VIKRAMA SIMHAPURI UNIVERSITY::NELLORE
DEPARTMENT OF BOTANY

Syllabus for M.Sc. Botany (2 Year Course) for V.S. University College, Kavali and Affiliated Colleges under the jurisdiction of Vikrama Simhapuri University, Nellore with effect from the Academic Year – 2020-2021

Vision

- To improve internationally recognized status of the Department through excellence in higher education and application-oriented basic research in the field of plant science.
- To perceive and disseminate the importance of plant diversity, its conservation and sustainableutilization.
- To inspire intellectual pursuit and experimental skills through innovative teaching and researchin basic processes of Plant life.

Mission

- Development of advanced infrastructural and technological facilities to strengthen quality education and research,
- To promote and foster collaborative research with scientific institutes and industry forenhanced scientific thinking and generating new ideas.
- To expand academic activity by offering new multidisciplinary courses and updating programsto suit to a wider spectrum of students and researchers.

Programme Structure with Course titles:

S. No.	Course code	Course/Subject	No. of credits	Internal Marks	External Marks	Total
SEMESTER - I						
1	20RMSCBOT101	Microbiology, Mycology and Plant Pathology	4	30	70	100
2	20RMSCBOT102	Biology and Diversity of Algae, Bryophytes and Pteridophytes	4	30	70	100
3	20RMSCBOT103	Biology and Diversity of Gymnosperms and Ethnobotany	4	30	70	100
4	20RMSCBOT104	Taxonomy ofAngiosperms	4	30	70	100

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5	20RMSCBOT105P	Practical: TheoryPapers BOT 101 & 102	4	-	100	100
6	20RMSCBOT106P	Practical: TheoryPapers BOT 103 & 104	4	-	100	100
SEMESTER - II						
1	20RMSCBOT201	Techniques in CellBiology and Cytology	4	30	70	100
2	20RMSCBOT202	Genetics	4	30	70	100
3	20RMSCBOT203	Molecular Biology of Plants	4	30	70	100
4	20RMSCBOT204	Plant Development	4	30	70	100
5	20RMSCBOT205P	Practical: TheoryPapers BOT 201 & 202	4	-	100	100
6	20RMSCBOT206P	Practical: TheoryPapers BOT 203 & 204	4	-	100	100
SEMESTER - III						
1	20RMSCBOT301	Plant Physiology and Metabolism	4	30	70	100
2	20RMSCBOT302	Plant Reproduction	4	30	70	100
3	20RMSCBOT303 & 304 (A)	Plant Ecology	4	30	70	100
4	20RMSCBOT303 & 304 (B)	Biodiversity and Conservation	4	30	70	100
5	20RMSCBOT303 & 304 (C)	Plant Resource Utilization	4	30	70	100
6	20RMSCBOT305	Practical: TheoryPapers BOT 301 & 302	4	-	100	100
7	20RMSCBOT306	Practical: TheoryPapers BOT 303 & 304 (A/B/C)	4	-	100	100
8	20RMSCBOT307	***External Elective:*** Marine Plant Resources	4	-	100	100

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SEMESTER - IV						
1	20RMSCBOT401	Plant Cell and Tissue Culture	4	30	70	100
2	20RMSCBOT402	Plant Genetic Engineering andGenomics	4	30	70	100
3	20RMSCBOT403 & 404 (A)	Molecular PlantPhysiology	4	30	70	100
4	20RMSCBOT403 & 404 (B)	Phytomedicine	4	30	70	100
5	20RMSCBOT403 & 404 (C)	Applied Plant Pathology	4	30	70	100
6	20RMSCBOT405	Practical: TheoryPapers BOT 401 & 402	4	-	100	100
7	20RMSCBOT406	Practical: TheoryPapers BOT 403 & 404 (A/B/C)	4	-	100	100
8	20RMSCBOT407	*External Elective:* Organic Farming	4	-	100	100

Programme Educational Objectives:

1. M.Sc. Botany program is designed with an objective to encourage and support the growing demands and challenging trends in the educational scenario. Our training focuses on the all-round development of the students to face the competitive World.
2. Understand the scope and significance of the discipline.
3. Imbibe love and curiosity towards nature through the living plants.
4. To consider knowledge of Science as the basic unbias of education.
5. In order to make students open-minded and curious, we try our best to enhance and develop a scientific attitude.
6. We make the students fit for the society by enabling them to work hard.
7. Make the students exposed to the diverse life forms.
8. Make them skilled in practical work, experiments, laboratory equipment and to interpret correctly on biological materials and data.

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9. Develop interest in Biological research.
10. Encourage the students to do research in related disciplines.
11. Develop a thirst to preserve the natural resources and environment.
12. Develop the ability for the application of acquired knowledge in various fields of life so as to make our country self-sufficient.
13. Appreciate and apply ethical principles to biological science research and studies.

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PROGRAMME OUTCOMES: At the end of the program, the student will be able to:

PO1	Use of principles of basic science and fundamental process to study and analyze the plant forms.
PO2	Identify, formulate, and analyze advanced scientific problems reaching substantiated Conclusions using plant science principles.
PO3	Formulate new concepts for a green world, sustainable development, betterment of human health, specifically from medicinal plants, new formulation of phytochemical contents to meet specific need & eco-friendly environment.
PO4	Use research-based knowledge and methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Create, select, and apply appropriate techniques, resources, and modern scientific Tools to biological problems with an understanding of the limitations.
PO6	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues, and the consequent responsibilities relevant to the Professional scientific practice.
PO7	Understand the impact of the scientific solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Apply ethical principles and commit to the norms of scientific practice.
PO9	Work with responsibility as a member or leader in team works
PO10	Communicate effectively the scientific temperament for the betterment of the society, propagate effective reports, proper documentation, and presentation.

PROGRAM SPECIFIC OUTCOMES: At the end of the program, the student will be able to:

PSO1	Acquire the fundamental and advance concepts of different branches of Botany.
PSO2	Perform and design experiments in the areas of Microbiology, Cryptogams, Phanerogams, Techniques related to Cytology, Molecular biology, Genetics, Physiology, Anatomy and Embryology, Ecology, Conservation, Plant biotechnology, Phytomedicine.
PSO3	Apply the concepts of Botany in Research and Development, Academia, Industry, Entrepreneurship in the plant field.

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PROGRAMME	**M.Sc. Botany**	**SEMESTER**	I
COURSE CODE & TITLE	**20RMSCBOT101: MICROBIOLOGY, MYCOLOGY AND PLANT PATHOLOGY**		
NUMBER OF CREDITS	4	**HOURS/WEEK**	6
COURSE OBJECTIVES	1. To impart the knowledge on basic principles and techniques of microbiology. 2. To provide understanding on antigen-antibody interactions and scope of vaccines. 3. To give an insight on Fungal/Bacterial and Viral diseases to plants. 4. To describe the structure and isolation of different Viruses.		

UNIT	CONTENT	NO. OF HOURS
I	Viruses: General characters and Classification of viruses, Ultra structure of viruses, Isolation and Purification of Viruses; Chemical nature, Replication, Transmission and Economic importance of viruses. Phytoplasmas: General characteristics and role in causing plant diseases. Principles of Immunology: Antigen, Antibody interactions.	15
II	Bacteria: Archaea; Eubacteria: general account, Ultra structure, Nutrition and Reproduction. Biology and economic importance of Cyanobacteria – Salient features and biological importance.	15
III	Mycology: General characters of fungi, Cell ultra structure, Unicelluar and Multicelluar organization. Cell wall composition, Nutrition (Saprobic, Biotrophic and Symbiotic): Reproduction, (Vegetative, Asexual, and Sexual): Heterothallism: Heterokaryosis and Para sexuality. Classification of Fungi: Recent trends in Classification Phylogency of Fungi; General account of Myxomycota; Eumycota; General account of Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, and Deuteromycotina. Fungi in industry, Medicine and as Food.Fungal diseases in plants and humans. Mycorrihizae, Fungi as biocontrol agents.	15
IV	General principles of plant pathology: Infection, disease development symptomatology and Epidemiology of plant diseases incited by fungi, Bacteria, Viruses, Viroids and Phytoplasmas. Principles of plant disease control.	15

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REFERENCES

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2. Mandahar, C.L. 1978. Introduction to Plant viruses. Chand & Co., Ltd., Delhi.
3. Mehrotra, R.S. and Aneja, K.R. 1998. An introduction to mycology. New AgeInternation alPress.
4. Mehrotra, R.S. 1980. Plant Pathology. Tata Mcgraw hill, India.
5. Rangaswamy, G. and Madhaven, A. 1999. Diseases of Crop Plants in India (4th Ed.) Prentice hall of India Pvt. Ltd., NewDelhi.
6. Sharma, P.D. 2000. Plant Pathology. Narosa Publishing House,India.
7. Susila, S.B. and Shantharam, S. 2000. General Microbiology. Oxford & IBH Publ., New Delhi.
8. Webster, J 1985. Introduction to Fungi. Cambridge Univ.Press.

COURSE OUTCOME

On the successful completion of course students will be able to		Knowledge
CO1	Understand and Develop the skill of isolation and identification of Pathogenic and Non-Pathogenic microorganisms.	K1, K2, K3
CO2	To prepare different media for cultivation of industrially important microorganisms.	K1, K2, K3
CO3	Equip themselves with the methods to control Plant Pathogens.	K1, K2, K4
CO4	Understanding Plant diseases and Ag-Ab mechanism.	K2, K3, K4

COs – POs MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	2	2	2	-	2	3	2	2
CO2	3	2	1	-	2	2	2	2	-	2	2	3	2
CO3	3	2	-	-	2	2	2	-	2	2	2	3	2
CO4	3	2	2	-	2	2	2	-	2	2	2	2	2

Low:1, Medium:2, High:3

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PROGRAMME	M.Sc. Botany	**SEMESTER**	I
COURSE CODE & TITLE	**20RMSCBOT102: BIOLOGY AND DIVERISTY OF ALGAE, BRYOPHYTES AND PTERIDOPHYTES**		
NUMBER OF CREDITS	4	**HOURS/WEEK**	6
COURSE OBJECTIVES	1. To create awareness on classification and description of lower plants. 2. To create the knowledge about lower plants and their utilization in different methods. 3. Economic importance of lower plants. 4. To provide basic distribution pattern and structural organization of lower plants.		

UNIT	CONTENT	NO. OF HOURS
I	**Phycology**: Range of Structure, interrelations in Evolution of different groups; Cyanophyceae; Chlorophyceae; Xanthophyceae; Bacillariophyceae; Phaeophyceae and Rhodophyceae.	15
II	**General account of Algae**; Algae in Diverse habitats (Terrestrial, Fresh water Marine and invertebrate Association): Thallus organization; Cell ultra structure Reproduction (Vegetative, Asexual and Sexual: Criterial for Classification of Algae; Pigments; Reserve food. Economic importance of Algae; Algal Blooms, Algal Biofertilizers, Algae as Food, Feed and Medicines; Algae in Industry; Algae as Bio-diesel. Biology and Ecological importance of Lichens.	15
III	**Bryophytes**; Origin, Distribution, Morphology, Structure, Reproduction, Evolution of Sporophyte; Life history; Classification, Fossil Bryophytes. General account of Marchantiales, Jungermaniales and Polytrichales; Economic and Ecological importance.	15
IV	**Pteridophytes:** Origin, Morphology, Anatomy and Reproduction; Classification and Evolution of Stele. Heterospory and Origin of Seed habit; Apogamy and Apospory; Ecological importance, Chemical factors controlling Gametophyte; Antheridia, Archegonia, Strobilus and Evolution of Sorus; Fossil Pteriodophytes; Introduction to psilophytopsida, Psilopsida, Lycopsida, Sphenopsida and Pteropsida.	15

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<table>
<tr><td>REFERENCES</td><td colspan="3">1. Kumar H. D. 1988. Introductory Phycology. Affiliated East-West Press Ltd., New Delhi.
2. Morries, I. 1986. An Introduction to the Algae. Cambridge University Press, U.K
3. Puri, P. 1980. Bryophytes. Atma Ram & Sons, Delhi.
4. Round, F.E.1986. The Biology of Algae, Cambridge University Press, Cambridge.
5. Sporne, K.R.1991. The Morphology of Pteridophytes, B.I. Publishing Pvt. Ltd., Bombay.
6. Stewart, W. N. and Rathwell, G. W. 1993. Paleobotany and the evolution of Plants. Cambridge University Press.</td></tr>
<tr><td rowspan="5">COURSE OUTCOME</td><td colspan="2">On the successful completion of course students will be able to</td><td>Knowledge</td></tr>
<tr><td>CO1</td><td>Recall the morphological structure, evolution and differentiate the general characters of different algal groups.</td><td>K1, K2, K4</td></tr>
<tr><td>CO2</td><td>Describe the classification, reproduction and economic importance of Algae and understand the features of Lichens.</td><td>K2, K3, K4</td></tr>
<tr><td>CO3</td><td>Explain about structure, classification, reproduction, life cycle and economic importance of Bryophytes.</td><td>K1, K2</td></tr>
<tr><td>CO4</td><td>Summarize the Structure, reproduction, life cycle, stelar evolution, fossilization and analyse geological time scale.</td><td>K1, K2, K4</td></tr>
<tr><td>COs – POs MAPPING</td><td colspan="3">
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<tr><th>CO/PO</th><th>PO1</th><th>PO2</th><th>PO3</th><th>PO4</th><th>PO5</th><th>PO6</th><th>PO7</th><th>PO8</th><th>PO9</th><th>PO10</th><th>PSO1</th><th>PSO2</th><th>PSO3</th></tr>
<tr><td>CO1</td><td>3</td><td>3</td><td>2</td><td>2</td><td>-</td><td>1</td><td>2</td><td>1</td><td>-</td><td>2</td><td>3</td><td>3</td><td>1</td></tr>
<tr><td>CO2</td><td>3</td><td>3</td><td>2</td><td>2</td><td>2</td><td>1</td><td>1</td><td>1</td><td>2</td><td>2</td><td>2</td><td>2</td><td>2</td></tr>
<tr><td>CO3</td><td>3</td><td>3</td><td>2</td><td>2</td><td>2</td><td>1</td><td>1</td><td>1</td><td>2</td><td>2</td><td>2</td><td>2</td><td>1</td></tr>
<tr><td>CO4</td><td>3</td><td>3</td><td>2</td><td>2</td><td>-</td><td>1</td><td>1</td><td>1</td><td>-</td><td>2</td><td>3</td><td>3</td><td>2</td></tr>
<tr><td colspan="14">Low:1, Medium:2, High:3</td></tr>
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PROGRAMME	M.Sc. Botany	**SEMESTER**	I
COURSE CODE & TITLE	**20RMSCBOT103: BIOLOGY AND DIVERSITY OF GYMNOSPERMS AND ETHNOBOTANY**		
NUMBER OF CREDITS	4	**HOURS/WEEK**	6
COURSE OBJECTIVES	1. To learn about living and fossil gymnosperms 2. Identify local ethnobotanically useful species; Patterns of human plant selection for food, medicine, poison, ritual and religion. 3. To understand important interactions between cultural practices, ecosystems, and modern science. 4. To develop indigenous knowledge of plants for conservation of biodiversity.		

UNIT	CONTENT	NO. OF HOURS
I	Introduction & Structure of Gymnosperms, Structure and Reproduction, Classification and Distribution of Gymnosperms.Structure and Reproduction in Cycadales, Ginkgoales, Coniferales, Ephedrales, Welwitschiales and Gnetales. Evolution of Gymnosperms.	15
II	**Fossil Gymnosperms**: Brief account of the families of Pteridospermales (Lyginopteridaceae, Medullosaceae, Caytoniaceae and Glossopteridaceae): General account of Cycadeoidalesand Cordaitales.	15
III	**Ethnobotany**: Scope and importance; Interdisciplinary approaches in Ethnobotany; Tribals of Andhra Pradesh and their traditional usage of plants in Medicine, Food and for other purposes.	15
IV	Scientific Evaluation and Significance of some important Plant species discovered and Conserved by the Tribals of India. Role of Indigenous people in Biodiversity Conservation through Faith, Tradition and Sustainable Agricultural methods. Application of Ethnobotany in Modern Medicine and Phytomedicine.	15

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2. Jain, S.K. 1968. Medicinal Plants. National Book Trust of India, New Delhi.
3. Jain S.K. 1981. Glimpses of Indian Ethnobotany, Oxford and IBH Publishing Co., New
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COURSE OUTCOME	**On the successful completion of course students will be able to**		**Knowledge**
	CO1	Recall the morphological structure, evolution and differentiate the general characters of different algal groups.	**K1, K2, K4**
	CO2	Describe the classification, reproduction and economic importance of Algae and understand the features of Lichens.	**K2, K3, K4**
	CO3	Explain about structure, classification, reproduction, life cycle and economic importance of Bryophytes.	**K1, K2**
	CO4	Summarize the Structure, reproduction, life cycle, stelar evolution, fossilization and analyse geological time scale.	**K1, K2, K4**

COs – POs MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	2	2	-	1	2	1	-	2	3	3	1
CO2	3	3	2	2	2	1	1	1	2	2	2	2	2
CO3	3	3	2	2	2	1	1	1	2	2	2	2	1
CO4	3	3	2	2	-	1	1	1	-	2	3	3	2

Low:1, Medium:2, High:3

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PROGRAMME	M.Sc. Botany	**SEMESTER**	I
COURSE CODE & TITLE	**20RMSCBOT104: TAXONOMY OF ANGIOSPERMS**		
NUMBER OF CREDITS	4	**HOURS/WEEK**	6
COURSE OBJECTIVES	1. Learn vegetative and reproductive features and terminology that are useful in the identification of flowering plants. 2. Gain ability to use published keys for the identification of flowering plants. 3. Learn to recognize some of the common and unusual families of flowering plants in Maine. 4. Understand the principles of plant taxonomy, including evolutionary trends, patterns of speciation, biogeography, Classification of organisms and floral biology.		

UNIT	CONTENT	NO. OF HOURS
I	**Systems of Angiosperm Classification**: Historical development of phonetic versus phytlogenetic systems of classification. Merits and demerits of Bentham and Hooker, Engler and Prantle, Bessey, Hutchinson, Cronquist, Thorne, Dehlgren, and APG classification systems. Herbarium Methodology.Plant identification and Taxonomic keys. Taxonomic hierarchy: The species Concept; Species, Genus, Family and other categories; Principles used in assessing relationships; Delimitations of Taxa and attribution of Rank.	15
II	**Origin of Angiosperms**: Origin and Evolution of Angiosperms. International code of Botanical nomenclature: Salient features of Binomial Nomenclature; Rules of ICBN Typification, Rule of priority, Effective and Valid publication; Author citation; Retention choice and Rejection of names, Nomennudum and Nomen- Novo.	15
III	**Evidences**: Morphology, Anatomy, Palynology, Embryology, Cytology, Phytochemistry; Genome analysis and Nucleic acid hybridization; Serological, Biochemical and Molecular techniques; Numerical Taxonomy, Computer applications, Internet.	15
IV	Study of Magnoniales, Centrospermae, Tubiflorae, Amentiferae, Helobiales and Glumiflorae.	15

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11. Pullaiah, T. 1997. Taxonomy of Angiosperms. Regency Publications, NewDelhi.
12. Rad Ford, A.E. 1986. Fundamentals of Plant Taxonomy. W. H. Freemen and Company, SanFrancisco.
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14. Stebbins, G. L. 1974. Flowering plants Evolution above the Species level. Academic Press London.

COURSE OUTCOME

	On the successful completion of course students will be able to	Knowledge
CO1	Distinguish and classify the plants based on the Morphological variation for experimental work.	K1, K2
CO2	Summarize and illustrate plant species as per the rules formulated by IUCN.	K2, K3
CO3	Describe and identify the plants for the research needs.	K2, K3, K4
CO4	Differentiate the orders and demonstrate the preparation of Herbaria for identification purpose.	K1, K3, K6

COs – POs MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	2	1	-	2	2	2	3	2	2	2	2
CO2	3	3	2	1	-	1	1	2	3	2	3	3	2
CO3	3	3	2	1	-	1	1	2	3	2	3	2	3
CO4	3	3	2	1	-	1	1	2	3	2	2	3	3

Low:1, Medium:2, High:3

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PROGRAMME	**M.Sc. Botany**	**SEMESTER**	2
COURSE CODE & TITLE	**20RMSCBOT201: TECHNIQUES IN CELL BIOLOGY AND CYTOLOGY**		
NUMBER OF CREDITS	4	**HOURS/WEEK**	6
COURSE OBJECTIVES	1. Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles 2. Students will understand how these cellular components are used to generate and utilize energy in cells 3. Students will understand the cellular components underlying mitotic cell division. 4. Students will apply their knowledge of cell biology to selected examples of changes or losses in cell function. These can include responses to environmental or physiological changes, or alterations of cell function brought about by mutation.		

UNIT	CONTENT	NO. OF HOURS
I	**Optical and Electron Microscopy:** Basic Principles, Types and Applications; Chromatography – Basic Principles, Types – paper, Thin layer and Column Chromatography techniques and their applications. Tracer Techniques: Principles and Applications of Radio isotopes in Biology.	15
II	**Spectroscopy:** Lambert and Beer's law, Absorbance and Transmittance: Extinction Co- efficient. Centrifugation – Basic principles, Types and Applications: SDS-PAGE technique.	15
III	**Structural Organization of plant cells:** Cell wall structure and Function. Plasmodesmata- Structure and Functions of plasma Membrane; Cytoskeleton and Cell mobility, stricture and Functions of Endoplasmic Reticulum, Golgi Apparatus, Lysosomes and Peroxisomes: Structural organization of Chloroplast, Mitochondraia Ribosomes.	15
IV	**Nucleus:** Interphase Nucleus, Chromatin organization, Nucleosome organization, Molecular organization of Centromore and Tolomere. Structural organization of Chromosomes. Cell Cycle and its Regulation.	15

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5. Krishnamurthy, K.V 2000. Methods in Cell Wall Cytochemistry.
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10. Rost, T,etal. 1998. Plant Biology. Wadsworth Publishing Co., California, USA.
11. Upadyaya, A., Upadyaya, K., and Nath, N. Biophysical chemistry principles and Techniques. Himalaya Publishing House, New Delhi.
12. Wolfe, S.L. 1993. Molecular and Cellular Biology. Wadsworth Publishing Co., California. USA.

COURSE OUTCOME

	On the successful completion of course students will be able to	**Knowledge**
CO1	Demonstrate and operate different instruments related to cell biology.	**K2, K3**
CO2	Know about recent advancements in cell biology research and technologies that has enabled us understanding the structure and function of the cell.	**K2, K3, K4**
CO3	Understand an overview of cell cycle; ultra- and fine-structure of difference cell organelles such as mitochondria, nucleus, chloroplast, golgi apparatus etc.	**K1, K2**
CO4	Differentiate and relate the role of each and every cell organelle of the cell.	**K1, K2**

COs – POs MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	2	2	3	-	-	1	2	2	2	3	2
CO2	3	2	2	2	3	-	-	1	2	2	3	3	2
CO3	3	2	2	2	3	-	-	1	2	2	2	2	2
CO4	3	2	2	2	3	-	-	1	2	2	2	2	3

Low:1, Medium:2, High:3

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COURSE OUTCOME

On the successful completion of course students will be able to		**Knowledge**
CO1	Demonstrate and operate different instruments related to cell biology.	**K2, K3**
CO2	Know about recent advancements in cell biology research and technologies that has enabled us understanding the structure and function of the cell.	**K2, K3, K4**
CO3	Understand an overview of cell cycle; ultra- and fine-structure of difference cell organelles such as mitochondria, nucleus, chloroplast, golgi apparatus etc.	**K1, K2**
CO4	Differentiate and relate the role of each and every cell organelle of the cell.	**K1, K2**

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CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	2	2	3	-	-	1	2	2	2	3	2
CO2	3	2	2	2	3	-	-	1	2	2	3	3	2
CO3	3	2	2	2	3	-	-	1	2	2	2	2	2
CO4	3	2	2	2	3	-	-	1	2	2	2	2	3
Low:1, Medium:2, High:3													

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PROGRAMME	M.Sc. Botany	**SEMESTER**	2
COURSE CODE & TITLE	**20RMSCBOT202: GENETICS**		
NUMBER OF CREDITS	4	**HOURS/WEEK**	6
COURSE OBJECTIVES	1. To understand Mendelian and Neo-mendelian genetics 2. To study the phenomenon of dominance, laws of segregation, independent assortment of genes. 3. To make the students to understand basis and process of inheritance of genes and their mapping in eukaryotes and microbes 4. To understand the different types of genetic interaction, incomplete dominance, codominance, inter allelic genetic interactions, multiple alleles and quantitative inheritance etc.		

UNIT	CONTENT	NO. OF HOURS
I	Eukaryotic Genetics: Mendelian Laws and Physical basis of inheritance; Multiple Alleles, Epistatic Gene interactions, Linkage and Linkage Groups, Mechanism of Crossing over, Gene Mapping. Cytoplasmic inheritance. Sex Determination Mechanisms in plants.	15
II	**Genetics of prokaryotes:** Phage phenotypes and gene mapping. Analysis of r II locus. Tranformation, Conjugation, Transduction and Gene Mapping in Bacteria. Tetrad Analysis in Fungi. **Mutations:** Gene Mutations – Types physical and Chemical Mutagens, Molecular basis of Gene Mutations. Transposable Elements in Prokaryotes and Eukaryotes, Mechanism of Transposition. Site- directed Mutagenesis.	15
III	**Structural and numerical alterations in chromosomes:** Origin Meiotic behaviour of Duplication, Deficiency, inversion and Translocation, Structural Heterozygotes. Origin, Production and Meiotic behavior of Haploids, Autopolyploids, and Allopolyploids. Genome analysis of Allopolyploids Production. Meiosis and significance of Trisomics and Monosomics.	15
IV	**Evolution and plant Breeding:** Origin of life Species Concept Mechanism of Speciation. Phyletic Gradualism, Punctuated Equilibrium, Synthetic Theory, Natural Selection and Adoptive Radiation. Hardy – Weinberg Law. **Centres of Diversity:** Origin and Evolution of Wheat & Maize. Methods of Breeding and selection of self, cross pollinated and Vegetatively Propagated Plants. Inbreeding Depression and Heterosis.	15

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3. Bumham, C.R. 1962. Discussions in Cytogenetics, Burgess Publishing Co., Minnesota, USA.
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COURSE OUTCOME

	On the successful completion of course students will be able to	**Knowledge**
CO1	Summarize the eukaryotic genetics	**K1, K2**
CO2	Predict the phenotypic classes and their ratios from monohybrid and dihybrid crosses involving dominant and recessive alleles	**K1, K2, K3**
CO3	Acquire knowledge on Structural and Numerical alterations in Chromosomes	**K1, K2**
CO4	Understand the methods of conventional and advanced breeding approaches in plant breeding programs	**K1, K2, K4**

COs – POs MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	1	1	-	2	1	1	-	2	2	2	1
CO2	3	2	1	1	-	2	1	1	-	2	3	3	2
CO3	3	2	1	1	-	2	1	1	-	2	2	2	2
CO4	3	2	1	1	-	2	1	1	-	2	3	2	3

Low:1, Medium:2, High:3

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PROGRAMME	**M.Sc. Botany**	**SEMESTER**	2
COURSE CODE & TITLE	**20RMSCBOT203: : MOLECULAR BIOLOGY OF PLANTS**		
NUMBER OF CREDITS	4	**HOURS/WEEK**	6
COURSE OBJECTIVES	1. Understanding of the relationship between structure and function of macromolecules that carry and express genetic information. 2. Examine the Organization of Genomes and Genes. 3. To study transcription and translation mechanisms in prokaryotes and eukaryotes. 4. To study the Gene Regulation and Chromatin remodeling and understand RNA interference, gene silencing and its applications.		

UNIT	CONTENT	NO. OF HOURS
I	**Structure and Replication of DNA:** Structure of DNA, Polymorphism – A B & Z DNA. Biochemical and Physical properties of DNA. DNA replication in prokaryotes and Eukaryotes. Enzymes and accessory proteins involved in replication. Q, D – loop, and rolling circle models. DNA damage and repair mechanisms.	15
II	**Organization of Genomes and Genes:** Nuclear Genome content and C – Value paradox in plants. DNA kinetics and Cot curves: Satellite DNA and Moderately Repetitive Sequences. Fine structure of Prokaryotic and Eukaryotic genes – Promoters. Types of Genes – Split gens, Housekeeping genes, Structural and Regulatory Genes. Polyproteins and Nested genes, r-RNA and –t-RNA genes. Multi gene families and Gene Amplification Organization of Chloroplast and Mitochondrial genomes Bacterial Nucleoid organization. Concept and structure of Operon.	15
III	**Gene Expression:** Principles; Transcription – RNA polymerases and plant Transcriptional Factors; Mechanism in prokaryotes and Eukaryotes. Post Transcriptional Modifications. RNA Transport and Stability. Translation : Elucidation of Genetic code. Role of rRNA and tRNA in translation. Mechanism of Translation in Prokaryotes and Eukaryotes. Post Translational Modifications and Protein Folding Protein Targeting.	15
IV	**Gene Regulation:** Principles of Regulation. Prokaryotes – Organization of Lac and Tryptophan operons; Negative and Positive Control and Attenuation mechanisms. Eukaryotes; cis-acting elements – Enhancers, Silencers, Insulators, Locus Control regions, MAR's. Transacting factors, Activators, Co-activators, Suppressors and Co-suppressors and other Regulatory proteins. DNA Methylation and Gene Regulation: Chromatin Remodeling and histone code. Environmental and Developmental gene regulation. RNAi and Gene Silencing.	15

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12. Wolfe, S.L. 1993. Molecular and Cellular Biology. Wadsworth Publishing

COURSE OUTCOME

On the successful completion of course students will be able to		**Knowledge**
CO1	Describe Nucleic acids structure and mechanism of DNA replication and estimate the nucleic acid content in plants	**K1, K2, K4**
CO2	Describe and analyze gene organization in prokaryotes and eukaryotes.	**K1, K2**
CO3	Distinguish mechanism of Transcription and Translation, and processing of gene products in Prokaryotes and Eukaryotes.	**K1, K2**
CO4	Explain the mechanisms of regulation of gene expression in Prokaryotes and Eukaryotes.	**K1, K2, K3**

COs – POs MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
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CO2	3	2	2	1	2	1	-	1	2	1	2	3	2
CO3	3	2	2	1	2	1	-	1	2	1	3	3	2
CO4	3	2	2	1	2	1	-	1	2	1	3	2	3

Low:1, Medium:2, High:3

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PROGRAMME	M.Sc. Botany	**SEMESTER**	2
COURSE CODE & TITLE	**20RMSCBOT204: PLANT DEVELOPMENT**		
NUMBER OF CREDITS	4	**HOURS/WEEK**	6
COURSE OBJECTIVES	1. To study the method of respiration in plants 2. To study HMP pathway in plants 3. To study importance of growth regulators 4. To study the fat metabolism in plants		

UNIT	CONTENT	NO. OF HOURS
I	Differentiation and Tissue Systems, Growth, Differentiation and Morphogenesis Definition of Development and Differentiation with examples. Tissue Types and Tissue systems in Plants.	15
II	**Root Growth and Development** The Root Apical Meristems: Cell division – Cell Expansion and Cell Elongation in the Root Meristem. Differentiation of the Root; Vascular tissue, Root hair formation; Lateral Root Formation Regulation of Root Growth.	15
III	**Stem Growth and Development** Organization of the shoot. Vascular tissue differentiation in the shoot apex Xylem regeneration in Stem internodes, Calli and isolated cells. Vascular Cambium and its activity. Phloem differentiation; wood development in relation to Environmental conditions Abnormal secondary growth with examples.	15
IV	**Leaf and Flower development:** Development of Leaf, Histology, Specialized cells and Tissue differentiation. Development and Anatomy of Flower including Transition to Flowering and Reproductive Shoot apex.	15

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COURSE OUTCOME

On the successful completion of course students will be able to		Knowledge
CO1	Describe the organization of shoot and root apices and development of shoot and root;	K1, K2
CO2	Describe the root apical meristem, lateral root formation and root growth regulations.	K2, K3
CO3	Differentiation of vascular tissue and wood formation	K1, K2
CO4	Describe development and differentiation of leaf, transition to flowering and flower development	K1, K2

COs – POs MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
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CO3	3	3	2	2	2	2	2	1	2	2	3	2	2
CO4	3	3	2	2	2	2	2	1	2	2	2	3	2

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PROGRAMME	M.Sc. Botany	**SEMESTER**	3
COURSE CODE & TITLE	**20RMSCBOT301: PLANT PHYSIOLOGY AND METABOLISM**		
NUMBER OF CREDITS	4	**HOURS/WEEK**	6
COURSE OBJECTIVES	1. To study the method of respiration in plants 2. To study HMP pathway in plants 3. To study importance of growth regulators 4. To study the fat metabolism in plants		

UNIT	CONTENT	NO. OF HOURS
I	Thermodynamic Concepts: Free energy, Chemical potential, Redox potential. Translocation of Water and Solutes: Plant cell water relations, Mechanism of water uptake and transport in plants; SPAC concept; Stomatal movements, Phloem transport of organic substances – Phloem loading and unloading; Passive and active solute transport; Membrane transport proteins. Fundamentals of Enzymology: General concepts, Allosteric mechanism, Mode of Enzyme action, Regulator and Active sites, Isozymes.	15
II	Photosynthesis: General concepts and historical background; Photosynthetic pigments, Photosystems and light harvesting complexes; Photo oxidation of water - Oxygen evolving complex, Water oxidation clock; Mechanisms of Photosynthetic Electron and Proton transport; Photophosphorylation – ATPase; Carbon assimilation - Calvin cycle, C4 cycle and CAM pathway; Biosynthesis of starch and sucrose.	15
III	Respiration and Lipid metabolism: Over view of plant Respiration, Glycolysis, TCA cycle, Electron transport and ATP synthesis, Pentose Phosphate Pathway. Structure and functions of Lipids, Glyoxylate cycle, Fatty acid biosynthesis; Synthesis of Membrane, Structural and storage lipids; Catabolism of lipids. Nitrogen and Sulphur metabolism: Biological Nitrogen Fixation, Mechanism of Nitrate uptake and reduction, Ammonia assimilation; Sulphate uptake and assimilation.	15
IV	Plant growth Regulators and Elicitors: Physiological effects and Mechanism of action of Auxins, Gibberellins, Cytokinins, Ethylene, Abscisic acid, Brassinosteroids, Polyamines, Jasmonic acid and Salicylic acid.	15

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COURSE OUTCOME

On the successful completion of course students will be able to		Knowledge
CO1	Define thermodynamic concept and gain knowledge about enzymology and water relations.	K1, K2
CO2	Recall and describe metabolic activities like photosynthesis,.	K1, K2, K3
CO3	Recall and describe respiration, Lipid metabolism and nitrogen metabolism	K2
CO4	Describe various plant growth regulators, elicitors and their mechanism of action.	K2, K3, K4

COs – POs MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	2	2	1	2	2	2	2	2
CO2	3	3	2	2	2	2	2	1	2	2	3	3	2
CO3	3	3	2	2	2	2	2	1	2	2	3	2	2
CO4	3	3	2	2	2	2	2	1	2	2	2	3	2

Low:1, Medium:2, High:3

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PROGRAMME	M.Sc. Botany	**SEMESTER**	3
COURSE CODE & TITLE	**20RMSCBOT302: PLANT REPRODUCTION**		
NUMBER OF CREDITS	4	**HOURS/WEEK**	6
COURSE OBJECTIVES	1. To study the method of respiration in plants 2. To study HMP pathway in plants 3. To study importance of growth regulators 4. To study the fat metabolism in plants		

UNIT	CONTENT	NO. OF HOURS
I	Introduction: History and Scope of Embryology; Reproduction: Vegetative options and Sexual reproduction; Flower development, Genes controlling Floral Organ Differentiation. Male gametophyte: Structure of anther; Microsporogenesis, Role of Tapetum; Pollen Development, Pollen Germination, Pollen tube growth and Guidance; Pollen storage; Pollen allergy; Elements of Palynology.	15
II	Female gametophyte: Ovule – Structure and development; Megasporogenesis; Development and Organization of the mature Embryo Sac; Structure of the Embryo Sac cells; Embryo Sac Haustoria. Pollination, Pollen - Pistil interaction and Fertilization: Floral characteristics, Pollination mechanisms and Vectors; Breeding Systems; Structure of the Pistil; Pollen - Stigma Interactions, Sporophytic and Gametophytic Self-Incompatibility; Double Fertilization.	15
III	Seed and Fruit Development: Endosperm Development during Early maturation and Desiccation stages; Embryogenesis – Dicot types; Monocot embryo; Polyembryony; Apomixis; Parthenocarpy. Dynamics of Fruit growth and Seed Development.	15
IV	Experimental and Applied Embryology: In vitro Pollination and Fertilization, Test tube plants; in vitro culture of Ovary, Ovule, Nucellus, Endosperm, Embryo and seed. Gametic transformations.	15

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COURSE OUTCOME

On the successful completion of course students will be able to		Knowledge
CO1	Acquire the knowledge of formation of male and flower development.	K1, K2
CO2	Acquire the knowledge of female gametophytes developments and types.	K1, K2, K3
CO3	Gain knowledge of Seed and fruit development.	K1, K2
CO4	pollination, pollen tube germination and Double fertilization and development of endosperm, embryogenesis.	K1, K2

COs – POs MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	2	2	1	2	2	2	2	2
CO2	3	3	2	2	2	2	2	1	2	2	3	3	2
CO3	3	3	2	2	2	2	2	1	2	2	3	2	2
CO4	3	3	2	2	2	2	2	1	2	2	2	3	2

Low:1, Medium:2, High:3

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PROGRAMME	M.Sc. Botany	**SEMESTER**	3
COURSE CODE & TITLE	**20RMSCBOT303 & 304 (A): PLANT ECOLOGY**		
NUMBER OF CREDITS	4	**HOURS/WEEK**	6
COURSE OBJECTIVES	1. To understand the geographical distribution of organisms. 2. To know the inter-relationship between population and communities. 3. To learn the management of natural resource and pollution. 4. To develop the concept of Pollution and its Control.		

UNIT	CONTENT	NO. OF HOURS
I	Soil, Climate and vegetation patterns: Soil profile Types, Texture, Physical and Chemical properties, Organic matter and Micro flora – Plant Association. Major Climate Zones: Concept Types of Tropical, Temperate, Alpine, Grass land, Aquatic and Desert Biomes.	15
II	Vegetation Organization and Development: Plant Succession, Concept of Community, Community Coefficient. Intra and Interspecific Association, Competition, Predation, Mutualism, Insect Plant Interaction, figs- fig wasps, Concept of Ecological Niches.	15
III	Ecosystem Dynamics: Structure and Functions, Primary Production, Energy Dynamics, Trophic Organization, Energy Flow pathways, Ecological Efficiencies, Bio-Geo chemical Cycles of C,N,P,S and H_2O.	15
IV	Air, Water, Soil, Sound, Radiation, Heavy Metals and Atomic Pollutions - Effects on Plants and Ecosystems and Control measures. Climate Change: Green House Gases and Global Warning: Ozone hole, impact on Plant and Ecosystem, Restoration.	15

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COURSE OUTCOME	**On the successful completion of course students will be able to**		**Knowledge**
	CO1	Understand the concepts of biome and their importance	**K1, K2**
	CO2	Develop concern about the environment protection and conservation.	**K1, K2**
	CO3	Evolve the relation between biotic and abiotic factors in an ecosystem.	**K1, K2, K3**
	CO4	Comprehend the factors leading to environmental degradation and their impact.	**K2, K4**
	CO5		

COs – POs MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
3	2	-	1	-	3	2	-	2	2	1	2	2	
3	2	2	1	2	3	2	-	2	2	2	3	2	
3	2	2	1	2	3	2	-	2	2	3	3	2	
3	2	2	1	2	3	2	1	2	2	3	1	1	

Low:1, Medium:2, High:3

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PROGRAMME	M.Sc. Botany	**SEMESTER**	3
COURSE CODE & TITLE	**20RMSCBOT 303 & 304 (B): BIODIVERSITY AND CONSERVATION**		
NUMBER OF CREDITS	4	**HOURS/WEEK**	6
COURSE OBJECTIVES	1. To create awareness in the biodiversity on globe. 2. To create interest in identifying the available resources in the world. 3. To inculcate interest to conserve the natural resources on the Earth. 4. To identify the endangered species in Hotspots.		

UNIT	CONTENT	NO. OF HOURS
I	**Concept and Importance of Biodiversity**: Status in India, World Centers of Primary Diversity, Types of Bio-diversity, Causes for Loss of Species and Genetic Diversity: Arborata, Palmata.	15
II	**Status and Analysis of Species Diversity**: Remote sensing – Concept, Principles, Application and Role in Study and Identification of Phyto Diversity and Natural Resources. GIS, Application of Microwaves and Radiation.	15
III	**Principles of Diversity:** Concepts of Phyto Geography, Continental drift, Plate Tectonics of World and India, Endemism, Hotspots, Species rarity and Extinction, Red Data Book, Exploration, invasions, introduction of Species, Status of Species based on IUCN.	15
IV	**Strategies for Conservation of Diversity:** In situ Conservation – Scantuaries, National Parks, Biosphere Reserves, MPCA, MPDA, Mangroves, Coral Reefs, Sacred Groves, Ex-situ Conservation – Botanical Gardens, Gene Banks, Seed Banks, Traditional Role of National and International Organizations – WWF, IPGN, LUCN, NBPGR, BSI, ICAR, CSIR, DBT, DST, NGOs.	15

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COURSE OUTCOME

On the successful completion of course students will be able to		**Knowledge**
CO1	Understand variations in living organisms	**K2**
CO2	Analyze species diversity and understand modern tools like Remote Sensing and GIS	**K2, K3, K4**
CO3	They would get awareness in endemic, threatened species and participate in protection of the Taxa	**K2, K3**
CO4	Know the causes for degradation of biodiversity and contribute to the protection of nature (Plants/Animals/Minerals/Air/Water)	**K2, K4**

COs – POs MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	1	1	1	-	1	1	-	2	1	2	2	2
CO2	3	2	2	2	2	1	1	1	2	1	3	3	3
CO3	3	2	2	1	2	1	1	1	2	1	3	2	2
CO4	3	1	1	1	-	1	1	-	2	1	2	3	2

Low:1, Medium:2, High:3

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PROGRAMME	M.Sc. Botany	**SEMESTER**	3
COURSE CODE & TITLE	**20RMSCBOT 303 & 304 (C): PLANT RESOURCE UTILIZATION**		
NUMBER OF CREDITS	4	**HOURS/WEEK**	6
COURSE OBJECTIVES	1. To understand the utilization of plants in day today life and commercial use. 2. Explain method for identification and authentication of herbal drugs; To be familiar with the modern extraction techniques, characterization and identification of the herbal drugs and phytoconstituents. 3. To acquire knowledge about non-wood forest products. 4. Acquire an understanding of the preparation of biofertilizers, biopesticides, bioinsecticides and mushroom cultivation.		

UNIT	CONTENT	NO. OF HOURS
I	**Diversity of plants:** Food Yielding Plants (Major & Minor crops-Cereals, Pulses, Oil seeds, Vegetables and Fibers); Wood and Timber Yielding plants and their utilization in day to day human life.	15
II	**Plants in Medicine:** Medicinal and Aromatic Plants (Ethno medicinal or Traditional Medicinal plants); Poisonous plants; Medicinal plants used to cure human diseases, Insect bites/ Snake bites; Veterinary diseases (Live stock); plants used in Ayurvedic; Homeopathy, Allopathy, Sidha and Unani Medicines.	15
III	**Non wood forest products :**Spices and condiments ; beverages, Sweetening's, Starch, Honey, Bio vitamins; Bamboos, Rattans, Gums, Waxes, Resins, Tannins, Dyes, Fruits, Nuts, Cork, Paper, Pulp, Rubber, Volatile oils; Petroleum substitutes.	15
IV	**Preparation and application of plants as Bio fertilizers** (N2 fixers; Jeevamrutham, Vermi compost); Bio-pesticides (For Fungal, Bacterial and viral diseases); Bio-insecticides (mosquitoes repellents; Book worms; Beatles, mushroom cultivation, plants as preservatives.	15

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COURSE OUTCOME	**On the successful completion of course students will be able to**		**Knowledge**
	CO1	Recognize useful plants to the affairs of mankind	**K1, K2**
	CO2	Identify medicinal and aromatic plants and their utility	**K1, K2**
	CO3	Demonstrate the useful plants to the local and world economy	**K2, K3**
	CO4	Formulate biofertilizers, organic compost and bioinsecticides	**K2, K3, K4**

COs – POs MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	-	-	1	-	1	1	1	2	1	1	2	2
CO2	3	-	-	1	-	1	1	1	2	1	2	2	2
CO3	3	-	-	1	2	1	1	1	2	1	2	3	3
CO4	3	-	2	2	2	1	1	1	2	1	3	3	3
Low:1, Medium:2, High:3													

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PROGRAMME	M.Sc. Botany	**SEMESTER**	3
COURSE CODE & TITLE	**20RMSCBOT 307: MARINE PLANT RESOURCES**		
NUMBER OF CREDITS	4	**HOURS/WEEK**	6
COURSE OBJECTIVES	1. To describe the common coastal habitats of marine algae and factors affecting marine life. 2. To familiarize students with the diversity of marine and estuarine microalgae, macroalgae, and submerged and emergent vascular plants, and their distribution, classification, identification, and ecology. 3. In addition, students will learn about the ecological roles of locally occurring marine and estuarine microalgae, macroalgae. 4. Acquire knowledge of economical/industrial importance of algal byproducts.		

UNIT	CONTENT	NO. OF HOURS
I	Marine plant groups and Organisms – Brief account on Marine Phytoplankton – Seaweeds, Seagrasses and Mangroves. Marine Ecology – Abiotic factors (Chemicals, Physical and Geological) – Biotic factors – floral and faunal components- Types of coasts and Estuaries – Impact of climate Change in marine ecosystem – Algal blooms – Red tide. Ecological significance of Algae (Seaweeds), Mangroves, Seagrasses and Corel reefs.	15
II	**Photosynthesis of algae (Micro and macro) in sea** – algal plastids – Photosynthetic pigments – carbon fixation – Photosynthetic rate – C3 and C4 characters in algae. Photosynthesis of mangroves – carbon fixation – Photosynthetic enzymes – accumulation of free aminoacids – photorespiration – Nutrition – Salinity regulation and Metabolism of Seaweeds and Mangroves and their methods of regeneration – Biogeochemical role of algae.	15
III	**Seaweed Polysaccharides** – Commercial and economical products of Seaweed (Agar, Algin and Carrageenan) and Low molecular weight compounds in algae – Methods of collection and preservation of Marine algae – Commercial cultivation of seaweeds (Traditional and Recent methods) – Application and uses of Seaweeds - Economic importance of seaweeds.	15
IV	Seaweed, Seagrasses, Mangroves and Coral reefs research in India and World. Marine Pollution – human Impact - Conservation strategies of Marine vegetation - Use of Remote sensing techniques in mapping of marine vegetation with GIS.	15

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COURSE OUTCOME

On the successful completion of course students will be able to		Knowledge
CO1	Compare various algal divisions	K2, K4
CO2	Distinguish structure, pigmentation, food reserves and methods of Photosynthesis and Reproduction of Algae	K1, K2
CO3	Estimate the Ecological and Economic importance of marine algae, Mangroves and other marine plants	K2, K3
CO4	Illustrate occurrence, distribution, structure and life history of Seaweed, Seagrasses, Mangroves and Coral reefs	K2, K3

COs – POs MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	1	2	-	2	1	2	2	2
CO2	3	2	2	2	1	1	2	-	2	1	3	3	2
CO3	3	2	2	1	2	1	2	-	2	1	3	3	3
CO4	3	2	2	2	2	1	2	-	2	1	2	3	3

Low:1, Medium:2, High:3

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PROGRAMME	M.Sc. Botany	**SEMESTER**	4
COURSE CODE & TITLE	**20RMSCBOT 401: PLANT CELL AND TISSUE CULTURE**		
NUMBER OF CREDITS	4	**HOURS/WEEK**	6
COURSE OBJECTIVES	1. Understanding of Principles and Techniques of Plant Tissue Culture. 2. Know the concept and importance of genetically modified crops. 3. Understand the molecular mechanism of r-DNA technology. 4. To develop the skill on Cell Culture Technique.		

UNIT	CONTENT	NO. OF HOURS
I	**Plant Cell and Tissue Culture:** General introduction, history, scope, Concept of Cellular Toti potency and Differentiation. Organization of Tissue culture laboratories. Principles of sterilization. Types, Composition & preparation of nutrient media. Role of Plant Growth regulators and factors governing *in vitro* behaviour of cultures.	15
II	**Organogenesis** & indirect. Modes, Stages and Application of Micropropagation. Production of Pathogen free plan, **Propagation and Embryogenesis**: Fundamental aspects of Morphogenesis. Organogenesis-direct ts and their application. Clonal purity, origin and application of Somaclonal variation. Somatic embryogenesis, role of physical and chemical factors in the induction; Synthetic seeds-production and uses.	15
III	Applications of Plant Tissue Culture: Production of Haploids and its significance in Crop improvement. Secondary metabolite production through Cell and Organ cultures–Hairy roots. Shikonin production. Cryopreservation, methods and in vitro conservation of Germplasm.	15
IV	**Somatic hybridization**: Protoplast isolation, Fusion and culture, Hybrid selection and Characterization of hybrids. Symmetric and Asymmetric hybrids, Cybrids, Significance, Achievements and limitations of Protoplast research.	15

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COURSE OUTCOME

On the successful completion of course students will be able to		**Knowledge**
CO1	Develop skill to produce tissue culture plants of economic importance	**K2, K3**
CO2	Describe the production of transgenic plants	**K2**
CO3	Perform the molecular technique for Crop improvement	**K2, K3**
CO4	Design Cell Culture systems for production of Secondary Metabolites	**K1, K2**

COs – POs MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	1	2	1	-	1	-	-	-	1	2	3
CO2	3	3	3	2	3	2	1	1	2	1	2	2	2
CO3	3	3	3	2	3	2	1	1	2	1	3	3	3
CO4	3	2	3	2	3	1	1	1	2	1	3	3	3

Low:1, Medium:2, High:3

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PROGRAMME	M.Sc. Botany	**SEMESTER**	4
COURSE CODE & TITLE	**20RMSCBOT 402: PLANT GENETIC ENGINEERING AND GENOMICS**		
NUMBER OF CREDITS	4	**HOURS/WEEK**	6
COURSE OBJECTIVES	1. Basic principles and modern age applications of recombinant DNA technology and proteomics. 2. Learning molecular and technical skills along with applications of the instrumentation. 3. Designing/conducting experiments and analyzing experimental data. 4. Ethics of Recombinant DNA Technology and proteomics.		

UNIT	CONTENT	NO. OF HOURS
I	Genetic Engineering History Basic concepts and scope Principles of Gene Cloning and Analysis : DNA isolation, Chemical synthesis, use of Restriction Endonucleases, DNA and Modifying enzymes, Homo Polymers, Linkers and Adaptors used in Genetic Engineering. Cloning vectors – Plasmids, Phages, Cosmids, Phagemids, YAC's and BAC's. Host systems Bacterial transformation and Transfection. Selectable markers and Reporter Genes. Genomic DNA and DNA Libraries. Nucleic acid probes. Colony and Plaque hybridization. Dot Blotting, Southern, Northern, Western blotting. Analysis of cloned gene products.	15
II	**Genetic Engineering of Plants**: Aims and strategies, Plant Gene isolation – Transposon & T – DNA tagging and map based cloning. Ti and Ri plasmids – mechanism of T – DNA transfer, Viral and other vectors. Physical methods of gene transfer. PEG mediated gene transfer, Electroporation, Biolistics, Microinjection and other techniques. Chloroplast transformation, Gene targeting. Optimization of transgene expression. Stable and transient gene expression, Regulations of Release and concerns of Genetically Modified Crops: intellectual Property Rights.	15
III	**Applications of Transgenics:** Engineering herbicide resistance, Disease resistance, Pest and Nematode resistance, Salinity and Drought tolerance. Improving nutritive value of seed proteins, Golden Rice, Seed oil quality. Engineering biosynthesis of Flavonoids, Floral pigments, Biopharmaceuticals. Enzymes, Hormones, Edible vaccines, Plant bodies and Biodegradable plastics. Symbiotic and Non- symbiotic Nitrogen fixation, *nif* genes and engineering.	15
IV	**Structural and functional Genomics**: PCR variation and significance. DNA marker systems-RFLP, RAPD, AFLP, SSR & SNP's, Molecular Genetic maps and physical maps. DNA sequencing, DNA databases. Genome and Gene Annotation. Bioinformatics Tools for Gene identification and Function. Rice and Arabidopsis Genome Projects. DNA Micro arrays and SAGE – functional analysis. Proteome Analysis – 2D Electrophoresis, Mass Spectrophotometry and Sequencing. Yeast two hybrid and phage display – protein interaction studies, Phylogenetic trees.	15

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REFERENCES

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9. Bioinformatics:APracticalguidetotheanalysisofgenesandproteins1998,EditedbyD. Baxevanis and B.F.
10. Computer Applications in Biotechnology, 1998, by T.Yosida
11. Aurther, M. Lesk. 2002. Introduction to Bioinformatics. Oxford University Press,USA.
12. Durbin, R. Eddy S. R. Krogh, A., Mitchison, G. 1998. Biological Sequence Analysis: Probabilistic models of Proteins and Nucleic acids. AmazonPublications.

COURSE OUTCOME

On the successful completion of course students will be able to		**Knowledge**
CO1	Summarize the tools and techniques of genetic engineering DNA manipulation enzymes, genome and transcriptome analysis and manipulation tools, gene expression regulation, production and characterization of recombinant proteins	**K1, K2, K3**
CO2	Associate the applications of genetic engineering in biological research	**K2, K3**
CO3	Perform basic genetic engineering experiments at the end of course	**K3, K4**
CO4	Acquire knowledge of advances in biotechnology- healthcare, agriculture and environment cleanup via recombinant DNA technology	**K2, K4**

COs – POs MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	2	-	1	2	1	3	2	2
CO2	3	3	2	2	2	2	-	1	2	1	2	2	3
CO3	3	3	2	2	2	2	1	1	2	1	3	3	3
CO4	3	3	2	2	2	2	-	1	2	1	2	3	3

Low:1, Medium:2, High:3

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PROGRAMME	M.Sc. Botany	**SEMESTER**	4
COURSE CODE & TITLE	**20RMSCBOT 403 & 404 (A): MOLECULAR PLANT PHYSIOLOGY**		
NUMBER OF CREDITS	4	**HOURS/WEEK**	6
COURSE OBJECTIVES	1. To study molecular aspects of the physiological and metabolic processes in plants. 2. To deliver molecular understanding of signal transduction mechanisms of plants. 3. To inculcate interest in Nanotechnology. 4. To illustrate knowledge of molecular responses to abiotic stress in plants.		

UNIT	CONTENT	NO. OF HOURS
I	**Signal Transduction:** Overview, Receptors and G –Proteins, Phospholipid signaling, role of cyclic nucleotides, Calcium – Calmodulin Cascade, Protein Kinases. MPK and Phosphatases, Specific Signalling Mechanisms – two components sector regulatory system in plants, Sucrose – Sensing mechanism, Hormone Receptors. Signal Transduction and Gene Expression. Molecular changes associated with Leaf Senescence.	15
II	**Molecular Biology of Photosynthesis**: Regulation of PSI and PS II activities, Energy spill over mechanism; ATPase and photophosphorylation; RUBISCO activation and its mechanism of action; Light Activation of Photosynthetic enzymes; Chloroplast Protein Phosphorylation and Enzyme regulation of Photosynthetic Carbon Assimilation; mechanism, Regulation and significance of Photorespiration.	15
III	**Nanotechnology:** Nanotechnology in Biology, Chemical and Physical synthesis and Bio-synthesis of Nanoparticles. Characterization and Diversity of Nano-particles; Nano-sensors, Nano-probes, Nano-shells, Nano-tubes; Application in Agriculture, Medicine and Industry; Quantam dots (Properties, Synthesis, Solubilization & Bioconjugation, Diversity, Binding specificity and application).	15
IV	**Stress physiology**: Plant Molecular Responses and Tolerance Mechanism to Abiotic Stress such as Water, Salt, Heavy Metal and High Temperature Stresses; Biotic Stresses and Combination of Stresses.	15

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REFERENCES

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2. Dennis, D.T. Turpin, D.H., Lefebvre, D.D. and Layzell, D.B. (Eds.) 1997. Plant Metabolism (2nd Ed.) Longman, Essex,England.
3. Galston, A.W. 1989. Life Processes in Plants. Scientific American Library, Springer- Verlag. New York,USA.
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10. Charles P. Poole, Jr. Frank, J. Owens. Introduction to Nanotechnology. John Wiley & SonsPublications.
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COURSE OUTCOME

	On the successful completion of course students will be able to	Knowledge
CO1	Summarize signal transduction mechanisms in plants.	K1, K2
CO2	Describe the synthesis of food materials by plants through photosynthesis.	K2, K4
CO3	Know about the diversity and characterization of various nano- particles and their utility in agriculture	K2, K3
CO4	Distinguish the response of the plants in stressed conditions i.e., in low or excess availability of water, salts, heat, cold and pathogens.	K2, K4

COs – POs MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	2	2	3	1	1	2	2	1	2	2	2
CO2	3	2	2	2	3	2	2	-	2	1	3	3	3
CO3	3	2	2	2	3	2	2	2	2	1	2	3	3
CO4	3	2	2	2	3	3	3	-	2	1	3	3	3

Low:1, Medium:2, High:3

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PROGRAMME	M.Sc. Botany	**SEMESTER**	4
COURSE CODE & TITLE	**20RMSCBOT 403 & 404 (B): PHYTOMEDICINE**		
NUMBER OF CREDITS	4	**HOURS/WEEK**	6
COURSE OBJECTIVES	1. To study various modes of traditional alternative medicinal systems and create awareness of knowledge about surrounding medicinal plants. 2. Acquire an understanding cultivation, processing and marketing of medicinal plants. 3. Identification of plant medicines and adulteration. 4. Qualitative and quantitative analysis of crude drugs; formulations of plant medicines.		

UNIT	CONTENT	NO. OF HOURS
I	**Origin, Scope and Source of Plant Medicines:** Brief History, origin and scope of Plant Medicines. Ayurveda, Unani and Homeopathy. Study of Medicinal plants from the following groups: Gymnosperms, Angiosperms (Ranunculaceae, Leguminosae, Apocynaceae, Asclepiadaceae, Solanaceae, Lamiaceae, Liliaceae and Zingiberaceae, etc.	15
II	**Cultivation, Multiplication, Collection, Processing and Marketing:** Macro and Micro Propagation and cultivation of medicinal plants; Multiplication of Medicinal Plants and Production of Specific Biologically Active Molecules through Tissue culture; Methods of collection, Processing, Storage, Market Potential and Trade of Plant Medicines. Adoption of GATT, Patent Rights for the plant medicines.	15
III	**Adulteration, Identification and Substitutions:** Macroscopy and microscopy of medicinally usefull plant parts such as Leaves, Stems, Underground parts, Flowers, Fruits and Seeds (Senna, Datura, Cinnamon, Cinchona, Ginger, Clove, Fennel, Nux-vomica & Ipecacuanha). Plant Medicines - Adulteration, Identification and Substitutions. Abuse of plant Medicines and Repercussions.	15
IV	**Formulations, Diagnostic features and Biological activity of Plant Medicines:** Formulations and dosage forms of plant medicines; Pharmacology and Pharmacognosy; Study of the important Diagnostic Features of Active Constituents, Quality, Purity; and Pharmaceutical uses of important Plant Medicines. Biological Active Principles of Established Herbal Medicines. Herbal Cosmetics and Dietetics.	15

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REFERENCES

1. Arber, A. 2008. Herbal Plants & Drugs. Agro Science Book Centre, New Delhi.
2. Cutler.S. J. & Cutler.H. G. 1999. Biologically Active Natural Products – Pharmaceuticals, Agro Science Book Centre, New Delhi.
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4. Kokate, C.K. Purohit, A.P. Gauchely, S.B. 1990. Pharmacognosy, (Narial Prakashan).
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11. Wallis, T.E. 1999. Text Book of Pharmacognosy, (5th Ed.) CBS Publishers & Distributions, New Delhi.

COURSE OUTCOME

On the successful completion of course students will be able to		**Knowledge**
CO1	Gain knowledge about some medicinal plants used in different alternative systems of medicine	**K1, K2**
CO2	Understanding cultivation and processing methods of medicinal plants	**K2, K3**
CO3	Recognize about drug adulteration and methods of detecting the same	**K2, K3**
CO4	Perform phytochemical and biological screening of herbal drugs; Preparation of some herbal formulations	**K2, K4**

COs – POs MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	-	-	2	-	1	1	1	-	-	2	2	2
CO2	3	2	2	2	3	2	2	1	2	1	3	3	3
CO3	3	2	2	2	3	2	2	1	2	2	2	2	3
CO4	3	2	2	2	3	3	3	1	2	2	3	3	3

Low:1, Medium:2, High:3

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PROGRAMME	M.Sc. Botany	**SEMESTER**	4
COURSE CODE & TITLE	**20RMSCBOT 403 & 404 (C): APPLIED PLANT PATHOLOGY**		
NUMBER OF CREDITS	4	**HOURS/WEEK**	6
COURSE OBJECTIVES	1. Introduce students to the basic principles and concepts of plant pathology. 2. Illustrate the major groups of organisms that cause plant diseases. 3. To understand the principles of host-pathogen interactions and how diseases occur in plants; the defense mechanisms plants have against plant pathogens. 4. Learn about interplay of signalling pathways in plant disease resistance.		

UNIT	CONTENT	NO. OF HOURS
I	**Symptoms and Diagnosis of Plant Diseases** Disease development: Stages in Disease cycle – inoculums, inoculums Potential, Penetration, infection, Invasion, Reproduction, Spread and Survival of the Pathogens. Susceptibility, Specificity. Toxins, Enzymes and Growth Regulators. Plant Disease Epidemiology: Development of Plant Disease Epidemics, Modeling, Computer Simulation of Epidemics.	15
II	**Physiology of the infected plant** Changes in Respiration, Photosynthesis, Carbohydrate metabolism, Nitrogen metabolism, Nucleic acid metabolism and growth characteristics of plants.	15
III	Plant Disease Management: Physical, Chemical and Cultural, Plant fungal and Bacterial Disease Control. **Bio-Control : Principles** (a) Biopesticides – Microbal, Fungal, Bacterial, Viral and Botanicals. (b) Integrated Pest Management – Integrated control in a Perennial Crop and integrated Control in Annual Crops. **Transgenics** (i) Insect (pest) Resistant Plants (Bt – Cotton), (ii) Disease Resistant Plants (Virus Resistance) Principles of disease resistance: Physical, chemical (Phytoalexins), HR, tissue culture methods.	15
IV	Specific Plant disease: Symptoms, Aetiology, Disease cycle and control of the following diseases. Club-rot diseases of crucifers, Damping-off Vegetables, Late blight of potato, Green ear disease of Bajra, White rusts of Brassica, powdery mildew of Cucurbits, Ergot of Bajra, Leal spot of Turmeric, Groundnut rust, Whipsmut of Sugarcane, Leaf spot of Groundnut, Brown spot of Rice, Blast of Rice and Blight of Rice.	15

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REFERENCES

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5. Schaad, N.W. 1990 Laboratory Guide for identification of plant pathogenic bacteria (2nd Ed) , APS (USA)
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COURSE OUTCOME

	On the successful completion of course students will be able to	Knowledge
CO1	Introduce students to the basic principles and concepts of plant pathology	K1, K2
CO2	Understanding changes in metabolic activities of diseased plants	K2, K3
CO3	Understand the principles of host-pathogen interactions and how diseases occur in plants; the defense mechanisms plants have against plant pathogens	K2, K3
CO4	Understanding and identification of plant diseases and control.	K2, K4

COs – POs MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	-	-	2	-	1	1	1	-	-	2	2	2
CO2	3	2	2	2	3	2	2	1	2	1	3	3	3
CO3	3	2	2	2	3	2	2	1	2	2	2	2	3
CO4	3	2	2	2	3	3	3	1	2	2	3	3	3

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PROGRAMME	M.Sc. Botany	**SEMESTER**	4
COURSE CODE & TITLE	**20RMSCBOT 407: ORGANIC FARMING**		
NUMBER OF CREDITS	4	**HOURS/WEEK**	6
COURSE OBJECTIVES	1. To reduce the toxicity of Chemical Fertilizers. 2. To save soil health and promote soil fertility. 3. To popularize the importance of organic fertilization. 4. To bring awareness about techniques related to Vermicompost		

UNIT	CONTENT	NO. OF HOURS
I	**Concept of organic farming:** Principles, types and benefits of organic farming. Conventional farming versus Organic farming. Types of compost, Green manure, Farmyard manure, Vermicompost, Methods of compost preparation. Processing, packing and storage of vermicompost. Nutritive value of compost. Panchagavya; collection, processing, advantages and disadvantages.	15
II	**Biofertilizers:** Production, processing and storage of biofertilizers and organic preparations. Cost of production system. Benefit cost ratio. Marketing: export and import. Maintenance of records, farm management system and role of NGOs.	15
III	**Panchagavya** – Collection, processing, advantages and disadvantages, preparation, types, maintenance, cowdung micro flora, liquid and solid Panchagavya – chemical nature of cow urine.	15
IV	**Vermicompost Technology:** Production, types of tubs, construction of tubs, preparation, processing, watering of raw material, casting collections, drying, sieving, packing and marketing. Chemical composition of vermin compost – different species of earth worms - vermi wash and its applications.	15

REFERENCES

1. Handbook of organic farming and Biofertilizers by M.K. Gupta.
2. The Organic Farmer's Business Handbook by Richard Wiswal.
3. Practical Handbook of Agricultural Science by Hanson.
4. Year Round Vegetables, Fruits and Flowers by Bob Randall.
5. Organic Management for the Professional by Howard Garrett.
6. Handbook of organic farming and Biofertilizers by M.K. Gupta.
7. Biofertilizer Technology by R. Shankara Reddy, Biofertilizer
a. Technology by Kannaiyan. S

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COURSE OUTCOME	**On the successful completion of course students will be able to**		**Knowledge**
	CO1	Understand the importance of organic fertilizers in preventing environmental pollution	**K1, K2**
	CO2	Prepare Organic fertilizers and apply it to field level	**K2, K3**
	CO3	Develop the skill of preparing farmyard compost	**K2, K3**
	CO4	Learn the techniques of production and maintenance of Vermicompost	**K2, K3, K4**

COs – POs MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	2	2	1	1	-	1	2	-	2	-	2	2	2
CO2	3	2	2	2	2	2	3	-	2	2	2	3	3
CO3	2	2	3	2	3	2	2	-	3	2	3	3	3
CO4	3	2	3	3	3	1	1	2	2	3	3	3	3

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