DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSIT, AURANGABAD

M. Sc. BOTANY SYLLABUS FOR UNIVERSITY DEPARTMENT

Illustrative Credit distribution structure for Two year P. G. Programme with Multiple Entry and Exit option

Class: M. Sc. I year ACADEMIC AUTONOMY Semester: I Semester

Course code: SAD265001T

Course name: CELL AND MOLECULAR BIOLOGY

Course type: Major Mandatory Discipline Specific Course

Credits: 3, Contact Hours: 45 clock hours, 3 hours/ week

Marks: 75, Internal assessment: 30, External assessment: 45

Unit I Cell Membrane

i) The fundamental structure of cell

ii) Plasma membrane: Molecular organization, current models and functions. Cell wall architecture, biosynthesis, assembly, growth and cell expansion.

iii) Plasmodesmata: Structure and role in movement of molecules and macromolecules

Unit II Cell Organelles

i) Chloroplast and Mitochondria: Ultrastructure, function and biogenesis. The organization of genome and patterns of gene expression.

ii) Vacuoles: Tonoplast membrane, ATPases, transporters, as storage organelle.

Unit III Other Cellular Organelles

i) Structure and functions of microbodies, Golgi apparatus, Lysosomes and Endoplasmic reticulum.

ii) Nucleus: Microscopic and submicroscopic organization. Structure and function of nuclear Envelope. The ultrastructure of nucleolus and its role in rRNA biosynthesis.

iii) Ribosomes: Structure and site of protein synthesis. Mechanism of translation, details of initiation, elongation and termination. The structure and role of RNA.

Unit IV Cytoskeleton

i) Organization and role of microtubules and microfilaments, Implications in flagellate and other movements.

Unit V Cell Cycle and its molecular aspects

i) Control mechanism, the role of cycline and cycline dependent kinases, Retinoblastoma and E_2F proteins. Cytokinesis and cell plate formation. Mechanism of programmed cell death (Apoptosis) and Senescence.

Suggested Readings for BOT/MJ/UD/500 Theory

1. Lewin, B. 2000, Genes VII, Oxford University Press, New York.
2. Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K. and Watson, J.D.I 999. Molecular Biology of the cell. Garland Publishing, Inc. New York.
3. Wolfe, S. L. 1993. Molecular and cellular biology. Wodsworth publishing company, California, U. S. A.
4. De, D. N. 2000. Plant cell vacuoles. An introduction. CSIRO Publication, Collingwood, Australia.
5. Kleinsmith, I. J. and Kish, V. M. 1995. Principles of Cell and Molecular Biology (End Edition). Harper Collins College publishers, New York, U.S.A.
6. Lodish, H., Berk, A., Zipursky, S. Z., Matsudaira, P., Baltimore, D. and Darnell, J., 2000. Molecular Cell Biology. (4th Edition). W.H. Freeman and company, New York, U .S. A
7. Click, B. R. and Thompson, J. E. 1998. Methods in Plant Molecular biology and biotechnology. CRC Press, BOCA RBTON Florida.
8. Glover, D. M. and Hames, B. D. (Eds.) 1995. DNA cloning I :: A practical approach, Core techniques, first edition, TASIRL Press al Oxford University Press, Oxford.
9. Gunning B. E. S. and Steer, M. W. 1996. Plant cell biology, structure and function. Jones and Bartlet Publishers, Boston, Massachusetts.
10. Hackett, P. B., Funchs, J. A. and Messing, J. W. 1998. An Introduction to recombinant DNA techniques : Basic experiments in gene manipulation. The Benjamin Cummings Publishing Company, Inc. Memno Park, California.
11. Hall, J. L. and Moore, A. L. 1983. Isolation of membranes and organelles from plant cells. Academic Press, London, U.K,
12. Harris, N. and Opataks, K. J. 1994. Plant Cell Biology : A practical approach. IRL Press at Oxford University Press, Oxford, U. K.
13. Shaw, C. H. (Ed.) 1988. Plant Molecular Biology: A Practical Approach. IRL Press, Oxford.

Review Journals

1. Annual review of plant physiology and molecular biology.
2. Current advances in Plant Sciences.
3. Trends in Plant Sciences.
4. Nature reviews: Molecular and Cell Biology.

Course code: SAD265011T

Course name: BIOLOGY & DIVERSITY OF ALGAE AND BRYOPHYTES

Course type: Major Mandatory Discipline Specific Course

Credits: 3, Contact Hours: 45 clock hours, 3 hours/ week

Marks: 75, Internal assessment: 30, External assessment: 45

Unit I. i. Introduction and history of phycology with special reference to Indian work.

ii. Algae in diversified habitats (Terrestrial, fresh water, marine).Algal blooms.

iii. Criteria used in classification of algae, pigments, reserve food and flagella and important systems of classification of algae.

Unit II. A general account of thallus organization, reproduction and life history of algae. Study of important groups of algae with reference to General account, cell structure and method of reproduction and their economic importance -

a) **Cyanophyta:** *Nostoc, Oscillatoria, Rivularia* and *Spirulina*
b) **Chlorophyta:** Volvocales (*Chlamydomonas, Volvox*), Oedogonials (*Oedogonium, Cladophora*), Zygnematales (*Spirogyra, Zygnema*and *Cosmarium*)
c) **Xanthopyta**: *Botrydium* and *Vaucheria*.
d) **Bacillariopyta**: *Pinularia* and *Navicula*
e) **Phaeophyta:** *Ectocarpus* and *Sargassum*.
f) **Rhodophyta**: *Batracospermum* and *Polysiphonia*

Bryophytes:

Unit III. Characteristic features, classification, distribution, Habit and Habitat of Bryophytes.

Unit IV. External and internal morphology, reproduction, gametophytes and sporophytes, phylogeny and interrelationships of the orders:

- Sphaerocarpales, Takakiales, Marchantiales, Jungermanniales, Anthocerotales, Sphagnales, Andreales, Bryales.

Unit V. Bioprospecting of Algae and Bryophytes: BGA bio-fertilizers, Freshwater and Marine algae as food and fodder, Algae in industry. Role of algae in human welfare. Ecological and Economic importance of Bryophytes.

Suggested Readings on Biology & Diversity of Algae and Bryophytes

Algae:

1. Chapman V. J. & D. J. Chapman (1983). The Algae, The MacMillan Press Ltd., London.

2. Desikachary T. V. (1959) Cyanophyta, 1CAR, New Delhi.

3. Fritsch F. E. (1961). The Structure and Reproduction of the Algae, Vol.I & H, Cambridge University Press, London.

4. Kumar H. D. (1988) Introductory Phycology, Affiliated East-West Press Pvt. Ltd., New Delhi.

5. Prescott G. W. (1969). The Algae: A Review, Thomas Nelson .and Sons Ltd., Melbourne.

6. Round F. E. (1981). The Ecology of Algae, Cambridge University Press, London.

7. Smith G. M. (1950). The fresh water algae of the United states, McGrawIIill Hoc Co., New York.

8. Vijayraghavan & Sunita Kumari (1995). Chlorophyta, Bisen Singh Mahendra P. Singh, Dehra Dun.

9. Sharma O. P. (2018), A text Book of Algae, Tata Mc Graw Hill, New Delhi

10. Bilgrami, K. S. (2020), A text Book of Algae,

11. Arungnam N., Ragland Anita and Kumarion N, (2018), Fundamentals of Algae and Bryophytes, Saras Publication, Tamil Nadu

12. Samba Murty A. V. S. S. (2020), A text book of Algae, Wiley Publication, New Delhi

Bryophytes:

1. Smith (1955) Cryptogamic Botany I & II, McGraw-Hill, New York.
2. Prem Puri (1980) Bryophytes, Atmaram& Sons, Delhi.
3. Parihar N. S. (1991) Bryophytes, Central Book Dept., Allahabad.
4. Verdorn - (1932) Manual of Bryology, TheHegue.
5. Bower P. O. (1935) Primitive; land Plants, Macmillan and Co., London.
6. Campbell (1940) Evolution of land Plants, Stanford University Press.
7. Kashyap S. R. (1929, 1932), Liverworts of Western Himalays and the Pan); plain, Vol. I & II, The University of Punjab, Lahore.
8. Tewari, Shiv Datt and Giri Bala Pant (2005) Bryophytes of Kumaun Himalaya. Publisher- Bhishan Singh Mahendra Pal
   Singh- Dehradun.

Course code: SAD265021T

Course name: TAXONOMY OF ANGIOSPERMS

Course type: Major Mandatory Discipline Specific Course

Credits: 3, Contact Hours: 45 clock hours, 3 hours/ week

Marks: 75, Internal assessment: 30, External assessment: 45

UNIT- I: Angiosperms: Definition, its characteristic features and probable causes of their evolutionary success. Taxonomy: Definition, scope, principles, aims and objectives and functions of taxonomy. Phases of plant classification.

Phylogeny of Angiosperms: A general account of origin of Angiosperms with reference to time and place and possible ancestors: Euanthial theory (Bennettitales, Caytoniales, Gnetales, Cycadales) and Pseudanthial theory (Pentoxylales, Pteridospermales, Glossopteridales).

UNIT- II: Categories of classification – Major, Minor and Infra-specific categories; Species Concepts, Speciation, Causes of variations in population. Brief history on account of artificial, natural, phylogenetic systems of classifications with special reference to Bentham and Hooker, Cronquist'system, Takhtajan's system and Broad outline of APG IV (2016) system of classification and its merits and demerits.

UNIT-III: Botanical Nomenclature: Concept of nomenclature, Binomial nomenclature and its advantages, formation of code, Melbourne Code 2012, Shenzhen Code 2018, Principles of International Code of Nomenclature of Algae, Fungi and Plants (ICN), ending of taxa names, Typification.

UNIT-IV: Taxonomic evidences: Morphology, anatomy, embryology, palynology, cytology, phyto-chemistry and numerical taxonomy. Taxonomic tools: Serological and molecular techniques, GIS, GPS, Use of computers in angiosperms taxonomy (Use of computer and data bases for identification of plants with the help of websites). Herbarium Techniques, Major herbaria of the World and India. Contributions of Herbarium BAMU.

UNIT-V: Angiosperm Families: Nymphaeaceae, Hydatellaceae, Magnoliaceae, Papaveraceae, Malvaceae, Leguminaceae, Sapotaceae, Apiaceae, Asteraceae, Rutaceae, Apocynaceae, Solanaceae, Liliaceae, Arecaceae and Poaceae.

Suggested Readings

1. Cole, A. J. 1969. Numerical Taxonomy. Academic Press. London.

2. Davis, P. H. and Heywood, V. H. 1973. Principles of AngiospermsTaxonomy. Robert E. Krieger Pub. Co. New York.

3. Daniel Mammen (2009) Taxonomy, Evolution at work, Narosa Publication, New Delhi.

4. Grant, V. 1971. Plant Speciation, Columbia, University Press, New York.

5. Grant, W. F. 1984. Plant Biosystematics, Academic Press, London.

6. Harrison, H . J. 1971. New concepts in Flowering Plant Taxonomy. Hieman Educational Book Ltd.,London.

7. Heslop-Harrison, J. 1967. Plant Taxonomy. English Language Book Soc. & Edward Arnold Pub. Ltd. U. K.

8. Heywood, V.H. and Moore, D. M. 1984. Current Concepts in Plant Taxonomy, Academic Press, London.

9. Jones, A. D. and Wilbins, A. D. 1971.Variations and Adaptions in Plant species.Hieman&Co.Educational Ltd. London.

10. Jones S. B. Jr. &Luchsinger, A. E. 1986. Plant Systematics, (2nd Edition) McGraw-Hill Book Co. NewYork.

11. Naik V. N. (1989) Taxonomy of angiosperms, Tata Mc Graw Hill Co. Ltd. New Delhi

12. Naik V. N. (1998) Flora of Marathwada, Amrut Prakashan, Aurangabad

13. Radford, A. E. 1986 Fundamentals of Plant Systematics. Harper & Raw Publications, U.S.A.

14. Solbrig. O. T. & Solbrig D.J. 1979. Population Biology and Evolution. Addison Wesley Publication Co. Inc.U.S.A.

15. Stebbins, G. L. 1974 Flowering Plant- Evolution above Species Level. Edward Arnold Ltd., London.

16. Stace, C. A. 1989. Plant Taxonomy and Biosystamatics. (2nd Edition)Edward Arnold,, London.

17. Takhtajan A. L. 1997. Diversity and Classification of Flowering Plants. Columbia University Press, New York.

18. Woodland D. W. 1991. Contemporary Plant Systematies. Prentice Hall, New Jersey1

Course code: SAD265001P

(Practical based on BOT/MJ/UD/500)

Course name: Practical - CELL AND MOLECULAR BIOLOGY

Course type: Major Mandatory Discipline Specific Course

Credit: 1, Contact Hours: 30 clock hours, 2 hours/ week

Marks: 25, Internal assessment: 10, External assessment: 15

1. To determine mitotic Index in different plant materials.
2. Karyomorpholpgical studies from slide/photograph.
3. Induction of mitotic abnormalities through chemical treatment.
4. Demonstration of SEM and TEM organelles.
5. Demonstration of acid phosphatases and succinic dehydrogenase activity in plants.
6. Demonstration of native and SDS PAGE profiles of seed proteins.
7. Isolation of plant DNA and its quantitation by spectrophotometric method.
8. Separation of plant RNA by Agarose gel electrophoresis and visualization by ethidium bromide staining,
9. Demonstration of Western blotting.
10. Estimation of seed proteins by Lowry's method.

Course code: SAD265011P

(Practical based on BOT/MJ/UD/501)

Course name:

Practical - BIOLOGY & DIVERSITY OF ALGAE AND BRYOPHYTES

Course type: Major Mandatory Discipline Specific Course

Credit: 1, Contact Hours: 30 clock hours, 2 hours/ week

Marks: 25, Internal assessment: 10, External assessment: 15

Algae :

1. Morphological study of algal forms: *Microsystis, Oscillatoria, Lyngbya, Nostoc, Anabacna, Scytonema, Tolypothrix, Rivularia, Gloeotrichia, Cahthrix, Chlamydomonas, Pandorina, Eudorina, Volvox, Hydrodictyon, Scenedesmus, Pedistruium,Ulothrix, Ulva, Odeogonium, Cladophora, Pithophora, Draparnaldia, Draparnidiopsis, Coleochaete, Cosmarium, Closterium, Caulerpa, Acetabularia, Chara, Nitella, Botrydium, Vaucheria, Pinnularia, Navicula, Fragillaria, Ectocarpus, Diciyota, Fucus, Batrachospermum, Polysiphonia, Corallina.*
2. Collection and submission of algae.

Bryophytes:

i. Vegetative Organization- *Marchantia, Riccia, Anihoceros, Porella, Sphagnum, Polytrichum.*

ii. Anatomical Organization: *Marchantia, Cyalhodhim, Anthoceros, Porella, Sphagnum*.

iii. Archegonia and Antheridia and their Organization: *Riccia, Marchantia, Porella, Anthoceros, Sphagnum*.

iv. Sporophytes: *Riccia, Marchantia, Pellia, Porella, Anthoceros, Funaria, Sphagnum, Polytrichum.*

v. Collection and submission of Bryophytes.

vi. Botanical excursion of about one week duration to any botanically rich location preferably outside the State.

Course code: SAD265021P

(Practicals Based on BOT/MJ/UD/502)

Course name: Practical - TAXONOMY OF ANGIOSPERMS

Course type: Major Mandatory Discipline Specific Course

Credit: 1, Contact Hours: 30 clock hours, 2 hours/ week

Marks: 25, Internal assessment: 10, External assessment: 15

1. Morphology: Terminologies related to Habit and life span, root, stem, leaves, inflorescence, Flower, fruits.
2. Phytography: preparation of scientific botanical description of plant specimens.
3. Study of at least 20 locally available families of flowering plants.
4. Identification of genus and species of locally available wild plants.
5. Preparation of botanical keys at generic level by locating key characters.
6. Knowledge of at least 10 medicinal plant species.
7. Knowledge of food plants (Cereals, Pulses, Fruits, Vegetables, Spices and Condiments)
8. Demonstration of the utility for secondary metabolites in the taxonomy of some appropriate genera.
9. Field trips within and around the University Campus, compilation of field notes and preparation of herbarium sheets of plants.
10. Botanical excursion of about one week duration to any botanically rich location preferably outside the State.

Course code: SAD265031P

Course name: Practical - HORTICULTURE TECHNIQUES

Course type: Major Mandatory Discipline Specific Course

Credit: 2, Contact Hours: 60 clock hours, 4 hours/ week

Marks: 50, Internal assessment: 20, External assessment: 30

1. Horticulture : 1.1 Introduction, Definition, Scope and importance of Horticulture
   1.2. Disciplines of Horticulture, i) Pomology ii) Olericulture iii) Floriculture iv) Ornamental horticulture v) Landscape horticulture
2. Study of Garden tools and equipment: Sprayer, Duster, Pruning knife, Sprinkler.
3. Study of propagation requirement: i) Media ii) Containers iii) Potting iv) Repotting Practicals
4. Study of propagation methods:
   4.1. Sexual Propagation: Advantages and Disadvantages, Various Scarification treatments to seed
   4.2. Asexual /Vegetative Propagation: Advantages and Disadvantages
   4.3. Natural methods of vegetative propagation: Bulb, Corm, Tuber, Rhizome, Runner, Offset, Sucker
5. Artificial methods of vegetative propagation **Cutting:**
   a) Definition b) Types of Cutting: i) Stem cutting - Soft wood cutting and Hard wood Cutting ii) Leaf Cutting iii) Root Cutting
6. Artificial methods of vegetative propagation **Layering:**
   a) Definition b) Types of Layering: i) Simple layering ii) Compound layering iii) Air layering/ Gootee
7. Artificial methods of vegetative propagation **Budding:**
   a) Definition b) Types of Budding – i) Shield/T – Budding ii) Patch Budding
8. Artificial methods of vegetative propagation **Grafting:**
   a) Definition b) Types of Grafting – i) Whip grafting ii) Tongue grafting
9. Preparation of preserved products: Mix fruit Jam, Papaya Jelly, Wood apple/Guava Jelly, Lemon/Orange Squash, Tomato ketchup
10. Visit to any one Nursery Unit, Commercial orchard and Fruit processing unit

REFERENCE BOOKS

1. Azad, K. C. and Sharma, V. K. (2000). Horticulture Technology (Vol. I&II). Deep and Deep Publications, New Delhi, India.

2. Bal, J. S. (1997). Fruit growing. Kalyani Publication, New Delhi, India.

3. Bose, T. (1996). Fruit tropical and Sub tropical. Naya Pracation , Calcutta, India.

4. Edmond, J. B., Senn, T. L., Andrew, F. S. and Halfacr, R. G. (1990). Fundamentals of Horticulture. Tata McGraw Hill Publishing Co. Ltd. New Delhi, India.

5. Girdhari Lal., Siddhappa, G. S. and Tandon, G. L. (1998). Preservation of fruits and vegetables. ICAR New Delhi, India.

6. Hartmann, H. T. and Kester, D. E. (1989). Plant propagation principles and practice. Prentice Hall of India (P) Ltd. New Delhi, India.

7. Khan, M. R. (1995). Horticulture and Gardening. Nirali Prakashan, Pune, India.

8. Sen, S. (1992). Economic Botany. New Central Book Agency, Calcutta, India. 9. Sharma, N. K. and Arora, S. K. (1985). New Routes to increase Brinjal production. Fmr. Parlim 20 (6) 11 - 12.

10. Sharma,V. K. (2004). Advances in Horticulture. Deep and Deep Publications, New Delhi, India.

11. Sharma, V. K. (1999). Encyclopedia of Practical Horticulture.

12. Singh, V. B. (1990). Fruits of NE Region. Wiley Eastern Limited, New Delhi, India.

13. Sonane, H. N., Deore, B. P. and Patil, S. K. (1984). Vaishali (RHR 51) A High yielding Variety of Brinjal for Maharashtra. Journal of Maharashtra Agriculture Uni. 9(3):341-342

14. Vishnu Swarup (1997). Ornamental horticulture. Macmillan Ltd. New Delhi, India.

15. Reddy, Mallikarjun and Rao, Aparna (2010). Applied Horticulture. Pacific Book International, Delhi, India.

16. Sharaf, Sandhya (2012). Green House Management of Horticulture Crops. Oxford book Co. New Delhi, India.

17. Sharon Pastor Simson, Martha C. Straus (2010). Basics of Horticulture. Oxford Book Co. New Delhi, India.

18. George, Acquaah (2008). Horticulture: Principles and Practices, 4th Ed. PHI Learning private Ltd. New Delhi, India.

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Course code: SBD265041T

Course name: Crop Genetics and Plant Breeding – I

Course type: Discipline Specific Elective Course

Credits: 3, Contact Hours: 45 clock hours, 3 hours/ week

Marks: 75, Internal assessment: 30, External assessment: 45

Unit I: Crop genetic resources:

Importance of genetic Conservation, Global network for genetic conservation and utilization in major crops of the world. Institutes engaged in conservation and improvement of crop genetic resources.

Unit II: Food supplies, nutrition and crop breeding:

World food situation, Nutritional problems, Nutritional objectives, Contribution of M. S. Swaminathan and H. Y. Mohan Ram

Unit III: Methods of plant breeding:

Introduction, selection, Pure line selection, W. L. Johansons experiments on beans and their significance, Variety acclimatization, genetic significance of pollination methods, methods of breeding self and cross pollinated crops and asexually and vegetatively propagated crops.

Unit. IV: Incompatibility in plant breeding:

Types, nature, characteristics genetic and biochemical basis, methods of induction and overcoming, incompatibility as a tool in breeding crops.

Unit. V: Male sterility and Back cross

i. **Male sterility:** Definition and classification, Male sex expression and chemical Induction of male sterility, perspectives.
ii. **Back cross:** Genetic basis, Methodology in selection to character under transfer, Transfer of two or more characters, Inter-varietal. Inter-specific and intergeneric transfer.

Course code: SBD265041P

(Practical based on BOT/DSE/UD/507)

Course name: Practical - Crop Genetics and Plant Breeding – I

Course type: Discipline Specific Elective Course

Credits: 1, Contact Hours: 30 clock hours, 2 hours/ week

Marks: 25, Internal assessment: 10, External assessment: 15

1. Study of floral biology of different crop plants.
2. Demonstration of hybridization technique in self and cross pollinated crops.
3. Study of pollen germination and demonstration of incompatibility.
4. Demonstration of male sterility in Jowar.
5. Study of pollen fertility.
6. Study of pollen viability.
7. Karyotype analysis in crop plants such as *Tradescantia, Rheo,* Maize, Onion
8. Aneuploid analysis in crop plants.

Suggested readings for BOT/DSE/UD/507 and BOT/DSE/UD/508

1. Plant Breeding - B. D. Singh.
2. Plant Breeding - J. R. Sharma.
3. An Introduction of plant breeding - H. K. Chaudhary.
4. Evolution of crop plants - Edited by Simmonds N. W (1986)
5. Breeding field crops - Poehlrnann and Sleper.
6. Plant Breeding perspectives - Edited by Sheep and Mendnkasen.
7. Crop Breeding, P. B. Vose and S. G. Blixt
8. Genes. Chromosomes and Agriculture.Chrispels and Simmonds.
9. Principles of Genetics - Snusted and Simulants.
10. Manual of mutation breeding by FAO/IAEA.
11. Mutation Research -Aurebach.
12. Chemical mutagenesis - Fishbeiri *et al*.
13. Discussions in cytogenetics. Burnhan C. R. 1962
14. Genetics - Principles and analysis. Khush G. S. 1973
15. Genetics Principles and analysis. Haiti and Jones 1998
16. Molecular biology of the gene. Watson J. D. 1989

Course code: SBD265051T

Course name: Mycology and Plant Pathology-I

Course type: Discipline Specific Elective Course

Credits: 3, Contact Hours: 45 clock hours, 3 hours/ week

Marks: 75, Internal assessment: 30, External assessment: 45

UNIT - I

1. Introduction and History of Plant Pathology
2. Classification of plant diseases: Symptomology of Fungal, Bacterial, Viral and Phytoplasmal diseases.

UNIT - II

1. Plant diseases caused by phanerogamic plant parasite- *Loranthus, Orobanche, Striga* and *Cuscuta.*
2. Nematode diseases – Root knot of Tomato caused by *Meloidogyne*.
3. General account of post – harvest fungal diseases of food crops, fruits and vegetables and their management.

UNIT – III: Plant diseases caused by Bacteria, Viruses, Phytoplasma

a. Plant diseases caused by Bacteria

1. Citrus canker
2. Angular leaf spot of Cotton
3. Leaf spot of Mango
4. Gummosis of Sugarcane
5. Wilt of Tomato
6. Soft rot and Scab of Fruits.

b. Plant diseases caused by Viruses

1. Yellow vein of mosaic of Bhendi (YVMV)
2. Papaya leaf mosaic
3. Bunchy top of Banana
4. Tomato leaf curl virus (TLCV)
5. Bud necrosis of Groundnut
6. Bean common mosaic
7. Tobacco mosaic virus

UNIT – IV: Fungal Diseases of Cereals, Pulses and Oil Seeds

a. Cereals

1. Ergot of Bajra
2. Loose smut of Wheat
3. Karnal bunt of Wheat
4. Grain smut of Sorghum
5. Loose smut of Sorghum
6. Downy mildew of Bajra
7. Common smut of Maize
8. Leaf spot of Rice

b. Pulses and Oil Seeds

1. Pigeon pea wilt
2. Blight of Grams
3. Tikka disease of Groundnut
4. Rust of Groundnut
5. White rust of Mustard
6. Sunflower rust
7. Damping off of seedling

UNIT – V: Fungal diseases of Fruit, Vegetables and Cash Crops

a. Fruits

1. Downy mildew of Grapes
2. Powdery mildew of Grapes
3. Mango Anthracnose
4. Citrus Gummosis

b. Vegetables

1. Powdery mildew of Cucurbits
2. Leaf spot of Tomato
3. Leaf spot of Brinjal
4. Chili Die-back

c. Cash Crop

1. Whip smut of Sugarcane
2. Cotton wilt
3. Rhizome rot of Ginger
4. Red rot of Sugarcane

Course code: SBD265051P

Course name: Practical - Mycology and Plant Pathology-I

(Practical based on BOT/DSE/UD/509)

Course type: Discipline Specific Elective Course

Credits: 1, Contact Hours: 30 clock hours, 2 hours/ week

Marks: 25, Internal assessment: 10, External assessment: 15

1. Collection and preservation of diseases specimens.
2. Sick Plot: Screening for crop disease and soil fungi
3. Symptomology, histopathology of disease from Mastigomycotina, Ascomycotina, Basidiomycotina, Deuteriomycotina.
4. Investigation of Diseases prescribed in theory.
5. Principal and working of instruments, Sterilization Methods.
6. Preparation of Media, stains and Isolation of Fungi from infected plants.
7. Culture and identification of Pathogen.
8. Virulence test for pathogens.
9. Visits to fields for study of diseases.

1. Agrios, G. N. (1969) Plant Pathology, Academic Press, New York.
2. Rangaswami, G. and A. Mahadevan (2001) Disease of crop plants in India, Printic Hall of India,Pvt. Ltd., New Delhi.
3. Gupta, V. K. and V. S. Paul (2001) Disease of vegetable crops. Kalyani Publ. Ludhiana,
4. Gupta, V. K. and S. K. Sharma (2000) Disease of fruit crops, Malyani Publ. Ludhiana.
5. Raychaudhari, S. P. and T. K. Nariani (1977), Virus and Mycoplasma disease of plants in India.Oxford and IBK Publ. Corp., New Delhi.
6. Bos L. (1999), Plant viruses, unique and intriguing pathogens. Backhugs Publ. Leiden.
7. Rangaswami, G. and S. Rajagopalan (1973), Bacterial plant pathology, T. N. Agri. Uni. Coimbatore.

Course code: SBD265061T

Course name: Taxonomy of Angiosperms – I

Course type: Discipline Specific Elective Course

Credits: 3, Contact Hours: 45 clock hours, 3 hours/ week

Marks: 75, Internal assessment: 30, External assessment: 45

UNIT-I: **Angiosperms:** Characteristic features**,** Secrets of success of Angiosperms.

Taxonomy: Aims and objectives, Approaches, Principles of taxonomy, functions and phases of taxonomy; taxonomy as synthetic discipline.

Keys: Types, preparation and use

UNIT-II: **Phylogeny of angiosperms:** monophyletic and polyphyletic origin of angiosperms, herbaceous origin hypothesis, Various theories of origin of Angiosperms, origin of monocotyledons; molecular evidence to angiosperm origin, cradle of angiosperms.

UNIT-III: **Taxonomic hierarchy:** it's major, minor and intraspecific categories and ranks. Species as basic unit of classification. Criteria used for classification. A brief history of Pre-Darwinian and post Darwinian systems of classification with special emphasis on Thorne's, Dahlgren's, Takhtajan's and Cronquist's systems of classification, Outline of APG IV system of Classification.

UNIT-IV: **Concept of taxonomic character:** Definition of character, Unit character, analytical and synthetic, qualitative and quantitative, genetically and environmentally controlled, good and bad character, character weighing, taxonomic coefficient with examples.

UNIT-V: **Phylogenetic relationship:** Primitive and advanced characters, monophyletic, paraphyletic and polyphyletic, homology and analogy, parallel and convergent evolution, plesiomorphic and apomorphic characters. **Cladistics:** Operational Taxonomic Units (OTU), characters and coding, measuring of similarity, cladograms.

Course code: SBD265061P

(Practical based on BOT/DSE/UD/511)

Course name: Practical - Taxonomy of Angiosperms – I

Course type: Discipline Specific Elective Course

Credits: 1, Contact Hours: 30 clock hours, 2 hours/ week

Marks: 25, Internal assessment: 20, External assessment: 25

1. To study variation in the population of a species.
2. Study of morphology of and general evolutionary trends in Inflorescences, flowers, stamens, carpels and fruits.
3. Study of different types of roots, stems, leaves, their modifications and evolutionary trends therein.
4. Taxonomic distribution of special units of pollen dispersal- bi celled pollen, tetrads, polyads andpollinia and pollen types.
5. Study of plant surface attributes with the help of SEM photographs.
6. Descriptions, sketching, classification and identification of at least 30 families represented in local flora.
7. Several one-day botanical excursions to botanically rich locations.
8. Botanical excursion of about one week to any botanically rich location preferable outside the State.

Course code: SBD265071T

Course name: ADVANCED PLANT PHYSIOLOGY AND BIOCHEMISTRY – I

Course type: Discipline Specific Elective Course

Credits: 3, Contact Hours: 45 clock hours, 3 hours/ week

Marks: 75, Internal assessment: 30, External assessment: 45

Unit I. **Plant Composition :** Structure and biochemical role of major plant constituents, carbohydrates and its derivatives, structure and classification of proteins, glycoproteins, peptidoglycans, lipids and glycoproteins, lipid and triglycerides, fatty acid, vitamins nucleic acids.

Unit II. **Pigments and metabolites:** Chlorophylls, phycobiliproteins, phenolics, sterols, alkaloids, carotenoids, phytochorme, anthocyanine, phenolics, porphyrins, organic acids, isolating these chemicals for human welfare.

Unit III. **Principles use and application** of Colorimeters, photometry flame photometers, spectrophotometry, chromatography (ion exchange, affinity, thin layer, high pressure liquid), gel filtration, electrophoresis, electro focusing and ultracentrifugation,

Unit IV. **Application of radioactive tracer technique** in biology, radioactive isotopes Autoradiography, Biophysical methods X ray diffraction, fluorescence UV, NMR and ESRAtomic absorption spectroscopy

Unit V. **Growth analysis:** Growth, growth curve, lag, log and senescence phase, growth rates AGR, RGR, NAR, LAP, LAI, CGR and LAD productivity potential of dwarf varieties, causes of dwarfism, morphological and physiological factors in relation to height. Yields of dwarf plants,

Course code: SBD265071P

(Practical based on BOT/DSE/UD/513)

Practical - Advanced Plant Physiology and Biochemistry – I

Course type: Discipline Specific Elective Course

Credits: 1, Contact Hours: 30 clock hours, 2 hours/ week

Marks: 25, Internal assessment: 10, External assessment: 15

1. Estimation of B - carotene with column chromatography.
2. Estimation of reducing sugars by Folin – Wu tube.
3. Estimation of cellulose by Cramption and Maynord Method.
4. Estimation of free fatty acids.
5. Estimation of nitrates.
6. Thin layer chromatographic technique.
7. Techniques of flame photometry: estimation of sodium and potassium.
8. Estimation of gross energy by chromic acid oxidation method.
9. Estimation of N by micro – K jeldhal methods.

Suggested Readings

1. Bajrachrys D. Experiment in Plant Physiology, Narosa Publishing House, New Delhi.
2. Bidwell R. G. S., Plant physiology: Mac Millan Publishers Co., New York.
3. Bormer, J. and Galston, A. W., Principles of plant physiology,
4. Hess, Plant physiology, Narosa Publishing House, New Delhi.
5. Datta, S. C., Plant Physiology, Willey Eastern Limited, Culcutta.
6. Devlin, R. M. and Hostan, F. H., Plant physiology, CBS Publishers and Distributors, New Delhi.
7. Fairley, J. L. and Kilgon, G. L., Essentials of Biological Chemistry, Earr west Press Pvt. Ltd., Delhi.
8. Goodwin T. W. & E. I. Mercer (2003) Introduction to Plant Biochemistry, CBS, New Delhi
9. Hess, D. Plant Physiology, Narosa Publishing House, New Delhi.
10. ICAR Handbook of Agriculture, ICAR, New Delhi.

11. Jayraman, J., Laboratory Manual in Biochemistry, New Age International Publishers, Mumbai.
12. Lehninger, A. L. Principles of Biochemistry, CBS Publishers and Distributors, New Delhi.
13. Mertz, E. T., Vakils, Elementary Biochemistry, Fetter and SimsonsPvt Ltd. Mumbai.
14. Mukharji S., A. K. Ghosh, Plant Physiology, New Central Book Agencies, Kolkatta.
15. Mukharji, S. and Ghosh, A. K. Plant Physiology. New Central Book Agencies, Kolkatta.
16. Mungikar, A. M. Bibliography of leaf protein in Marathwada University.
17. Nels R. Lersten (2014) Flowering Plant Embryology, Wiley, New Delhi
18. Noggle G. R. and Fritz, G.S., Introductory plant physiology, Prentice Hall, USA.
19. Noggle, G. R. and Fritz, G. S. Introductory plant physiology, Prentice Hall, U. S. A.
20. Pandey S. N. & Sinha B. K., Plant Physiology, Vikas Publishing House, New Delhi
21. Pine, N. W. (1971) Leaf protein, its preparation, quality and use, Blackwell Scientific Publ. U. K.
22. Salisbury F. N. and C. W. Ross, Plant physiology: CBS Publishers and Distributors, New Delhi.
23. Slyter, R. O. Plant Water Relationships, Academic Press, New York.
24. Telek, H. and Graham, LT. (1983) Leaf protein concentrates, AVI, Publishing Co., USA.
25. Vaidya, V. G., Sahasrabuddhe, K. R. and Khupse, V. S. Crop production and field experimentation Continental Prakashan, Pune - 30.
26. Wilkins M. B., Advanced plant physiology, English Language Book Society, London.

Course Code: SRD265101T

Course Name: Research Methodology

Course type: Research Methodology Course

Credits: 4, Contact Hours: 60 clock hours, 4 hours/ week

Marks: 100, Internal assessment: 40, External assessment: 60

Course Objectives:

1. To define research and describe the research process and research methods
2. To understand qualitative research and methods used to execute and validate qualitative research
3. To know how to apply the basic aspects of the research process in order to plan and execute a research project.
4. To provide insight into the processes that lead to the publishing of research.
5. To be able to present, review and publish scientific articles

Course Outcomes:

Students will be able to -

- understand and explain research process
- do systematic literature survey, formulation of a research topic, study design, analysis and interpretation of data.
- to design a research approach for a specific research issue of their choice.
- select a suitable analytical method for a specific research approach.
- demonstrate a good understanding of how to write a research report.
- critically assess published quantitative research with regard to the statistical methods and approaches adopted
- create a research document for implementation research project

Course Contents:

Part – 1 (02 credit: 30 Contact Hours)

Unit - I: Research Fundamentals and Identification of Research Problem: (10 Hrs.)
Research Fundamentals

Introduction: Definition, objectives of the research, characteristics of the research, what makes people to do research, importance of research**,** Qualitative and Quantitative Research: Qualitative research - Quantitative research - Concept of measurement, causality, generalization, and replication. Merging the two approaches.

Identification of Research Problem

Defining the research problem: Identification of research problems, selection of research problem, facts one should know regarding selection of research problem, the process of research problem definition, some facts involved in defining research problem, Research Design: Concept and Importance in Research - Features of a good research design - Exploratory Research Design - concept, types and uses, Descriptive Research Designs - concept, types and uses. Experimental Design: Concept of Independent & Dependent variables, Case Studies,

Unit - II: Formulation of Research Problem (10 Hrs.)

Formulation of the problems: steps involved in defining a problem, formulation of the problems, Formulation of hypothesis: Concept of hypothesis, hypothesis testing, developing the research plan: implementation, interpreting and reporting the findings, Importance of hypothesis in decision making, Case Studies. Interpretation of Data. Measurement: Concept of measurement- what is measured? Problems in measurement in research- Validity and Reliability. Levels of measurement Nominal, Ordinal, Interval, Ratio.

Unit – III : Research Report and Proposal Writing (10 Hrs.)

Introduction, research proposal writing: costing, the research proposal, rationale for the study, research objectives, research methodology, target respondents, research Centres, sample size and sample composition, sampling procedures, research project execution, research units; An insight into research report and proposal, research project synopsis, research report writing : types of research reports, guidelines for writing reports; Steps in writing report, report presentation, typing the report, documentation and bibliography, formatting guidelines for writing a good research report / research paper, Paper Writing- Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, When and where to publish ? Ethical issues related to publishing, Plagiarism and Self-Plagiarism. Case Studies.

Part – II (02 credit : 30 Contact Hours)

Presentations, case studies, Assignments, Tutorials based on Unit I to III **(30 Hrs.)**

Students are expected to do the Followings

i) Select Broad topic of Research Project (to be implemented from second semester onwards)
ii) Read the Basic concepts / fundaments of broad topic
iii) Identify 10 SCOPUS / WEB OF SCIENCE Indexed Journals related to broad topic
iv) Search and download 20 research articles from above research Journals
v) Do systematic review of above 20 research articles
vi) While doing review of each of above mentioned 20 research articles, students are expected prepare notes on following points:

a) What are the objectives of the research article?
b) What methodology has been adopted?
c) What are prominent results?
d) How these results of relevant to the latest development of the subject?
e) What is novelty of research article?

f) What are prominent shortcomings of this research a presented in this research article?
g) What are your plans to address those shortcoming?

vii) Draft the fine-tuned title of research project
viii) Draft hypothesis
ix) Draft Objectives and Methodology
x) Draft expected outcome of the research project

At the end of the assignment, students are expected to prepare a report having following points

i) Fine-tuned title of Research Project
ii) Fundamental aspects of the fine-tuned research topic
iii) Hypothesis
iv) Objectives
v) Methodology
vi) Detailed Experimental plan
vii) Expected outcome
viii) References

References:

1. Research Methodology by Dr. S. L. Gupta, Hitesh Gupta; International Book House Pvt Ltd **(2013),** ISBN-10: 8191064278, ISBN-13: 978-8191064278
2. Basic Research Methods-Gerard Guthrie SAGE Publications, India, Pvt Ltd, New Delhi **(2010),** ISBN-10: 8132104579, ISBN-13: 978-8132104575
3. Research Methodology-methods and techniques By C. R. Kothari, New Age International Publishers **(2011)** ISBN 978-81-224-1522-3
4. Principles of Research Methodology- Phyllis G. Supino, Jeffrey S. Borer; Springer, Verlag New York **(2012),** ISBN-ebook: 1461433592, ISBN (Hardcover): 978-1461433590
5. Research Design Qualitative, Quantitative. and Mixed Methods Approaches- John W. Creswell; SAGE Publications Ltd, UK **(2011),** ISBN-9780857023452
6. Research Methodology -A Step-by-Step Guide for Beginners- Ranjit Kumar; Sage Publications Ltd. **(2010)**, ISBN- 1849203016.
7. Scientific Writing and Communication- Angelika Hofmann; Oxford University Press, US **(2010),** ISBN-13-: 978-0 199947560, ISBN-10: 01 99947562
8. Writing Science: How to Write Papers That Get Cited and Proposals That Get Funded- Joshua Schimel, Oxford University Press, **(2011)**, ISBN: 9780199760237
9. Handbook of Scientific Proposal Writing- A. Yavuz Oruc; CRC Press, Taylor & Francis group **(2011)**, ISBN: 9781439869185