



M.Sc., BOTANY
SYLLABUS
(WITH EFFECTIVE FROM 2021)

M.Sc. BOTANY PROGRAMME – Course Structure under CBCS Pattern

(For the candidates admitted from the academic year 2021 onwards)

S. No.	Sem	Course Code	Paper	Hrs/Week	Credit	Exam Hrs.	Marks		
							Internal	External	Total
Semester - I									
1	I	21PBT1	CoreCourseI-Plant Diversity-I (Algae,FungiandBryophytes)	7	5	3	25	75	100
2	I	21PBT2	CoreCourseII-PlantDiversity – II (Pteridophytes,GymnospermsandPaleobotany)	7	5	3	25	75	100
3	I	21PBTE1A (OR)	ElectiveCourseI- Ecology,PhytogeographyandConservation	7	5	3	25	75	100
	I	21PBT E1B (OR)	ElectiveCourseI- Man and Microbes	7	5	3	25	75	100
	I	21PBTE1C	ElectiveCourseI – BiodiversityandClimateChange	7	5	3	25	75	100
Semester - II									
4	II	21PBT3P	Core Course III –Practical-I	6	5	3	40	60	100
5	II	21PBT4P	Core Course IV –Practical- II	6	5	3	40	60	100
6	II	21PBT5	CoreCourseV – TaxonomyofAngiospermsandEconomic Botany	6	5	3	25	75	100
7	II	21PBT6	CoreCourseVI- Anatomy,EmbryologyandHistochemistry	6	5	3	25	75	100
8	II	21PBTE2A (OR)	ElectiveCourseII – HorticultureandGardening	7	5	3	25	75	100
	II	21PBTE2B (OR)	ElectiveCourseII-Medicinal Plants	7	5	3	25	75	100
	II	21PBTE2C	ElectiveCourseII-ForestryandWoodscience	7	5	3	25	75	100
9	II	21PBTE1	ExtraDisciplinarycourse-paperI-General Botany for Competitive Examinations	5	5	3	25	75	100
Semester - III									
10	III	21PBT7	CoreCourseVII-CellandMolecularBiology	6	5	3	25	75	100
11	III	21PBT8	CoreCourseVIII – GeneticsandPlantBreeding	6	5	3	25	75	100
12	III	21PBT9	CoreCourseIX–GeneralMicrobiology	6	5	3	25	75	100
13	III	21PBTE3A (OR)	ElectiveCourseIII–Environmental Challenges	6	5	3	25	75	100
	III	21PBTE3B (OR)	ElectiveCourseIII–Genomics and Proteomics	6	5	3	25	75	100
	III	21PBTE3C	ElectiveCourseIII–Phytochemistry andPharmacognosy	6	5	3	25	75	100
Semester - IV									
14	IV	21PBT10	CoreCourseX– PlantPhysiology,BiochemistryandBiophysics	6	5	3	25	75	100
15	IV	21PBT11	CoreCourseXI–Biotechnology, Bioinformatics andGeneticEngineering	6	5	3	25	75	100
16	IV	21PBT12	CoreCourse XII - Techniques in Botanyand Biostatistics	6	5	3	25	75	100
17	IV	21PBT13P	CoreCourseXIII–PracticalIII	4	5	4	40	60	100
18	IV	21PBT14	PWI –Project	12	5	3	25	75	100
Total				120	90				1800

Program outcome (PO):
1. Students can grasp the knowledge on diversity and their role in environment. They can understand internal organization of cells, tissues and functions of life forms.
2. Preference is given to morphology, taxonomy, anatomy and embryology to know external and internal characters of plants for their identification and classification to involve plants further in biochemical and pharmaceutical aspects.
3. Students can also acquire knowledge on the applied sciences like horticulture and gardening, microbes, Proteomics and Genomics.
4. To know the fundamental of biostatistics, bioinformatics tools and biophysical principles for the analysis of relevant biological situations and for developing intellectual skills on biological data and databases.
5. To elucidate the molecular and physiological adaptations in plants in response to biotic and abiotic stress. Identifying genes responsible for stress tolerance and genetic engineering of plants. Through microbiological core concepts the students were able to inter-relate integral and ubiquitous role of microbes with their environment.
Program Specific Outcome:
1. Students will have the capability to demonstrate proficiency in the experimental techniques and methods of analysis appropriate for botany.
2. Students will be able to explain how organisms function at that level of the gene, genome, cell, tissue, organ and organ –system. Drawing upon this knowledge, they will be able to give specific examples of the physiological adaptations, development, reproduction and behavior of different forms of life.
3. Students will be able to identify the major groups of organisms with an emphasis on plants and be able to classify them within a phylogenetic framework. Students will be able to compare and contrast the characteristics of plants, algae and fungi that differentiate them from each other and from other forms of life.
4. Students will have excellent research skills (field, laboratory, plant growth facilities and library).
5. Students can be able to know Communications skills to discuss and analyze problems using oral and written communication skills.
6. Students will acquire the knowledge about the cultivation of medicinal and aromatic plants

SEMESTER - I

Course Code: 21PBT1	PLANT DIVERSITY - I
ALGAE, FUNGI AND BRYOPHYTES	Syllabus version: 2020 – 2021

Course Objectives:

1. To understand the major groups of cryptogamic plants and their characteristics.
2. To understand the morphology, structure, reproduction and importance of organisms.

Course outcomes:

1. To understand the major groups of cryptogamic plants and their characteristics.
2. To know the classification, life cycle and economic importance of Algae.
3. They understood about thallus organizations, vegetative and sexual reproduction.
4. They understood the general features, distribution and nutrition of fungi.
5. They gained the knowledge on Algae, Fungi and Bryophytes.

UNIT - I : ALGAE

Thallus structure –Range,origin and evolution. Sex in algae - phylogeny and interrelationships of algae - Alternation of generations - Classification of algae (Bold and Wynne; Fritsch, 1945) - Fossil algae - Ecology of Algae: freshwater algae, marine algae, soil algae, symbiotic algae and parasitic algae - Algae as pollution indicators and algal blooms. Economic importance of algae.

UNIT - II STRUCTURE AND LIFE CYCLE OF ALGAL GROUPS

General characters - habitats, thallus organization, cell ultra structure, reproduction (sexual, asexual and vegetative), lifecycle patterns, classification schemes and salient features of Cyanophyta, Chlorophyta, Bacillariophyta, Xanthophyta, Phaeophyta and Rhodophyta.

UNIT - III FUNGI

General characters - life cycle patterns, ultra-structure, mycelial growth, cell wall composition, nutrition (necrotrophs, biotrophs and symbionts), methods of reproduction (Vegetative, Asexual and Sexual).classification of Fungi (Ainsworth, 1973; Alexopoulos and Mims, 1983) - Heterothallism, heterokaryosis, brachymeiosis, parasexuality - Recent trends in classification and phylogenetic relationship among fungal groups.

UNIT - IV STRUCTURE AND LIFE CYCLE OF FUNGAL GROUPS

Comparative account of *Mastigomycotina*, *Zygomycotina*, *Ascomycotina*, *Basidiomycotina* and *Deuteromycotina*- Economic importance of fungi in industries, medicines and as food - fungi as biocontrol agents - Poisonous fungi - Mycorrhizae.

UNIT - V BRYOPHYTES

Distribution, morphology, structure, reproduction and classification (Rothmaler, 1951) of Bryophytes - Comparative study of *Marchantiales*, *Jungermanniales*, *Anthocerotales*, *Sphagnales*, *Funariales* and *Polytrichales* - Fossil Bryophytes - Origin and evolution of bryophytes - Economic importance of Bryophytes - Role of bryophytes in succession.

Text Books:
1. Singh, Pande and Jain. 1998. A text book of Botany, Rastogi Publication, Meerut.
2. Venkataraman <i>et al.</i> , 1974, Algae-Form & Function. Today and Tomorrow, Pub. Co.
3. PremPuri, 1973. Bryophytes - a broad perspective. Atma Ram & Sons, New Delhi.
Reference:
1. Vashishta, B. R. and Sinha, A. K. (2007). Botany for Degree Students - Fungi. S. Chand, New Delhi.
2. Cavers F. 1911. The interrelationship of Bryophytes. New Phytologist.
3. Alexopoulos, C.J., Mims, C.W. and Blackwell, M. (1996). Introductory Mycology, John Wiley & Sons Ind.
4. Anderson, R.A. (2005) Algal Culturing Techniques. Physiological Society of America. Elsevier Academic Press. USA.
5. Fritsch, F.E. (1939, 1945). The Structure and Reproduction of Algae Vols. Cambridge University Press. Cambridge. UK.
6. Fritsch, F.E. (1945). The structure and Reproduction of Algae. Vol. II. University press, Cambridge. UK.
Related Online Contents:
1. https://www.schandpublishing.com/books/higher-education/commerce-management/public-finance/9789352710805/#.Wwz_pUiFPIU
2. https://www.abebooks.com/book-search/title/introduction-to-the-algae-structure-and-reproduction/

Mapping with programme outcomes					
Cos	P01	P02	P03	P04	P05
C01	S	M	M	S	M
C02	S	S	M	M	M
C03	M	S	S	S	S
C04	S	S	M	S	S
C05	S	M	S	S	M

*S- STRONG, M- MEDIUM, L- LOW

SEMESTER – I

Course Code: 21PBT2	PLANT DIVERSITY – II
PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY	Syllabus version: 2020 – 2021

Course Objectives:

1. To understand the major groups of lower vascular plants and their characteristics.
2. To study the morphology, anatomy and reproduction of representative genera.
3. To acquire knowledge on Geological periods, fossilization and types of fossils

Course outcomes:

1. Understanding the general features distribution and economic importance of Pteridophytes and Gymnosperms.
2. Expertise to study the morphology, anatomy and reproduction of representative genera.
3. Acquiring knowledge on Geological periods, fossilization and types of fossils.
4. Understanding the general characters and Classification to identify the species.
5. Getting knowledge on different techniques for studying fossils.

UNIT - I PTERIDOPHYTES

General characters, classification (Reimer's, 1954; Sporne, 1975) and life cycle - Theories of origin of sporophyte -Telome concept - Sporangium development- eusporangiate, leptosporangiate and intermediate type - Range of structure, reproduction and evolution of the gametophytes. Apogamy and Apospory - Stelar and soral evolution in Pteridophytes- Heterospory and seed habit.

UNIT - II MORPHOLOGY AND REPRODUCTION OF PTERIDOPHYTES

General account, distribution, classification and inter-relationships of the Pteridophyta with special reference to Rhyniophytosida, Psilotosida, Lycopsida, Sphenopsida and Pteropsida classes - Economic importance of Pteridophytes - Brief account of fossil pteridophytes.

UNIT - III GYMNOSPERMS

General characters and Classification (Sporne, 1967) - Phylogeny and economic importance of gymnosperms - Living fossils -Affinities of gymnosperms with angiosperms and pteridophytes

UNIT - IV GYMNOSPERMS REPRODUCTION

Comparative study of distribution, morphology, anatomy, reproduction, life history and evolutionary trends of Cycadopsida, Coniferopsida and Gnetopsida.

UNIT - V PALEOBOTANY

History, formation and types of fossils - Techniques of fossil study - Geological time scale- Detailed study of the following fossil forms - **Pteridohytes:** *Rhynia*, *Lepidodendron*, *Sphenophyllum* and *Calamites* - **Gymnosperms:** *Lyginopteris*, *Cordaites* and *Welwetschia* - Paleobotany and evolution of vascular plants - Applied aspects of botany - Use in coal and petroleum exploration.

Text Books:
1. Vashista PC, Sinha AK and Anilkimar. 2005. Botany for degree students, Gymnosperms, S Chand, New Delhi.
2. Pandey BP. 1998. A Text Book of Botany Vol. II. S Chand, New Delhi.
3. Pandey, S.N., S.P. Misra and P.S. Trivedi. 2002. A Textbook of Botany. Volume II. Vikas Publishing House Pvt Ltd, New Delhi.
4. Rashid.A. 2007. An Introduction to Pteridophyta - Vikas publications, New Delhi.
5. Johri, RM, Lata S, Tyagi K (2005), A text book of Gymnosperms, Dominate Pub and Distributor, New Delhi
Reference:
1. Stewart,W.N.and Rathwell.G.W.1993.Paleobotany and the Evolution of plants. Cambridge University Press,UK.4.
2. Phatnager,S.P. and Moitra.A.1996.Gymnosperm. New Age International Pvt. Ltd. NewDelhi.
3. Arnold, Chester A 2000 Introduction to Paleobotany , Agrobios , India
4. Sunderarjan S,2001 Introduction to Pteridophyta , New Age International Publishers, New Delhi

Related Online Contents:
1. https://www.schandpublishing.com/books/higher-education/commerce-management/public-finance/9789352710805/#.Wwz_pUiFPIU
2. https://www.abebooks.com/book-search/title/introduction-to-the-algae-structure-and-reproduction/
3. https://www.schandpublishing.com/books/higher-education/biology/college-botany-volume-ii/9788121906012/#.W0LrB9IzbIU

Mapping with programme outcomes					
Cos	P01	P02	P03	P04	P05
C01	S	S	S	S	S
C02	M	S	S	M	M
C03	S	S	S	S	S
C04	M	M	M	S	S
C05	S	M	S	M	M

*S- STRONG, M- MEDIUM, L- LOW

SEMESTER - I

Course Code: 21PBTE1A	ELECTIVE COURSE I
ECOLOGY, PHYTOGEOGRAPHY AND CONSERVATION	Syllabus version: 2020 – 2021

Course Objectives:
1. To make aware on ecosystem role in environmental health.
2. To understand the effect of pollution on different ecosystem and its conservation.
Course Objectives
1. The course is designed to help students in understating principles of ecology,
2. Understand mechanisms by which organisms interact with other organisms and with their physical environment.
3. Describe biotic and abiotic factors that influence the dynamics of populations.
4. Understanding the inter-relationship between organism in population and communities.
5. Realize the role of various international Organizations for the protection and safeguard of environment.

UNIT I - ECOSYSTEM

Ecology: Definition, history, scope and subdivisions - Role of ecology in sustainable development - Characteristics of populations: size, density, dispersion, age, structure, nationality and mortality - Factors affecting population growth - Intra-specific and inter-specific interactions' - Concept of ecosystem: structure, function and classification: Primary productivity and secondary grasses productivity - Energy dynamics - Tropic organization - Energy flow pathways, food chains and food webs, Ecological pyramids - Ecological efficiency - Ecosystem stability - concept (resistance and resilience) - Successional evolution of ecosystems.

UNIT - II ENVIRONMENTAL IMPACT

Succession: Definition, concept and causes - Classification of successions - Successional changes, autogenic and allogenic, primary and secondary, autotrophic and heterotrophic - Retrogressive changes in succession - Concept of climax or stable communities - Ecological balance and survival threshold - Biogeochemical cycle H₂ cycle, carbon cycle, nitrogen cycle and O₂ cycle - Environmental impact assessment (EIA) - Introduction, origin and development - Aims and Course Objectives of EIA - Development of EIA in India - Requirements for impact assessment - Main steps of impact assessment - pre-study - Study period and post-study period activities.

UNIT - III ENVIRONMENTAL POLLUTION

Soil -profile, types - Erosion and conservation - Environmental pollution - causes, Effects Air, Water, Soil, Noise, Thermal and Radioactive Pollution, Prevention Measures.

UNIT- IV PHYTOGEOGRAPHY

Phytogeography - Principles relating to distribution of plants, age and area hypothesis - Dispersal and migration - concept of Barriers - Continental drift – endemism – hotspots - plant indicators - Phytogeography of Western Ghats - Vegetational types of India - Tropical Rain forest - Shola and deciduous forest- sand dunes, mangroves and scrub jungle, Phytogeographical regions of India - Vegetational Region of India - Remote Sensing - GIS

UNIT - V CONSERVATION BIOLOGY

Conservation ; Approaches - *in-situ* and *ex-situ* conservation Biodiversity, its importance, assessment, loss and world organization for biodiversity conservation, biodiversity act (2002), Red list categories of IUCN.

Text Books:
1. Anathakrishnan, T.N., 1982 - Bioresource Ecology-Oxford & IBH Publ. Co/Inc Belmont.
2. Anbasht, R.S. 1974 - A text book of plant ecology (3rd Edn.) Students' Friends. & Co., Varanasi, India.
3. Chawla, S. 2011. A text book of Environment & Ecology. Tata McGraw-Hill, New Delhi.
4. Sharma P.D, 2009. Ecology and Environment. Rastogi Publications. Meerut.
Reference:
1. Odum, E.P.1970. Fundamentals of Ecology, 3rd edn, W.B.Saunders Ltd., UK,
2. Melchials G 2001 Biodiversity and Conservation. Science Publishers Inc, NH USA
3. Krishnamurthy K.V.2003. An advanced text book on Biodiversity Principle and Practice.Oxford and IBH Publishing Co., New Delhi.
Related Online Contents:
1. http://rastogipublications.com/index.php?route=product/product&product_id=216&search=ecology&category-id=20
2. https://www.schandpublishing.com/books/higher-education/biology/

Mapping with programme outcomes					
COs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	M
CO2	S	M	M	S	S
CO3	S	S	S	S	S
CO4	S	S	M	S	S
CO5	M	M	M	M	S

*S- STRONG, M- MEDIUM, L- LOW

SEMESTER - I

Course Code: 21PBTE1B	ELECTIVE COURSE - I
MAN AND MICROBES	Syllabus version: 2020 – 2021
Course Objectives:	
1. To know the immense use of microbes to man.	
2. To realize that all life on this planet ultimately depends on the activities of microorganisms.	
Course Objectives	
1. Understating role of microbes in food processing industry.	
2. Knowing the importance of microbes in crop cultivation.	
3. Acquiring knowledge on industrial application of microbes.	
4. Understanding the inter-relationship between plant and microbes.	
5. Realize the role of microorganism in human health.	

UNIT – I FOOD MICROBIOLOGY

Microbiology – definition, scope and history (Anton van Leeuwenhock, Louis Pasteur)
Types of microorganisms. Microbes in food processing – milk and milk products -idli, bread & pickle. Food spoilage - food poisoning. Food preservation methods – physical and chemical.

UNIT - II AGRICULTURE MICROBIOLOGY

Enrichment of soil fertility through microorganisms – use of biofertilizers - algal (BGA) bacterial (*Azospirillum*), Fungal- (*Mycorrhiza*). Use of biopesticides in the control of microbial plant diseases (*Trichoderma*-Sheath blight of paddy, *Pseudomonas* – Citrus canker).

UNIT- III ENVIRONMENTAL MICROBIOLOGY

Treatment and recycling of liquid and solid waste. Production of organic compost and its uses. Biogas production. Role of microbes in liquids and solid waste management. Microbial biodecomposition of cellulose (coconut fibre & paddy straw), visit to sewage treatment plant.

UNIT-IV INDUSTRIAL MICROBIOLOGY

Bioreactors, stock cultures of microorganisms, types of media for large scale production of ethanol, vinegar (acetic acid), antibiotic (penicillin) and vaccines. Microbes in biofuel generation (methane).

UNIT-V HUMAN HEALTH MICROBIOLOGY

Microflora of intestine and stomach-Beneficial probiotics (*Lactobacillus* & *Saccharomyces*), Harmful (*E.coli* & *Proteus*). Role of microbes in disease development – causes, symptoms and control measures of typhoid, tuberculosis, measles, jaundice, amoebiasis, malaria, AIDS, Avian flu & SARS.

Text Books:
1. Michel J. Pelczar, Chan, E. C. S. and Noel R. Krieg. 1993. Microbiology concepts & applications. McGraw- Hill, Inc, New York.
2. Rangaswami, G. and Bagyaraj, D. J. 1993. Agricultural Microbiology. Prentice – Hall of India private Ltd, New Delhi.
3. Power, C. B. and Dagainawala, H. F. 1993. General Microbiology Vol I & II. Himalaya Publishing House, New Delhi.
References:
4. Tauro, P., Kapoor, K. K. and Yadav, K. S. 1997. An introduction to microbiology. Wiley Eastern Company Ltd., New Delhi.
5. Ronald M. Atlas & Richard Bartha. 1981. Microbiology - Fundamentals and applications – Addition & Wiley Publication, London.
E-Source:
<ul style="list-style-type: none"> • https://www.sciencedirect.com/science/article/pii/S0168644594901112/pdf?md5=97c91d568810fd408b0ddfd06d3045ec&pid=1-s2.0-0168644594901112-main.pdf • https://link.springer.com/content/pdf/10.1007/s10739-006-0008-2.pdf • http://cdn.intechopen.com/pdfs/28707/InTech-Plant_beneficial_microbes_and_their_application_in_plant_biotechnology.pdf • https://www.soinc.org/sites/default/files/uploaded_files/4-17_MICROBES_AND_ECOLOGY.pdf • http://www.icukonline.org/download/Ningyi%20Zhou_Environmental%20microbiology.pdf

Mapping with programme outcomes					
Cos	PO1	PO2	PO3	PO4	PO5
C01	M	M	S	S	M
C02	S	S	S	S	S
C03	S	S	S	M	M
C04	M	S	S	S	S
C05	S	S	M	S	S

*S- STRONG, M- MEDIUM, L- LOW

SEMESTER – I

Course Code: 21PBTE1C	ELECTIVE COURSE - I
BIODIVERSITY AND CLIMATE CHANGE	Syllabus version: 2020 – 2021

Course Objectives:
1. To understand the emerging trends of low-carbon economy.
2. To elucidate the strategies of protecting the bio - resources.
Course outcomes:
1. Students articulated why society strives to conserve biodiversity.
2. They identified key threats to biodiversity.
3. They evaluated which management options are likely to be effective for conserving biodiversity in different settings.
4. Students developed appropriate policy options for conserving biodiversity in different settings.
5. Acquiring knowledge on alternative energy sources and Energy efficiency and conservation

UNIT – I BIODIVERSITY

Biodiversity- Types – Genetic, species and ecosystem diversity; Global biodiversity. Plant genetic resources, mega-centers of origin of genetic diversity. World's major plant gene banks.

UNIT – II BIODIVERSITY CONSERVATION

Conservation – Sacred groves, endangered flora, fauna and their identification. Red Data Book. Conservation strategies: *in-situ* approach, biosphere reserves, reserve forests, parks and sanctuaries. *ex-situ* approach: collection garden and cryopreservation. International organizations in conservation – IUCN, IBPGR, WWF, UNEP, and FAO.

UNIT – III CLIMATE CHANGE

Climate change: Components of the atmosphere, the greenhouse gases and its effect, global warming and climate change, consequences and evidence of climate change. Greenhouse gas emissions and the causes – electricity generation, transport. Burning fossil fuels, deforestation.

UNIT - IV CARBON SEQUESTRATION

Carbon di - oxide - capture and storage methods: Geological storage, Ocean storage, Mineral storage & Leakage. CO₂ reuse mechanisms - single step methods: CO₂ → methanol, CO₂ → hydrocarbons and CO₂ → CO → hydrocarbons. CCS projects.

UNIT - V STRATEGIES IN ENERGY CONSERVATION

Climate change adaptation and mitigation: strategies for emission reduction - Alternative energy sources and Energy efficiency and conservation. Kyoto protocol, Bali Action Plan –

IET and, CDMs. Carbon credits and carbon economics; UNFCCC & IPCC, climate change conference - Copenhagen & Mexico – attempt towards legally binding protocol.

Text Book(s):
1. Melchias G 2001. Biodiversity and Conservation. Science Publishers, NH USA
2. Krishnamurthy KV 2003. Advanced Textbook on Biodiversity. Oxford & IBH, New Delhi IUCN 1985.
3. The World Conservation Strategy. IUCN, Switzerland

References:
1. Melchias G 2001. Biodiversity and Conservation. Science Publishers, NH USA
2. Krishnamurthy KV 2003. Advanced Textbook on Biodiversity. Oxford & IBH, New Delhi IUCN 1985.
3. The World Conservation Strategy. IUCN, Switzerland.

Related Online Contents:
1. https://www.amazon.in/Textbook-Biodiversity-K-V-Krishnamurthy/dp/1578083257
2. http://www.ebooks-for-all.com/bookmarks/detail/Climate-Change/onecat/Electronic-books+Environment-and-nature/0/all_items.html
3. https://books.google.com/books?id=4Bs1J0TmhJcC&printsec=frontcover&redir_esc=y&hl=en#v=onepage&q&f=false

Mapping with programme outcomes					
COs	P01	P02	P03	P04	P05
C01	S	M	M	S	M
C02	M	S	S	M	S
C03	S	M	S	M	S
C04	S	S	S	S	S
C05	S	M	M	S	S

*S- STRONG, M- MEDIUM, L- LOW

SEMESTER I & II

Course Code: 21PBT3P	CORE COURSE III - PRACTICAL - I - PLANT DIVERSITY I & II
ALGAE, FUNGI, LICHEN, BRYOPHYTES, PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY	Syllabus version: 2020 – 2021

Course Objectives:
1. To get practical on morphological and anatomical features of algal and fungal, Pteridophytes, and Gymnosperm species
2. To understand the reproductive system of algal and fungal, Pteridophytes, and Gymnosperm species.
Course outcomes:
1. Experiencing in handling specimens and preservation of algae, fungi etc.
2. Imparting knowledge on identification characters of algae and fungi
3. Acquiring knowledge on diversity of pteridophyte and gymnosperms.
4. Understanding symbiotic relationship of algae and fungi in lichen
5. Acquiring knowledge on fossil evidence for studying primitive plants.

ALGAE

- Microscopic observation of algal types and their slides included in the syllabus
- Transverse Section of the algal specimens mentioned in the syllabus
- Identification of algal types in the algal mixture (only microscopic types).

FUNGI

- Microscopic observation of slides of the genera included in the syllabus.
- Section cutting of different plants infected by fungal strains included in the theory syllabus.

LICHEN

- Observation of different thalli of Lichens.
- Microscopic observations in slides of *Usnea*.

BRYOPHYTES

Morphological and anatomical study of representatives of the following: *Marchantiales*, *Jungermanniales*, *Anthocerotales*, *Sphagnales*, *Funariales*, & *Polytrichales*.

PTERIDOPHYTES

A study of the morphology, anatomy of the vegetative and reproductive parts of the sporophytes and gametophytes (wherever available) of living genera included in the syllabus and analysis of their slides.

GYMNOSPERMS

A study of the morphology, anatomy of the vegetative and reproductive parts of the sporophytes and gametophytes (wherever available) of living genera included in the syllabus and analysis of their slides.

PALEOBOTANY

Analysis of slides of fossil forms given in the syllabus.

Field visit to the sea shores in Tamil Nadu for one or two days to collect the algal specimens. Submit the field notebook.

Mapping with programme outcomes					
COs	PO1	PO2	PO3	PO4	PO5
C01	M	S	S	M	S
C02	S	S	S	S	M
C03	S	M	M	S	M
C04	S	S	S	S	S
C05	S	S	M	M	S

*S- STRONG, M- MEDIUM, L- LOW

SEMESTER - III & IV

Course Code: 21PBT4P	CORE COURSE IV - PRACTICAL - II	
MORPHOLOGY AND TAXONOMY OF ANGIOSPERMS AND ECONOMIC BOTANY, ANATOMY, EMBRYOLOGY AND HISTOCHEMISTRY	Syllabus version (2020 - 2021)	

Course Objectives:
1. To get practical on morphological and anatomical features of Angiosperms.
2. To identify and classifying angiosperms by morphological features.
3. To understand the anatomical difference of monocots and dicot plants.
4. To know the staining procedure for embryology and histochemistry study.
Course outcomes:
1. Experiencing in handling specimens and preservation of Angiosperms.
2. Imparting knowledge on identification characters of Angiosperms.
3. Acquiring knowledge on developing taxonomy keys for plant identification.
4. Understanding embryonic development in angiosperms
5. Acquiring knowledge staining methods to study anatomical features of plants.

MORPHOLOGY AND TAXONOMY OF ANGIOSPERMS

- Vegetative morphology – Root, Stem, Leaf and its modification
- Reproductive morphology – Inflorescence, flower and fruit
- Key preparation
- Study the plants belongs to the syllabus families with minimum two examples.
- Training in dissection, observation, identification and sketching of floral parts of plant belonging to the families mentioned in the syllabus along with diagrams and floral formula
- Field study of flora. Submission of 25 Herbarium specimens.

ECONOMIC BOTANY

- Find the Botanical name, Family name, Useful parts and uses of economic plants included in the syllabus.

National level Botanical Tour for three to five days and Submit the Field Note Book with all Details**ANATOMY**

- T.S of thickening xylem using Maceration techniques.
- Anatomy of Monocot and Dicot Root, Stem and Leaf
- Secondary growth of Root and stem

- Nodal Anatomy – unilocular, trilocular and multilocular node
- Identification of types of stomata – anamocytic, anisocytic, diacytic, paracytic and gramineae type using leaf peel off
- Structure of stomatal frequency and stomatal index
- Anomalous secondary growth in Dicot stem of *Achyranthes*, *Nyctanthes*, *Boerhaavia* and *Bougainvillea*

EMBRYOLOGY

- Slides showing developmental stages of Anther , Embryo sac, Endosperm and Embryo
- Dissection of Endosperm Haustoria – Cucumber
- Dissection of embryo using *Tridax* flower
- Dissection of Pollinia using *Calotropis* flower
- Methods of testing pollen viability – 1. Alexander’s stain 2. Acid test

HISTOCHEMISTRY

- Detect and localize the following :Primary metabolites : starch [PARS test], Protein [Coomassie brilliant blue staining], Lipids [Sudan Black method], secondary metabolites: alkaloids, terpenes and phenolic compounds [Kokateet *al.* method].

Mapping with programme outcomes					
Cos	P01	P02	P03	P04	P05
C01	S	M	S	S	S
C02	S	S	M	S	M
C03	M	S	S	M	S
C04	S	S	S	S	M
C05	S	M	S	M	S

*S- STRONG, M- MEDIUM, L- LOW

SEMESTER - II

Course Code: 21PBT5	CORE COURSE - V
MORPHOLOGY AND TAXONOMY OF ANGIOSPERMS AND ECONOMIC BOTANY	Syllabus version: 2020- 2021

Course Objectives:
1. To understand the relevance of molecular techniques in plant systematics.
2. To study the classical taxonomy with reference to different parameters
Course outcomes:
1. Students recognized the major groups of vascular plants and their phylogenetic relationships.
2. Experiencing of diagnostic features of the major plant families
3. They explored the uses of plants as medicine by traditional indigenous approaches.
4. They gained proficiency in the use of keys and identification manuals for identifying any unknown plants to species level.
5. Knowing the values of useful parts and economical importance.

UNIT- I MORPHOLOGY OF ANGIOSPERM

Vegetative morphology- Root and stem .Modification of root and stem.Leaf morphology – simple and compound leaf, leaf shape, leaf tip, types of venation and phyllotaxy.Types of inflorescence [Raceme, cyme, special and mixed]. Floral parts and their arrangements, types of aestivation and placentation.Floral diagram and floral formula. Fruit – types.

UNIT - II PRINCIPLES OF TAXONOMY

Systems of classification- Artificial system [Linnaeus], Natural system [Bentham and Hooker classification], Phylogenetic system [Engler and Prantl classification, Hutchinson classification].ICNAFP.Types and typification - Herbarium Preparation with key. Applied taxonomy : chemotaxonomy – based on primary and secondary metabolites. Numerical taxonomy : cladistics. Biosystematic taxonomy -relation to anatomy, embryology, palynology, ecology and cytology.Molecular taxonomy [RFLP].

UNIT - III SALIENT FEATURES OF ANGIOSPERMIC FAMILIES

Study of diagnostic features of the following families- Ranunculaceae, Capparidaceae, Portulacaceae, Tiliaceae, Rutaceae, Rhamnaceae, Sapindaceae, Rosaceae, Combretaceae, Lythraceae, Passifloraceae, Cactaceae, Umbelliferae.

UNIT - IV SALIENT FEATURES OF ANGIOSPERMIC FAMILIES

Study of diagnostic features of the following families- Rubiaceae, Asteraceae, Plumbaginaceae, Sapindaceae, Apocynaceae, Boraginaceae, Bignoniaceae, Nyctaginaceae, Polygonaceae, Euphorbiaceae, Amaryllidaceae, Commelinaceae, , Musaceae.

UNIT- V ECONOMIC BOTANY

Binomical, Family name, useful parts and economical importance –

Cereals – Wheat, Rice, Maize, Ragi, Barley, Oats, Pearl millet.

Legumes – Red gram, Black gram, Green gram, Beans, peas, lentil.

Vegetables – Brinjal, cabbage, tomato, Potato, and Cauliflower.

Fruits –Mango, Apple, Pine apple, Banana and Orange.

Spices and condiments- Anise, Cumin, Ginger, Turmeric and Cardamom.

Fibers – Cotton, Jute.

Timber – Teak, Rosewood, Sal.

Oil – Sunflower oil, Groundnut oil and Palm oil.

Text Books:

1. Davis, P.H. & Heywood, V.M 1963, Principles of Angiosperm Taxonomy, Oliver & Boyd.
2. Harborne, J.B. & Turner, B.L, 1984, Plant Chemosystematics, Acad. Press, London.
3. Heywood, V.K & Moore, D.M., 1984, Current Concepts in Plant Taxonomy, AP, London.
4. Lawrence, G.H.M., 1955, The Taxonomy of Vascular Plants, Central Book Depot, MacMillan, New York.

Reference:

1. Burkill, I.H., 1965, Chapters of the history of Botany in India, Government of India Press, Nasik, The Manager of Publications.
2. Grant, W.F., 1984, Plant Biosystematics, Acad Press Inc., Canada.
3. Young DA and Seiyler DS (eds.) Phytochemical and angiosperm phylogeny. Praeger publications. NY.
4. Heywood, V.H., 1967, Plant Taxonomy. English Language Book Society, London.
5. Hillis, DM., Moritz, C & Mable, BK (eds) 1996, Molecular Systematics, Sinauer Associates, Sunderland, USA.
6. Jeffrey, C., 1982, Introduction of Plant Taxonomy, Cambridge Uni. Press, Cambridge.
7. Jain, S.K., 1981, Glimpses of Indian Ethnobotany, Oxford & IBH Publ. Co., New Delhi.

Related Online Contents:

1. http://rastogipublications.com/index.php?route=product/product&product_id=108&search=taxonomy
2. <https://www.schandpublishing.com/books/higher-education/biology/a-textbook-botany-angiosperms/9788121904049/#.W0LtwdIzbiU>
3. http://rastogipublications.com/index.php?route=product/product&product_id=110&search=economic+botany&category_id=20
4. <https://www.schandpublishing.com/books/higher-education/biology/economic->

botany/9788121903417/#.W0LucNlzbIU

Mapping with programme outcomes					
Cos	P01	P02	P03	P04	P05
C01	M	S	M	S	M
C02	S	S	S	S	M
C03	S	S	S	M	S
C04	S	M	M	S	S
C05	M	S	S	S	S

*S- STRONG, M- MEDIUM, L- LOW

SEMESTER - II

Course Code: 21PBT6	CORE COURSE - VI
ANATOMY, EMBRYOLOGY AND HISTOCHEMISTRY	Syllabus version: 2020 - 2021

Course Objectives:
1. To understand the basic principles of differentiation of cell types.
2. To know the process of growth and development embryo in plant.
3. To localize the chemical components in plant tissues.
Course outcomes:
1. Students understood meristematic tissue.
2. They differentiated primary and secondary meristem and their function.
3. They understood the structure and function of vascular cambium.
4. They could the difference between dicot and monocot embryo.
5. Students knew the importance of polyembryony.

UNIT - I ORIGIN AND DEVELOPMENT OF TISSUES

Meristematic tissues – Definition, Structure, function, and classification of meristematic tissues. Root apex shoot apex – Theories – apical cell theory, Histogen theory and Tunica – Corpus theory. Root apex – theories – Histogen theory and Korpe – kappe theory. Simple Tissues- types and function of parenchyma, collenchyma and sclerenchyma. Complex Tissues-structural diversity and phylogenetic trends of specialization of xylem and phloem. Cambial Tissues – types, development, differentiation and functions. Secretory tissues. Wound healing.

UNIT - II VASCULAR DIFFERENTIATION

Anatomical characteristics and vascular differentiation in primary structure of Root and Stem of Dicot and Monocot. Root Stem transition zone. Secondary growth in Dicot stem and Root. Anatomy of monocot and Dicot leaves. Anomalous secondary growth in *Bignonia*, *Aristolochia*, *Nyctanthes*, *Boerhaavia* and *Bougainvillea*. Types of Stomata - Nodal anatomy - Floral vasculature.

UNIT - III STRUCTURE AND DEVELOPMENT OF MICRO – MEGASPORANGIUM

Microsporangium – structure, development and microsporogenesis, Microspore – structure and microgametogenesis. pollen dehiscence, Germination and viability of pollen grains. Megasporangium – structure, types, development and megasporogenesis. Development of Embryo sac – monosporic [*Polygonum* type], bisporic [*Allium* type], tetrasporic [*Peperomia* type]. Nutrition of embryo sac. Fertilization – Double fertilization and triple fusion - Post fertilization changes.

UNIT - IV DEVELOPMENT OF EMBRYO AND SEED

Endosperm – types and function. Endosperm haustoria, cytology of endosperm. embryo – development of monocot and dicot embryo, nutrition of embryo. polyembryony – types. apomixis, apospory. parthenogenesis and parthenocarpy. Seed Germination.

UNIT - V LOCALIZATION OF CHEMICALS IN TISSUES

Histochemistry – Scope, detection of molecules in living cells, in situ localization by techniques such as FISH and GISH. Detection and localization of primary metabolites-carbohydrates [PARS reaction], Protein [Coomassie brilliant Blue staining], Lipids [Sudan Black method]. Secondary metabolites – alkaloids, terpenes, phenolic compounds.

Text Books:

1. Fahn.A. (1989) Plant Anatomy. Maxwell, Macmillan, Singapore.
2. Bhojwani, S.S., (1981) Embryology, of Angiosperms, Vikar&Bhatnagar, New Delhi

Reference:

1. Clowes, F.A.L., (1961) Apical Meristems. Blackwell Scientific, Oxford.
2. Cutter, E.G., (1978) Plant Anatomy. Edward Arnold Ltd., London.
3. Esau, K., (1953) Plant Anatomy. Jon Willey & Sons Inc, New York.
4. Maheshwari, P.,(1988) An Introduction to the Embryology of Angiosperms, McGraw-Hill.
5. Raghavan, V., (1976) Experimental Embryogenesis in Vascular Plant, Academic press.
6. Kierman, J.A.1999.Histological and Histochemical Methods. Butterworth Publ. London.
7. Pearse, A.G.E.1960. Histochemistry. Vol.I&Vol.II,J&A. Churchill, London.
8. Ruzin, Z.E.1999. Plant Micro technique and Microscopy. Oxford Press, New York.
9. Krishnamoorthy, K.V. 1990. Histochemical methods.

Related Online Contents:

1. https://www.abebooks.co.uk/servlet/BookDetailsPL?bi=20569837712&searchurl=t%3Dhandbook%2Bof%2Bthe%2Bbritish%2Bflora%26sortby%3D17%26an%3Dbentham%2Bg&cm_sp=snippet-_-srp1-_-title1
2. <https://trove.nla.gov.au/work/16054012>
3. https://books.google.co.in/books/about/A_Text_Book_Ofbotany_Plant_Anatomy_and_E.html?id=uMOglvnKUpQC&redir_esc=y

Mapping with programme outcomes					
COs	P01	P02	P03	P04	P05
C01	S	S	S	M	S
C02	S	M	S	S	M
C03	M	S	M	S	S
C04	S	S	S	M	S
C05	M	S	M	S	S

*S- STRONG, M- MEDIUM, L- LOW

SEMESTER - II

Course Code: 21PBTE2A	ELECTIVE COURSE – II
HORTICULTURE AND GARDENING	Syllabus version: 2020 – 2021

Course Objectives:
1. To understand the methods of plant propagation
2. To know the state of art in landscape designing and its aesthetic values.
Course outcomes:
1. Students learnt the importance of horticulture – career and occupational opportunities
2. They knew about hydroponics and its importance
3. They learnt the techniques of gardening - Types, Methods & Tools
4. Students learnt about Olericulture - Cultivation of commercial flower crops
5. They learnt the techniques in Pomology - Cultivation of important fruit crops & tree species

UNIT - I FUNDAMENTALS OF HORTICULTURE

Scope and importance, classification of horticultural crops, nursery techniques and their management, soil and climate, types of gardens – principles, planning and layout, Principles Course Objectives, types and methods of pruning and training of fruit crops, types and use of growth regulators in horticulture, water management– irrigation methods, plant propagation method- cutting, layering, grafting, budding, stock-scion relationship.

UNIT – II CULTIVATION OF FRUITS AND VEGETABLE CROPS

Fruit crops - cultivation of important fruit crops – Mango, citrus,banana,papaya, sapota,amlaand Guava – Vegetable crops: classification, cultivation of important vegetable crops: Tomato, Brinjal, Chillies,Capsicum, Okra, Curbits, andMoringa.

UNIT – III POST-HARVEST MANagements OF HORTICULTURAL CROPS

Importance and scope of post-harvest management of horticultural crops in India. Pre- and Post-harvest treatments of Horticultural crop viz. pre harvest sprays, curing, pre cooling, waxing, fumigation and irradiations. Different systems/methods of storage including cold storage. Packaging methods, types of packages and recent advances in packaging. Types of containers and cushioning materials.

UNIT – IV IMPORTANCE AND TYPES OF GARDENING

History, definitions, scope and importance of gardening, aesthetic values, Classification, design values and general cultivation aspects for ornamental plants viz. Annuals, biennales herbaceous perennials, grasses and bulbous ornamentals. Importance, design and establishment of garden features/components viz. hedge, edge, borders, flower beds, fences, garden walls, shade garden, sunken garden, roof garden, terrace garden, pebble garden, and rockery garden.

UNIT – V LANDSCAPING

Introduction to Landscape, landscape design principles, landscape structures, landscape planning, selection of landscaping plants, landscape in interiors landscape, design elements. urban landscaping, landscaping for specific situations, institutions, industries, residents, hospitals, roadsides, traffic islands, damsites, it parks, corporates.lawn types, establishment and maintenance.

Text Book(s):
1. Kumar N., 1990, Introduction to Horticulture, Rohini agencies, Nagercoil.
2. Prasad, 2005, Principles of Horticulture, International Book Dept., Deharadun.
Reference:
1. Chauhan, D.V.S., 1968, Vegetable production in India, Ram Prasad, Agra.
2. Edmund J.B. Senn T.L Andrews F.S &Halforce R.G., 1990, Funamentals of Horticulture 14th Edn., Tata McGraw Hill Co. Pvt., London.
3. Gopalaswamylengar K.S., 1970, Complete Gardening in India, Kalyan Press, Bangalore.
Related Online Contents:
1. https://www.amazon.in/Horticulture-Green-World-Gail-Lang-ebook/dp/B00EOEHY7K/ref=sr_1_7?s=digital-text&ie=UTF8&qid=1531113481&sr=1-7&keywords=horticulture
2. https://www.amazon.in/Gardening-Beginners-Perennial-Vegetables-Horticulture-ebook/dp/B01GF3UI9S/ref=sr_1_3?s=digital-text&ie=UTF8&qid=1531113444&sr=1-3&keywords=horticulture

Mapping with programme outcomes					
COs	P01	P02	P03	P04	P05
C01	S	S	M	S	S
C02	M	S	S	S	S
C03	S	M	S	M	S
C04	S	S	S	M	S
C05	S	M	M	S	M

*S- STRONG, M- MEDIUM, L- LOW

SEMESTER - II

Course Code: 21PBTE2B	ELECTIVE COURSE - II
MEDICINAL PLANTS	Syllabus version: 2020 – 2021

Course Objectives:
4. To understand the Value of medicinal plants.
5. To know the process of cultivation of medicinal plants.
6. To impart knowledge on medicinal properties of herbals.
Course outcomes:
1. Students knew about history and relevance of herbal drugs in Indian system of medicine.
2. They learned the macroscopic and microscopic characters, chemical constituents, adulterants, therapeutical and pharmaceutical uses of medicinal plants
3. They understood the techniques for drug evaluation (Chemical, Physical and Biological), Phytochemical investigations, standardization and quality control of herbal drugs
4. Students knew the technique of medicinal gardening - Cultivation practices, and preparation and marketing of herbal preparations.
5. Students knew the importance of medicinal plants for human health.

UNIT - I HISTORY OF MEDICINAL PLANTS

History of medicinal and aromatic plants - some important terms used in herbal medicine; Herbal industry; WTO Indian scenario- Prospects and constraints, export and import status; AAYUSH – Amchi (Tibetan), Ayurveda, Unani, Siddha and Homoeopathy; Chinese; Bach's flower remedy; Aromatherapy.

UNIT - II IMPORTANCE OF MEDICINAL PLANTS

Relevance of herbal medicine as primary health care package; sources of information on medicinal plants; Organization of information in database (national and international); Causes for the decline and the current scenario in Indigenous systems of medicine; a comparative evaluation of accessibility and benefits of different systems of medicine.

UNIT - III REMEDIAL PLANTS AND PSYCHOACTIVE PLANTS

Remedial plants for heart, respiratory, skin, cancer, autoimmune, and liver diseases. Psychoactive plants: Classification; stimulants, nootropic plants (Plants for mental health), hallucinogens, depressants and anti-depressants.

UNIT - IV POISONOUS AND ALLERGIC PLANTS

Poisonous plants – classification; chemical constituents, symptoms, treatment and systematic description of some poisonous plants - *Papaversomnifera*, *Calotropisgigantea*, *Gloriosasuperba*, *Digitalis purpurea*, *Daturametel*, *Strychnosnux-vomica* Plant Allergens –

Types and classification; description, symptoms, chemical constituents and treatment of the following allergic plants -*Partheniumhysterophorus*, *Urtica sp.*, *Acacia sp.*,

UNIT – V MEDICINAL PLANTS OF INDIA

Potentials of medicinal plants – WHO and Indian Scenario; herbal medicine – a natural resource; commercial and medicinal uses of medicinal plants in India; Study of few commercial /raw drugs medicinal plants - *Rauwolfiaserpentina*; *Withaniasomnifera*; *Coleus forskohlii*; *Embllicaofficinalis*; *Saracaasoca*; *Aloe vera*; *Glycyrrhizaglabra*; *Commiphoramukul*, *Bosweliaserrata*.

Text Book(s):
1. Weiss, Rudolf Fritz 2000 Herbal Medicine, 2nd Edition Thieme Medical Publishers.
2. S. Somasundaram 1997. MaruthuvaThavaraiyal, IlangovanPadhippagam, Palayamkottai.
3. Kokate CK, Purokit AP and Gokahale, 2006. Pharmacognosy, NiraliPrakashan.
4. S. Anbazhakan, Plant systematic and Medical Botany
Reference:
1. Roberts <i>Pharmacognosy</i> K.M. Vergheese Co. Bombay.
2. Wallis TE <i>Text Book of Pharmacognosy</i> . R.S. Publishers, New Delhi.
3. Shah CS and Qudry JS <i>A text book of Pharmacognosy</i> . BS Shah Prakasm, Ahmedabad.
Related Online Contents:
1. http://www.gallowglass.org/jadwiga/herbs/preparations.html
2. http://shawnacohen.tripod.com/thetribaltraditions/id51.html
3. http://www.vasundharaorissa.org/Research%20Report%20GlobalisationAndMedicinalplantsOfOrissa.pdf
4. http://www.emea.europa.eu/docs/en_GB/document_library/Scientific_guideline/2009/09/WC500003393.pdf

Mapping with programme outcomes					
COs	P01	P02	P03	P04	P05
C01	M	S	S	M	S
C02	S	M	S	M	M
C03	S	S	M	S	S
C04	M	S	S	S	S
C05	S	S	M	S	S

*S- STRONG, M- MEDIUM, L- LOW

Course Code: 21PBTE2C	ELECTIVE COURSE - II
FORESTRY AND WOOD SCIENCE	Syllabus version: 2020 - 2021

Course Objectives:
1. To prepare students for careers in the forest service's and wood products industry.
2. To educate students to provide technical expertise to the wood industries.
Course outcomes:
1. Students learnt the forest types and their utilization
2. They learnt about composition and cell types of wood
3. They knew about growth rings, annual rings, dendrochronology.
4. They knew about the commercial value of timber, fuel wood, pulp and paper making, match –stick wood, plywood and economic importance of pulp and wood species.
5. Knowing the commercial value of timbers and their production.

UNIT - I INTRODUCTION TO FORESTRY

Forest and forestry. Classification- branches and relationships. Status and types of forests in India and their distribution. Definition, objectives and scope of Silviculture. Genetic Engineering and its application in forestry; Remote sensing and GIS in forestry.

UNIT - II Forest Resources and utilization

Forest products; Non-Timber Forest Products (NTFPs) - definition and scope; gums, resins, oleoresins, fibres, oil seeds nuts, rubber, canes, bamboos, medicinal plants. Forest industries; Role of social forestry in cottage industry and Indian economy. Biomass conversion strategies - energy plantations.

UNIT - III NATURE OF WOOD

General and physical features of wood: Features visible on the cross surface of log- sapwood and heartwood, growth rings and growth marks, rays, pored and non-pored woods (softwoods and hardwoods), features visible on longitudinal surface of wood. Colour, Lustre, odor & taste, weight, grain, texture, figure. Durability of wood. Pycnoxylic and manoxylic wood; dendrochronology; Wood seasoning and preservation.

UNIT - IV MANAGEMENT OF WOOD

Degradation of wood due to biotic and non-biotic factors. Wood damage due to wood boring insects species, Injury and control. Nature of damage - Galls, Cankers. Wood deterioration- fungi, insects and other agents. Wood protection - Principles and components of pest control. Chemical processing of wood.

UNIT - V WOOD PRODUCTS

Composite wood: adhesives-manufacture, properties, uses, manufacture and uses of plywood, fiber boards and particle boards. Present status of composite wood, paper and rayon industries - Wood substitution.

Text Books:
1. De Vere Burton L., 2000, Introduction to Forestry Science, Delmar publishers, N Y.
2. J.L. Bowyer, R. Shmulsky and J.G. 2007. Haygreen. Forest Products and Wood Science: An Introduction, Blackwell Publishing Professional.
3. Franz F. P. Kollmann, Wilfred A. Jr. Cote. 2012. Principles of Wood Science and Technology: I Solid Wood, Springer.

Reference:
1. Negi, S.S., 1994, India's Forests, Forestry and Wildlife, Indus Publishing Com., New Delhi.
2. Jha, L.K., 1996. Forestry for rural development, APH Publishing Corporation, New Delhi.
Related Online Contents:
1. https://www.takealot.com/forest-products-and-wood-science-ebook/PLID37370116

Mapping with programme outcomes					
COs	P01	P02	P03	P04	P05
C01	S	S	M	S	M
C02	M	M	S	S	M
C03	S	S	S	S	S
C04	S	S	S	M	S
C05	S	M	M	S	M

*S- STRONG, M- MEDIUM, L- LOW

Course Code: 21PBTE1	EXTRA DISCIPLINARY PAPER - I
GENERAL BOTANY FOR COMPETITIVE EXAMINATIONS	Syllabus version: 2020 – 2021

Course Objectives:
1. To prepare Students for attend the competitive examinations to get botany job.
Course outcomes:
1. Understand core concepts of Economic Botany and relate with environment, populations, communities, and ecosystems
2. Develop critical understanding on the evolution of concept of organization of apex new crops/varieties, importance of germplasm diversity, issues related to access and ownership
3. Develop a basic knowledge of taxonomic diversity and important families of useful plants
4. Increase the awareness and appreciation of plants & plant products encountered in everyday life
5. Appreciate the diversity of plants and the plant products in human us

UNIT – I DIVERSTIY OF LIVING ORGANISMS

i) Viruses - A general account of viruses-Transmission and control measures of viruses - Vector relationships, multiplication – lytic and lysogenic cycle. ii) Bacteria - A general account of bacteria with reference to cell morphology, appendages, envelops and nutrition, growth, structure and reproduction, methods of recombination in bacteria. Economic importance of bacteria. iii. a) Algae: A comparative study of the range of structure, organization, reproduction, life history and classification of algae (Bold and Wynne, 1978). Ecology of Algae-Productivity in the sex, algae as indicators meant of pollutions, algicides, economic importance of algae. b) Fungi -Classification (Alexopoulos and Mims 1979). A systematic study of the range of structure, reproduction, life cycles phylogeny and affinities of the main classes of fungi; Economic importance of fungi. c) Lichens - A general account of lichens - Structure, nutrition; reproduction, classification and economic importance of lichens - A systematic study of the range of structure, reproduction, life cycles phylogeny and affinities of the main classes of bryophytes, pteridophytes and gymnosperms.

UNIT – II ADVANCES IN BOTANY

Introduction, scope and importance of biotechnology, biotechnology scenario in India.enzymes used in genetic engineering: restriction endonucleases, ligases, polymerases, kinases and phosphatases, dnamethylases and topoisomerases. use of vectors in cloning: plasmids, phages, cosmids, ssDNA vectors, BAC, YAC, MACs. Expression Vectors, sequencing vectors, vectors for cloning PCR products, binary and shuttle vectors. Improved Agrobacterium based vectors and virus based vectors for plants. Nucleic acid hybridization- Southern and Northern blotting techniques.

UNIT – III ENVIRONMENTAL BIOLOGY

Pollution: sources, nature, impact of air, water, soil and radioactive pollution, noise pollution – assessment, control and management, solid waste management global environment changes. toxicology: principles of toxicology and types of toxins, sources, metabolism and biological monitoring of arsenic, mercury, cadmium, chromium, zinc, lead and nickel. plant indicators of pollution: bioindicators, biomonitoring, bioremediation, bio fueling, biofilm and bio-corrosion.

UNIT – IV ECONOMIC BOTANY

Introduction: plants in commerce and industry. general account: history, methods of cultivation and uses - rice, wheat, maize, tea, coffee, rubber, sunflower, safflower, groundnut, lin seed, cotton, jute, coconut, agave, teak, mahogany and vegetable sponges. family, useful parts and chemical constituents: cardamom, cinnamon, clove, ginger, pepper, coriander, fennel, henna, indigofera, butea, arecanut, beetle leaf, tobacco, turmeric and vanilla. herbal drugs: roots, stem, wood, leaves, flowers, fruits and seed.

UNIT – V ECOLOGY AND PHYTOGEOGRAPHY

Ecosystems - components, types of ecosystem – aquatic (pond), terrestrial (grass land and forest), dynamic of eco systems – food chain, food web, ecological pyramid, primary and secondary production, energy flow in ecosystem - introduction and history: physical features of the world (climate, deserts) aims, methods and principles of plant geography. islands of botanical interest. Continental drift and evidence in its favour. biogeographical regions of the world phytochoria of Indian sub-continent. floristic regions of the world; hansen classification and Ronald Good's classification. Plant distribution: continuous, discontinuous, centre of origin endemic, bathymetric distribution, centre of origin of crop plants. evolution and plant migration, dispersal, isolation, migration and barriers, vicarious species, relict species, isofloras, polytopy, centres of origin of crop plants.

Text Book:
1. Pandey, BP. 2005. Simplified course in Botany, S. Chand and Company Ltd., New Delhi.
References:
1. Sharma, OP. 1992. Text Book of Algae. Tata McGraw Hill, New Delhi.
2. Gangulee, HC. & Kar, AK. 1989. College Botany, Vol-II, Books & Allied Pvt. Ltd., Calcutta.
3. Singh V, Pande PC & Jain OK. A text book of Botany, Rastogi Publications, Meerut.
4. Smith, GM. 1955. Cryptogamic Botany Vol-1&II, McGraw Hill, New York.
5. Hale, ME Jr. 1983. The biology of Lichens, New Age International publishers, New Delhi.
6. Butler, M. 1987. Animal cell technology, Principles and Products, Open University Press, New York.

7. Odum, E.P., 1970. Fundamentals of Ecology, 3rd edn, W.B. Saunders Ltd., UK.
8. Hill AW <i>Economic Botany</i> . Tata McGraw Hill, New Delhi.
E-Books:
1. https://www.schandpublishing.com/books/higher-education/commerce-management/public-finance/9789352710805/#.Wwz_pUiFPIU
2. https://www.schandpublishing.com/books/higher-education/biology/a-textbook-biotechnology/9788121926089/

Mapping with programme outcomes					
COs	P01	P02	P03	P04	P05
C01	S	S	M	M	S
C02	S	S	S	S	M
C03	S	M	S	S	S
C04	M	S	M	M	S
C05	S	M	S	S	S

*S- STRONG, M- MEDIUM, L- LOW

Semester - III

Course Code: 21PBT7	CORE COURSE - VII
CELL AND MOLECULAR BIOLOGY	Syllabus version: 2020 – 2021

Course Objectives:

1. To understand the structural organization and function of different cell organelles.
2. To study the basic principles of the central dogma of life

Course outcomes:

1. Students learnt about structural organization and function of intracellular organelles
2. They gained knowledge on the organization of genes and chromosomes
3. They studied about the structure of atoms, molecules and chemical bonds & Composition, structure and function of biomolecules
4. Evaluate the experiments establishing central dogma and genetic code. • Gain an understanding of various steps in transcription, protein synthesis and protein modification.
5. Evaluate the experiments establishing central dogma and genetic code. • Gain an understanding of various steps in transcription, protein synthesis and protein modification.

UNIT – I STRUCTURE OF CELL AND ORGANELLES

Prokaryotic and Eukaryotic cell structure, structure of plasma membrane and cell wall. occurrence, ultra structure, function of endoplasmic reticulum, golgi apparatus, lysosomes, peroxisomes glyoxysomes, mitochondria, chloroplast and ribosomes. nucleus: ultra-structure of nuclear membrane, nucleoplasm, chromatin fibers. chromosomes: morphology, ultra structure, special types and functions.

UNIT - II CELL DIVISION AND CELL GROWTH

Cell division and Cell cycle: mitosis and meiosis, their regulation, steps in cell cycle, regulation and control of cell cycle. levels of cell growth: limited and unlimited growth, kinetics of cell growth, mechanisms, RNA synthesis and cell growth, nucleolus and cell growth, protein synthesis and cell growth.

UNIT – III GENETIC MATERIAL AND REPLICATION

Identification of genetic materials-direct and indirect evidence for DNA as the genetic material, evidences for RNA as the genetic material of some viruses. Nucleic acids – types of DNA, chargaff's rule, size, chemical nature. Replication of DNA in prokaryotic and eukaryotic cell. circular and super helical DNA ; types of RNA, molecular structure of RNA.

UNIT – IV GENOME AND FUNCTIONS

Gene: fine structure, split gene, exons and introns. Gene function transcription, translation and expression in prokaryotes and eukaryotes – splicing mechanisms – reverse transcriptions. translation, overlapping genes. protein synthesis, mechanisms, post translation modification. regulation of gene action in prokaryotes and eukaryotes.

UNIT – V GENETIC ENGINEERING AND TOOLS

Isolation, Sequencings and synthesis of DNA. Isolation and use of restriction enzymes, Molecular vectors: types –Plasmid, PBR322 and its derivatives – gene markers, phage and cosmid vectors, artificial chromosome vectors: BAC & YAC, shuttle vectors and expression vectors. DNA finger printing and application of genetic engineering.

Text Books:
1. Satyanarayana U. 2007. Biotechnology. Books and allied (P) Ltd
2. Verma P.S and Agarwal V.K. 2006. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand & Company Ltd
3. Lewin B. 2008. Genes IX. Jones and Bartlett publishers
References:
1. Watson JD, Hopkins NH, Roberts JW et al.1987. Molecular Biology of the Gene (4th ed.) The Benjamin/Cummings Publishing Company, Inc
2. Hartl DL and Jones EW. 2000. Genetics – Analysis of Genes and Genomes (5th ed.) Jonesd and Barlett Publishers.
3. Tamarin RH. 1999. Principles of Genetics (6th ed.)WCB McGraw-Hill
4. Lodish H, Berk A, Matsudaira P et al 2004. Molecular Cell Biology (5th ed.) W.H. Freeman and Company, New York.
5. Becker MW, Kleinsmith LJ and Hardin J. 2007. The world of the Cell (6th ed.) Tata McGraw Hill Publications.
Related Online Contents:
1. www.journals.elsevier.com/journal-of-molecular-biology/
2. www.springer.com > Home > Life Sciences > Cell Biology

Mapping with programme outcomes					
COs	PO1	PO2	PO3	PO4	PO5
C01	S	S	S	S	S
C02	S	M	M	S	S
C03	S	M	S	M	S
C04	S	S	S	S	M
C05	M	S	M	S	S

*S- STRONG, M- MEDIUM, L- LOW

SEMESTER - III

Course Code: 21PBT8	CORE COURSE - VIII
GENETICS AND PLANT BREEDING	Syllabus version: 2020 - 2021

Course Objectives:

1. To understand the principle and the hereditary mechanisms.
2. To study the structure and functions of genetic materials.
3. To study the importance of plant breeding in food production.
4. To understand the methodology of plant breeding.

Course outcomes:

1. Students learnt about Mendelian principles
2. They knew about gene mapping methods & Extra chromosomal inheritance
3. They familiarized about Evolution & Emergence of evolutionary thoughts
4. Students gained knowledge on molecular mapping.
5. Students knew in detail about breeding systems
6. They learnt the techniques of Hybridization
7. They learnt about the selection methods for self pollinated, cross pollinated plants
8. Students understood the role of mutations in plant breeding

UNIT- I MENDELIAN GENETICS

Experiments, monohybrid and dihybrid cross, test cross, back cross, genetic ratios, Mendelian law of inheritance, Concepts of gene- allele, multiple allele, pseudo alleles, complementation tests - extension of Mendelian genetics – co-dominance, incomplete dominant, gene interactions, pleiotropy, penetrance, gene expressivity and phenocopy.

UNIT - II LINKAGE AND CROSSING OVER

Crossing over types - sex determination in plants- sex linkage- dominant and recessive, sex linked genes, holandric genes - sex linked diseases- hemophilia, colour blindness - extra chromosomal inheritance- cytoplasmic inheritance- kappa particles in paramecium, shell coiling in snail, plasmid inheritance, maternal inheritance.

UNIT - III DIFFERENTIATION IN GENE

Gene pool, Gene bank, Estimation of allele and genotype, frequency of dominant genes, genetic equilibrium, polymorphism. population genetics: genetic drift, random drift, eugenics, eugenics, Hardy – Weinberg law and its applications.

UNIT - IV MOLECULAR MAPPING AND MUTATION

Molecular mapping- Methods, RFLP, Gene mapping, walking and jumping of chromosome, mutation-chromosomal aberration and its types, mutation and its types, mutagens, lethal mutation - loss and gain of functions by mutation, somatic mutants.

UNIT - V PLANT BREEDING

Principles, importance of plant breeding in green revolution with reference to wheat, rice, sugarcane, cotton and maize. methods of crop improvements- selection, - mass, clonal and pure line, hybridization- technique, heterosis - causes and effects. ploidy breeding, mutation breeding – procedure, achievements. Disease resistance breeding – nature, causes, methods and its advantages. Role of polyploidy in agriculture.

Text Books:
1. Verma, P.S. & V.K. Agarwal, 2003, Genetics. S. Chand, New Delhi-55.
Reference:
2. Gardner E J, Simmons M J, Snustad D P (1991). Principles of Genetics (III Edn). John Wiley and Sons Inc. 8th Edn., New York.
3. Snustad D P, Simmons M J (2000). Principles of Genetics (III Edn). John Wiley and Sons.
4. Strickberger (2005). Genetics (III Edn). Prentice Hall of India Pvt. Ltd.
5. William S Klug, Michael R Cummings (1994). Concepts of Genetics. Prentice Hall.
6. Robert J Brooker (2009). Genetics: Analysis and principles (III Edn). McGraw Hill.
7. Daniel L Hartl, Elizabeth W Jones (2009). Genetics: Analysis of genes and genomes (VII Edn). Jones and Bartlett publishers.
8. D Peter Snustad and Michael J Simmons (2010). Principles of genetics. John Wiley & Sons.
Related Online Contents:
1. https://onlinelibrary.wiley.com/doi/book/10.1002/9781118313718
2. https://www.springer.com/in/book/9783642879302
3. https://trove.nla.gov.au/work/16054012?q&sort=holdings+desc&_id=1527503199193&versionId=23683670
4. https://www.amazon.com/Chromosome-Atlas-Flowering...Darlington/dp/B0014B1YJA

Mapping with programme outcomes					
COs	P01	P02	P03	P04	P05
C01	S	S	M	S	S
C02	M	S	S	M	M
C03	S	S	S	S	S
C04	M	M	S	M	S
C05	S	S	S	S	S

*S- STRONG, M- MEDIUM, L- LOW

SEMESTER - III

Course Code: 21PBT9	CORE COURSE – IX
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GENERAL MICROBIOLOGY**Syllabus version: 2020 – 2021****Course Objectives:**

1. To enable the students to understand the basic concepts in microbial diversity, metabolism and genetics.
2. To deal with microbial products and pathogenesis. It also introduces the students to some key aspects of virology.

Course outcomes:

1. Students learnt about classification, characteristics, ultra structure of Prokaryotic and Eukaryotic microbes.
2. They applied an appropriate microbiology laboratory techniques, methodologies, instruments and equipment in accordance with current laboratory safety protocol.
3. Develop understanding of the significance of intrinsic and extrinsic factors on growth of micro-organism
4. Identify ways to control microbial spoilage of foods
5. Analyze the practices involved in Food Microbiology

UNIT - I FUNDAMENTALS OF MICROBES

Scope, branches of Microbiology. Whittaker's five kingdom concept (1969). Prokaryotic and Eukaryotic microbes. General features of virus, classification, ultrastructure, replication, economic importance, SARS virus and its types (Coronavirus disease (COVID-19)- infection, symptoms, prevention and control. **Bacteria:** General account, ultrastructure, nutrition, growth and reproduction. Methods of bacterial recombination. Bergey's manual of systematic Bacteriology (1984-1991).

UNIT - II TECHNIQUES IN MICROBIOLOGY

Microbiological Techniques - Sterilization, pure culture techniques, and types of media - media preparation - preservation of cultures - aerobic and anaerobic culture techniques - growth of bacteria: batch and synchronous culture - factors influencing growth - growth curve. Methods to study microbial morphology - wet mount and hanging drop method. Staining techniques - Gram's acid fast, spore and capsule staining.

UNIT - III INDUSTRIAL MICROBIOLOGY

Industrial application of microorganisms. Alcohol production, production of beverages and liquors. Microbial production of organic acids (vinegar, lactic acid and citric acid) food processing- milk products, antibiotics - penicillin, tetracyclines, streptomycin. Production, harvest and uses of enzymes and vitamins. Vaccines.

UNIT-IV AGRICULTURAL MICROBIOLOGY

Roles of microbes in agriculture, biofertilizers-types, production and utilization. Steps for preparing biofertilizers. Biopesticides - preparation, production and utilization and its

significance. Biodegradation of cellulose, lignin and petroleum wastes and heavy metal waste.

UNIT - V ENVIRONMENTAL MICROBIOLOGY

Role of microorganisms in waste management, Composting, types of composting, biogas production, sewage treatment. Solid waste management - Biodegradation- Petroleum and pesticides. Microorganisms in abatement of heavy metal pollution. Role of microorganisms in metal removal-mechanism of metal removal. Biodeterioration of stored food materials, metals and plastics.

Text Books:
1. Prescott et al., 2009 7e, Microbiology. Wm. C. Brown Publishers.
2. Dubey R.C., and D.K.Mahashwari 2010. A Text Book of Microbiology. S.Chand and Company Ltd, NewDelhi.
Reference:
1. Pelczar et al. 1998, Microbiology - Concepts & Applications. Tata McGraw Hill New Delhi.
2. Adams MR and Moss MO, 2008, Food Microbiology. Royal Soc. Chem., Cambridge, UK.
3. Dickinson M. 2003. Molecular Plant Pathology. BIOS Scientific Publishers, London.
Related Online Contents:
1. http://rastogipublications.com/index.php?route=product/product&product_id=69&search=microbiology
2. https://www.schandpublishing.com/books/higher-education/biology/a-textbook-microbiology/9788121926201/#.W0LwytIzbiU

Mapping with programme outcomes					
Cos	P01	P02	P03	P04	P05
C01	S	S	S	M	S
C02	S	S	M	S	S
C03	S	M	S	S	S
C04	S	S	S	M	M
C05	M	S	M	S	S

*S- STRONG, M- MEDIUM, L- LOW

SEMESTER - III

Course Code: 21PBTE3A	ELECTIVE COURSE- III
INTELLECTUAL PROPERTY RIGHTS	Syllabus version: 2020 – 2021

Course Objectives:

1. To understand the basics of the intellectual property rights.
2. To compare and contrast the different forms of intellectual property protection in terms of their key differences and similarities.
3. To analyze the effects of intellectual property rights on society as a whole.

Course outcomes:

1. Students having ability to demonstrate a capacity to identify, apply and assess ownership rights and marketing protection.
2. Gaining knowledge on current and emerging issues relating to the intellectual property protection, including those relating to indigenous knowledge or culture.
3. Understanding intellectual property law as applicable to information, ideas, new products and product marketing.
4. Imparting knowledge on information technology especially the distribution of material on the internet, biotechnology and international trade.
5. Getting awareness on necessity of IPR for new invention.

UNIT – I INTRODUCTION TO INTELLECTUAL PROPERTY RIGHT AND PATENT

Concept and kinds. IPR in India and world: Genesis and scope, some important examples. IPR and WTO (TRIPS, WIPO). Patent: objectives, rights, Patent Act 1970 and its amendments. Procedure of obtaining patents, Infringement. Patent offices in India.

UNIT – II COPYRIGHTS AND TRADEMARKS

Copyright: Introduction, Works protected under copyright law, Rights, Transfer of Copyright, Infringement. Trade marks - Objectives, Types, Rights. Trade secrets: Course Objectives and types. Eg. Tirunelveli Halwa, Karuppatti Kadalai, Coca Cola, ABT Parcel Service

UNIT – III GEOGRAPHICAL INDICATIONS

Course Objectives, Justification, International Position, Multilateral Treaties, National Level, Indian Position. Bio-Prospecting and Bio-Piracy, Traditional Knowledge on the International Arena, at WTO, at National level, Traditional Knowledge Digital Library.

UNIT – IV PROTECTION OF PLANT VARIETIES

Plant Varieties Protection-Course Objectives, Justification, International Position, Plant varieties protection in India. Rights of farmers, Breeders and Researchers. National gene bank, Benefit sharing. Protection of Plant Varieties and Farmers' Rights Act, 2001.

UNIT – V BIOTECHNOLOGY AND INTELLECTUAL PROPERTY RIGHTS

Biotechnology and Intellectual Property – IPR and IPP. Patenting Biotech Inventions: Objective, Applications, Concept of Novelty, Concept of inventive step, Microorganisms, Patenting of Biological materials : Obligations and implications.

Text Books:
1. N.K. Acharya: Textbook on intellectual property rights, Asia Law House (2001).
2. Manjula Guru & M.B. Rao, Understanding Trips: Managing Knowledge in Developing Countries, Sage Publications (2003).
REFERENCE:
1. P.Ganguli, Intellectual Property Rights: Unleashing the Knowledge Economy, Tata McGraw-Hill (2001).
2. Arthur Raphael Miller, MichealH.Davis; Intellectual Property: Patents, Trademarks and Copyright in a Nutshell, West Group Publishers (2000).
3. JayashreeWatal, Intellectual property rights in the WTO and developing countries, Oxford University Press, Oxford.
Related Online Contents:
1. https://www.icsi.edu/docs/webmodules/Publications/9.4%20Intellectual%20Property%20Rights.pdf https://www.amazon.in/Intellectual-Property-Rights-Neeraj-Pandey/dp/812034989X
2. https://www.wipo.int/edocs/pubdocs/en/wipo_pub_450_2020.pdf
3. https://www.bits-pilani.ac.in/Uploads/MicroModule/2011-12-12--7-46-19-276 Patent ManualOct 25th 07.pdf
4. https://docs.manupatra.in/newslines/articles/Upload/41C26FED-7AFE-40EA-8736-4E6C516917AE.pdf

Mapping with programme outcomes					
Cos	PO1	PO2	PO3	PO4	PO5
C01	S	S	S	M	M
C02	M	M	S	S	S
C03	S	S	S	M	S
C04	M	S	S	S	S
C05	S	S	S	S	S

*S- STRONG, M- MEDIUM, L- LOW

Course Code: 21PBTE3B	ELECTIVE COURSE - III
GENOMICS AND PROTEOMICS	Syllabus version: 2020 – 2021

Course Objectives:

1. To understand genome and sequence technique.
2. To familiar the techniques in proteomics
3. To get the experience in the novel science

Course outcomes:

1. The student will be able discern the crucial concepts and techniques applied in genomics, transcriptomics and proteomics. • •
2. Be able to classify the complexity of genome/ proteome structural and functional organization
3. Imparting knowledge on genome and sequence technique.
4. Getting familiar handling the techniques in proteomics
5. Formulate and assess experimental design for solving theoretical and experimental problems in Genomics and Proteomics fields.

UNIT -I INTRODUCTION TO GENOMICS

Genome definition, Genomics and its diversifications, Structural organization of Prokaryotic and eukaryotic genomes; C - value paradox, types and significance of repeats in the genome, Organelle genomes.

UNIT-II SEQUENCING TECHNIQUES AND WHOLE GENOME SEQUENCING

Conventional Sequencing techniques (Maxam Gilbert and Sanger Sequencing), Strategies for Whole Genome Sequencing – hierarchical and whole genome shotgun sequencing, role of genetic and physical maps in genome assembly, de novo and reference-based assembly, Genome finishing – gaps and their resolution, basic concepts of genome annotation – ORF and homology based Gene prediction, Second generation sequencing techniques – Pyrosequencing and Virtual terminator Sequencing.

UNIT-III ASSESSING GENOMIC VARIATIONS

Dominant and co-dominant markers, Homoplasmy concept, Identical by state Vs Identical by descent markers, Hybridization based marker system – RFLP, PCR based marker systems – RAPD, AFLP, CAPS, SCAR, SSRs, Microarray based SNP detection techniques, Applications of DNA markers proteomics.

UNIT-IV PROTEOMIC TECHNOLOGIES

Transcriptomes and analysis; SAGE, Microarray technology; Analytical proteomics tools (1-D & 2-D gel electrophoresis); Mass spectrometry and analysis (ESI, MALDI and Hybrid), LC/MS-MS; Applications of mass spectrometry (PMF and PTMs).

UNIT-V INTERACTION PROTEOMICS

Interactomes and Proteomic interactions (Y2H approaches, Co-IP); Proteome- wide interaction maps; protein structure determinations and structural proteomics tools (experimental and computational); Concepts of protein engineering.

Text Books:
Genome III – T.A. Brown Garland Science Publ. June 08, 2006. ISBN-10: 0815341385
Introduction to Proteomics: Tools for the New Biology. Daniel C. Liebler, Humana Press Inc., 2002. ISBN-10: 0896039919
Bioinformatics and Functional Genomics – Jonathan Pevsner - 2nd edition, WileyBlackwell, 2009. ISBN-10: 0471210048
Reference Books:
1. Discovering Genomics, Proteomics and Bioinformatics, 2nd Edition. Campbell AM & Heyer LJ, Benjamin Cummings 2007; CSH Press, NY. ISBN-10: 8131715590
2. Introduction to Genomics. A.M Lesk, Oxford University press, 2007. ISBN-10: 0199557489
Related Online Contents:
1. http://crdd.osdd.net/raghava/slides/COMPARATIVE%20GENOMICS.ppt
2. https://en.wikipedia.org/wiki/Genome
3. https://www.britannica.com/science/gene
4. https://tomato.cfaes.ohio-state.edu/Proteomics%20Presentation.pdf
5. https://bio.as.uky.edu/sites/default/files/overview%20of%20proteomics_0.pdf .

Mapping with programme outcomes					
COs	PO1	PO2	PO3	PO4	PO5
C01	S	S	S	S	S
C02	S	S	S	S	M
C03	S	S	M	S	S
C04	S	M	S	S	M
C05	M	S	S	M	S

*S- STRONG, M- MEDIUM, L- LOW

SEMESTER - III

Course Code: 21PBTE3C	ELECTIVE COURSE - III
PHARMACOGNOSY AND PHYTOCHEMISTRY	Syllabus version: 2020 – 2021

Course Objectives:
• To understand the basics of Pharmacognosy and drugs.
• To understand therapeutic potential of active principles in plants.
• To know about the various traditional systems of medicine.
• To understand the methods of storage and preparation of plant extracts.
• To understand the characterization phytochemical in plants.
Course outcomes:
1. The student shall be able to understand importance of pharmacognosy in Indian medicine
2. Getting experience on techniques in the cultivation and production of crude drugs
3. Imparting knowledge on the crude drugs, their uses and chemical nature
4. Getting experience on the evaluation techniques for the herbal drugs
5. Improving capacity to analyze the chemical characterization of crude drugs.

UNIT- IPHARMACOGNOSY:

Definition, history, scope and development of Pharmacognosy. Sources of Drugs – plants, animals, marine & tissue culture organized drugs, unorganized drugs (dried latex, dried juices, dried extracts, gums and mucilage). Classification of drugs: - Alphabetical, morphological, taxonomical, chemical, pharmacological. Quality control of Drugs of Natural Origin:- Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical, chemical and biological methods and properties.

UNIT – IICULTIVATION AND COLLECTION OF HERBAL DRUGS

Cultivation and Collection of herbal drugs - Factors influencing the cultivation of medicinal plants. Plant hormones and their applications. Polyploidy, mutation and hybridization with reference to medicinal plants. Conservation of medicinal plants.

UNIT – IIIPHARMACOGNOSY IN VARIOUS SYSTEMS OF MEDICINE

Indian Systems of Medicine – Ayurveda – Principles, methods of preparation of drugs, branches of Ayurveda - Siddha: History, principles, methods of preparation of drugs – Unani system of medicine – Homeopathy system of medicine – Aromatherapy – Nature cure – Role of National Medicinal Plants Board in India.

UNIT – IVEXTRACTIONOFPHYTOCHEMICALS

Scope of phytochemistry, plants as source of chemical compounds, primary and secondary metabolites. Selection of plant samples, processing and storage of samples for extraction. Extraction methods – infusion, decoction, digestion, maceration, percolation, solvent extraction, fluid extraction and ultrasound.

UNIT-V CHARACTERISATION AND ANALYSIS OF PHYTOCHEMICALS

Preliminary, qualitative and quantitative techniques – paper chromatography, thin layer chromatography, Column chromatography – HPLC, GC (qualitative and quantitative) Colour reactions for amino acids, sugars, phenolics, flavonoids, alkaloids, terpenes, saponins, oils, lipids. Characterization using spectroscopic techniques- UV/VIS, FTIR, DSC (differential scanning calorimeter).

Text Books:
1. Tyler, V.E., Brady, L.R. and Robbers, J.E., Pharmacognosy, 9th Edn., Lea and Febiger, Philadelphia, 1988.
2. T.E. Wallis, Textbook of Pharmacognosy, 5th edition, CBS Publishers & Distributors, New Delhi, 2005
3. Mohammad Ali. Pharmacognosy, CBS Publishers & Distributors, New Delhi 2008
5. C.K. Kokate, Purohit, Gokhlae. Text book of Pharmacognosy, Gokhlae (2007), 37th Edition, NiraliPrakashan, Pune, 2007
4. SH.Ansari, Essentials of Pharmacognosy, IInd edition, Birla publications, New Delhi, 2007
5. C.K. Kokate, Practical Pharmacognosy, 5th edition, VallabhPrakashan, New Delhi, 2016.
REFERENCE:
1. Handbook of Medicinal Plants Dr. Arun K. Zingare 978-93-82664-03-1, Satyam , 2014
2. Chemistry of Natural Products by K.W. Bentley
3. Practical Evaluation of Phytopharmaceuticals by K.r. Brain, T.D. Turner.
4. The Chemistry of Natural Products, Edited by R.H. Thomson, Springer International Edn. 1994.
5. Natural Products from Plants, 1st edition, by Peter B. Kaufman, CRC Press, New York, 1998
Related Online Contents:
1. https://www.kngac.ac.in/elearning-portal/ec/admin/contents/2_18KP3BELB3_2020101608341246.pdf
2. https://www.mdpi.com/2223-7747/6/4/42/pdf
3. https://www.scielo.br/pdf/cta/v37n3/0101-2061-cta-1678-457X23516.pdf

Mapping with programme outcomes					
C0s	P01	P02	P03	P04	P05
C01	S	M	S	S	M
C02	M	S	M	S	S
C03	S	S	S	M	S
C04	S	S	S	S	S
C05	S	M	S	S	M

*S- STRONG, M- MEDIUM, L- LOW

SEMESTER - IV

Course Code: 21PBT10	CORE COURSE - X
PLANT PHYSIOLOGY, BIOCHEMISTRY AND BIOPHYSICS	Syllabus version: 2020 – 2021

Course Objectives:

1. To gain knowledge about recent advance in the field of plant physiology.
2. To elucidate the interrelationships of the various pathways.
3. To know about the recent trends in the plant biochemistry.

Course outcomes:

1. Understanding the various functions of plants.
2. Gaining knowledge about the various aspects of physiological processes in plants
3. Gaining knowledge on biochemical and metabolic aspects of plants.
4. Imparting kknowledge on the basic structure and function of biochemical compounds
5. Getting understanding the metabolic processes in plants.

UNIT –I PLANTS AND WATER RELATIONSHIP

Movement of materials into and out of the cells - Diffusion, Osmosis. Absorption- Definition, mechanism- active absorption and passive absorption. Transpiration -Classification, mechanism of stomatal opening (theories) significance of transpiration, Guttation. Ascent of Sap - definition, path of ascent of sap, Mechanism of Vital and Physical force theories.

UNIT - II MANUFACTURING AND UTILIZATION OF ENERGY

Photosynthesis- Significance- Red drop- Emerson's enhancement Effect. Mechanism - Pigment system I and II, Dark reaction or Calvin cycle (C₃ Pathway), C₄ Pathway, CAM Pathways. Respiration -Introduction, mechanism, Glycolysis (EMP Pathway) Fermentation, Aerobic oxidation of Pyruvic acid or Krebs's cycle – Significance. Photorespiration and Respiratory quotient.

UNIT - III ACTION OF MINERALS, ENZYMES AND GROWTH HORMONES

Mineral Nutrition: Essential elements (macro and micronutrients) and their role in plant metabolism, deficiency symptoms. –Methods of mineral ion uptake - Enzymes: General characteristics, mechanism of enzyme action and factors regulating enzyme action. Growth and development: definition, phases and kinetics of growth - Physiological effects of phytohormones - Auxins, Gibberellins, Cytokinin and Ethylene. photoperiodism and vernalistion. Seed dormancy.

UNIT– IV BIOMOLECULES AND METABOLISM OF CARBOHYDRATES

Atomicstructure;chemicalbonds

Ionicbond,covalentbond,coordinationbond,hydrogenbond;Radioactivity; Hydrogen ion concentration (pH), buffers.Biomolecules: Introduction, Classification of carbohydrates- Monosaccharides – chemistry, isomerism, ring structure. Disaccharides – classification and

chemistry. Polysaccharides – classification and chemistry, significance of carbohydrates and metabolism of carbohydrates.

UNIT - V PROTEIN AND LIPID METABOLISM AND BIOENERGETICS

Protein: Structure (primary, secondary, tertiary and quaternary) and properties, synthesis (transcription and translation). Biomolecules: Lipids – Structure of fatty acids and glycerol – phospholipids, glycolipids, steroids – Biosynthesis and Oxidation of fatty acid - Glyoxylate pathway – Gluconeogenesis. light – dual nature of light- laws of thermodynamics- bioenergetics and ATP.

Text Books:
1. Pandey, S.N. & Sinha, 2010, Plant Physiology, Vikas Publishing, New Delhi.
Reference:
1. Noggle, G.R. and Fritz, G.J. 2001, Introductory Plant Physiology, Prentice Hall, India.
2. Devlin, R.M., 2000, Plant Physiology, Affiliated East West Press Pvt. Ltd.
3. Epstein, E., 2000, Mineral Nutrition in Plants-Principles and Perspectives, Wiley.
4. Lincoln, T and Zeiger, Plant Physiology. 2010 www.plantphys.net .
5. Buchanan, B.B. Grissem, W. and Jones, R.L. 2004. Biochemistry and Molecular Biology of plants. I.K. International PVT., New Delhi.
Related Online Contents:
1. www.divbiolchem.org
2. www.ercenzymes.com
3. http://rastogipublications.com/index.php?route=product/product&product_id=113&search=plant+physiology
4. https://www.schandpublishing.com/books/higher-education/biology/fundamentals-plant-physiology/9789352533343/#.W0LymtIzbiU

Mapping with programme outcomes					
COs	PO1	PO2	PO3	PO4	PO5
C01	S	S	S	S	S
C02	S	S	S	M	S
C03	S	S	M	S	M
C04	M	M	S	S	S
C05	s	M	S	S	S

*S- STRONG, M- MEDIUM, L- LOW

SEMESTER - IV

Course Code: 21PBT11	CORE COURSE - XI
BIOTECHNOLOGY, BIOINFORMATICS AND GENETIC ENGINEERING	Syllabus version: 2020 – 2021

Course Objectives:

1. To know the art of recombining genes and traits.
2. To develop the skills in handling genetic material.
3. To apply genetic concepts into manipulating living things for human welfare.
4. Understanding the revolutions that unfold in biotechnology

Course outcomes:

1. Students learnt the techniques in biotechnology and plant tissue culture.
2. Students understood the process of somatic embryogenesis
3. They knew about the application of tissue culture in forestry, horticulture, agriculture and pharmaceutical industry.
4. They had the ability to explain the main techniques of in vitro culture of plant cells & tissues.
5. Students knew the patenting procedures for patenting biological products.

UNIT - I BASIC MOLECULAR BIOLOGY

The flow of genetic information - The structure of DNA and RNA, Gene organization-Gene structure in prokaryotes and Eukaryotes, Gene expression. Working with nucleic acids- Isolation of DNA and RNA, Quantification of nucleic acids, Radiolabeling of nucleic acids- End labeling, Nick translation, Labelling by primer extension, Nucleic acid Hybridization- Gel electrophoresis (AGE).

UNIT- II ENZYMES AND VECTORS IN GENETIC ENGINEERING

The tools of the trade- Restriction enzymes-cutting DNA, Type II restriction endonuclease, Use of restriction endonuclease, Restriction mapping , DNA modifying enzymes- Nuclease, polymerase, Enzymes that modify the ends of DNA molecules, DNA ligase-joining DNA molecules. Host cell types- Prokaryotic and Eukaryotic hosts, Gene cloning vectors- Plasmids,PUC118 and PUC119.use in *E.coli*- Bacteriophage, λ phage, M13, Vectors-Hybrid plasmid phage vectors, Cosmid, Plant cell vector Ti Plasmid, Shuttle vector, Expression vector, Vectors for use in eukaryotic cells. Getting DNA into cells- Transformation and transfection, packaging DNA *in vitro*, Alternative DNA delivery systems.

UNIT - III CLONING STRATEGIES AND BIOINFORMATICS

Cloning from mRNA-Synthesis of cDNA, Cloning cDNA in plasmid vectors, Cloning cDNA in bacteriophage vectors. Cloning from Genomic DNA- Genomic libraries, Preparation of DNA fragments for cloning, Ligation, packaging and amplification of libraries. Expression of cloned cDNA molecules, Cloning large DNA fragments in YAC vectors, The polymerase chain reaction (PCR). Introduction to bioinformatics: Biological Database – Protein and DNA sequence data base, Structure database, literature database, (PubMed, NCBI, Medline). Sequence Alignment, Database similarity searching; FASTA; BLAST, Proteomics – protein structure prediction (primary, secondary & tertiary), Human Genome Project.

UNIT - IV SELECTION, SCREENING AND ANALYSIS OF RECOMBINANTS

Genetic selection and screening methods- The use of chromogenic substrates, Insertional inactivation, Complementation of defined mutations, Other genetic selection methods- Screening using nucleic acid hybridization- Nucleic acid probes, screening clone banks, Immunological screened for expressed genes-Analysis of cloned genes- Characterization based on mRNA translation *in-vitro*, Restriction mapping, Blotting techniques and Types, DNA sequencing. Specific gene transfer-Sexual-Gene transfer using pollen or pollen tube, Dry seeds, embryos, Cells in DNA tissue- Asexual methods-Non specific and specific gene transfer, *Agrobacterium* mediated gene transfer, Lipofection, Microinjection, Bombardment, Electroporation.

UNIT - V APPLICATION OF GENETIC ENGINEERING

Transgenic plants –plant cells, Making transgenic plants, Engineered resistance against Herbicide, viral and fungal pathogen, Genetic engineering in plant lipids and storage proteins, Genetic engineering for nitrogen fixation, Transfer of Nod genes to increase host range- Spin off technologies- Recombinant DNA technology and medicine, The human genome project. Miscellaneous applications- Commercial applications, Transgenic mosquitoes as vaccinators, Gene replacement therapy, Whole animal transformation, Gene therapy for melanoma, Anti-sense DNA therapy for asthma, cancer. Control of environmental pollution.

Text Books:
1. Old RN and Primrose S B. 2004, Principles of gene manipulation - Blackwell
2. Sci., USA.
3. Watson JD et al., 2005. Recombinant DNA. Blackwell Science Publ. USA.
Reference:
1. Adrian Slater et. al., 2003, Plant Biotechnology, Oxford University press, U.K.
2. Glick BJ & Pasternack JJ. 2004. Molecular biotechnology. Panima Publ. Bangalore.
3. European Commission Report of a NEST High-Level Expert Group, 2005. Synthetic Biology: Applying Engineering to Biology.
4. Presidential Commission for the Study of Bioethical Issues, 2010. (www.bioethics.gov)

5. ETC Group, Canada, 2010. Extreme Genetic Engg - an introduction to synthetic biology.
6. Young, E and Alper, H, 2010. Synthetic Biology: A Review. J Biomedicine and Biotechnology.
7. Benner SA. & Sismour AM, 2005. Synthetic Biology, Nature Reviews, Genetics, 6: 533.
8. Friefelderd 2005. Molecular biology. second edition. Narosapub. House

E. Books:

1. https://www.schandpublishing.com/books/higher-education/biology/a-textbook-biotechnology/9788121926089/
2. http://rastogipublications.com/index.php?route=product/product&product_id=57&search=biotechnology

Mapping with programme outcomes

COs	P01	P02	P03	P04	P05
C01	S	S	S	S	S
C02	S	S	M	S	M
C03	S	S	S	S	M
C04	S	S	S	M	S
C05	S	M	S	S	S

*S- STRONG, M- MEDIUM, L- LOW

SEMESTER - IV

Course Code: 21PBT12	CORE COURSE - XII
TECHNIQUES IN BOTANY AND BIostatISTICS	Syllabus version: 2020 – 2021

Course Objectives:

1. To acquire the knowledge on various microscopes.
2. To understand the various separation techniques and spectroscopies
3. To test the significance, validity and reliability of the research.

Course outcomes:

1. Students should have a good understanding of the scientific method of handling various microscopes and instruments.
2. They should be details oriented in their work, have good interpersonal skills and mental stamina to work long hours.
3. Other essential skills are computer skills and to keep up with new findings in plant science through biostatistics.
4. Gaining knowledge on the various separation techniques and spectroscopies
5. Getting familiar on application of statistical tools in research work.

UNIT –MICROSCOPY

Introduction, principles and properties of light and laser light; polarization of light, magnification, resolving power-numerical aperture; polarized and lambda filters. Principles and working of: Phase contrast microscopy, dark field microscopy, Bright field microscopy, Fluorescent microscopy; Confocal Raman microscopy, Atomic Force Microscopy and Electron microscopy (TEM & SEM).

UNIT – II SEPARATION TECHNIQUE

Centrifugation – Principles, types, and theory of centrifugation; Chromatography – introduction, principle, types of chromatography – paper chromatography, thin layer chromatography, HPTLC, column chromatography – HPLC, gas chromatography. Electrophoresis – Introduction, principle, buffers, detection and assay, recording and storage, safety and applications, factors affecting electrophoresis; types of electrophoresis – moving boundary electrophoresis, paper electrophoresis, gel electrophoresis – polyacrylamide gel electrophoresis (PAGE), agarose electrophoresis; isoelectric focusing gel electrophoresis, immune electrophoresis, denaturing gradient electrophoresis, temperature gradient electrophoresis, capillary electrophoresis.

UNIT - III SPECTROSCOPIC AND RADIOCHEMICAL TECHNIQUES

Introduction, Principle of Spectroscopy – visible and UV; Atomic absorption spectroscopy. Introduction to Radioactivity, Units of radioactivity, Stable and radioactive isotopes, half-life of radioisotopes, Specific

activity, Isotopic dilution techniques, theory and construction of GM Counter, Liquid and Scintillation counter, autoradiography and applications of tracer techniques. Gene isolation and characterization through PCR, Microarrays, DNA based molecular markers - RAPD, AFLP, RFLP.

UNIT-IV TECHNIQUES IN SAMPLING OF DATA

Sampling techniques: sampling theory - types of sampling - steps in sampling - sampling and non-sampling error - sample size - advantages and limitations of sampling. Collection of data: primary data - meaning - data collection methods - secondary data - meaning - relevances, limitations and cautions.

UNIT-V METHODS IN STATISTICS

Statistics in research - measure of central tendency - dispersion - skewness and kurtosis in research. Hypothesis - fundamentals of hypothesis testing - standard error - point and interval estimates. Simple correlation, correlation coefficient, regression, simple linear regression, Positive and negative correlation and regression, basic ideas of significance test, hypothesis testing, level of significance, t-test, 'chi' square, ANOVA.

Text Books:
1. Kothari, C.R. 2000. Research Methodology - Methods & Techniques. Wishwa Prakashan.
2. Misra, R.P, 2000 Research Methodology - a handbook, Concept Publ g Company, New Delhi.
3. Pillai and Bagavathi, 2008 Statistics, S.Chand & Company Ltd, New Delhi
4. Nageswara Rao, G. 1983. Statistics for Agricultural Science Oxford & IBH, New Delhi
5. Gupta, S.C, 2013. Fundamentals of statistics, Himalaya Publishers, Mumbai.
Reference:
1. Hawkins, C and Sorgi, M. 2000 Research, Narosa Publishing House, New Delhi.
2. Daniel, W.W., 1983, Biostatistics; A Foundation for Analysis in the Health Science, John Wiley and Sons Inc., New York.
Related Online Contents:
1. https://www.schandpublishing.com/books/higher-education/sciences/bioinformatics-genomics-proteomics/9789325978553/#.W0L0qdIzbiU
2. https://www.schandpublishing.com/books/higher-education/biology/introduction-biostatistics-a-textbook-biometry/9788121923293/#.W0L06NizbiU

Mapping with programme outcomes					
C0s	P01	P02	P03	P04	P05
C01	S	S	S	S	S
C02	S	S	M	S	M
C03	S	S	S	S	M
C04	S	S	S	M	S
C05	s	M	S	S	S

*S- STRONG, M- MEDIUM, L- LOW

SEMESTER - III & IV

Course Code: 21PBT13P	CORE COURSE XIII - PRACTICAL - III
CELL AND MOLECULAR BIOLOGY, GENETICS AND PLANT BREEDING, GENERAL MICROBIOLOGY, PLANT PHYSIOLOGY, BIOCHEMISTRY AND BIOPHYSICS, BIOTECHNOLOGY, BIOINFORMATICS AND GENETIC ENGINEERING AND TECHNIQUES IN BOTANY AND BIOSTATISTICS	Syllabus version: 2020 – 2021

Course Objectives:

1. To train on handling of laboratory equipment and analytical work.
2. To isolate and study the genomic DNA.
3. To understand the medallion genetics through solving genetic problems.
4. To know the methods to study the Microbiology, Biotechnology and Plant Physiology.

Course outcomes:

1. Experiencing in handling laboratory equipment and apparatus.
2. Imparting knowledge on isolation and identification Microorganisms.
3. Acquiring knowledge on practical demonstration of plant physiological activity.
4. Deep Understanding different method of plant breeding.
5. Acquiring knowledge on biotechnology tools in studying pant species.

MOLECULAR BIOLOGY:

- Isolation of Plasmid DNA from bacteria.
- Isolation of Genomic DNA.
- Estimation of DNA and RNA by Spectrophotometric method.

GENETICS: Working out the problems in genetics and drawing of genetic charts.

PLANT BREEDING:

- Charts depicting mass selection, pure line selection, backcross breeding and double cross in Maize
- Study of different kinds of plant propagation

MICROBIOLOGY:

- Preparation of medium – bacteria-nutrient agar, fungi - pda medium.
- Isolation of microbes by serial dilution techniques
- Isolation of fungi and bacteria from air and soil
- Isolation of fungi and bacteria from sewage water.
- Preparation of spread plate, streak plate (simple and quadrant) and pour plate.

- Effect of different antibiotic sensitivity, pH and Temperature on bacterial growth.

PLANT PHYSIOLOGY :

- Determination of water potential in different tissues.
- Effect of temperature on the membrane permeability.
- Determination of stomatal frequency.
- Determination of rate of transpiration by ganong'spotometer.
- Determination of respiratory quotient using ganong'srespirometer.
- Determination of evolution o₂ during photosynthesis.
- Determination of chlorophyll-a, chlorophyll-b and total chlorophyll by the Arnon's method.
- Determination of carotenoids.
- Estimation of total phenols.
- Separation of pigments by paper chromatography

BIOCHEMISTRY:

- Estimation of Protein (Lowry's method), Estimation of Amino acids, Estimation of Starch, Estimation of Total lipid, Estimation of Amylase, Estimation of Protease.

PLANT BIOTECHNOLOGY AND GENETIC ENGINEERING

- Isolation of genomic DNA from plants and bacterial sources - Demonstration
- Isolation of plasmid DNA from *E. coli* - Demonstration

BIOINFORMATICS

- NCBI
- MIPS – SWISS PROT

BIOSTATISTICS

- Calculation as per syllabus

**Visit and enhance current techniques in biological institutes
available in south India**

Mapping with programme outcomes					
COs	PO1	PO2	PO3	PO4	PO5
C01	S	S	S	M	S
C02	M	S	S	S	M
C03	S	S	M	S	S
C04	S	S	S	S	S
C05	S	S	S	S	M

*S- STRONG, M- MEDIUM, L- LOW

SEMESTER - IV

Course Code: 21PBT14	PW1 - PROJECT
DISSERTATION AND VIVA- VOCE	Syllabus version: 2020 – 2021

Course Objectives:

1. To familiarize with basic of research and the research process.
2. To enable in conducting research work and formulating research synopsis and report.
3. To familiarize with Statistical packages such as SPSS/EXCEL
4. To impart knowledge for enabling students to develop data analytics skills and meaningful interpretation to the data sets so as to solve the business/Research problem

Course outcomes:

1. The aim of the course is to provide participants with an introduction to research methods and report writing
2. Develop understanding on various kinds of research, objectives of doing research, research process research designs and sampling.
3. Have basic knowledge on qualitative research techniques
4. Have adequate knowledge on measurement and scaling techniques as well as the quantitative data analysis.
5. Have basic awareness of data analysis-and hypothesis testing procedures.

Each candidate should take up a Project Work; submit Project Report at the end of the second year. The candidate concerned will have to defend his project work in an open Viva- Voce examination.

Mapping with programme outcomes

COs	P01	P02	P03	P04	P05
C01	S	S	S	S	S
C02	S	M	S	S	S
C03	S	S	M	S	S
C04	S	M	S	S	M
C05	M	S	S	M	S

*S- STRONG, M- MEDIUM, L- LOW