *Lyginopteris* – (Cycadofilicales), *Williamsonia* – (Cycadeoidales), *Pentoxylon* – (Pentoxylales) and *Cordaites* – (Cordaitales). A brief account of Prof. Birbal Sahni.

Suggested Topics for Seminar/Presentation/Group Discussion:

- Emergence of seed habit in lower plants
- Sorus modification and evolution of reproduction in pteridophytes
- Comparative account of primitive and advanced features of gymnosperms
- Ontogeny of vessel in *Gnetum* sp
- Radio carbon dating

Suggested Readings:

Text Books:

1. Vashishta, B.R.Sinha, A.K. and Singh, V.P. Pteridophytes – 9th Revised Edition. S.Chand & Co., Ltd., New Delhi, 2002.
2. Singh, V., Pande, P.C. and Jain, D.K. A Text Book of Botany. Rastogi Publications, Meerut. 2021.
3. Pandey, B. P. College Botany Vol-II. S. Chand & Co. New Delhi, 2016.

Reference Books:

1. Rashid. A. An introduction to Pteridophytes. Second Revised Edition. Vikas Publishing House Pvt., Ltd., New Delhi, 2006.
2. Sporne. KR. Morphology of Pteridophytes. Hutchinson & Co., London, 1985.

3. Smith. G.M. Cryptogamic Botany Vol.II. Tata McGraw Hill.New Delhi, 1955.
4. Sharma, O. P. Pteridophyta (2nd ed). Macmillan India Ltd. 2006.

Web Sources:

1. http://www.bsienvis.nic.in/Database/Pteridophytes-in-India_23432.aspx
2. http://www.jnpg.org.in/WebDoc/EContent/science/General%20characters%20of%20Pteridophytes.pdf
3. https://www.uou.ac.in/sites/default/files/slm/BSCBO-103.pdf
4. https://www.conifers.org/zz/gymnosperms.php
5. https://www.uou.ac.in/lecturenotes/science/MSCBOT-17/Gymnosperm%20(BOT-503)%20by%20Dr.%20Prabha%20Dhondiyal-converted%20(1).pdf
6. https://courses.lumenlearning.com/wmopen-biology2/chapter/seed-plants/
7. https://www.biodiversitylibrary.org/search?stype=F&searchTerm=Paleobotany#/titles
8. https://palaeobotany.org/

Title of the Course: Genetics and Evolution **Semester: II**

Course Code: LPBYCT22 **Contact hours: 5hrs/w** **Credit: 4**

Course Learning Outcomes:

On completion of the course, the students are able to

- have conceptual understanding of laws of inheritance, genetic basis of loci and alleles and their linkage.
- comprehend the effect of chromosomal abnormalities in numerical as well as structural changes leading to genetic disorders.
- develop critical understanding of chemical basis of genes and their interactions at population and evolutionary levels.

- analyze the effect of mutations on gene functions and dosage.
- appreciate the importance of genetics as a foundation other fields of life sciences

Pre-required Knowledge:

- Concepts and terminologies in genetics
- DNA structure
- Central dogma

Unit I: Organization of chromosomes:

Morphology and chemistry of chromosome; molecular organization of centromere and telomere. Structural and numerical alteration of chromosome (Eu and polyploidy) and its significance. Mutation types, causes and detection, mutant types, insertional mutagenesis

Unit II: Principles of genetics:

Mendel's Laws of inheritance; Chromosome theory of inheritance and linkage; Incomplete dominance and codominance; Interaction of Genes; Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Recessive and Dominant traits, Penetrance and Expressivity, Mendelian segregation and gene interaction: Numerical; Polygenic inheritance;

Unit III: Linkage, crossing over and Extra-nuclear Inheritance:

Theories of linkage – Morgan's work in *Drosophila* – importance of test cross in linkage studies – significance in plant breeding. Sex determination in plants. Extra chromosomal inheritance involving chloroplast and mitochondria. Endosymbiotic Theroy.

Unit IV: Gene structure and expression:

Evolution of Gene Concept - Classical vs molecular concepts of gene : One gene one character; One gene-one enzyme, one gene-one polypeptide hypothesis and beyond; gene as unit of function, Operon concept - inducible operon "lac" – repressible operon. "trp" attenuation, transposans.

Unit V: Population and Evolutionary Genetics:

Allele frequencies, Genotype frequencies, Hardy-Weinberg Law, role of natural selection mutation, genetic drift. Genetic variation and Speciation. Theories of organic evolution – Lamarckism – Neo Lamarckism – Darwinism – Neo Darwinism Modern synthetic theories – Natural selection and speciation.

Suggested Topics for Seminar/Presentation/Group Discussion:

- Genetic Factors for Human Type 1 Diabetes (C-Y Wang et al.)
- Genetic Susceptibility to Human Obesity (Y-J Liu & H-W Deng)
- Hereditary Breast and Ovarian Cancers (W-T Yang et al.)
- Inheriting traits in humans
- Selection pressures

Suggested Readings:

Text Books:

1. Gardner,E.J.Simmons, M.J. and Snustad,D.P. Principles of Genetics, John, Wiley & Sons, Inc. New York, 2006.
2. Freifelder. D. And Malcineski, G.M. Essentials of molecular Biology, 2nd Edition. Jones and Battlet Publishers, Inc London, 1993.
3. Verma.P.S and Agarwal,V.K. Genetics.S.Chand &Co.New Delhi, 1991.

Reference Books:

1. Levin,B.. Biology of the Gene VIIth Edition OUP UK, 2001.
2. Levin.B. Genes VII. OUP UK., 2000.
3. Watson.J.D.et at Molecular Biology of the Gene. 4th Edition. The Bengamin / cummings Publishers. California, New York, 1987.
4. Burns.G.W. The Science of Genetics, Collier Mac Millan, New York, 1980.

5. Strickberger. M.W. Genetics, Prentice – Hall of India Pvt Ltd, NewYork, 2001.
6. Tamarin. R.H. Principles of Genetics, Prentice Hall of Indian Pvt Ltd, New Delhi, 2002.

Web Sources:

1. http://www.mendelweb.org/
2. http://www.sci.sdsu.edu/~smaloy/MicrobialGenetics/problems/
3. http://www.ornl.gov/TechResources/Human_Genome /genetics.html

---

Title of the Course: Cell and Molecular Biology **Semester: II**

Course Code: LPBYCT23 **Contact hours:5hrs/w** **Credits: 4**

Course Learning Outcomes:

On completion of the course, the students are able to

- understand the structure and chemical properties of DNA and RNA.
- differentiate the main types of prokaryotes and eukaryotes.
- gain and understand the concept of genomics, proteomics, transcription and translation.
- gain the information on the replication of DNA, molecular events of protein synthesis, regulator of gene expression.
- understand the basic study of rice genome projects.

Pre required knowledge:

- Cell organelles.
- Mitosis and Meiosis.
- Cell cycle and cell division.

Unit I:The structure of cell

Cell as a living entity, Cell types, prokaryotic and eukaryotic plant cells. Variation in cell size structure and organization an overview of ultra-structure of a plant cell. Cell cycle – molecular events – phases – mitosis and meiosis.

Unit II: The cell wall and its components

Cell wall composition and organization, plasma membrane – properties and functions. Cell organelles – mitochondria, chloroplast, nucleus, lysosomes and Golgi apparatus.

Unit III:Nucleus and its functions

Nucleus organization – nuclei in different forms, fine structure of DNA, chromosomal types – giant chromosomes – polytene and lampbrush. Forms of DNA and RNA, super coiling and topoisomerase.

Unit IV: DNA replication

DNA replication, Experiments of Meselson and Stahl. Cairn – Okazaki fragments rolling circle model, prokaryotic and eukaryotic DNA replication and associated enzymes. C-value paradox.

Unit V:Function of gene

Central dogma of molecular biology, Protein synthesis - Transcription – initiation, elongation, termination -Translation – Post translational modification. Genomics and Proteomics – definition and concepts – Rice genome project – prospects and issues.

Suggested Topics for Seminar/Presentation/Group Discussion:

- Mitosis and meiosis
- Cell organelles and its function
- DNA Replication
- Types of chromosomes
- Human genome projects

Suggested Readings:

Text Books:

1. Maniates, et al. 2000. Molecular cloning: a laboratory manual cold spring Harbor Laboratory Press New York.
2. Roberties and Roberties, 1988. Cell and Molecular Biology, K.M.Varchese Publications
3. Verma.P.S and Agarwal,V.K. Genetics.S.Chand &Co.New Delhi, 1991.

Reference Books:

1. Gerald Karp.1996. Cell and Molecular Biology.
2. Gardner. Simmons, Snustad et.al. 1999. Principles of genetics, VIII Edition.
3. Benjamine Lewin 2001. Biology of the gene. VII edition. O.U.P.UK.
4. Benjamine Lewin.2000. Genes VII O.U.P. UK.
5. Freifelder.D., and Malcinski, G.M.1993. Essentials of Molecular biology. II Edition. Johns and Battle Publishers INC. London.
6. Watson.J.D. et al., 1987. Molecular biology of the gene. IV Edition. The Benjamine / Cummings Publications, California.
7. Meyers. R.A.1995. Molecular biology and biotechnology. A comprehensive desk reference VCH Publishers, New York.

Web Sources:

1. https://www.britannica.com/science/cell-biology
2. https://medlineplus.gov/genetocs/understanding/basics/cell/
3. https://www.britannica.com/science/molecular-biology
4. https://en.wikipedia.org/wiki/molecularbiology

Title of the Course: Practical – III Plant Diversity – II Semester: II
(Pteridophytes, Gymnosperms and Paleobotany

Course Code: LPBYCL21 Contact hours: 5hrs/w Credit: 2

Course Learning Outcomes:

On completion of the course, the students are able to:

- understand the habit, cellular organization of lower groups of plants both externally and internally.
- realize the range of structural variations among all type specimens.
- develop skill on geographical distribution of specimens in various habitats and to identify the individual species.

- compare the features of members of Pteridophytes and Gymnosperms.
- analyze and comprehend the characteristics of fossil and living members.

Pre-required knowledge:

- Habit of Pteridophytes and gymnosperms
- Fossilization
- Components of wood

List of Experiments:

1. Pteridophytes:

Critical study of the following living forms: *Isoetes*, *Ophioglossum*, *Angiopteris*, *Adiantum*, *Cyathea*and*Azolla*.

a. Fossil slides observation**:** *Calamites, Lepidodendron, Lepidocarpon* and *Sphenophyllum.*

2. Gymnosperms:

Critical study of the following living forms: *Cycas*, *Pinus*, *Cupressus*, *Cryptomeria*, *Podocarpus*, *Araucaria*, *Ginkgo* and *Gnetum*.

3. Fossil slides observation:

Cordaites(stem, leaf & root); Lygenopteris (stem & cupule); Cardianthus and Cardiocarpusspinatus.

4. Wood Anatomy:

Critical study on the structural organization of wood of the following: *Cupressus*, *Podocarpus*, *Araucaria* and *Cryptomeria*.

Suggested Reading:

1. Bendre, M. Ashok and Ashok Kumar, A Text Book of Practical Botany-1 (10th ed). Rastogi Publications, Meerut. 2020.

Title of the Course: Practical IV - Genetics and Evolution & Cell and Molecular biology **Semester: II**

Course Code:LPBYCL22 **Contact hours: 5hrs/w** **Credit: 2**

Course Learning Outcomes:

On completion of the course, the students are able to

- understand the fundamental genetic principles through simple problems
- explain the key concepts in heritability and genetic variations
- appreciate the importance of genetics as a foundation of other fields of life sciences especially in plant breeding
- perception into the basic molecular biology techniques
- gain the information on electrophoretic techniques

To work out problems in the following chapters:

- The physical basis of heredity
- Single gene inheritance
- Two or more genes
- Genetic interaction
- The genetics of sex
- Linkage and crossing over
- Population genetics
- The biochemical basis of heredity
- Molecular genetics

Demonstration of Experiments

- Agarose gel electrophoresis
- Plant DNA extraction

Suggested Readings:

Reference Books:

1. Stickberger, M.W. Genetics, Prentice – Hall of India Pvt. Ltd., New Delhi, 2001.
2. Gardner, E.J.Simmon. M.J and Snustad, D.P. Principles of Genetics, John Wiley & Sons, Inc. New York, 2006.

3. William D. Stansfield. Theory and Problems of Genetics. 3rd Edition. McGraw Hill,Inc.1991.
4. Russell, P. J. *i*Genetics- A Molecular Approach. III Edition. Benjamin Cummings. 2009

Title of the Course: Plant Pathology **Semester: II**

Course Code: LPBYDS21 **Contact hours: 3hrs/w** **Credit: 3**

Course Learning Outcomes:

On completion of the course, the students are able to

- gather the knowledge on plant pathology.
- understand the symptoms, etiology, disease cycle and management of major diseases of various crops.
- gain the information on significance of plant pathogens.
- acquire the knowledge on growth and reproduction of plant pathogens.
- obtain the information on defense mechanisms of plants and its control measures.

Pre-required knowledge:

- Blast disease of rice
- Phytoplasmas,
- Antibiotics

Unit-1 Fundamentals of plant pathology:

Importance of plant diseases, scope and objectives of Plant Pathology. History of Plant Pathology and Pathogenesis. Symptoms, etiology, disease cycle and management of major diseases of following crops: Field Crops: Rice: blast and brown spot, Groundnut: early and late leaf spots, wilt, Sugarcane: red rot.

Unit –II Important plant pathogenic organisms:

Fungi, bacteria, fastidious vesicular bacteria, phytoplasmas, spiroplasmas, viruses, viroids, algae, protozoa, phanerogamic parasites and nematodes with examples of diseases caused by them.

Unit- III Growth and reproduction of plant pathogens:

Liberation / dispersal and survival of plant pathogens. Types of parasitism and variability in plant pathogens. Pathogenesis. Role of enzymes, toxins and growth regulators in disease development.

Unit –IV Defence mechanism in plants:

General symptoms of plant diseases: disease cycle – Host- parasite interaction. Epidemiology: Factors affecting disease development. Principles and methods of plant disease management. Nature, chemical combination, classification, mode of action and formulations of fungicides and antibiotics.Plant microbe interaction – *Rhizobium.*

Unit –V Principles of Integrated Pest and Disease Management (IPM):

IPM: Introduction, history, importance, concepts, principles and tools of IPM. Diseases and pest risk analysis. Methods of detection and diagnosis of insect pest and diseases.

Methods of control: Host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control. Introduction to conventional pesticides for the insect pests and disease management.

Suggested Topics for Seminar/Presentation/Group Discussion:

- Host-parasite interaction
- Blast disease of rice
- Principles and methods of plant disease management
- Methods of detection and diagnosis of insect pest and diseases.
- Role of enzymes, toxins and growth regulators in disease development.

Suggested Readings:

Text books:

1. Pathak, V. N. 1972. Essentials of Plant Pathology. Prakash Pub., Jaipur

2. Agrios, GN. 2010. Plant Pathology. Acad. Press.
3. Kamat, M. N. 1962. Introductory Plant Pathology. Prakash Pub, Jaipur
4. Singh RS. 2008. Plant Diseases. 8 th Ed. Oxford & IBH. Pub. Co.
5. Singh RS. 2013. Introduction to Principles of Plant Pathology. Oxford and IBH Pub. Co.

Reference books:

1. Alexopoulos, Mims and Blackwel. 1979. Introductory Mycology
2. Mehrotra RS & Aggarwal A. 2007. Plant Pathology. 7 th Ed. Tata Mc Graw Hill Publ. Co. Ltd.
3. Gibbs A & Harrison B. 1976. Plant Virology - The Principles. Edward Arnold, London.
4. Hull R. 2002. Mathew.s Plant Virology. 4th Ed. Academic Press, New York.
5. Verma JP. 1998. The Bacteria. Malhotra Publ. House, New Delhi.

Web Sources:

1. https://en.wikipedia.org/wiki/Plant-pathology
2. https://www.seciencedirect.com/topics/agriculture-and-biological-sciences/plant-pathology
3. https://www.britannica.com/science/plant-disease.
4. https://www.planetatural.com/pest-problem-solver/plant-disease/

Title of the Course: Genomics and Proteomics **Semester: II**
Course Code:LPBYDS22 **Contact hours: 3hrs/w** **Credit: 3**

Course Learning Outcomes:

On completion of the course, the students are able to

- realize the subject on Genomics and Proteomics that deals with a rapidly evolving scientific area.
- learn about genomics, proteomics and bioinformatics and offer basic knowledge of genome sequencing.

- understand major differences between prokaryotic and eukaryotic genomes, basic proteomics and its applications.
- gain skills in applied bioinformatics, comparative, evolutionary, human genomics and functional genomics.
- acquire knowledge that would be helpful to those students who want to work in core facilities and commercial biological and medical laboratories.

Pre-required knowledge:

- Concepts of gene
- Basics of gene regulation
- Structure of protein

Unit I: Genetics

Genetics: Segregation of single gene, two or more genes. Genetic linkage and Chromosome Mapping - coupling & repulsion of syntenic alleles - Linkage & Crossing over - Map distance and frequency of recombination - Genetic mapping with three-point crosses - Mapping by Tetrad analysis *(Neurospora)*.

Unit II: Genome Organization

Gene fine structure: Concept of the gene, units of genetic structure and genetic function, Gene - cistron relationship in prokaryote and eukaryote. Basics of Gene Regulation - Transcriptional regulation in prokaryotes: Inducible and repressible systems of positive and negative regulation - Operon system.

Unit III: Comparative Genomics

Comparative genomics: Bacteria, Organelles and Eukaryotes. Genome Mapping-Types and uses. Human physical map. Sequencing strategies and automation: (Maxam and Gilbert, Sanger's method,) advanced methods (Automated DNA sequencing) -Human Genome Project.

Unit IV: Functional Genomics

Functional genomics (Functional studies at genetic level): Genetic interaction mapping, Transcriptome profiling:

(Microarray, ChIP, SAGE) RNAi -Studying gene function through protein-protein interaction.

Unit V: Proteomics

Proteomics: Protein sequencing, Protein expression analysis by 2-DE, 2DMALDI- TOF MS, LC-MS/MS. Quantitative Proteomics-Tandem Mass spectrometry, peptide mass fingerprinting. Mining the proteome, Protein expression profiling, Protein tags; protein arrays and antibody arrays.

Suggested Topics for Seminar/Presentation/Group Discussion:

- Mapping of genes
- Operon and gene regulation
- Human genome project
- Genetic interaction and mapping
- Protein expression and analysis

Suggested Readings:

Text Books:

1. Westermeier R and Naven T. 2002. Proteomics in Practice: A Laboratory Manual of Proteome Analysis, John Wiley & Sons Ltd, England.
2. Brown T.A. 2007. Genomes 3. Garland Science Publishing.
3. Daniel L. Hartl and Elizabeth W. Jones. 2009. Genetics (Ed: 7) Jones and Barlett Publishers Inc,Subury.

Reference Books:

1. Primrose S.B. and Twyman R.M. 2004. Principles of Genomics and Proteomics (Ed: 3). Blackwell Science Ltd. Oxford, UK.
2. Cullis C. A. 2004. Plant Genomics and Proteomics. John Wiley & Sons, Inc., Hoboken, New Jersey.
3. Dale J. W and M.V. Schantz. 2002. From Gene to Genomes: Concepts and Applications of DNA Technology, John Wiley& Sons, Ltd., England.
4. Grandi G. 2004. Genomics, Proteomics and Vaccines, John Wiley & Sons Ltd., England.

5. Liebler D.C. 2002. Introduction to Proteomics: Tools for the new biology, Humana press, Totowa, New Jersey

Web Sources:

1. https://guides.lib.montana.edu/c.php?g=221822&p=1493272
2. http://www.mendelweb.org/
3. https://www.genome.gov/about-genomics/teaching-tools/Genomics-Education-Websites
4. https://authors.library.caltech.edu/9665/1/VAIieeecsm04.pdf
5. http://www.igntu.ac.in/eContent/IGNTU-eContent-279020679913-B.Sc-Biotechnology-6-Dr.ParikipandlaSridevi-GenomicsandProteomics-3,4.pdf

---

Title of the Course: Pharmaceutical Technology **Semester: II**

Course Code:LPBYAE21 **Contact hours: 2hrs/w** **Credit: 2**

Course Learning Outcomes:

On completion of the course, the students are able to

- evaluate basic concepts in the field of drug delivery systems that is used in pharmaceutical technology
- understanding on design solution formulations.
- analyze the lists and solves the problems of physical stability of suspensions.
- explain the importance of rheology in terms of pharmaceutical technology.
- discusses the advantages and disadvantages in the form of emulsion drug delivery systems.

Pre-required Knowledge:

- Herbal Drug Industries
- World Health Organization
- Indian system of Medicines

Unit-I Herbal Drug Industry

Infrastructure of herbal drug industry - standardized extracts and various dosage forms. Upgrading and modernization of herbal formulations. Pilot plant scale–up

techniques, case studies of herbal extracts. Formulation and production management of herbals

Unit-II Regulatory Requirements for Setting Herbal Drug Industry

Global marketing management. Export - Import (EXIM) policy, TRIPS. Quality assurance in herbal drug products. Concepts of TQM, GMP, GLP, ISO-9000.

Unit-III Monographs of Herbal Drugs

General parameters of monographs and comparative study in Ayurvedic, Siddha and Unani Pharmacopoeia, American herbal pharmacopoeia, British herbal pharmacopoeia. WHO guidelines in quality assessment.

Unit-IV Testing of Natural Products and Drugs

Herbal medicines - clinical laboratory testing

Stability testing of natural products, protocols

Unit-V Patents for Herbal / Natural Products

Indian and international patent laws and amendments. Geographicalindication, Copyright, Patentable subject maters, novelty, procedure for Indian patent filing, processing, grant, rights, cases of patents, opposition and revocation, search and literature and Controllers.

Suggested Topics for Seminar/Presentation/Group Discussion

- Modernization of herbal formulations
- Quality assurance in herbal/natural drug products
- Ayurvedic, Siddha and Unani Pharmacopoeia
- Stability testing of natural products
- Indian and international patent Laws

Suggested Readings:

Text Books:

1. Kokate, C.K., Purohit, Gokhlae, Nirali Prakashan. 2007. Text book of Pharmacognosy. New Delhi.
2. Vinod D. Rangari. 2000. Text book of Pharmacognosy and Phytochemistry. Part I & II, Career Publication, Nasik, India.

3. Wagner, H and S. Bladt. Plant drug analysis. Springer, Berlin.
4. Kohli D.P.S. and D.H.Shah. Drug Formulation Manual. Eastern Publisher, New Delhi.

Reference Books:

1. R.D. Choudhary. 2005. Herbal Drug Industry. Eastern Publisher, New Delhi.
2. Pulok K Mukharjee. 2010 GMP for Botanicals - Regulatory and Quality issues on Phytomedicine. Business horizons Robert Verpoorte, New Delhi.
3. Pulok K Mukarjee. 2006. Quality control of herbal drugs. Business Horizons Pharmaceutical Publisher, New Delhi.
4. V. Rajpal. 2003. Standardization of Botanicals. Testing and extraction methods of medicinal herbs. Vol.I, Eastern Publisher, New Delhi.

Web Sources:

1. https://www.mondaq.com/india/patent/54494/patent-law-in-india
2. https://pcimh.gov.in/show_content.php?lang=1&level=1&ls_id=57&lid=55
3. https://pcimh.gov.in/show_content.php?lang=1&level=1&ls_id=56&lid=54
4. https://www.ema.europa.eu/en/human-regulatory/research-development/scientific-guidelines/multidisciplinary/herbal-medicinal-products-scientific-guidelines

---

Title of the Course: Ethnobotany **Semester: II**

Course Code: LPBYSC21 Contact hours: 2hrs/w **Credit:2**

Course Learning Outcomes:

On completion of the course, the students are able to

- appreciate the need to conserve floristic and cultural diversity of the region.

- rescue and document Ethnobotanicals for sustainable use of plant resources.
- understand the need for development of new drugs for safe and more rational use of herbal preparations.
- recognition of intellectual property rights and its benefit to people and society who share their knowledge and wisdom.
- develop laboratory skill in testing of herbal drugs and new commercial products.

Pre-required Knowledge:

- Ethnobotancial Knowledge
- Ethnobotanical data
- Antioxidant activity

Unit I: Ethnobotanical Research Institutes

Introduction, relevance, scope and status. Centres of Ethno botanical studies in India, AICRPE-All India Coordinated Research Project on Ethno biology, FRLHT-Foundation for the Revitalisation of Local Health Traditions. Contributions of FRLHT to ethno biology of India. Study in brief about Tribal/Folk communities of Kerala State focussing on Anthropology, Customs and Beliefs & Archaeological Ethnobotany. (Koraga, Kurichiya, Adiyan, Paniya, Cholanaikan, Kadar, Kurumba, Kuruman, Kani, Ulladan). Role of ethnomedicine and its scope in modern times. Role of Ethnobotany in conservation and sustainable development.

Unit II: Ethnobotanical Data Collection

Methods and techniques used in Ethnobotany-Field level activities for data collection- Approach, Documentation(Audio, Video recording, Photographs, Interview – Methods, Questionnaire, and Data sheet), Consent forms, Forest productivity check by analysing the log books of Forest, EDC, VSS etc), Authentication of plant species (Field Book, Herbarium) Field and Lab Procedures, Preparation of Data Sheet and Data Base. People's biodiversity Register (PBR). Impact of Ethnobotany in herbal-medicine industry, land-use development, agriculture, forestry, betterment of rural

livelihoods and education. Biodiversity and conservation of some useful medicinal plants.

Unit III: Phytochemistry

Introduction, scope and relevance. Brief account of Phytochemistry, pharmacodynamics and pharmacokinetics. Difference between herbal/botanicals and pharmaceutical medicine. Classification and sources of crude drugs. Quality, safety and efficacy of herbal medicines/ neutraceuticals. Role of ethnopharmacology in drug development.

Unit IV: Biopiracy & Intellectual Property Rights

Basic definition and types of toxicology, Regulatory guidelines for conducting toxicity studies as per OECD, Alternative methods to animal toxicity testing. Biopiracy, Intellectual Property Rights(IPR). Ethnopharmacology and IPR issue. Integrated drug development programme, technology transfer and commercialization of Traditional medicine.

Unit V:Indigenous/Traditional Knowledge

Plants used by ethnic groups as food, medicines (Ethnomedicine), beverages, fodder, fibre, resins, oils, fragrances and other uses. NWFP(Non-Wood Forest Produces), animal products, minerals, artefacts, and rituals, used by Tribal and Folk Communities of Tamil Nadu. Traditional/indegenous knowledge and its importance. Ethnobotany and Ethnopharmacology as a tool to protect interests of ethnic groups and rural development.

Suggested Readings:

Text Books:

1. Jain, S. K., Mudgal, V., Banerjee, D. K., Guha, A., Pal, D. C. and Das, D. (1984). Bibliography of Ethnobotany. Botanical Survey of India, Howrah
2. Shashi, S. S.(1995). Tribes of Kerala (Encyclopedia of Indian tribes Series-8). Ammol Publication Pvt. Ltd. Ansari Road, Daryagang, New Delhi

References Books:

1. Traditional plant medicines as sources of new drugs. P J Houghton in Pharmacognosy Trease and Evan's.16 Ed .2009.
2. Cunningham, A. B. (2001). Applied Ethnobotany. Earthscan publishers Ltd. London & Sterling, VA, USA Cotton, C.M. (1996).
3. Ethnobotany-Principles and application. John Wiley& Sons Ltd., West Sussex, England
4. In vivo and in vitro assays Glimpses of ethnopharmacology 1994 Eds. P Pushpangadan,V George and U.Nyman .
5. Faulks, P.J. (1958). An introduction to Ethnobotany, Moredale Publ. London.
6. Jain, S. K. (1981). Glimpses of Indian Ethnobotany. Oxford & IBH publishing Co. Pvt. Ltd., New Delhi .
7. Jain, S. K. (1989). Methods and approaches in Ethnobotany. Society of Ethnobotanists, Lucknow
8. Jain, S. K. (1995). A manual of Ethnobotany. Scientific Publishers, Jodhpur.
9. Jain S.K.(1997). Contribution to Indian Ethnobotany, Sci. Publ. Jodhpur.
10. Jose Boban K. (1998). Tribal Ethnomedicine: Continuity and change. APH publishing
11. corporation 5, Ansari Road, Darya Ganj, New Delhi.
12. Phytochemical Methods. Harborne JB. 1984 .Chapman and Hall , London.
13. Mathur, P. R. G. (1977). Tribal situation in Kerala. Kerala Historical Society, Trivandrum.
14. Snehalatha and Jain, S. K. (1998). Historical Archive in Ethnobotany. Institute of Ethnobotany, NBRI, Lucknow.
15. Medical Pharmacology, Padmaja Udaykumar. Sixth Edition, CBS Publishers & Distributors Pvt Ltd.

Web Sources:

1. http://www.worldcat.org/identities/lccn-n85-4353/

2. http://www.frlht.org/
3. http://www.pharmatips.in/Articles/Pharmaceutics/Parenteral/Pharmacokinetic-And- Pharmacodynamic-Characteristics-Of-The-Drug.aspx

---

Title of the Course: Field Methods for Vegetation Mapping **Semester: II**
Course code: LPBYSC22 **Contact hours: 2hrs/w** **Credits: 2**

Course Learning outcomes:

On completion of the course, the students are able to

- develop theoretical understanding of vegetation analysis
- understand the methods of mapping
- evaluate vegetation dynamics, variations and distribution of vegetation
- analyse the data reviews, and sampling approach
- mapping using modern tools

Pre-required knowledge:

- Diversity distribution patterns
- Sampling methods
- Mapping techniques

Unit I: Diversity analysis

Field sampling methods- Quadrat, line transect, random spot method: Nature of vegetation, community vs. continuum, vegetation structure, parameters of vegetation description (Species occurrence, Frequency, Cover). Species area curve; Minimum quadrat size.

Unit II: Vegetation dynamics

Spatial distribution of vegetation: Implications for sampling design, common sampling approaches (Sampling scale issue, ecological gradients, random vs. representative sampling, stratified random sampling, gradient oriented Transect (Gradsect) sampling).

Unit III: Classification and mapping

Relationships between classification and mapping (Scale considerations), characteristics of a successful sampling approach (Flexibility, Replicability, Cost effectiveness, Integrated field methods to support multiple objectives). Evaluation of different indices of plant biodiversity.

Unit IV:Field methods

Overview of planning process and field methods-Preliminary collection and review of existing Information, Initial site visit, information gathering and team development, data review and Identification of experts,

Unit V: Sampling Pattern

Determination of sampling approach, field data collection, GIS and GPS, Remote Sensing, management and analysis, Photo-interpretation and mapping, map validation accuracy assessment.

Suggested topics for seminar / group discussion:

1. Determination of size of Quadrat
2. Diversity analysis methods
3. Recent techniques of mapping
4. Remote Sensing management and analysis
5. Role of GIS and GPS

Suggested Readings:

Text Books:

1. Causton, D.R. (1988). An Introduction to Vegetational Analysis: Principles, Practice and Interpretation. Unwin Hyman, Boston.
2. Pearcy, R.W., Mooney, H.A., and Rundel, P.W. (2011). Plant Physiological Ecology: Field methods and instrumentation. Springer.
3. Ferretti, M., and Fischer, R. (2013). Forest Monitoring: Methods for Territorial investigations in Europe with an overview of North America and Asia. Elsevier.

Reference Books:

1. Brocklehurst, P., Lewis, D., Napier, D., and Lynch, D. (2007) Northern Territory Guidelines and Field Methodology for Vegetation Survey and Mapping. Technical Report No. 02/2007D. Department of Natural Resources, Environment and the Arts, Palmerston, Northern Territory.
2. USGS/NPS Vegetation Mapping Program. (1994). Field Methods for Vegetation Mapping. Prepared by : The Nature Conservancy 1815 N. Lynn St. Arlington, Virginia 22209 USA Environmental Systems Research Institute, Inc. 380 New York Street Redlands, California 92373.
3. William G. Cochran. (2012). Sampling Techniques (3ed), Wiley.

Web sources

1. https://www.fs.fed.us/emc/rig/documents/protocols/vegClassMapInv/EVTG_v2-0_June2015.pdf
2. https://www.esri.com/en-us/home
3. https://map.sdsu.edu/gisbook/

Title of the Course: Plant Systematics **Semester: III**

Course Code:LPBYCT31 **Contact hours: 5hrs/w** **Credit:5**

Course Learning Outcomes:

On completion of the course, the students are able to

- understand plant morphological terminology and use it accurately in the description and identification of plant species.
- understand the various aspects of plant nomenclature and classification.
- gain knowledge about combine classical plant taxonomy with modern molecular phylogeny.
- identify and/or verify unknown species using dichotomous keys.
- learn various advanced tools to study plant taxonomy.

Pre-required Knowledge:

- Scope and historical development of plant systematics
- Plant classifications
- Vegetative and floral characteristics

Unit I: Introduction to Plant Systematics

Definition, Principles, Scope and historical development. Chemotaxonomy, Numerical taxonomy and Molecular taxonomy. Field inventory; Herbarium techniques; Important herbaria and botanical gardens of world and India; Virtual herbarium; E-flora;Documentation: Flora, Monographs, Revision,Journals; Keys: intended (yolked) and bracketed keys.

Unit II: Taxonomic Hierarchy and Modern Techniques

Taxonomic Hierarchy: Concept of taxa; Categories and taxonomic hierarchy; Species concepts (biological, morphological, evolutionary). Biometrics, Numerical Taxonomy and Cladistics: Role of Computers in systematics Characters and attributes; Variations; OTUs (Operational Taxonomic Unit) classify plant by group of closely related individual, character weighting and coding.

Unit III: Classification

History of botanical research in India; Angiosperm classifications: Natural system (Bentham and Hooker), Artificial system (Linnaeus) and Phylogenetic system (Hutchinson, Takhtajan) and APG-IV (2016). Principles and rules (ICN); Phylocode, Ranks and names; Typification, author citation, valid publication, rejection of names, principle of priority and its limitations; Names of hybrids.Web resources for nomenclature– BHL (Biodiversity Heritage Library), IPNI (International Plant Name Index), Species 2000 and The Plant List.

Unit IV: Polypetalae & Gamopetalae

Vegetative and floral characters: Ranunculaceae, Magnoliaceae, Capparidaceae, Rhamnaceae, Polygalaceae, Balsaminaceae, Sapindaceae, Passifloraceae, Asteraceae,

Gentianaceae and Boraginaceae, Bignoniaceae, and Scrophulariaceae.

Unit V: Monochlamydeae & Monocot

Vegetative and floral characters: Nyctaginaceae, Aristolochiaceae, Loranthaceae, Moraceae, Polygonaceae, Amaryllidaceae, Orchidaceae, Commenlinaceae, Cyperaceae and Poaceae.

Suggested Topics for Seminar/Presentation/Group Discussion

- Numerical Taxonomy
- Species Concepts
- Natural Classification
- Web sources for plants nomenclature.
- Field identification of families.

Suggested Readings:

Text Books:

1. Sharma O.P. Plant Taxonomy. 1996. Tata Mc Graw Hill Publishers. New Delhi.
2. Lawrence, H. M. 1986. Taxonomy of Vascular Plants. Oxford & IBH Publishers, New Delhi.
3. Sharma, O.P. 2013. Plant Taxonomy. McGraw Hill Education Pvt. Ltd. New Delhi.
4. Anonymous (Angiosperm Phylogeny Group (APG)). 2016. An update of the Angiosperm Phylogeny Group Classification for the orders and families of flowering plants: APG IV. Botanical Journal of the Linnaean Society, 181: 1-20.
5. Pullaiah, T and S. Karuppusamy. 2018. Taxonomy of Angiosperms. 4th Edition, Regency Publication, New Delhi.

Reference Books:

1. Rendle, A.B. 1979. The classification of flowering plants, vol I and II. Vikas publishers private Ltd. New Delhi..

2. Samuel B.J. and Luchsinger A.E. 1987. Plant systematics. Mc Graw Hill International edition. New York.
3. Jeffrey, C. 1982. An introduction to plant Taxonomy. Allied Publishers Pvt Ltd. Bombay.
4. Jeffery, C. 1989. Biological nomenclature. Edward Arnold Publishers. London.
5. Vasistha, B.R. 1989. Taxonomy of Angiosperms. S. Chand and Co. New Delhi.
6. Pullaiah, T. 2007. Taxonomy of Angiosperms, 3rd Edition. Regency Publication, New Delhi.
7. Hutchinson, J. 1979. Families of flowering plants. Lubrecht & Cramer Publication.
8. Albert. E. Radford. 1986. Fundamental of plant systematics. Harper & Rao Publication.

Web Sources:

1. https://www.ipni.org/
2. http://www.theplantlist.org/
3. https://www.sp2000.org/home

Title of the Course: Plant Biotechnology **Semester: III**

Course Code: LPBYCT32 **Contact hours: 5hrs/w** **Credit: 5**

Course Learning Outcomes:

On completion of the course, the students are able to

- understand the core concepts and fundamentals of plant biotechnology and genetic engineering
- develop their competency on different types of plant tissue culture
- analyze the enzymes and vectors for genetic manipulations
- examine gene cloning and evaluate different methods of gene transfer
- critically analyze the major concerns and applications of transgenic technology

Pre required knowledge:

- Nutrition media
- Cryopreservation
- Molecular scissors

Unit I: Plant Tissue Culture

Historical perspective; Formulation of nutrient media; Sterilization tools , role of vitamins andhormones; Totipotency; Organogenesis; Embryogenesis (somatic and zygotic); Organ culture,Embryo culture, Anther and triploid culture, Callus culture, Protoplast isolation.Plant tissue culture facility and Green house**.**

Unit II: Application of Tissue Culture

Tissue culture applications including micropropagation, androgenesis, production of virus free plants, secondary metabolite production, haploids, triploids and hybrids and germplasm conservation, Cryopreservation and usages.

Unit III: Restriction enzymes- Types and classification

Restriction Endonucleases (History, Types I-IV and subtypes of II, Structures, biological role,Mechanism, and usages in cloning); Restriction Mapping (Linear and Circular); Ligases,Polymerse, kinase and phosphatase.

Unit IV: Cloning Vectors

History, basic components of vector, types of bacterial vectors (pUC18 and pUC19, pBR322, Ti plasmid, BAC); Yeast vector, viral vectors including Lambda phage, M13 phagemid, Cosmid, Shuttle vector; Plant expression Vectors (YAC).Plant viral vectors. Si RNA vectors

Unit V: Methods of gene transfer

Basic concept of Gene cloning, advantages of gene cloning, Agrobacterium-mediated Transformation, Infiltration, viral mediated direct gene transfer method by Electroporation, Microinjection, Microprojectile

Suggested Topics for Seminar/Presentation/Group Discussion:

- Used Organogenesis to rise a plant
- Restriction mapping
- Production of virus free plants using tissue culture techniques
- Bacterial vectors and its benefits
- *Agrobacterium* - mediated gene transfer method

Suggested Readings:

Text Books:

1. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice.
2. Elsevier Science Amsterdam. The Netherlands.
3. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles andApplications of recombinant DNA. ASM Press, Washington.
4. Slater, N.W. Scott and M.R. Fowler (2008). Plant Biotechnology. Second Edition.Oxford.
5. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley andSons, U.K.

Reference Books:

1. Stewart, C.N. Jr. (2008). Plant Biotechnology & Genetics: Principles, Techniques and Applications. John Wiley & Sons Inc. U.S.A.
2. Chrispeels, M.J. and Sadava, D.E. (1994). Plants, Genes and Agriculture. Jones & Bartlett Publishers.
3. N. Santosh and A. Madhavi. (2010). Practical Book of Biotechnology and Plant Tissue Culture. S. Chand & Co.

Web Sources

1. https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/plantbiotechnology
2. https://en.wikipedia.org/wiki/Biotechnology
3. https://www.isaaa.org/resources/publications/pocketk/2/default.asp
4. https://.britannica.com/technology/biotechnolog/

5. https://manavrachna.edu.in/blog/scope-of-biotechnology/

Title of the Course: Bioinstrumentation **Semester: III**

Course Code: LPBYCT33 **Contact hours: 5hrs/w** **Credit: 5**

Course Learning Outcomes:

On completion of the course, the students are able to

- gather the information about significance of buffer solution for bioassay
- know the various instruments for biological sample analysis
- understand the principles and operation procedure of UV spectrophotometer
- acquire the knowledge about uses and implementation of GC and HPLC
- take students to higher levels of research on metabolomics

Pre-required knowledge:

- Spectrophotometer
- Principles of separation
- Gravitational forces

Unit I: Microscopy

Principles, instrumentation and applications of simple, compound and electron microscopes. pH metry: Principles, Operation method and uses. Buffer solutions for biological investigations. Colorimetry: principles, operating principle and applications. Spectroscopic techniques: General principles- UV-visible spectrophotometer- principles, instrumentation and applications.

Unit II: Chromatography

Principles of paper chromatography, thin layer chromatography, adsorption chromatography, ion exchange chromatography, molecular sieve chromatography, affinity chromatography, high performance liquid chromatography (HPLC).

Unit III:Centrifugation techniques

Basic principles and sedimentation coefficient – Types of centrifuges and centrifugation: different types: differential centrifugation, density gradient centrifugation, - applications of centrifuge.

Unit IV: Radioactive isotope techniques

The nature of radioactivity – Detection and measurement of radioactivity –- Liquid Scintillation counting – Geiger-Muller counting of radioactivity – Autoradiography, applications.

Unit V: Molecular techniques

Extraction of DNA, RNA and Protein – principle – method. Purification of DNA, RNA and Protein – principle – method. Electrophoresis: Principles–Types: Paper electrophoresis, Agarose Gel Electrophoresis (AGE) Polyacrylamide gel electrophoresis (PAGE) and Capillary electrophoresis (CE). Applications of electrophoresis.

Suggested Topics for Seminar/Presentation/Group Discussion

- Applications of Microscopy
- Principles and applications of column chromatography
- Detection and measurement of radioactivity
- Agarose Gel Electrophoresis (AGE)
- Polyacrylamide Gel Electrophoresis (PAGE)

Suggested Readings:

Text Books:

1. Plummer, D. 1988. An introduction to Practical Biochemistry, Tata McGraw – Hill Publishing Company Ltd., New Delhi.
2. Palanivelu, P. 2004. Laboratory Manual for analytical biochemistry and separation techniques, School of Biotechnology, Madurai Kamaraj university, Madurai.
3. Jayaraman.J.1981. Laboratory Manual in Biochemistry. Whiley Eastern Limited, New Delhi.

Reference Books:

1. Wilson, K and J. Walker. 2005. Principles and Techniques of Practical Biochemistry, 5thEdition. Cambridge University press, New York.
2. Williams, B. L. and K. Wilson. 1983. A Biologist‘s guide to Principles and Techniques of Practical Biochemistry, Edward Arnold Publishers Ltd., London
3. Rodney Boyer, 2000. Modern Experimental Biochemistry,3rd Edition. Published by Addison Wesley Longman. Singapore.
4. Pyrczak, F. and Bruce, R. 2017 (8th Edition), Routlage Publishers, USA.
5. Rosner, B. 2010. (11th Edition) Fundamentals of Biostatistics, Brooks and Cole Publishers, UK.

Web Sources:

1. https://en.wikipdia.org/wiki/bioinstrumentation
2. https://www.britannica.com/science/chromatography
3. https://en.wikipedia.org/wiki/electrophoresis
4. https://microbenotes.com/centritugation.principal-types-and application

---

Tittle of the Course: Practical - Plant Systematics, Plant Biotechnology, Bioinstrumentation **Semester: III**

Course Code:LPBYCL31 Contact hours: 4hrs/w Credit: 2

Course Learning Outcomes:

On completion of the course, the students are able to

- dissect and display the floral parts of the different families of Angiosperm.
- evaluate and discuss groups of plants in terms of their diversity and describe their evolution, and phylogeny.
- acquire practical knowledge on identification of various groups of plants
- develop skill on geographical distribution of plants in various habitats and to identify the individual species.

- learn various advanced tools to study plant taxonomy

List of experiments

Plant Systematics

1. Demonstration of herbarium techniques.
2. Simple Nomenclatural problems.
3. Demonstration of the floras and manuals for plant identifications.
4. Construction of dichotomous keys for the plants to family level using flora and Manuals
5. Identification of plants to species level using flora and manuals
6. Study of Salient features, vegetative and sexual characters of the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula and systematic position according to Bentham & Hooker's system of classification):
   - Polypetalae families: Ranunculaceae, Magnoliaceae, menispermaceae, Capparidaceae, Polygalaceae, Rhamnaceae, Balsaminaceae, Sapindaceae, Passifloraceae, Apiaceae
   - Gamopetalae families: Asteraceae, Boraginaceae and Gentianaceae Rubiaceae Bignoniaceae, Scrophulariaceae,
   - Monochlamydeae families: Aristolochiaceae, Nyctaginaceae, Polygonaceae, Moraceae
   - Monocotyledons: Amaryllidaceae, Orchidaceae, Commenlinaceae, Cyperaceae and Poaceae.
   - Preparation of artificial keys for Polypetalae, Gamopetalae, monochlamydae and Monocot families.
7. Preparation and submission of fifty wild plants herbarium sheets, photoplates and field note book.
8. Planting and maintenance of minimum of one plant from above families in the department garden.
9. Botanical Study tour for a minimum period of four days.

Plant Biotechnology, Bioinstrumentation

1. pH meter
2. Spectrophotometer
3. AGE
4. PAGE
5. Column Chromatography
6. Requirements for plant Tissue culture Laboratory
7. Techniques in plant Tissue culture
8. Media components and preparation
9. Sterilization techniques and Inoculation of various explants
10. Synthetic seed production

Title of the Course: Conservation of Natural Resources and Policies **Semester: III**

Course Code: LPBYSC31 **Contact hours: - -** **Credit:2**

Course Learning Outcomes:

On completion of the course, the students are able to

- the course will introduce intellectual property rights and legal protection towards it.
- state the key provisions of major natural resource policies
- explain the historical development of these policies
- enlighten the dynamics of natural resource policy development
- critically evaluate natural resource policies using basic economic tools

Pre-required knowledge

- Natural Resource
- Land resources & Water resources
- Mineral resources

Unit I: Natural resource

Introduction to Natural Resource Bases: Concept of resource, classification of natural resources. Factors influencing resource availability, distribution and uses. Interrelationships among different types of natural resources.

Unit II: Different types of resources

Forest as a resource: forest vegetation, status and distribution, major forest types and their characteristics. Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people, forest management. Land as a resource: Land degradation, man induced landslides, soil erosion and desertification. Water as a resource: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

Unit III: Resource Management

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. Resource Management Paradigms: Resource management the evolution and history of resource management paradigms. Resource conflicts: Resource extraction, access and control system.

Unit IV: Common International Resources

Management of Common International Resources: Ocean, climate, International fisheries and management commissions; Antarctica: the evolution of an international resource management regime.

Unit V: Legal Policy

Overview of legal policy instruments in Natural Resource Management: National ForestPolicy of 1988, National Environment Policy of 2004, National Conservation Policy, NationalAction Plan on Climate Change of 2008, Coastal Protection Act. Wildlife Protection Act of1972, Forest Protection Act of 1980. Biological Diversity Act of 2002 and Rule 2004, ForestRights Act of 2006.Green Tribunal Act, 2009.

Suggested Readings:

Text Books:

1. Francois Ramade 1984. Ecology of Natural Resources. John Wiley & Sons Ltd.
2. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p.
3. Knight, Richard L, et al. 1995. A New Century for Natural Resources Management. Island Press.
4. Heal, Geoffrey. 2000. Nature and the Marketplace: Capturing The Value of Ecosystem Services. Island Press.

Reference Books:

1. Coastal Ecology & Management, Mann, K.H. 2000. Ecology of Coastal Waters with Implications for Management (2nd Edition).Chap. 2-5, pp.18-78 & Chap. 16, pp.280-303.
2. Agarwal, K.C., 2001. Environmental Biology, Nidhi Publication Ltd. Bikaner.
3. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publishing House.
4. Kareiva, Peter, and Michelle Marview. 2010. Conservation Science: Balancing the Needs of People and Nature. Roberts and Company.
5. Cubbage, Frederick, Jay O'Laughlin, and M. Nils Peterson. 2017. Natural Resource Policy. Waveland Press: Long Grove, IL.

Web Sources:

1. https://www.masterclass.com/articles/how-to-conserve-natural-resources#8-ways-to-conserve-natural-resources-at-home
2. https://www.iucn.org/
3. Environmental Studies - Land Resources https://www.tutorialspoint.com/environmental_studies/environmental_studies_land_resources.htm
4. Land, Water, and Forests https://assembly.thegef.org/sites/default/files/publications/GEF_COP17_UNFCCC_CRA_0_1.pdf

5. Gundimeda, H., Sukhdev, P., Sinha, R. K., & Sanyal, S. (2007). Natural resource accounting for Indian states-illustrating the case of forest resources. Ecological Economics, 61(4), 635-649.

Title of the Course: Forensic Botany **Semester: III**

Course Code: LPBYSC32 **Addl.** **Credit: 2**

Course learning outcomes:

On completion of the course, the students are able to

- conceptualize classification of plants from forensic point of view.
- understand forensic importance of different parts of plants.
- collect and preserve botanical evidences of crime and analyze classic and DNA based forensic botany cases**.**
- learn various advanced tools to study DNA.
- identify various types of poisonous samples.

Pre-required Knowledge:

- Plant systematics plants
- Types of plants yielding drugs
- DNA Analysis

Unit I: Introduction to Forensic Botany

Sub specialization of forensic botany- plant morphology, plant anatomy, plant systematic, polynology, plant ecology, limnology, Plant architecture- roots, stems, flowers, leaves. Practical plant classification schemes: - vegetables and herbs, fruits bearing trees and plants, landscaping plants: trees, shrubs and vines, grasses.

Unit II: Types of Wood and Forensic Aspects of Fibre Examination

Various types of woods, timbers, seeds and leaves and their forensic importance, Identification and matching of various types of wood, timber varieties, seeds and leaves. Types of fibers – forensic aspects of fiber examinations,

Identification and comparison of man–made and natural fibres. Various types of Planktons and diatoms and their forensic importance, Study and identification of pollen grains.

Unit III: Classification of Poisonous Plants

Various types of poisonous plants-*Abrus precatorius*, *Aconitum*, *Argemone mexicana*, *Cannabis sativa*, *Atropa belladonna*, *Erythroxylum coco*, *Jatropha curcas*, *Lathyrussativus*, *Manihot utilissima*, *Nerium indicum*, *Nicotiana tabacum*, *Plumbago*, *Ricinuscommunis*, *Semicarpus anacardium*, *Thevetia nerifolia*.

Unit IV: Drug Yielding Plants

Types of plants yielding drugs of abuse – *Opium, Cannabis, Coco, Tobacco, Datura,* and mushrooms.

Unit V: Collection and Analysing of DNA Molecule

Collection and preservation of botanical evidences: Botanical samples, outdoor crime scene consideration, Analysis of samples, DNA analysis, plant DNA typing, Classic forensic botany cases: Case histories by using Plant anatomy and systematic, Palynology, Limnology, Drug enforcement and DNA.

Suggested Topics for Seminar/Presentation/Group Discussion:

1. Plant Classification
2. Types of Woods
3. List out the various types of poisonous plants.
4. Various types of Drug yielding plants.
5. DNA Sampling & Analysing

Suggested Readings:

Text Books:

1. James S.H., Nordby J.J., Bell S. (2015). Forensic Science: An Introduction to Scientific and Investigative Techniques. CRC Press; 4 edition.
2. Bock J H and Nrris D O (2016) Forensic Plant Science, Academic Press.

Reference Books:

1. Coyle H M (2004) Forensic Botany: Principles and Applications to CriminalCasework. CRC Press.
2. Hall D W and Byrd J (2012) Forensic Botany: a practical guide. Wiley Blackwell, 1edition.
3. Matthew A Gietzendanner (2012) Forensic Botany. A Practical guide (pp.93-106)

Web Sources:

1. http://scitechconnect.elsevier.com/forensic-botany-underutilized-resource/
2. http://www.theplantlist.org/
3. http://oishimaya.blogspot.com/2015/12/8-poisonous-plants-in-india-that-can.html
4. http://medbox.iiab.me/kiwix/wikipedia_en_medicine_2019-12/A/Poly_drug_use

DEPARTMENT OF ENGLISH - PG-CBCS -LOCF

Title of the Course: English for Career Development (NME) Semester: III

Course code: LPENNM31 Contact hours: 5hrs/w Credits: 4

Course Learning Outcomes:

On completion of the course, the students are able to

- have the comprehensive understanding of the language ability required in the competitive examination
- effectively use the vocabulary for the fluent and accurate communication
- exercise their grammatical competence in their communications
- confidently meet the job interview requirements
- practise the proficient language skills in all Professional and social interactions

Pre-required knowledge:

- Use of Basic Grammar for Job
- Communicative English for Career
- Writing Skills for Job Purposes

Unit I

Situational Grammar, Tenses, Voices, Prepositions, Articles

Unit II

Sentence Completion

One word Substitution

Homonyms

Phrasal Verbs

Unit III

Reading Comprehension

Analogy

Jumbled Sentence

Errors and How to avoid them

Unit IV

Job Application and Preparing a CV

Expansion of Idea

Report Writing

Essay Writing

Unit V

Interview

Group Discussion

Tips for taking Exam

Suggested Topics for presentation:

- Application process for various jobs
- Providing strategies for identifying the jobs
- Preparing resume for professional jobs
- Writing a clear and concise formal letter
- Developing interview skills

Suggested Readings:

i)Text Book:

Bhatnagar,R.P.*English for Competitive Examinations,*Madras: Laxmi Publication, 2009.

ii) Reference Books:

1. Sharma,Manish.ITI*Employability Skills*.Neelkand publishers,2016.
2. Dixit,Shilpi.*EmployabilitySkills.*BFC Publications,2021.
3. Dhanavel,S.P.*English and Soft Skills.*Orient Blackswan,2011.

iii) Web Source:

1. https://www.coursera.org/learn/careerdevelopment
2. https://www.my.mooc.com/en/mooc/english-for-careerdevelopment
3. https://www.naukri.com/learning/english-for-careerdevelopmentcourse-couri202

DEPARTMENT OF HISTORY – PG - CBCS – LOCF

Course Title : Indian History for Competitive Exams (NME)		**Semester: III**
Course code: LPHSNM31	**Contact Hours: 5**	**Credits: 4**

Course Learning Outcomes:

On completion of this course, the students are able to

- understand the Indus Valley Civilisation.
- explain the administration of Mughals.
- analyse the causes and result of 1857 Mutiny.
- describe the salient features of Constitution of India.
- asses the current events in India and abroad.

Pre- required knowledge:

- Topics of competitive exams.
- Need of General Knowledge.
- Importance of Competitive exams.

Unit I : Ancient Indian History

Sources, - Indus Valley Civilization- Vedic Period - Mauryan Dynasty Buddhism and Jainism- Guptas.

Unite II: Medieval Indian History

Advent of Islam- Establishment of Delhi Sultanate – Mughals and Marathas- Advent of Europeans-Expansion and

consolidation of British Rule- Social Reforms-Religious Movements.

Unite III: Indian National Movement

1857 Revolt - Indian National Congress -– Gandhian Era –Role of Tamil Nadu in Freedom Struggle.

Unit IV: Indian Polity

Constitution of India-Preamble- Salient Features - Fundamental Rights and Duties - Panjayat Raj - Center and State Relation- Emergency Provisions- Election Commission- Amendments.

Unit V: Current Events

Profile of States - Defense - National Security and Terrorism, NGO - Eminent Persons and Places- Sports - Books and Authors-Cultural Panorama – Historical Events in India – Covid 19 .

Suggested topics for group discussion and presentation:

- Mauriyan Administration.
- Establishment of Delhi Sultanate.
- Indian National Movement.
- Emergency Provisions.
- Covid 19

Suggested Readings:

Text Books:

1. Ishwari Prasad, History of Medieval India, The Indian Press Ltd., Calcutta, 2006.
2. BipinCandra, History of Modern India, Orient Blackswan Publication, Hydrabad, 2009.

Reference Books:

1. NilakandaSastri, K. A. History of South India, Oxford Publication, Calcutta, 1982.
2. Basham, A.L. Wonder that was India, Rupa and Co Publisher, Delhi, 1967.
3. Bipan Chandra, Modern India, NCERT, New Delhi, 2005.

4. India and the contemporary World- I and II, NCERT, New Delhi.2000
5. Indian History, Part I,II, and III, NCERT, New Delhi,2007.

Web Sources:

- www.clearIAS.com
- www.jagranJosh.com
- www.UPSC.gov.in

DEPARTMENT OF ECONOMICS – PG – LOCF

Title of the Course: Economics for Competitive Examinations (NME)		**Semester: III**
Course Code: LPECNM31	**Contact Hours: 5hrs/w**	**Credits: 4**

Course Learning Outcomes

On completion of the course, the students are able to

Grasp the measures of Economic development and role of NITI Aayog Acquire the Skill of analysing the Government policies on poverty and population growth. Evaluate India's trade policy and gain knowledge on IMF, IBRD and ADB. Analyse the working of Indian Money Market. Understand the issues in the Indian Federal system and competently appear for Competitive examinations.

Pre- required Knowledge

Economic growth, Economic development and Economic Planning.

Absolute Poverty Vs Relative Poverty.

Internal trade Vs International trade.

Indian Financial Market:Meaning and Structure.

Direct tax, Indirect tax and Non-tax Revenue.

Unit I: Economic Development and Planning

National Income – Various Committees on National Income estimation – Measures of Economic Development(PQLI, HDI, HPI and GDI) – National Income as a measure of welfare – Green Revolution and agriculture

development- History of Economic Planning in India – Planning Commission Vs NITI Aayog – India's role in BRICS.

Unit II: Population and Poverty

Population growth in India – Demographic features of India - India's Population Policy – Report of Lakdawala, Tendulkar and Rangarajan Committees on Poverty (Salient Points only) – Poverty Eradication Programme (IRDP, PMGAY, MGNREGA).

Unit III: International Trade Policy and Institutions

India's Trade Policy – Special Economic Zones – Foreign Investment Policy – Foreign Exchange Rate Policy – FEMA – Globalisation and WTO – International Financial Institutions: IMF, IBRD and ADB.

Unit IV: Indian Money Market

Money Market: Features and instruments – Banking Sector Reforms – Primary Market Reforms – Inflation and controlling measures in India

Unit V: Federal Financial System in India

Federal Structure – Consolidated and Contingency Funds of India – Public Account – Centre – State Financial Relation – Finance Commission – GST and GST Council - Fiscal Sector reforms in India – State Finances – Fiscal Responsibility and Budget Management (FRBM) Act - Local Finances.

Suggested topics for group discussion/ Presentation

1. NITI Aayog differs from Planning Commission in terms of composition and powers.
2. Poverty estimation suffers from various methodological issues.
3. International Monetary Fund (IMF) provides international liquidity.
4. Indian Banking Sector reform measures are based on Basel- III norms.

5. State governments are suspicious of the motives of the government of India in raising and sharing of tax revenues with them.

Suggested Readings

Text Books

1. Ramesh Singh(2019), Indian Economy for Civil services, Universities and other Examinations, McGraw Hill Education, New Delhi.
2. Misra and Puri, (2019), Sectoral Problems Of Indian, Economy, Himalayas Publishing House.
3. Rudder Datt and Sundaram, (2018), Indian Economy, S. Chand, New Delhi.

Reference Books

1. Francis Cherunilam, (2019) International Trade and Export Management, Himalaya Publishing House.
2. Uma kapila (Ed.) (2018), Indian Economy since independence, Academic Foundation, New Delhi, 29 th edition.
3. Gupta. K. R and Manoranjansharma (2018) , Indian Economic Policies and Data McGraw Hill Publications.
4. Abhijit, V. Banerjee et al. (2017), poverty and income distribution I India, juggernaut, New Delhi.
5. Prakash B.A (2009) , The Indian Economy since 1991, Edited Book, Pearson Education New Delhi.
6. Iswar C. Dhinkara, (2009) , The Indian Economy: Environment and Policy, Sultan Chand and Co.
7. Manmohan Agarwal and Amit shovon Toy, (2007) ,Globalisation and the Millinnium Development Goals, Orient Black Swan, Hyderabad.
8. Brahmananda, P. R, and V. R. Panchmuki (Eds) (2001), Development Experience in the Indian Economy: Inter-state Respective, Bookwell, Delhi.
9. Ahuluwalia, I. J and I. M. D. Little (Eds) , (1999), India's Economic Reforms and Development, oxford Universities Press, New Delhi.

10. Agarwal, A.N, (1981), Indian Economy, Vishwa prakashan, New Delhi.

Web Sources

https://www.vedantu.com/commerce/national-income

https://en.m.wikipedia.org/wiki/Demographics_of_India

https://en.m.wikipedia.org/wiki/Federation

DEPARTMENT OF COMMERCE - PG - CBCS - LOCF

Title of the Paper: Entrepreneurship Development (NME)	**Semester: III**
Course Code: LPCONM31 Contact Hours: 5hrs/w	**Credit: 4**

Course Learning Outcome:

On completion of the course, the students are able to

- know the factors affecting entrepreneurial growth.
- identify the problems faced by women entrepreneurs.
- identify the various institutional support to the entrepreneur.
- advocate for subsidy and incentives to be received from the Government.
- prepare the project reports.

Pre-required knowledge:

- ✓ Entrepreneurial venture
- ✓ Scope for women entrepreneurship
- ✓ Financial assistance from government

Unit- I: Introduction to Entrepreneurs

Entrepreneur - Definition - Concept - Characteristics - Qualities - Classification of entrepreneurs - Entrepreneur Vs Manager - Role of Entrepreneurs in the economic development -- Factors affecting entrepreneurial growth. **Entrepreneurship**- Concept - Distinction between Entrepreneur and Entrepreneurship

Unit- II: Women Entrepreneurs

Introduction - Definition - Problems - Suggestions to overcome - Government steps towards Women Entrepreneurs

- Institutions support to women Entrepreneurs in India.

Entrepreneurship Development Programmes (EDP):Meaning - Objectives - Stages in EDP- Pre-training Stage - Training phase - Post Training - Evaluation and Feedback of EDP.

Unit- III : Assistance to Entrepreneurs:

Financial and Non-Financial Institutions - TIIC and SFC - DIC - SIDBI - SIDCO - Commercial Banks.

Unit- VI : Incentives and Subsidies:

Incentives and subsidies of State and Central Govt - Objectives -Aims - Tax Concession - Assistance to MSME's - Backward areas - Industrial Estates

Unit-V : Project Report:

Meaning - Steps - Contents - Reasons for failure of a Project Report – Format – Guidelines.

Suggested Topics/Practical Exercises:

The learners are required to

- ✓ list the various factors affecting entrepreneurial growth.
- ✓ explain the steps to overcome the problem face by women entrepreneur.
- ✓ name any two financial institutions supporting entrepreneurs to grow in Tamilnadu.
- ✓ cite examples for the growth of business using Seed Capital Assistance / Scheme.
- ✓ draw a project report for a new business concern.

Suggested Readings:

(i) Text Books

1. Gupta.C.B. (2018). Entrepreneurship Development. New Delhi: Sultan Chand and Sons.
2. Gordon. E. and Dr. Natarajan. K. (2020). Entrepreneurship Development. Mumbai: Himalaya Publising House.

(ii) Reference Books

1. Gupta . C.B.& Srinivasan. N.P. (2018), Entrepreneurship Development. New Delhi: Sultan Chand and Sons.

2. Khanka S.S. (2018) Entrepreneurial Development. New Delhi: S.Chand & Company Ltd..
3. Kanishka Bedi. (2012). Management and Entrepreneurship, New Delhi: Oxford University Press.

(iii) Web-Sources:

1. www.tiic.in
2. www.sidco.in
3. www.dic.in

DEPARTMENT OF MATHEMATICS – PG – CBCS - LOCF

Title of the Course: Mathematics for Competitive Examinations (NME) **Semester: III**

Course Code: LPMSNM31 **Contact Hours : 5hrs/w** **Credits: 4**

Course Learning Outcomes:

On completion of the course, the students are able to

- formulate the problem quantitatively
- recall appropriate arithmetical methods to solve the problem
- demonstrate various principles involved in solving mathematical problems.
- evaluate various real life situations by resorting to analysis of key issues and factors
- develop various mathematical skills to solve the problems

✓ **Pre-required Knowledge:**

✓ Addition and subtraction

✓ multiplication and division

✓ product tables

Unit I:Quantitative Aptitude - I

HCF and LCM of numbers-Decimal Fractions – Simplification - Average-Problems on numbers-Problems on ages.

Unit II: Quantitative Aptitude – II

Percentage-Profit and loss-Ratio and proportion-Partnership-Simple interest-Compound interest.

Unit III: Quantitative Aptitude - III

Time and work-Time and distance-Problems on trains-Alligator or mixture.

Unit IV: Quantitative Aptitude and logic

Calendar – Clocks – Stock and shares - Odd man out and series.

Unit V: Reasoning

Verbal and non-verbal reasoning- verbal Reasoning – Analogy - Mathematical operations – Inserting the character. Non-Verbal Reasoning – Analytical Reasoning

Suggested Topics for Group Discussion/ Presentations:

1. Simplification
2. Simple and compound interest
3. Problems on trains
4. Stock and shares
5. Non-verbal reasoning

Suggested Readings:

(i) Text Books:

1. R.S. Agarwal, Quantitative Aptitude for Competitive Examinations Revised and Enlarged edition, S.Chand Publications, New Delhi, Reprint 2007.
2. R.S. Agarwal, Verbal and Non-Verbal reasoningS.Chand Publications, New Delhi,Reprint 2009.

Unit I: Book1: Section 2,3,4,6,7& 8.

Unit II: Section 10,11,12,13,21 & 22.

Unit III: Section 15,17,18& 20.

Unit IV: Section 27,28,29 & 35.

Unit V: Book 2:Part I – Section I- 2,13 &16. Part II – Section – 4

(ii) Reference books:

1. R.Gupta, Quantitative Aptitude, Unique Publishers Pvt. Ltd, 2013.
2. Arora. P.N. and Arora. S., Quantitative Aptitude Mathematics, Volume-1 S Chand & Company Ltd., New Delhi, 2009.
3. Kothari. C.R., Quantitative Techniques,Vikas Publishing House Pvt. Ltd., New Delhi, 1989.
4. Srinivasan. T.M., Perumalswamy. S. and Gopala Krishnan. M.D., Elements of Quantitative Techniques, Emerald Publishers, Chennai, 1985.

(iii) Web Resources:

1. https://mathematician0.weebly.com/
2. https://youtu.be/rHzggZDdtc4
3. https://youtu.be/ZADjT-wsQJw
4. https://youtu.be/ETiRE7N7pEI
5. https://www.youtube.com/watch?v=tnc9ojITRg4&list=PLpyc33gOcbVA4qXMoQ5vmhefTruk5t9lt

DEPARTMENT OF CHEMISTRY – PG – CBCS-LOCF

Title of the paper: CHEMISTRY FOR ALL (NME)		**Semester: III**
Course Code:LPCHNM31	**Contact Hours: 5hrs/w**	**Credits: 4**

Course Learning Outcomes:

On completion of the course, the students are able to

- ✓ know the basic chemistry involving types of elements and chemical reactions.
- ✓ study different concepts of acids and bases and various chemical processes
- ✓ gain awareness on Pollution and types of pollution
- ✓ know the details of plastics, glass, cement, types of fuels
- ✓ gain knowledge in vitamins, food adulterants and Classificationand biological functions of antibiotics

Pre-Required Knowledge

- ✓ Properties of Metals and non-metals
- ✓ Isotopes, Isobar and isotones
- ✓ Stability of Colloidal solution
- ✓ Thermosetting and thermoplastics
- ✓ Green house effect and global warning

Unit I: BASIC CHEMISTRY- I

Elements – atoms and molecules – Metals and non metal – metaolloid, alloy, ore and minerals - Chemical formulae and symbols – Important basic terms such as pressure, volume, atomic mass, molecular mass, temperature, atomic number – Types of chemical reactions (exothermic and endothermic, Physical and chemical changes, oxidation and reduction) – ideal and real gas - Important laws of Chemistry (Boyle's law, Charle'slaw, Hess's law, Grahams law of diffusion, Beer's law, Henry's law, Faraday's law, Law of conservation of matter or energy).

Unit II: BASIC CHEMISTRY- II: (Only elementary idea can be given)

Different concepts of Acids and Bases (Arrhenius, Bronsted and Lewis) – pH concept (no calculation) – Water – Hard and soft water - Chemical nature of metals- Steel and iron (no manufacture) – heat treatment of steel – Solutions and their types (True, Colloidal and suspension) – uses of colloidal solution – Buffer solution – Nuclear Chemistry – isotopes and radioactivity Definitions of some important chemical processes (Haber's, Contact's, Ostwald's, Processes)

Unit III: ENVIRONMENTAL CHEMISTRY

Pollution and types of pollution – Composition of atmosphere – Major regions of atmosphere and their characteristics – Elementary idea of Green house effects and Acid rain – Air pollution – Control of air pollution and their harmful effects – CFC, Global warming, substitute for CFC (Just name only)-Water pollution – Dissolved oxygen – BOD, COD and TDS (elementary idea only)

Unit IV: CHEMISTRY IN SERVICE OF MAN –I: (Only elementary idea can be given)

Plastics – Classification with examples – Polymer (natural and synthetic) – Soaps and Glass – Annealing of glass – Cement – Constituents and setting and hardening of cement – Rubber – Types with examples and vulcanization of rubber- Corrosion of metal – prevention – Lubricants (definition and classification) – Fuel – Classification with suitable examples - calorific value – LPG and Rocket fuel.

Unit V: Chemistry in service of man –II: (Only elementary idea can be given)

Food adulterants – common food adulterants and their harmful effects and tests to identify them– Classification and biological functions of Vitamins A, B6, B12, C, D, E and K (structural elucidation not required) – Classification and biological functions of antibiotics – penicillin, chloroamphenicol, streptomycin and tetracycline.

SUGGESTED TOPICS FOR GROUP DISCUSSION/ PRESENTATIONS

- ✓ Metals and nonmetal
- ✓ Steel and iron
- ✓ Green house effects
- ✓ vulcanization of rubber
- ✓ organic and Inorganic pesticides

Suggested Readings

Text Books:

1. A Text book of Environmental Chemistry, O.D.Tyagi, M. Mehra, Anmol Publication, 1990.
2. Puri, Sharma and Pathania, Principles of Physical Chemistry, Vishal Publishing Co., 2004
3. Puri, Sharma and Pathania, Principles of Inorganic Chemistry, Vishal Publishing Co., 2004

Reference Books:

1. Applied Chemistry, K. BagawathiSundari, MJP Publishers, Chennai – 2006.
2. General Studies Manual, The TMH Publishers, 2008
3. Basic concepts of chemistry (HB) by Pegasus sold by Amazon Asia-Pacific Holdings Private Limited, 2018.

Websites and e-Learning Sources:

1. https://youtu.be/eJXL0IrbtqE
2. https://2012books.lardbucket.org/pdfs/beginning-chemistry.pdf
3. https://youtu.be/J0v3stz7izA
4. https://youtu.be/EyBkPwsRY2E
5. https://youtu.be/yU3GwJu_yNA
6. https://youtu.be/uMBeXHnWhsE
7. https://youtu.be/lUg7r7fu_eo
8. https://youtu.be/eJXL0IrbtqE

DEPARTMENT OF PHYSICS – PG – CBCS - LOCF

Title of the Course: Physics for Competitive Examinations (NME)		**Semester: III**
Course Code: LPPHNM31	**Contact Hours: 5hrs/w**	**Credit: 4**

Course Learning Outcomes:

On completion of the course, the students are able to

- understand various systems of units and newton's laws of motion
- acquire the basic knowledge on gravitation
- understand the various aspects in electrostatics and electricity
- have knowledge on various properties of light
- understand the electronic devices, circuits and various number systems

Pre-Required Knowledge:

- ✓ Gravitational force, acceleration due to gravity mass and other physical quantities
- ✓ Heat, energy, temperature, basic mathematics, basic ideas on charge and current
- ✓ Elementary idea on planetary systems and space

Unit I: Systems of Units and Newton's Laws

System of units S.I.- Fundamental units- derived units – Dimension of physical quantity – uses of dimensional equations – limitation of dimensional analysis. Force and inertia, Newton's first law of motion – momentum – second law of motion – conservation of linear momentum – Newton's Third law of motion – friction – laws of limiting friction – static and dynamic friction.

Unit II: Gravitation

Gravitation-Kepler's law of planetary motion – universal law of gravitation – acceleration due to gravity – variation of 'g' at poles – equator – Altitude – depth – rotation of earth – difference between mass and weight – Inertial mass and gravitational mass –Satellite – Orbital velocity – escape velocity – Rocket.

Unit III: Electrostatics and Electricity

Charge and fields – Coulomb's law – electric field due to a point charge – Gauss law – Application of Gauss law – Electric field due to parallel sheet of charge – Electric potential –Potential due to a point charge – Capacitor – Principle of a capacitor – Capacitance of a parallel plate capacitor –Effect of dielectric on capacitance – current and resistance – Electric current –Current density – Expression for current density – Ohm's law and electrical conductivity – Kirchoff's law – Application of Kirchhoff's law to Wheatstone network and measurement of resistance.

Unit IV: Optics and Sound

Light – Reflection of light – Laws of reflection – Refraction of light – Laws of reflection – Dispersion visible range dual nature – Total internal reflection – Laser – Interaction of light

with matter – Population inversion - Applications of laser. Simple Harmonic motion – Progressive wave properties – stationary waves – properties – ultrasonic – Properties and applications.

Unit V: Electronics

Difference between conductor, insulator and semiconductor using band theory – Intrinsic and extrinsic semiconductor – semiconductor diode –diode as a rectifier – Photo diode – LED – Zener diode as a voltage regulator – Number system – Binary, octal, Hexadecimal – Inter conversion – Cray code – exes 3 code , ASCII code – Basic gates – De-Morgan's theorem – Universal gates – Binary addition –Binary subtraction – 2's complement method - 1's complement method – binary multiplication – binary division.

Suggested Topics for Group Discussion/Presentation:

- ✓ Newton's laws of motion, concept of friction and its associated quantities
- ✓ Newton's law of Gravitation-Kepler's law of planetary motion,
- ✓ Electrostatics force, Electric field, electric potential, capacitors. Ohm's law Kirchoff's law
- ✓ Various properties of light, laser fundamentals and applications, Ultrasonics and applications.
- ✓ Various types of semiconductor devices, binary number systems

Suggested Readings:

(i) Text Books:

1. Murugeshan, R. Mechanics, Properties of matter and sound. For Bsc ancillary physics, Reprint (2016).
2. Murugeshan, R. Optics, Spectroscopy and Modern Physics, For Bsc ancillary physics, 1st edition (2017).
3. Murugeshan, R. Electricity and electronics, for B.Sc Ancillary Physics, 1st edition, (2014).

(ii) Reference Book:

Halliday, D. Resnick, R and Walker, J. Principle of Physics, International Student version, Wiley India Private Ltd., 9th edition, reprint (2012).

(iii) Web Sources:

1. https://www.khanacademy.org/science/physics
2. https://ocw.uci.edu/courses/physics_3a_basic_physics.html
3. https://www.concepts-of-physics.com/dr-hc-verma/videos.php#hc-verma-videos-on-mechanics

---

Title of the Course: Plant Physiology **Semester: IV**

Course Code: LPBYCT41 **Contact hours:5hrs/w** **Credit: 5**

Course Learning Outcomes:

On completion of the course, the students are able to

- know the various plant water relations
- understand the mechanism of various metabolic processes in plants
- acquire basic knowledge about the growth and development in plants
- take students to higher levels of learning about the physiological process of plants
- gather the information about growth promoting hormones

Pre-required knowledge:

- Transpiration
- Photosynthesis
- N_2 cycle

Unit I: Water relations of plants

Osmosis, diffusion, plasmolysis and imbibition – water potential, osmotic potential and pressure potential. Absorption of water:- pathway and mechanism – passive and active absorption – apoplast and symplast. Ascent of sap:- pathway – theories and mechanisms.

Transpiration:- types; theories and mechanisms. Stomatal movement – antitranspirants – guttation. Uptake of minerals:- passive and active mechanisms.

Unit II: Photosynthesis

Pigments– photosynthetic unit – two photosystems – photoysis of water – red drop and Emerson enhancement – electron transport and photophosphorylation – non – cyclic, cyclic and pseudocyclic – carbon assimilation – C_3 and C_4 cycles – CAM pathway – photorespiration.

Translocation of organic solutes - source and sink relationship – mechanisms.

Unit III: Respiration

Aerobic and anaerobic – mechanism of aerobic respiration – Glycolysis, Pasteur effect, Krebs cycle and oxidative phosphorylation – electron transport chain – energetics of respiration – fermentation – Pentose phosphate pathway and its significance. Bioenergetics of chloroplasts and mitochondria Nitrogen metabolism: - sources of nitrogen – nitrogen fixation – symbiotic and asymbiotic – biochemistry of nitrogen fixation – nitrate reduction and assimilation of ammonia.

Unit IV: Senescence and PCD

Biochemical changes during senescence of leaves and petals and regulation of senescence. Programmed Cell Death. Photoperiodism and its significance, endogenous clock and its regulation, floral induction and development- genetic and molecular analysis, role of vernalization. Biochemical changes during development of seeds. Ripening of fruit and its regulation.

Unit V: Secondary metabolites

A brief account on physiological effects of auxins, gibberellins, cytokinins and ethylene. A brief idea about discovery, role and possible mechanism of action of a) Triacontanol, b) Brassins c) Salicylic acid, d) Jasmonates e) Polyamines. Secondary metabolites – Shikimate Pathway mevilinate pathway and its role in biosynthesis of secondary

Metabolites. Stress physiology – physiological responses of plants to abiotic stresses – water and salt.

Suggested Topics for Seminar/Presentation/Group Discussion

- Passive and Active Mechanisms
- Red drop and Emerson enhancement
- Symbiotic and asymbioticnitrogen fixation.
- Role of vernalization.
- Secondary metabolites of plants.

Suggested readings

Text Books:

1. Jain V.K. Fundamentals of Plant Physiology, S. Chand & Co., New Dekhi, 1974.
2. Taiz, L. And Zeiger, E. Plant Physilogy, Panima Publishing Corporation, New Delhi, 2003.
3. Verma, V.K. Text Book of Plant Physiology. Anes Book India, New Delhi, 2007.

Reference Books:

1. Devlin, R.M. and Witham, F.H. Plant Physiology, C.B.S. Publishers and Distributors, New Delhi, 1983.
2. Noggle, G.r. and Fritz. G.J. Introduction to Plant Physilogy, Prentice Hall of India Pvt., New Delhi, 2002.
3. Salisbury, F.B. and Ross, C.W. Plant Physiology. Thomas Wadsworth, U.K. & U.S., 1992.
4. Bidwell, R.G.S. Plant Physiology, Macmillan Publishing corporation, New Delhi, 1974.

Web Sources

1. https://en.wikipedia.org/wiki/Plant_physiology
2. https://www.sciencedirect.com/topics/agriculture-and0biological-sciences/plant- physiology.
3. https://learn.careers360.com/biology/plant-physiology-chapter/
4. https://www.biologydiscussion.com/plants/plant-physiology/top-6-processes-of- palnt-physiology/24154.

Title of the Course: Plant Biochemistry and Metabolism **Semester: IV**

Course Code: LPBYCT42 **Contact hours: 5hrs/w** **Credit: 5**

Course Learning Outcomes:

On completion of the course, the students are able to

- extend their knowledge of biochemistry fundamentals and will learn about the significance of biochemistry and important metabolic processes taking place in plants
- acquire a detailed knowledge about the chemistry of carbohydrates, lipids, proteins and amino acids and their classification
- describe the mechanism of enzyme action and identify the classes of enzymes and factors affecting action
- understands the structural organization of proteins, metabolism of saccharides, lipids
- acquainted with the widely used techniques in plant biochemistry like qualitative and quantitative tests for the important biomolecules.

Pre-required knowledge

- Basic knowledge on structure of atoms, molecules and chemical bonds
- Principles of biophysical chemistry
- Micro and macromolecules

Unit I: Biochemical energetics

General concept, laws of thermodynamics, entropy, enthalpy, free energy, redox-potential, energy rich phosphorus compounds, ATP as universal currency of energy

Unit II: Enzymes

Introduction, anabolic and catabolic pathways, regulation of metabolism, role of regulatory enzymes (allosteric, covalent modulation and Isozymes). Properties of enzymes, Co-factors, Isozymes, enzyme kinetics, Michaelis – Menten equation, mechanism of enzyme action, regulation of enzyme action.

Unit III: Carbohydrates

Carbohydrates: Classification, structure and function of carbyhydrates, monosaccharides, oligosaccharides, polysaccharides, storage polysaccharides, structural polysaccharides, glycoproteins. **Lipids:** Classification of lipids – simple lipids, compound lipids, sterols and terpenoids, biosynthesis of fatty acids, polyunsaturated fatty acids, lipoproteins, oxidation of fats, α-oxidation, β-oxidation, glyoxylate cycle, gluconeogenesis.

Unit III: Amino acid and Protein

Amino acids: General properties - Classification and characteristics - non protein amino acids - peptide bonds - Biosynthesis of amino acids with reference to GS and GOGAT. **Proteins:** Classification of proteins, Structure of proteins and Ramachandran plot

Unit V:Nucleic acids

DNA Structure: Miescher to Watson and Crick- historic perspective, DNA structure, Salient features of double helix, Types of DNA, Types of genetic material, denaturation and renaturation, cot curves; Organization of DNA- Prokaryotes, Viruses, Eukaryotes. RNA Structure_Organelle DNA - mitochondria and chloroplast DNA.The Nucleosome Chromatin structure- Euchromatin, Heterochromatin-Constitutive and Facultative heterochromatin.

Suggested Topics for Seminar/Presentation/Group Discussion:

- Metabolic Pathways, evolutionary background and their Regulation
- Developments in various processes and functions of plants
- Impact of climate change on food production – Quality and quantity
- Online tools for protein docking
- Drug designing

Suggested Readings:

Text Books:

1. Plant Physiology, biochemistry and molecular biology. David, T: Dennis and DavisTurnip. Longman. Scientific and technical U.K. 1990.
2. Outlines of biochemistry. 5th edition Con E.E. and Stump P.K. 1995. Willey
3. Principles of biochemistry, Lehnenger, A.L. 1982 CBS Publication

Reference Books:

1. Biochemistry, Strayer W.H. 1976. Foreman Company.
2. Introduction to Plant Physiology. Willium G. Hopkins and Norman P. A. Huner
3. Plant Physiology. Lincoln Taiz and Eduardo Zeiger. International Edition
4. Plant Biochemistry. P.M. Dey and J.B. Harborne
5. Plant Biochemistry. Hans-Walter Heldt
6. Physicochemical and Environmental Plant Physiology. Park S. Nobel

Web Sources:

1. https://nptel.ac.in/courses/102/107/102107075/
2. https://plantae.org/plant-physiology-top-articles-of-2020-based-on-altmetric-scores/
3. https://blog.aspb.org/best-of-2016-top-topics-in-plant-physiology-jounal/

Title of the Course:General Microbiology and Immunology Semester: IV
Course Code: LPBYCT43 Contact hours: 5hrs/w Credit: 5

Course Learning Outcomes:

On completion of the course, the students are able to

- acquire knowledge on the contributions of microbiologists, understand the evolution of microbiology and classification of bacteria and viruses.

- assess the bacterial growth and its control by physical and chemical methods..
- understand the basics principles and techniques of immunology and perform experiments on immune techniques.
- understand the structural organization of bacteria and viruses.
- gain knowledge on the application of ELISA and monoclonal antibodies.

Pre-required Knowledge:

- Eminent microbiologists
- Prokaryotic cell
- Immunology

Unit I: Introduction to Microbiology

History and scope of microbiology - contributions of eminent microbiologists -Anton van Leuwenhoek, Edward Jenner, Louis Pasteur, Alexander Fleming and Robert Koch. A brief study on the applications of microbiology in various fields.

Unit II: Classification of microbes

A detailed account onWhitaker's Five Kingdom classification. A brief outline on the bacterial classification as per Bergey's manual of determinative bacteriology and Bergey's manual of systematic bacteriology (I and II editions).

Virology: History of virology, General characters of viruses and its classifications.

Unit III: Study on microbial structure

An over view of prokaryotic cell structure- size , shape and arrangement- a brief study on prokaryotic cell organization with special reference to Ultra structure of bacterial cell wall, chemistry and its bio synthesis, ultra-structure bacterial flagella and nuclear organization.

Unit IV: Microbial growth

Nutritional types of bacteria – Growth and multiplication of bacteria. Growth phases - Cultivation of bacteria in batch,

continuous and synchronous systems. Factors affecting bacterial growth (pH, temperature and pressure) and Control of bacterial growth by physical method (temperature, pressure and radiation), chemical method – (antibiotics -streptomycin and sulpha drugs).

Unit V:Immunology

Basics of Immunology: Immune cells and lymphoid organs. Immunity - types of immunity. Humoral and cell mediated, Immune disorders - Hypersensitivity and auto immune disease. Basic structure and characters of Antigen and Antibody and its interactions . Immuno techniques - Agglutination, precipitation and Immuno diffusion, ELISA and monoclonal antibody (Ab types) production and its application.

Suggested Topics for Seminar/Presentation/Group Discussion

- History of Microbes
- Classification of Microbes
- Prokaryotic and Eukaryotic
- Cultivation of viruses
- Vaccination and immunization

Suggested Readings:

Text Books:

1. Michael J. Pelczar, ECS Chan and N.R. Krieg, Microbiology, an application based approach, Tata McGraw Hill Education Private Limited, New Delhi, 2011.
2. Parija S.C. 2016. Text book of Microbiology and Immunology. 3rd Edition.Elsevier.
3. Dubey, R. C. and D.K. Maheswari. Microbiology. S. Chand & Co. New Delhi. 2004

Reference Books:

1. L.M. Prescott, J.P. Harley and D.A. Klein, Microbiology, 5th Edition, McGraw Hill Higher Education, 2002.
2. Subhash Chandra Parija. 2009. Textbook of Microbiology and Immunology. Elsevier India.

Web Sources:

1. https://microbenotes.com/
2. https://www.austincc.edu/rohde/noteref.htm
3. https://microbenotes.com/category/immunology/

Title of the Course: (Practical)Plant Physiology, Plant Biochemistry and Metabolism, Microbiology and Immunology **Semester: IV**

Course Code: LPBYCT44 **Contact hours: 5hrs/w** **Credit: 2**

Course Learning Outcomes:

On completion of the course, the students are able to

- analyze the biochemical components of any plant samples.
- understand the role of pigment in photosynthetic mechanism and related events of plants.
- perform and assess experiments on bacterial culture, morphological properties of microbes.
- identify bacteria on the basis of Gram staining.
- analyze the potential of resistance bacteria against antibiotics.

List of Experiments

Minor Experiments

1. Estimation of starch
2. Estimation of glucose
3. Estimation of protein
4. Determination of iodine value of the given oil
5. Separation of amino acids from mixture by paper chromatography (ascending and circular)
6. Determination of solvents (acetone, ether, chloroform, benzene, alcohol) and detergent / temperature on membrane permeability
7. Determination of water potential by gravimetric method.
8. Preparation of glassware for microbiological practical.
9. Preparation of culture media for bacteria and fungi.

10. Staining of bacteria.
11. Pure culture technique - streak, pour and spread plate techniques.
12. Visualizations of bacteria by Gram's staining wet mounting of bacteria.
13. Isolation of bacteria from soil water, milk and soft drinks.

Major Experiments

1. Effect of substrate concentration on (NR) nitrate reductase activity
2. Estimation of chlorophyll content (chlorophyll a and b and total chlorophyll) of the given leaf material (two different ages).
3. Separation of chlorophyll pigments by column chromatography and to find out the absorption maxima
4. Estimation of proline content from leaves under water and salt stresses.
5. Isolation of bacteria from soil water, milk and soft drinks.
6. Coliform test in water.
7. Grading of milk by dye reduction test and Widal test.
8. Study on the effect of antibiotics on bacteria.

Reference Books:

1. Bendre, A.M. and Ashok Kumar, 2009. A text book of practical Botany. Vol. I & II. Rastogi Publication. Meerut. 9th Edituion.
2. Manju Bala, Sunita Gupta, Gupta NK. 2012. Practicals in Plant Physiology and Biochemistry. Scientific Publisher.
3. Dubey RC. And Maheshwari DK. 2020. Practical Microbiology. S. Chand Publication.

Title of the Course: Project Work / Dissertation **Semester: III, IV**

Course Code: LPBYPJ41 **Contact hours: 4+4hrs/w** **Credit: 4**

Learning Outcomes:

On the completion of the course, the students are able to

- familiarise with research activities
- understand the value of research in higher education
- know the recent innovative techniques in research
- exposure to various academic institutions for collection of literature survey.
- orient the students on the style of research writing

1. Each student will be allotted a Project Guide from the faculty of the Department concerned.
2. After the completion of the project work, the student has to submit four copies of Dissertation with report carrying his/her project report.
3. Project work will be evaluated by both the external and the internal (Project Guide) examiners for the maximum of 100 marks in total on the scale of the maximum of 50 marks for the internal and the external each.
4. Viva-voce will be conducted by the panel comprising HOD, External examiner and Project Guide for the maximum of 100 marks in total on the scale of the maximum of 50 marks for the internal and the external each.

Title of the Course: Intellectual Property Rights (IPR) **Semester: IV**

Course code: LPBYDS41 **Contact hours: 4hrs/w** **Credits: 3**

Course Learning Outcomes:

On completion of the course, the students are able to

- understand the concept of IPR
- differentiate between various agreements of IPR
- compare copyrights, patents and geographical indicators

- examine various legal issues related to IPR
- relate to various cyber issues concerning IPR

Pre required Knowledge:

- IPR-meaning and forms (Patent, Copyright and Trademark)
- Royalty-meaning and types (Copyright, mining royalty and patent royalty) royalty payments calculation and period of royalty
- Rent Vs Royalty-short working

Unit I: Intellectual Property Rights

Introduction to Intellectual Property Rights (IPR) Copyright Act and IPR, Economic importance. IPR in India and world: Genesis and scope, some important examples. IPR and WTO (TRIPS, WIPO). Objectives, Rights, Patent Act 1970 and its amendments.

Unit II: Patent and Copyright

Patents, Copyrights: Procedure of obtaining patents, working of patents. Infringement of patents Copyrights: work protected under copyright laws, Rights, Transfer of Copyright, and Infringement.

Unit III: Trademarks

Objectives of trademarks, Types, Rights, Protection of goodwill, Infringement, Passing off, Defenses, Domain name.

Unit IV: Traditional Knowledge

Protection of Traditional Knowledge and Plant Varieties: Objective, Concept of Traditional Knowledge, Holders, Issues concerning, Bioprospecting and Bio-piracy, Alternative ways, Protectability, need for a Sui-Generis regime, Traditional Knowledge on the International Arena, at WTO, at National level, Plant varieties protection in India. Rights of farmers, National gene bank; Benefit sharing. Protection of Plant Varieties and Farmers' Rights Act, 2001.

Unit V: Patenting Biotech inventions

Patenting Biotech Inventions: Objective, Applications, Concept of Novelty; Concept of inventive step,

Microorganisms, and Moral Issues in Patenting Biotechnological inventions.

Suggested Topics for Seminar/Presentation/Group Discussion:

- IPR in India and world Scenario
- Protocol for transfer of Copyright
- Objectives of Trademark
- Bio-prospecting and Bio-piracy
- Biotech inventions

Suggested Readings:

Text Books:

1. Gopalakrishnan, N.S. and Agitha, T.G. (2009). *Principles of Intellectual Property* Eastern Book Company, Lucknow.
2. Narayanan, P. (2010). *Law of Copyright and Industrial Designs*; Eastern law House, Delhi.

Reference Books:

1. David Kitchin Q.C., Llewelyn, D., Mellor, J., Meade, R., Thomas Moody-Stuart, and D. Keeling, Jacob, R. (2005). Kerly's *Law of Trade Marks and Trade Names* (14th Edition) Thomson, Sweet & Maxweel.
2. Parulekar, A. and D' Souza, S. (2006). *Indian Patents Law – Legal & Business Implications*; Macmillan India Ltd.
3. Wadehra, B.L. (2000). *Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications*; Universal law Publishing Pvt. Ltd., India.

Web Sources:

1. https://www.researchgate.net/publication/274737730_Development_Trend_of_Global_Design_Patent_Research
2. https://www.Drishtiias.com/to-the-points/paper3/intellectual-property-rights
3. http://www.annauniv.edu/ipr

Title of the Course: Computational Biology **Semester: IV**

Course Code: LPBYDS42 **Contact hours: 4hrs/w** **Credit: 3**

Course Learning Outcomes:

On completion of the course, the students are able to

- understand the concept of databases and use of different public domain for DNA and proteins sequence retrieval.
- understand the concept of pairwise alignment of DNA sequences using algorithms.
- explain the structure of proteins homology modeling approach using SWISS MODEL and SWISS-PDB. Reflect upon the role of various models in molecular evolution.
- analyze the role of (QSAR) techniques in Drug Design.
- construct the phylogenetic tree

Pre required knowledge:

- Bioinformatics resources
- Protein alignments
- Molecular evolution

Unit I : Bioinformatics

Introduction to bioinformatics, over view and exploring and querying (search and retrieval) available bioinformatics resources NCBI, PUBMED, EBI, EMBL, gene bank etc.

Unit II : Protein and DNA sequences

Pair wise alignment of protein and DNA sequences using algorithm software to deduce homology and interpretation of data. Database searches for homology using BLAST and FASTA and interpretation of the results to derive biological significance of the queried DNA/protein sequences.

Unit III : Protein structure analysis using Homology Models

Prediction of structure of proteins by homology modeling approach using SWISSMODEL and SWISS-PDB. Models of molecular Evolution, Selection of best-fitting models,

Unit IV: Methods of Phylogeny reconstruction

Phenetic vs. Cladistic, Neighbor Joining, UPGMA, Maximum Parsimony, Maximum Likelihood, Bayesian Inference, Software for Phylogenetic Analyses, Consistency of Molecular Phylogenetic Prediction

Unit V: Drug Design

Structural Bioinformatics in Drug Discovery, Quantitative structure-activity relationship (QSAR) techniques in Drug Design, Microbial genome applications, Crop improvement.

Suggested Topics for Seminar/Presentation/Group Discussion:

- Gene bank and its uses
- Biological significance of protein sequences
- SWISSMODEL and SEISS-PDB
- Molecular phylogenetic prediction
- Drug designing

Suggested Readings:

Text Books:

1. Arthur M. Lesk. (2003). Introduction to Bioinformatics, Oxford University Press, Indian edition.
2. Des Higgins and Willie Taylor. (2000). Bioinformatics, Sequence, structure and databanks. A practical approach. Oxford University Press, Indian edition, Second impression, New Delhi.
3. Imtiaz Alam Khan. (2005). Elementary bioinformatics. Pharma Book Syndicate, Hyderabad.

Reference Books:

1. Irfan Ali Khan and Attiya Khanum (eds.). (2005). Basic concepts of Bioinformatics, Ukaaz Publications, Hyderabad.
2. Irfan Ali Khan and Attiya Khanum (eds.). (2004). Introductory Bioinformatics. Ukaaz Publications, Hyderabad.

3. Krane Dan, E. and Raymer M.L. (2004). Fundamental concepts of Bioinformatics. Pearson education. New Delhi. Second Indian reprint.
4. Rastogi, S.C., Mediraттta, N. and Rastogi. P. (2004). Bioinformatics, methods and applications, genomics, proteomics and drug discovery, Prentice hall of India, pvt. Ltd., New Delhi

Web Sources:

1. https://en.wikipedia.org/wiki/computational-biology
2. https://www.britannica.com/science/computational-biology
3. https://cbd.cmu.edulabout-us/what-is-computational-biology.html..

Title of the Course: Biostatistics and Bioinformatics		**Semester: IV**
Course Code: LPBYSE41	**Contact hours: 2hrs/w**	**Credit: 2**

Course Learning Outcomes:

On completion of the course, the students are able to

- comprehend the fundamental concepts related to descriptive and inferential biostatistics.
- develop skills in data tabulation, its treatment, analysis, interpretation and graphical representation of data.
- analyze the implications of inferential statistics in biology.
- develop their competence in hypothesis testing and interpretation.
- develop skills on presenting large data

Pre-required Knowledge:

- Basic mathematical calculations
- Basic computer knowledge
- DNA & protein structure
- Databases
- Limitations of statistics

Unit I: Biostatistics, Data Summarization and Visualization

Concepts of statistical population and sample from a population; qualitative and quantitative data; discrete and continuous data. Collection of data: Primary data; designing a questionnaire and a schedule; secondary data and sources of secondary data. Presentation of data: Diagrammatic and graphical representation of data; frequency distributions and cumulative frequency distributions; histogram,

Unit II: Descriptive Statistics

Mean, median, mode - merits & demerits. Measures of dispersion - range, standard deviation, mean deviation - merits and demerits.

Unit III: Correlation and Regression

Correlation - types and methods of correlation, regression, simple regression equation, similarities and dissimilarities of correlation and regression.

Unit IV: Statistical inference

Hypothesis testing and P values, Confidence Intervals, Student't' test, chi square test.

Unit V: Bioinformatics

Bioinformatics in genome sequencing and annotation; Databases - NCBI, EMBL, DDBJ, Genbank, Pubmed, Online tools - BLAST, ORF finder, Primer, protein motif and structure prediction tools. Patent databases, TAIR, PDB, ATIDB.

Suggested Topics for Seminar/Presentation/Group Discussion

- Sequence homology and Gene annotation.
- Construction of phylogenetic tree.
- Student's t-test: Independent and dependent.
- Hand calculation and calculation using MS Excel.
- Primer designing using online tools.

Suggested Readings:

Text Books:

1. Dutta, N. K. (2004). Fundamentals of Biostatistics, Kanishka Publishers.
2. Gurumani N. (2005). An Introduction to Biostatistics, MJP Publishers.
3. Rastogi, S.C., Mediratta, N. and Rastogi. P. (2004). Bioinformatics, methods andapplications, genomics, proteomics and drug discovery, Prentice hall of India, pvt. Ltd.,New Delhi.

Reference Books:

1. Daniel, W. W. (2007). Biostatistics- A Foundation for Analysis in the Health Sciences,Wiley.
2. Rao, K. V. (2007). Biostatistics – A Manual of Statistical Methods for use in Health Nutrition and Anthropology.
3. Pagano, M.& Gauvreau, K. (2007). Principles of Biostatistics.
4. Rohatgi, V.K.& Saleh, A.K.Md. (2001). An Introduction to Probability and Statistics, John Wiley & Sons.
5. Sundaram, K.R.(2010) Medical Statistics-Principles & Methods, BI Publications, NewDelhi.
6. Arthur M. Lesk. (2003). Introduction to Bioinformatics, Oxford University Press,Indian edition.
7. Des Higgins and Willie Taylor. (2000). Bioinformatics, Sequence, structure anddatabanks. A practical approach. Oxford University Press, Indian edition, Secondimpression, New Delhi.

Web Resources:

1. https://nptel.ac.in/courses/102/101/102101056/
2. https://nptel.ac.in/courses/102/106/102106051/
3. https://faculty.franklin.uga.edu/dhall/sites/faculty.franklin.uga.edu.dhall/files/lec1.pdf

RULES AND REGULATIONS FOR THE PROJECT / DISSERTATION WORK (UG, PG AND M.PHIL)

- Research supervisors will be allotted to the students / scholars by the respective Department.
- Research topic shall be chosen by the student / scholar in consultation with his/ her research supervisor.
- Every department has to maintain the year-wise list of project works carried out by the students. Research works done by the students / scholars of the previous batches should not be repeated by the students / scholars of the current academic year.
- The general structure of the project report is given below.

  Title page with college emblem

  Research supervisor's certificate

  Student's declaration counter signed by Research Supervisor and the HOD

  Student's Acknowledgement

  Contents

  List of Tables if any

  Introduction

  Review of Literature

  Materials and Methods

  Results and Discussion

  Summary of Findings and Conclusion

  Bibliography

  Annexure

- Four copies of the project repot should be submitted, typed in A4 Paper in Times New Roman with the font size of 12 and 1.5 line spacing.

SARASWATHI NARAYANAN COLLEGE

(Autonomous Institution – Affiliated to Madurai Kamaraj University)

(Reaccredited with $B^{(2.78)}$ Grade by NAAC in the second cycle)

MADURAI -22

EVALUATION METHOD UNDER CBCS- LOCF

CONTINUOUS INTERNAL ASSESSMENT (CIA)

Internal assessment is based on the continuous evaluation of performance of the students in each semester. Internal mark is awarded to each course in accordance with the following guidelines.

UNDER GRADUATE, POST GRADUATE AND M.PHIL:

1. Internal test will be conducted for the maximum of 60 marks and converted to 15 marks.
2. Two internal tests will be conducted and the average of marks secured in the two tests will be taken as the Final Internal Test mark.
3. The distribution of Internal Assessment marks is given below.

THEORY			**PRACTICAL**		
Test	-	15	Record Note	-	10
Seminar	-	5	CIA	-	15
Quiz	-	5	Model Exam	-	15
Internal Maximum	-	25	Internal Maximum	-	40

4. There is no Cumulative Internal Assessment (CIA) for Self Learning Courses, Add on Certificate / Diploma Programmes and Part-1 subjects other than Tamil.

5. Internal marks for those UG, PG and M.Phil. students who have to Repeat the Semester (RS) for want of attendance should be marked “AA” in the foil card.
6. There is no minimum mark for Internal assessments marks for all the UG, PG and M.Phil. Programmes.
7. Internal test for improvement of marks is not allowed under any circumstances
8. Special Internal Assessment tests for the absentees may be conducted on genuine reasons with the prior approval of HOD, Dean and Principal. Such tests may be conducted before the commencement of the Summative Examinations.

SUMMATIVE EXAMINATIONS (SE)

1. Summative Examinations for all the UG, PG and M.Phil. Programmes are conducted in November and April for the Odd and the Even semesters respectively.
2. Question paper setting along with the scheme of valuation is purely external for all the UG, PG and M.Phil. Programmes.
3. The office of the CEO is conferred with the right of choosing the Question Paper Setters and the External Examiners from the Panels suggested by the Boards of Studies of Programmes offered by the respective Department and approved by the Academic Council of the College. The question papers set for the Summative Examinations will be finalised by the Scrutiny Committee constituted by the office of the COE.
4. Practical Examinations will be conducted by the External Examiner and the course teacher, who will act as the Internal Examiner. In the absence of course teacher / External Examiner, HOD will act as the Internal Examiner / External Examiner.
5. The marks scored by the students in the External Examinations in Self Learning Courses and Add – on Courses will be converted to 100 for each course.
6. The theses submitted by the M.Phil. scholars after the conduct of Awards Committee meeting can be valued and the Viva-Voce Examinations can be conducted. The Principal is empowered to declare the results and it can be ratified in the next Awards Committee meeting.

Knowledge levels for assessment of Outcomes based on Blooms Taxonomy

S. No	Level	Parameter Description	Description
1	K1	Remembering	Remembering It is the ability to remember the previously learned
2	K2	Understanding	The learner explains ideas or Concepts
3	K3	Applying	The learner uses information in a new way
4	K4	Analysing	The learner distinguishes among different parts
5	K5	Evaluating	The learner justifies a stand or decision
6	K6	Creating	The learner creates a new product or point of view

WEIGHTAGE OF K–LEVELS IN QUESTION PAPER

K-LEVELS (Cognitive Level)						Total
	K1	K2	K3	K4	K5/ K6	
SUMMATIVE EXAMINATIONS– 75 Marks Pattern	21	30	18	18	13	100
SUMMATIVE EXAMINATIONS– 50 Marks Pattern	24.5	24.5	17	17	17	100
CONTINUOUS INTERNAL ASSESSMENT(CIA)	24	26	14	25	11	100

QUESTION PATTERN FOR SUMMATIVE EXAMINATIONS For those who join in June 2022 UG and PG (Language Courses, Core Courses, Discipline Specific Electives, Generic Elective Courses, Non-Major Electives(PG)) TOTAL MARKS 75	
SECTION–A(Answer all questions) **I. Choose the correct answer (FIVE questions –ONE question from each unit)** (Q.No.1-5)-All questions are at K2 level **II. Fill in the blanks (FIVE questions - ONE question from each unit)** (5x1=5) (Q.No.6-10)-All questions are at K1 level	**10**
SECTION-B **Answer all questions not exceeding 50 words each. ONE set of questions from each unit** **Q. No. : 11 to 15** (5x2=10) K2 level – 2 Questions K3 level – 1 Question K4 level –1 Question K5/K6 level – 1 Question	**10**
SECTION-C-Either/or type **Answer all questions not exceeding 200 words each. ONE set of questions from each unit. Q. No. : 16 to 20** (5 x5=25) K1 level – 1 Question K2 level – 2 Questions K3 level – 1 Question K4 level – 1 Question	**25**

SECTION-D-Answer any THREE questions not exceeding 400 words each. ONE question from each unit. Q. No. : 21 to 25 (3x10=30) K1 level – 1 Question K2 level – 1 Question K3 level – 1 Question K4 level – 1 Question K5/K6 level – 1 Question	**30**
Total	**75**

QUESTION PATTERN FOR SUMMATIVE EXAMINATIONS For those who join in June 2022 UG and PG (Skill Enhancement Courses, Self Learning Courses, Non Major Electives (UG)and Part V Courses (except NCC)) TOTAL MARKS 50	
SECTION–A(Answer all questions) **I. Choose the correct answer (FIVE questions –ONE question from each unit)** (5x1=5) (Q.No.1-5)-All questions are at K2 level **II. Fill in the blanks (FIVE questions – ONE question from each unit)** (5x1=5) (Q.No.6-10)-All questions are at K1 level	**10**
SECTION-B **Answer all questions not exceeding 50 words each. ONE set of question from each unit Q. No. : 11 to 15** (5x2=10) K1 level – 1 Question K2 level – 1 Question K3 level – 1 Question K4 level – 1 Question K5/K6 level – 1 Question	**10**
SECTION-C **Answer any THREE questions not exceeding 400 words each. ONE question from each unit Q. No. : 16 to 20** (3x10=30) K1 level – 1 Question K2 level – 1 Question K3 level – 1 Question K4 level – 1 Question K5/K6 level – 1 Question	**30**
Total	**50**

QUESTION PATTERN FOR INTERNAL ASSESSMENT (CIA) For those who join in June 2022 UG and PG TOTAL MARKS 60	
SECTION–A(Answer all questions) **I. Choose the correct answer** (5 x 1 = 5) (Q.No.1-5)-All questions are at K2 level **II. Fill in the blanks** (Q.No.6-10)-All questions are at K1 level	**10**
SECTION-B **Answer all questions not exceeding 50 words each.** **ONE set of question from each unit** (4 x 2 = 8) Q.No. 11 – K2 level Q.No. 12 – K3 level Q.No. 13 – K3 level Q.No. 14 – K5/ K6 level	**8**
SECTION-C-Either/or type (**Answer all questions not exceeding 200 words each**. (3 x 6 = 18) Q.No. 15 – K3 level Q.No. 16 – K4 level Q.No. 17 – K5/K6 level	**18**
SECTION-D **Answer any TWO questions not exceeding 400 words each.** (2 x 12 = 24) Q.No. 18 – K1 level Q.No. 19 – K2 level Q.No. 20 – K4 level	**24**
Total	**60**

QUESTION PATTERN FOR SUMMATIVE EXAMINATIONS For those who join in June 2022 UG and PG (Language Courses, Core Courses, Discipline Specific Electives, Generic Elective Courses, Non-Major Electives(PG))						
DURATION:3HRS			**MAXMARKS:75**			
K-LEVELS SECTIONS	**K1**	**K2**	**K3**	**K4**	**K5/ K6**	**TOTAL MARKS**
SECTION A (Answer all questions, each question carries One Mark)	5	5				**10**
SECTION B (Answer all questions, each question carries TWO Marks, ONE question from Each unit)		4	2	2	2	**10**
SECTION C (Answer all questions-Either/or type-ONE Question from each unit)	5	10	5	5		**25**
SECTION D (Answer any THREE questions, ONE question from each unit, each question carries TEN Marks)	10	10	10	10	10	**30**
TOTAL	20	29	17	17	12	**75**

QUESTION PATTERN FOR SUMMATIVE EXAMINATIONS

For those who join in June 2022

UG and PG

(Skill Enhancement Courses, Self Learning Courses, Non Major Electives (UG)and Part V Courses (except NCC))

DURATION:2HRS			**MAX MARKS:50**			
K-LEVELS / SECTIONS	**K1**	**K2**	**K3**	**K4**	**K5/ K6**	**TOTAL MARKS**
SECTION A (Answer all questions, each question carries One Mark)	5	5				**10**
SECTION B (Answer all questions, each question carries TWO Marks, ONE question from Each unit)	2	2	2	2	2	**10**
SECTION C (Answer any THREE questions, ONE question from each unit, each question carries TEN Marks)	10	10	10	10	10	**30**
TOTAL	17	17	12	12	12	**50**

BLUE PRINT OF QUESTION PAPER FOR INTERNAL ASSESSMENT (CIA)						
DURATION:2HRS			**MAX MARKS:60**			
K-LEVELS / SECTIONS	**K1**	**K2**	**K3**	**K4**	**K5/ K6**	**TOTAL MARKS**
SECTION A (Answer all question. Each question Carries **ONE** Mark)	5	5				**10**
SECTION B (Answer all questions. Each question carries **TWO** Marks)		2	4		2	**8**
SECTION C (Answer all questions- Either/or type -Each question carries **SIX** Marks)			6	6	6	**18**
SECTION D (Answer any TWO questions. Each question carries **TWELVE** Marks)	12	12		12		**24**
TOTAL	17	19	10	18	8	**60**

VALUATION

1. Central valuation system is adopted.
2. Single Valuation system is followed for UG, PG and M.Phil. Theory examinations. The valuation is done by the external examiners only.
3. UG and PG Practical Examinations are valued by both Internal and External Examiners.
4. Any discrepancy in the question paper should be brought to the notice of the Controller of Examinations by the respective Course Teacher through the Head of the Department within five days from the date of examination.

DECLARATION OF RESULTS

1. The total credit should not exceed 140 for UG Programmes and 90 for PG Programmes, excluding the credits earned for additional credit courses. This is applicable to the students migrating from other colleges also.
2. The students migrating from other colleges have to appear for the Summative Examinations conducted by the college for non-equivalent theory and practical courses. Mark scored by such a student in the Summative Examinations conducted by the previous college shall be converted to 100 if it is less than 100 for any equivalent course.
3. The students who repeat the semester have to appear not only for Summative Examinations but also for internal tests. The Internal marks scored by such students in their previous attempts shall stand invalid.
4. Results will be published within 20 days from the date of completion of all the Examinations.
5. Results will be declared as per the norms given in the following table in consultation with the Awards Committee.

Maximum and Passing Minimum Marks

Course	External Exam (SE)		Aggregate Marks (CIA + SE)	
	Passing Minimum	Maximum Mark	Passing Minimum	Maximum Mark
UG (Theory)	27	75	40	100
UG – NME / SEC / Part V (except NCC)	18	50 (converted to 75 marks)	40	100
UG – SLC	20	50	40	100
UG (Practicals)	21	60	40	100
UG Project	18	50	40	100
PG (Theory)	34	75	50	100
PG (Practicals)	27	60	50	100
PG (Project)	23	50	50	100
M.Phil. (Theory)	34	75	50	100
M.Phil. Project				
1. Dissertation	50	**100** (Internal 50 + External 50)	-	-
2. Viva – Voce	50	**100** (Internal 50 + External 50)	-	-

REVALUATION AND SUPPLEMENTARY EXAMINATIONS

1. Students can apply for Revaluation within 10 days from the date of the publication of the results.
2. Final year students of UG and PG Programmes can appear for Supplementary Examinations for the arrear papers of only the V and VI Semesters of UG Programmes and III and IV Semesters of PG Programmes. Students having the maximum of three arrear papers alone are eligible for Supplementary Examinations.
3. Absentees in the Summative Examinations are not eligible to apply for the Supplementary Examinations.
4. Supplementary Examinations will be conducted every year in the month of July.

ATTENDANCE

1. Students with the minimum of 75% of attendance (68 days out of 90 days) in a semester are permitted to appear for the summative examinations.

2. Students who do not have the minimum attendance should go for condonation.

3. Students who do not have the minimum attendance of 20 hrs for Certificate Programme and the minimum attendance of 20 hrs for each course in Diploma Programme will not be permitted to appear for the summative examinations.

The following are the regulations for grant of condonation.

Attendance	Condonation Fee	Authority to Consider	Nature of Penalty
65% - 74% (59-67 days)	Rs.500/-	Head of the Department	As decided by the HOD
50% - 64% (58-45 days)	Rs.1000/-	Principal and the Examination Committee	Application for exemption to be made on prescribed form with the specified remarks of the Principal
< 50% (Below 45 days)	To repeat the whole semester	-----	-----

EXAMINATION RULES AND REGULATIONS

1. Students without hall ticket and identity card are not permitted to appear for the examinations.
2. Possession of materials in any form for copying is strictly prohibited in the examination hall.
3. Students indulging in any form of malpractices in the examination are liable for severe punishment.
4. Students are not allowed into the examination hall after 30 minutes of the commencement of the examination.
5. Students should not write their names or any other identification marking except their register number in the answer scripts.
6. Students who have discontinued the Degree Programme are not permitted to write the summative examinations.

7. Students who have not completed the theory and practical courses during the Programme of their study are allowed to appear for the Summative Examinations in the same syllabi up to a period of three years from the year of the completion of Programme. However, after the completion of three years, they have to appear for the summative examinations for the equivalent course in the current syllabi only. The equivalence of a course is to be decided by the respective HOD, Dean, the Controller of Examinations and the Principal. This is also applicable to those students who repeat the semester.

PENAL ACTIONS FOR VARIOUS FORMS OF MALPRACTICES IN THE SUMMATIVE EXAMINATIONS

Sl. No.	Malpractice	Penal Action
1	In Possession of Materials relevant to the examination concerned	Cancellation of that particular paper.
2	Copied from materials in his/her possession	Cancellation of all papers of that semester
3	Copied from neighbours	Cancellation of all papers including arrear papers of that semester Cancellation of that particular paper of the candidate who helped for copying
4	Copied by exchanging answer script between neighbours	Cancellation of all papers of the candidates who exchanged their answer scripts
5	Misbehaviour in the examination hall	Cancellation of that particular paper
6	Copying and Misbehaviour in the examination hall	Cancellation of all papers of that semester and debarring the candidate from appearing for the next semester examination.
7	Insertion of answer sheets which were previously stolen and written	Cancellation of all papers of that semester and debarring the candidate from appearing for the next semester examination.
8	Impersonation in the examination	Cancellation of all papers of that semester and recommending dismissal from the college.