DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, CHHATRAPATI SAMBHAJINAGAR.

CIRCULAR NO.SU/Sci./University Deptt./NEP/18/2024

It is hereby inform to all concerned that, the syllabi prepared by the Departmental Committee and recommended by the Dean, Faculty of Science & Technology, Academic Council at its meeting held on 08 April 2024 has accepted the following Syllabi under the Faculty of Science & Technology **as per National Education Policy – 2020 run at University Department, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapathi Sambhajinagar** as appended herewith.

Sr.No.	Courses	Semester
1.	M.Sc.Botany	IIIrd & IVth Semester
2.	M.Sc.Forensic Science	IIIrd & IVth Semester
3.	M.Sc.Nanoscience & Technology	IIIrd & IVth Semester

This is effective from the Academic Year 2024-25 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Chhatrapati Sambhajinagar
- 431 004.
REF.NO.SU/NEP/2024/ 2401
Date:- 21.06.2024.

★ ★ ★ ★ ★★★★★

Deputy Registrar,
Academic Section

Copy forwarded with compliments to :-

1] **Head of the Department,** Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
2] **The Director, University Network & Information Centre, UNIC**, with a request to upload this Circular on University Website.

Copy to :-

1] **The Director, Board of Examinations & Evaluation,** Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
2] The Section Officer,[M.Sc.Unit] Examination Branch, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
3] The Programmer [Computer Unit-1] Examinations, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
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5] The In-charge,[E-Suvidha Kendra], Rajarshi Shahu Maharaj Pariksha Bhavan, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
6] The Public Relation Officer, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
7] The Record Keeper, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,

CHHATRAPATI SAMBHAJINAGAR

FACULTY OF SCIENCE & TECHNOLOGY

2 Years P. G. Programme in Science

(M. Sc.)

For University Department (Academic Autonomy)

As per National Education Policy – 2020

(To be implemented from Academic Year 2024 – 2025)

III SEMESTER

Course structure and Curriculum

(Outcome Based Credit System)

Subject: BOTANY

(Effective from 2024 – 2025)

Prof. Dr. ARVIND S. DHABE
Chairman
Board of Studies in Botany,
Dr. Babasaheb Ambedkar Marathwada University,
Aurangabad - 431004

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, CHHATRAPATI SAMBHAJINAGAR

M. Sc. BOTANY SYLLABUS FOR UNIVERSITY DEPARTMENT AS PER NEP-2020

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 Type	Course Code	Course Name	Teaching Scheme (Hrs./Week)		Credits Assigned		Total Credits	Scheme of Examination			
								Theory Maximum Marks 75		Practical Maximum Marks 25	
			Theory	Practical	Theory	Practical		CA 40%	SEE 60%	CA 40%	SEE 60%
Major Mandatory DSC	BOT/MJ/UD/500	Cell and Molecular Biology	3	-	3	-	14	30	45		
	BOT/MJ/UD/501	Biology & Diversity of Algae and Bryophytes	3	-	3	-		30	45		
	BOT/MJ/UD/502	Taxonomy of Angiosperms	3	-	3	-		30	45		
	BOT/MJ/UD/503	Practical based on BOT/MJ/UD/500 Cell and Molecular Biology	-	2	-	1				10	15
	BOT/MJ/UD/504	Practical based on BOT/MJ/UD/501 Biology & Diversity of Algae and Bryophytes		2	-	1				10	15
	BOT/MJ/UD/505	Practical based on BOT/MJ/UD/502 Taxonomy of Angiosperms	-	2	-	1				10	15
	BOT/MJ/UD/506	Horticulture Techniques	-	4	-	2				20	30
DSE (Choose any one from pool of courses)	BOT/DSE/UD/507	Crop Genetics and Plant Breeding – I	3	-	3	-	4	30	45		
	BOT/DSE/UD/508	Practical based on BOT/DSE/UD/507 Crop Genetics and Plant Breeding – I	-	2		1				10	15
		OR									
	BOT/DSE/UD/509	Mycology and Plant Pathology-I	3	-	3	-		30	45		
	BOT/DSE/UD/510	Practical based on BOT/DSE/UD/509 Mycology and Plant Pathology-I		2	-	1				10	15
		OR									
	BOT/DSE/UD/511	Taxonomy of Angiosperms – I	3	-	3	-		30	45		
	BOT/DSE/UD/512	Practical based on BOT/DSE/UD/510 Taxonomy of Angiosperms – I	-	2	-	1				10	15
		OR									
	BOT/DSE/UD/513	Advanced Plant Physiology and Biochemistry –I	3	-	3	-		30	45		
	BOT/DSE/UD/514	Practical based on BOT/DSE/UD/513 Advanced Plant Physiology and Biochemistry –I	-	2	-	1				10	15
RM	BOT/RM/UD/549	Research Methodology	4	-	4	-	04	40	60		
			16	12	16	06	22				

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

Course Type	Course Code	Course Name	Teaching Scheme (Hrs./Week)		Credits Assigned		Total Credits	Scheme of Examination			
								Theory Maximum Marks 75		Practical Maximum Marks 25	
			Theory	Practical	Theory	Practical		CA 40%	SEE 60%	CA 50%	SEE 50%
Major Mandatory DSC	SAD265502T	Cytology and Genetics	3	-	3	-	14	30	45		
	SAD265512T	Plant Development and Reproduction	3	-	3	-		30	45		
	SAD265522T	Biology and Diversity in Fungi and Microbes	3	-	3	-		30	45		
		Practical based on BOT/MJ/UD/550 Cytology and Genetics	-	2	-	1				10	15
		Practical based on BOT/MJ/UD/551 Plant Development and Reproduction		2	-	1				10	15
		Practical based on BOT/MJ/UD/552 Biology and Diversity in Fungi and Microbes	-	2	-	1				10	15
	SAD265532P	Botanical Techniques	-	4	-	2				20	30
DSE (Choose any one from pool of courses)	SBD265542T	Crop Genetics and Plant Breeding – II	3	-	3	-	4	30	45		
		Practical based on BOT/DSE/UD/557 Crop Genetics and Plant Breeding - II	-	2	-	1				10	15
		OR									
	SBD265552T	Mycology and Plant Pathology-II	3	-	3	-		30	45		
		Practical based on BOT/DSE/UD/559 Mycology and Plant Pathology-II	-	2		1				10	15
		OR									
	SBD265562T	Taxonomy of Angiosperms – II	3	-	3	-		30	45		
		Practical based on BOT/DSE/UD/561 Taxonomy of Angiosperms – II	-	2	-	1				10	15
		OR									
	SBD265572T	Advanced Plant Physiology and Biochemistry –II	3	-	3	-		30	45		
		Practical based on BOT/DSE/UD/563 Advanced Plant Physiology and Biochemistry –II	-	2	-	1				10	15
RM	RM	OJT/FP/ Internship	-	8	-	4	04			40	60
			12	20	12	10	22 CREDITS				

Class: M. Sc. II year **ACADEMIC AUTONOMY** **Semester: III Semester**

Course Type	Course Code	Course Name	Teaching Scheme (Hrs./Week)		Credits Assigned		Total Credits	Scheme of Examination			
								Theory Maximum Marks 75		Practical Maximum Marks 25	
			Theory	Practical	Theory	Practical		CA 40%	SEE 60%	CA 50%	SEE 50%
Major Mandatory DSC	BOT/MJ/UD/600	Biology and Diversity of Pteridophytes and Gymnosperms	3	-	3	-	14	30	45	-	-
	BOT/MJ/UD/601	Plant Ecology and Conservation	3	-	3	-		30	45	-	-
	BOT/MJ/UD/602	Plant Biotechnology	3	-	3	-		30	45	-	-
	BOT/MJ/UD/603	Practical based on BOT/MJ/UD/600 Biology and Diversity of Pteridophytes and Gymnosperms	-	2	-	1		-	-	10	15
	BOT/MJ/UD/604	Practical based on BOT/MJ/UD/601 Plant Ecology and Conservation	-	2	-	1		-	-	10	15
	BOT/MJ/UD/605	Practical based on BOT/MJ/UD/602 Plant Biotechnology	-	2	-	1		-	-	10	15
	BOT/MJ/UD/606	Industrial Technology	-	4	-	2		-	-	20	30
DSE (Choose any one from pool of courses)	BOT/DSE/UD/607	Advanced Genetics– III	3	-	3	-	4	30	45	-	-
	BOT/DSE/UD/608	Practical based on BOT/DSE/UD/607 Advanced Genetics– III	-	2	-	1		-	-	10	15
		OR									
	BOT/DSE/UD/609	Mycology and Plant Pathology-III	3	-	3	-		30	45	-	-
	BOT/DSE/UD/610	Practical based on BOT/DSE/UD/609 Mycology and Plant Pathology-III	-	2		1		-	-	10	15
		OR									
	BOT/DSE/UD/611	Taxonomy of Angiosperms – III	3	-	3	-		30	45	-	-
	BOT/DSE/UD/612	Practical based on BOT/DSE/UD/611 Taxonomy of Angiosperms – III	-	2	-	1		-	-	10	15
		OR									
	BOT/DSE/UD/613	Advanced Plant Physiology and Biochemistry –III	3	-	3	-		30	45	-	-
	BOT/DSE/UD/614	Practical based on BOT/DSE/UD/613 Advanced Plant Physiology and Biochemistry –III	-	2	-	1		-	-	10	15
RP	BOT/FP/UD/649	OJT/FP/Internship	-	8	-	4	04	-	-	40	60
			12	20	12	10	22 CREDITS				

Class: M. Sc. II year ACADEMIC AUTONOMY Semester: IV Semester

Course Type	Course Code	Course Name	Teaching Scheme (Hrs./Week)		Credits Assigned		Total Credits	Scheme of Examination			
								Theory Maximum Marks 75		Practical Maximum Marks 25	
			Theory	Practical	Theory	Practical		CA 40%	SEE 60%	CA 50%	SEE 50%
Major Mandatory DSC	BOT/MJ/UD/650	Bioprospecting and Plant Resource Utilization	3	-	3	-	14	30	45	-	-
	BOT/MJ/UD/651	Phytochemistry and Pharmacognosy	3	-	3	-		30	45	-	-
	BOT/MJ/UD/652	Plant Physiology and Metabolism	3	-	3	-		30	45	-	-
	BOT/MJ/UD/653	Practical based on BOT/MJ/UD/650 Bioprospecting and Plant Resource Utilization	-	2	-	1		-	-	10	15
	BOT/MJ/UD/654	Practical based on BOT/MJ/UD/651 Phytochemistry and Pharmacognosy	-	2	-	1		-	-	10	15
	BOT/MJ/UD/655	Practical based on BOT/MJ/UD/652 Plant Physiology and Metabolism	-	2	-	1		-	-	10	15
	BOT/MJ/UD/656	Genetic Engineering and Bioinformatics	-	4	-	2		-	-	20	30
DSE (Choose any one from pool of courses)	BOT/DSE/UD/657	Advanced Genetics– IV	3	-	3	-	4	30	45	-	-
	BOT/DSE/UD//658	Practical based on BOT/DSE/UD/657 Advanced Genetics - IV	-	2	-	1		-	-	10	15
		OR									
	BOT/DSE/UD/659	Mycology and Plant Pathology-IV	3	-	3	-		30	45	-	-
	BOT/DSE/UD/660	Practical based on BOT/DSE/UD/659 Mycology and Plant Pathology-IV	-	2		1		-	-	10	15
		OR									
	BOT/DSE/UD/661	Taxonomy of Angiosperms – IV	3	-	3	-		30	45	-	-
	BOT/DSE/UD/662	Practical based on BOT/DSE/UD/661 Taxonomy of Angiosperms – IV	-	2	-	1		-	-	10	15
		OR									
	BOT/DSE/UD/663	Advanced Plant Physiology and Biochemistry –IV	3	-	3	-		30	45	-	-
	BOT/DSE/UD/664	Practical based on BOT/DSE/UD/663 Advanced Plant Physiology and Biochemistry –IV	-	2	-	1		-	-	10	15
RP	BOT/FP/699	FP	-	8	-	4	04	-	-	40	60
			12	20	12	10	22 CREDITS				

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CHHATRAPATI SAMBHAJINAGAR

M. Sc. BOTANY SYLLABUS FOR UNIVERSITY DEPARTMENT

AS PER NEP-2020

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

Class: M. Sc. II year **ACADEMIC AUTONOMY** **Semester: III**

Course code: BOT/MJ/UD/600

Course Name: Course Name:

BIOLOGY & DIVERSITY OF PTERIDOPHYTES & GYMNOSPERMS

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. Pteridophyta: Classification, Origin and evolution, Phylogenetic relationship with Bryophyta. Morphology, anatomy, phylogeny and interrelationships of the orders Psilopsida – Psilotales and Psilophytales, Lycopsida – Lycopodiales, Selaginellales, Isoetales, Equisetopsida – Equisetales and Pteropsida – Filicales.

Unit II. Sporophyte and gametophyte in Pteridophytes, Stelar organization and evolution, Origin of leaf and Telome concept, Sporocarp, Heterospory and seed habit, Comparison of Pteridophyta with Bryophyta and Gymnosperms.

Unit III. Gymnosperms: Introduction, Classification and distribution of Gymnosperms, Morphology, anatomy, reproduction, phylogeny of the orders Pteridospermales (Caytoniaceae, Medullosaceae) Bennettitales (Williamsoniaceae, Cycadeoideaceae) Cycadales (Cycadaceae) Ginkgoales (Ginkgoaceae) Coniferales (Pinaceae, Araucariaceae) Taxales (Taxaceae) Gnetales (Gnetaceae) and Economic importance of gymnosperms.

Unit IV. Paleobotany: Introduction, Geological time scale, Fossils and fossilization, Various types, Continental drift/ plate tectonics, Fossil localities in Maharashtra, Contributions of Prof. Birbal Sahani.

SUGGESTED READINGS:

Agashe, S. N. (1995) Paleobotany, Oxford & IBH, New Delhi

Bir, S. S. (2005) Pteridophytes their Morphology, Cytology, Taxonomy and Phylogeny.Today & Tomorrow's Printers and Publisher.

Biswas, C. and B. M. Johri (2004) The Gymnosperms, Narosa Publishing House, New Delhi

Campbell, C. J. (1940) Evolution of land Plants, Stanford University Press.

Coulter J. M. and C. J. Chamberlain (1978) Morphology of Gymnosperms, Central Book Depot, Allahabad

Eames, A. J. (1974) Morphology of Vascular Plants- lower groups, Tata Me Graw-Hill Publishing Co. New Delhi.

Foster, A. S. & F. M. Gifford (1967) Comparative morphology of vascular plants, Freeman Publishers, San Fransisco.

Kakkar, R. K. and B. R. Kakkar (1995) The Gymnosperms (Fossils and Living) Central Publishing House, Allahabad.

Kashyap S. R. (1932) Liverworts of Western Himalayas and the Plains.Vol. I & II, The University of Panjab, Lahore.

Parihar, N. S. (1976) The biology and morphology of the Pteridophyta, Central Book Depot, Allahabad.

PuriPrem (2005) Bryophytes Morphology, Growth and Differentiation- Pulisher- Atmaram and Sons New Delhi

Rashid, A. (1976) An introduction to pteridophyta, Vikas Publishing House Ltd., New Delhi.

Sambamurty, A. V. S. S., (2005) A Textbook of Bryophytes, Pteridophytes, Gymnosperms and Paleobotany, Today & Tomorrow's Printers and Publishers

Sharma O. P. (2002) Gymnosperms, Pragati Prakashan, Meerut.

Sharma P. N. and Sahni K. C. (2005) Gymnosperms of India and Adjacent Countries Publisher- Bhishan Singh Mahendra Pal Singh, Dehradun

Tewari, Shiv Datt and GiriBala Pant (2005) Bryophytes of Kumaun Himalaya. Publisher- Bhishan Singh Mahendra Pal Singh- Dehradun

Siddiqui K. A. (2002) Elements of Paleobotany, KitabMahal, Allahabad.

Smith, G. M. (1976) Cryptogamic Botany - Vol. II, Tata Me Graw-Hill Publishing Co. Ltd. New Delhi.

Sporne, K. R. (1976) Morphology of Pteridophyta. Hutchinson University Library, London.

Course code: BOT/MJ/UD/601

Course Name: PLANT ECOLOGY AND CONSERVATION

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. An introduction to plant ecology and its scope.

ii. **Structure of ecosystem:** Abiotic components (climatic factors, Topographic/factors, Edaphic factors); Biotic components (Interactions among organisms, Autotrophs and Heterotrophs) Ecological Pyramids (Pyramid of numbers, Biomass and energy)

iii. **Functions of ecosystem:** Productivity (Primary and secondary productivity, food chains, Grazing and detritus food chains) food webs. Biogeochemical cycles: C, N, P and S.

Unit II i. **Community ecology:** Classification, Analysis of communities, characteristics of communities, species diversity, Growth form and structure, origin, development and composition.

ii.Competition and coexistence, intra-specific interactions, interspecific interactions, scramble and contest competition model, mutualism and commensalism,prey-predator interactions.

Unit III. Biogeography: Major biomes of the World -Terrestrial, Tundra, arboreal coniferous forests, temperate and tropical grasslands and deciduous forests, Mediterranean and Desert vegetation, Tropical rain forests; Aquatic Ecosystems-Fresh water, Estuarine and marine. Endemism and hotspots of biodiversity.

Unit IV. i. **Environmental pollution** in relation to air, water and soil. Use of fertilizer, pesticides and other chemicals in agriculture and hygiene and their disposal.

ii. Climate change: Greenhouse gases, their sources, trends and role, Ozone layer and its depletion (Global warming, Sea level rise, UV radiation) acid rain, Bioindicator and biomarkers of environmental health.

iii. Concepts of ecological management and sustainable development.

Unit V. i. **Biodiversity:** Concept, types and situation in India. IUCN categories.

ii. **Strategies of conservation**: *In situ* conservation, protected regions in India: Sanctuaries, National parks, Wetlands, Sacred groves, mangroves for conservation of wild biodiversity. *Ex situ* conservation: Principles and practices, Botanic gardens- Definitions, Criteria and types; Important Botanic Gardens in India and World, BGCI, gene bank, seed banks, cryobanks and contribution of Smt. Rahibai Popre, Smt. Tulsi Gowda and Madhav Gadgil

Unit VI.i. General activities of Botanical Survey of India **(BSI)** and National Bureau of plant Genetic Resources **(NBPGR)** for conservation efforts.

ii. Biological Diversity Act 2002, 2020, Forest Conservation Act 1980, Wild Life Protection Act 1972 and related international conventions.

iii. Earth Summit, Climate Change 2021 UNO, MoEFCC recent report of Biodiversity in India.

SUGGESTED READINGS:

Ambasht, R. A. (1990) A text book of Plant Ecology, Students Friends & Co., Varanasi.

Benny Joseph (2005) Environmental Studies, Tata McGraw Hill Publishing Co., Ltd., New Delhi.

Conklin, A. R. Jr. (2004) Field Sampling: Principles and Practices in Environmental Analysis. CRC Press.

Fahey, T. J. and Knapp, A. K. (2007) Principles and Standards for Measuring PrimaryProduction. Oxford.

Grant, W. E. and Swannack, T. M. (2008) Ecological Modeling. Blackwell.

Hajra P. K. & V. Mudgal, 1997, Plant Diversity Hotspots in India – an overview, Botaniical Survey of India, MoEF & CC, Culcatta

Koromondy, E. J. (2005) Concepts of Ecology.4th Ed. Prentice Hall of India, New Delhi.

Muller, Dombosis, D. and H. Ellenberg (1974) Aims and methods of vegetation ecology, Wiley, New York.

Mungikar, A. M. (2003) Biostatistial Analysis. Saraswati Printing Press. Aurangabad.

Mungikar A. M. (2008) An Introduction to Biometry, Sarswati Printing Press, Aurangbad.

Odum E. P. (1971) Fundamentals of Ecology, Saunders, Philadelphia.

Rajagopalan, R. (2005) Environmental studies, Oxford University Press, New Delhi.

Ramkrishna, P. S. (2001) Ecology and Sustainable Development. National Book Trust, New Delhi.

Sharma, P. D. (2001) Ecology and Environment, Rastogi Publications. Meerut.

Stiling, Peter. (2004) Ecology- Theories and Applications.4th Ed. Prentice Hall of India, New Delhi.

Trivedi, P. R. (1999) Encyclopedia of Ecology and Environment. Vol. 1 - 10, Indian National Green Party, New Delhi.

Trivedi. R. K., Goel P. K., Trisal C. L. (1998) Practical Methods in Ecology and Environmental Science: Enviro-media Publisher, Karad

Wilkinson, D. M. (2007) Fundamental Processes in Ecology: An Earth system Approach. Oxford.

Wyse Jackson, P. S. and Sutherland, L. A. (2000) International Agenda for Botanic Gardens in Conservation, Botanic Garden Conservation International (BGCI) UK

Yadav, Manju (2003) Ecology. Discovery Publishing House, New Delhi.

WEBSITES:

www.nbaindia.org

www.envfor.nic.in

www.moef.nic.in

www.bgci.org.uk

www.bsi.nic.in

www.bsienvis.nic.in

www.nbpgr.ernet.in

www.maharashtrastatebiodiversityboard.gov.in,

www.iucn.org,

www.iucnredlist.org,

www.iucnredlistecosystems.org,

www.conservation.org,

www.biodiversity-a-z.org

Course code: BOT/MJ/UD/602

Course Name: PLANT BIOTECHNOLOGY

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. Biotechnology: Basic concept, Historical account, Discoveries of Plant Growth hormones in brief review, Contribution of Sir Gottlieb Haberlandt, Development of Tissue culture as a technique, Scope and Importance.

Unit II. Introduction to tissue culture: Principles of tissue culture, Tissue culture laboratory, Equipment's in Tissue culture laboratory, Preparation of Media, Media composition, Plant Growth Regulators and their Role, selection of media for specified applications, Selection of explant, Sterilization, Sterilizing agents, initiation of tissue culture

Unit III. Cellular totipotency: Cellular totipotency, Media for initiation of callus, dynamics of callus growth, measurement of growth, organogenesis and factors controlling it, genome instability in reaction to morphogenesis, somaclonal variation and its applications.

Unit IV. Cell and organ culture: Plant organ culture; shoot tip, shoot apical meristem, root, leaf, flower and ovary culture, embryo rescue, factors influencing embryogenesis, suspension culture in stationary and stirred tank reactors, isolation of single cells and their culture, measurement of growth.

Applications of tissue culture: Applications in agriculture and Horticulture, Forestry, pharmaceutical industry. *In situ* and *ex-situ* conservation. *In vitro* mutagenesis and its application. Production of transgenic plants.

Unit V. Practical approaches of single cell culture: Somatic embryogenesis, protoplast isolation, regeneration of protoplasts and protoplasts fusion, Synthetic seeds, generation of cybrid and hybrids, cryopreservation of plant cells.

Unit. VI. Recombinant DNA technology: Gene cloning and its techniques - Gene gun, Electroporation, Microinjection, Liposome mediated gene transfer, Ultra sonication and Pollen Mediated gene transfer. Role of *Agrobacterium* and other Vectors in DNA recombinant technology.

Suggested readings:

1. Henry, R. J. 1997, Practical application of plant molecular Biology, Champman and Hall.
2. Kalyan kumar De, 2004, Introduction to Plant Tissue culture, New Central Book
3. Bhojwani, , S. S. and Razdan M. K., 2003, Plant Tissue Culture: Theory and Practice., Elsevier.
4. Mantell S. H. 1985, Principles of Plant Biotechnology: Introduction to Genetic Engineering in plants, Weley-Blackwell publisher.
5. Glover, D. M. and Hanes, B. D. (eds.) 1995. DNA cloning 1: A practical approach, core techniques , 2nd edition, PAS, IRL press at Oxford University Press.
6. Victor M. Loyola-Vargas and Felique Vazquez – Flota, 2006, Plant cell culture protocols. Springer-Humana Press, Inc. New Jersey, USA.
7. Shaw, C. H. (ed.) 1998, Plant Molecular Biology. A practical approach IRI Press, Oxford.
8. Smith, R. H. 2000. Plant Tissue culture: Techniques and Experiments. Academic Press, New York.
10. Susan R. Barnum (1998). *Biotechnology: an introduction*. Thomson Brooks/cole.
11. George Acquaah (2005). *Understanding biotechnology*. Pearson.

12. Lewin, B. 2000, Genes VII, Oxford University Press, New York.
13. 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.
14. Wolfe, S. L. 1993. Molecular and cellular biology. Woodsworth Publishing Company, California, U.S. A.
15. 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.
16.

Course Code: BOT/MJ/UD/603

(Practical based on BOT/MJ/UD/600)

Course Name: Practical

BIOLOGY & DIVERSITY OF PTERIDOPHYTES & GYMNOSPERMS

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

Pteridophytes: Morphological and anatomical studies of

1) *Psilotum* 2) *Lycopodium.* 3) *Selaginella,* 4) *Isoetis,* 5) *Equisetum,* 6) *Ophioglossum,* 7) *Osmunda,* 8) *Gleichenia,* 9) *Pteris,* 10) *Adiantum,* 11) *Marselia,* 12) *Salvinia,* 13) *Azolla* and additional forms/species collected during study tour.

Gymnosperms : Study of the vegetative and reproductive parts, including anatomy of the following genera: 1) *Cycas* 2) *Zamia* 3) *Pinus* 4) *Cedrus* 5) *Taxodium* 6) *Cryptomeria,* 7) *Cupressus* 8) *Thuja* 9) *Juniperus* 10) *Podocarpus* 11) *Cephalotaxus* 12) *Agathis* 13) *Araucaria,* 14) *Taxus,* 15) *Ginkgo* 16) *Gnetum.*

Fossil Types: Impression, Compression, Petrifaction, Coal ball, TS of *Rhynia, Lygenopteris, Calamitis and Cycadeodea*

Course Code: BOT/MJ/UD/604

(Practical based on BOT/MJ/UD/601)

Course Name: Practical

PLANT ECOLOGY & CONSERVATION

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 calculate mean, variance, standard deviation, standard error, coefficient of variation and to use 't' test for comparing two means related to ecological data.
2. To find out relationship between two ecological variables using co-relation and regression analysis.
3. To find out association between important grassland species using chi-square test.
4. To determine minimum size and number of quadrates required for reliable estimate of biomass in grassland.
5. To determine diversity indices (Shannon-Wiever concentration of dominance) for protected and unprotected grass land stands.
6. To estimate IVI of the species in a wood land using point centerquadrate method.
7. To determine soil moisture content, porosity and bulk density of soils collected from varying depths at different locations.
8. To determine the water holding capacity of soils collected from different locations.
9. To estimate the DO content in water samples by Winkeler's method.
10. To estimate chlorophyll content in SO_2 fumigated and non-fumigated plant leaves.
11. Visits to different ecosystems and submission of report.
12. Scientific visits to laboratories / Industries / Research Institutes working in conservation of plants and submission of report.

Course Code: BOT/MJ/UD/605

(Practical based on BOT/MJ/UD/602)

Course Name: Practical

BIOTECHNOLOGY

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. Equipment's required in Tissue culture Lab
2. Media preparation
3. Sterilization of media
4. Sterilization of explant.
5. Explant Culture.
6. Anther culture
7. Pollen culture,
8. Micropropagation.
9. Embryo rescue technique.
10. Somaclonal variation.
11. *In vitro* mutation.
12. Isolation of plant protoplasts and viability testing.
13. Protoplast fusion by PEG.
14. Tissue culture of Horticultural plant Banana.
15. Tissue culture of Medicinal plants.

Course Code: BOT/MJ/UD/606

Course Name: Practical

INDUSTRIAL TECHNOLOGY

Course type: Major Mandatory Discipline Specific Course

Credits: 2, Contact Hours: 60 clock hours, 8 hours/ week

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

I. Introduction to basic Industrial Techniques, Lab. Safety; Methods of sterilization, media preparation and culturing.

II. Fermentation Equipments (Types of Fermenters) and Its Uses
   a. Simple Fermenters (batch and continuous)
   b. Fed batch Fermenter
   c. Multipurpose Fermenter and its auxiliary equipment

III. Commercial Production of Ethyl Alcohol and Citric Acid

IV. Yogurt fermentation

V. Beer fermentation

VI. Bakery Dough Preparation (*Saccharomyces* sp.)

VII. Legume technology: -
   a. Fermented Soy products
   b. Soy milk

VIII. Fruit Juices—Methods of Preservation.

IX. Dehydrated Food Production Technique. (Lemon peels Powder/Pudina Powder/Dehydrated Garlic Powder etc.)

X. Mushroom Cultivation and harvesting

XI. SCP (Production of Spirulina/Chlorella)

XII. Industry Visit (Seed/Beverage/Food Processing etc)

Reference: -

- Change. S.T. and P.G. Miles - Edible mushrooms and their cultivation.
- Berry, R. - Industrial mycology (Vol. I)

- Dubey, S.C. - Biotechnology.
- Jeffrey C. Pommerville - Alcamo's Fundamentals of Microbiology
- Arora D.R. and B. Arora - Text book of Microbiology
- Aneja, K. R. Experiments in Microbiology, Plant pathology and Biotechnology. New Age International.
- Presscott, Dunn, IndustrialMicrobiology, 1st edition, Agrobios (India), CBS Publication, 2004
- Casida Jr, L.E., Industrial Microbiology, 1st edition, New Age International (P) Ltd, 2007.
- A.H. Patel, Industrial Microbiology, 1st edition, MacMillan Publication, 2008.
- Desrosier- Technology of Food Preservation
- Cruss- Fruits and vegetable processing
- Falguera, V., & Ibarz, A. (Eds.). Juice processing: quality, safety and value-added opportunities. CRC Press.
- Plant cell culture Technology—MM Yeomen (2012) Blackwell
- Preservation of Fruits & Vegetables by IRRI

Course Code: BOT/DSE/UD/607

Course Name: ADVANCED GENETICS – 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. MICROBIAL GENETICS:

A. Microorganisms as model systems for genetic studies: Virus and phage organization, Lytic and temperate phages, recombination in phages and gene mapping.

B. Recombination in bacteria: transformation, transduction, conjugation and gene mapping, Tetrad analysis in fungi.

UNIT II. GENOME ORGANIZATION:

A. Genome size variation, cot curve analysis, DNA complexity, LINES and SINES, gene amplification and gene families

B. Mitochondria and chloroplast genome.

UNIT III. APPLIED GENETICS:

Genetic engineering: Isolation of DNA, restriction endonucleases, construction of genomic library, screening of DNA library for desired gene, Southern, Northern and Western blotting, prokaryotic and eukaryotic vectors, DNA sequencing, Maxam and Gilbert's procedure, Sanger Coulson method, automated DNA sequencing machine, PCR and DNA amplification, Marker gene, reporter and selection marker gene, Ti plasmids and viral vectors, Direct gene transfer through electroporation, biolistic gun, micro injection, liposome and PEG mediated gene transfers. Application of recombinant DNA technology in medicine, industry and agriculture.

UNIT IV. GENETIC BASIS OF CANCER:

Forms of cancer, genetic basis, Immortalization, transformation, cancer and cell cycle, oncogenes, genetic pathway to cancer, genetic counseling.

UNIT V. GENOMICS:

Structural genomics, cytogenetic maps, RFLP, RAPD, QT maps, FISH and chromosome specific library. Genome sequencing: Human, Yeast, Arabidopsis, functional genomics expressed sequences, DNA chips and genome evolution.

Suggested Readings:

1. Snustad, P. D. and Simmons, M. J. 2000, Principles of Genetics, 2Qd Ed, John, Wiley and Sons, Inc., London.

2. Lewin, R. 1999, Human genetics, Concepts and applications. 3rd Ed, McGraw Hill, Dubuque,

IA.

3. Lewin, B. 2000, Genes VII, Oxford University, New York.

4. Griffith, A. J. F., Miller, J. H. Suzuki, D. T. Lewontin, R. C. and Gilbert, .M, 2000. Introduction to genetic analysis, 5th Ed. W.H. Freeman, N. Y.

5. Lodish, H., Berk, A., Zipursky, S. L., Matsudaira, P., Baltimore, D. and Darnell, J. 2000.

Molecular cell Biology, Freeman, W. H. and Co., N. Y.

6. Watson, J. D., Gilman, M., Witkowski, J. and Zoller, M. 1992, Recombinant DNA

W.H. Freeman and Co., N. Y. A.. c
(Hi. (1994). Molecular Biology of cell, 3rd Ed. Garland

7. Albart A. et. al 1914 J.M.and Gingold, E. B. 1993, Molecular biology and Biotechnology,

Royal Soc., Publications,

8. U. K. Ifftinaiin, R. 1991, Principles of Genetics, 3rd Ed. Win Brown, Dubuque, USA.

9. Brown J. A. 1992. Genetics, a molecular approach II Ed.

10. Tamarin, R. 1991 principls of Genetics III edition, Win brown , Duabuque, USA

11. Watson J. D. 1989. Molecular biology of the gene

Course Code: BOT/DSE/UD/608

Course Name: Practical ADVANCED GENETICS – I

(Practical based on BOT/DSE/UD/607)

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. Isolation of genomic DNA using C TAB method and quantification.
2. Evaluation of quality of isolated DNA.
3. Isolation of plasmid DNA
4. Conjugation in E. coli
5. Study of growth curve in E. coli.
6. Transformation in bacteria.
7. Substrate induced enzyme induction in plants.
8. Comparative radio-sensitivity in two crop species.
9.

Course Code: BOT/DSE/UD/609

Course Name: MYCOLOGY AND PLANT PATHOLOGY-III

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 disease diagnosis and Preservation Techniques:

Field observations, laboratory investigations, isolation and purification of plant pathogens, Koch's postulates; identification of plant pathogens, Screening for crop disease and soil fungi, Plant disease clinics; History and development of plant pathology in India.

Culture media for Microbes–Types of media, Types of culturing, Sterilization methods and its types, Impact of physical and nutritional factors Microbial Growth. Preservation methods, Microbial culture collections and their importance. A brief account on ITCC, MTCC and ATCC.

Unit II. Dispersal of plant pathogens and Pathogenisis: Dispersal of pathogens: Direct, and Indirect transmission; Plant disease epidemiology; Some important epiphytotics.

Pathogenesis: Penetration and entry by plant pathogen; Pre-penetration; Entry through natural opening; Direct penetration; Entry through wounds, root hairs and buds.

Unit III. Disease Resistance in Plants: Primary infection resistance, Structural and Chemical defenses; Post infection resistance: Production and activities of phytotoxins. Histological accumulation of phenols, hypersensitive substances and enzymes, detoxification.

Unit IV. Genetics of host Pathogen interaction: Resistance and susceptibility, Vertical and horizontal resistance, Gene for Gene hypothesis, PR-Proteins, physiological specialization, mutation, heterokaryosis.

Unit V. Disease Management: Cultural Methods- Avoidance of pathogen, exclusion of inoculum, eradication of pathogen, Chemical methods- sulphur fungicides, Copper fungicides, Mercury fungicides, Quinone fungicides, Systemic fungicides, Antibiotics, Breeding for disease resistance, Biopesticides and bioagents; Trichoderma and VA Mycorrhiza. Application of Biotechnology in disease management.

Suggested Reading

Mehrotra, R. S. Plant Pathology, Tata Mc Graw Hill Publication Co., Ltd., New Delhi.

Agrios, G. N. Plant Pathology, Academic Press, New York and London.

Mukadam D.S., M. S. Patil, Ashok M Chavan, Anjali R. Patil (2006) 'The Illustrated of Fungi', Saraswati Printing Press, Aurangabad.

Mahendra Rai, and Paul Bridge, (2009). Applied Mycology. CABI, UK.

L. E. J. R. Casida (2019). Industrial Microbiology. New Age International Private Limited.

Chandnivala, M. (1955). Recent advances in plant pathology, Amol Publication, Pvt. Ltd.

Nurenburg, H.W. (1985) Pollution and their ecotoxicological significance, John Wiley and Sons, New York.

Bilgrami, K. S. and H. C. Dubey, A text book of Modem plant pathology, Vikas Publishing House, New Delhi.

Nene, Y. and P. N. Thaphyal Fungicides in plant disease control II lidiv Oxford and IBH Publishing Co., New Delhi

Vyas, S. C. Systemic fungicides, Vol. 1 - 3, Tata Mc Hill Publishing Co., Ltd., New Delhi.

Dekker, J. and S.G. Georgopoulos (Ed), Fungicides Resistance in plant Protection, CARD, Publications,

Pres loot Dunn, Industrial Microbiology Peppler, Industrial Microbiology Vol.I and Vol.II

Smith Fermentation fungi, Industrial mycology - Vol. I.

Keeney, Practical medical mycology.

Shrikant B. Mane 2023, Practical Manual for Mycology and Plant Pathology, Apex publication, Jaipur.

Ahenkan A, Boon E. Commercialization of non-timber forest products in Ghana: processing, packaging and marketing. *J Food Agricult Environ.* 2010; 8:962–9.

Belcher B, Ruiz Pérez M, Achdiawan R. Global patterns and trends in the use and management of commercial NTFPs: implications for livelihoods and conservation. *World Dev.* 2005:1435–52.

Calixto, J. B., Efficacy, safety, quality control, marketing and regulatory guidelines for herbal medicines (phytotherapeutic agents). Br. J. Med. Biol. Res., 2000, 33, 179–189.

William C G. 1989. A laboratory text book for Microbiology. W.H. Freeman and Company. New York.

Dubey R C and Maheshwari D K. 2007. A textbook of Microbiology, S. Chand and Company, New Delhi.

Dubey R C and Maheshwari D K. 2002. A Text book of Microbiology, S.C .Chand and Company, Ltd. Ramnagar, New Delhi.

Sharma R. 2006. Text book of Microbiology. Mittal Publications. New Delhi.305pp.

Alexepoulos C. J. and Mims C W. 1989. Introductory Mycology, Wiley Eastern Ltd., New Delhi.

Allas R M. 1988. Microbiology: Fundamentals and Applications, Macmillan publishing co. New York.

Brook T D, Smith D W and Madigan M T. 1984. Biology of Microorganisms, 4th ed. Eaglewood Cliffts. N. J. Prentice-Hall. New Delhi.

Burnell JH and Trinci APJ. 1979. Fungal walls and hyphal growth, Cambridge University Press. Cambridge.

Jayaraman J. 1985.Laboratory Manual of Biochemistry, Wiley Eastern Limited. New Delhi.

Powar C B and Daginawala. 1991. General Microbiology, Vol –I and Vol –II Himalaya publishing house, Bombay.

Sullia SB and Shantharam S. 1998. General Microbiology. Oxford and IBH publishing Co. Pvt. Ltd. New Delhi.

Schlegel HG. 1986. General Microbiology. Cambridge. University Press. London, 587pp

Course Code: BOT/DSE/UD/610

Course Name: Practical MYCOLOGY AND PLANT PATHOLOGY – III

(Practical based on BOT/DSE/UD/609)

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. Preparation of different Media and sterilization.
2. Isolation of Fungi and identification of Pathogen.
3. Detection of fungi and Bacteria from different crops, soil, and infected plants.
4. Microbial Preservation mineral oils.
5. Microbial Preservation lyophilisation.
6. Microbial Herbarium.
7. Study the effect of Physical factors on growth of fungi
8. Study the effect of Nutritional factors on growth of fungi
9. Evaluation of fungicide against plant pathogenic fungi.
10. Evaluation of Bio agents against plant pathogenic fungi.
11. Evaluation of antibiotics again pathogenic bacteria.
12. Antagonistic Activity of fungi and bacteria.
13. Collection, submission of fungal samples on different storage media (Five Samples Each).
14. Collection, submission of fungal Herbarium samples.
15. Cultural collection visit and tour report.

Course Code: BOT/DSE/UD/611

Course Name: TAXONOMY OF ANGIOSPERMS -III

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: Phylogeny of Angiosperms: Isoetes-monocotyledone theory, Coniferales-amentiferae theory, Gnetales-angiosperms theory, anthostrobilus theory, Bennettitalean theory, Caytonialean theory, Stachyspory-phyllospermae theory, pteridosperm theory, Pentoxylales theory and Durian theory; Co-evolution of insect and plants.

UNIT-II: Study of fossil angiosperms: Malvaceae: Sahniocarpon; Myrtaceae: Sahnipushpam; Soneratiaceae: Sahnianthus, Enigmocarpon; Palmae: Palmoxylon.

UNIT-III: Taxonomic tools: Serological and molecular techniques, Taxonomic keys: Construction and use of keys: types of keys.

UNIT-IV: Molecular Biology: Acquisition of Molecular Data, sources of DNA sequence data, Plant genomes, Polymerase Chain Reaction (PCR) analysis, DNA Sequencing Reaction, Types of DNA Sequence Data, Generation and analysis of DNA Sequence Data, Restriction Fragment Length Polymorphism analysis (RFLP), allozymes, micro-satellite DNA, Random Amplified Polymorphic DNA (RAPDs), Amplified Fragment Length Polymorphism (AFLPs).

UNIT-V: Recent system of classification: Angiosperm Phylogeny Group (APG IV) system. Study of the following orders as per the APG IV system: Magnoliales, Liliales, Asparagales, Zingiberales, Poales, Fabales

Suggested Readings:

1. AHMEDULLAH, M., AND M.P. NAYAR. 1987. Endemic Plants of the Indian Region. Vol. I. Botanical Survey of India. Howrah.

2. BENSON, L.D. 1962. Plant Taxonomy: Methods and Principles. Ronald Press, New York.

3. BHOJWANI, S. S. AND BHATNAGAR, S. P. 1984. Embryology of Angiosperms.Vikas Publ. House, New Dehli.

4. BILGRAMI, K.S. AND J.V. DOGRA. 1990. Phyto Chemistry and Plant Taxonomy. New Delhi, CBS Publishers

5. CRONQUIST, A. 1968. The Evolution and Classification of Flowering Plants.Houghton Mifflin. Boston.

6. CRONQUIST, A. 1981. An Integrated System of Classification of Flowering Plants. Columbia University Press, New York.

7. CRONQUIST, A. 1988. The Evolution and Classification of Flowering Plants (2nd ed.) Allen Press, U.S.A.

8. DANIEL, M. 2009. Taxonomy: Evolution at work. Narosa Publishing House Pvt. Ltd. New Delhi.

9. DAVIS, P.H., AND V.H. HEYWOOD. 1965. Principles of Angiosperm Taxonomy. Oliver & Boyd. Edinburgh.

10. DAVIS, P.H., AND V.H. HEYWOOD. 1991. Principles of Angiosperm Taxonomy. Today and Tomorrow Publications, New Delhi

11. DOBSON, A.P.1996. Conservation and Biodiversity.Scientific American Library. New York, U.S.A.

12. ERDTMAN, G. 1952. Pollen Morphology and Plant Taxonomy.Angiosperms.Almquist and Wiksell. Stockholm.

13. ERDTMAN, G. 1986. Pollen Morphology and Plant Taxonomy : Angiosperms An Introduction to Palynology. Netherland, E. J. Brill, Leiden.

14. FORMAN, L. AND D. BRIDSON. 1989. The Herbarium Handbook. Royal Botanic Gardens, Kew, U.K.

15. GRAHAM, L.E. 1993. Origin of Land Plants.John Wiley & Sons.Inc. New York.

16. GREUTER, W, (Ed.). 2007. International Code of Botanical Nomenclature. (VIENNA CODE).KoeltzVesentific Books. Germany.

17. GROOMBRIDGE, B, (Ed.). 1992. Global Biodiversity: Status of The Earth's Living Resources. Chapman and Hall. London.

18. HENRY, A.N., M.CHANDRABOSE. 1980. An Aid to International Code of Botanical Nomenclature. Today & Tomorrow's Printers and Publishers. New Delhi.

19. HESLOP-HARRISON, J. 1953. New Concepts in Flowering Plant Taxonomy.Heinemann Ltd. London.

20. HEYWOOD, V.H. 1967. Plant Taxonomy. Edward Arnold Ltd. Great Britain.

21. HEYWOOD, V.H. 1995. Global Biodiversity Assessment.Cambridge University Press, Cambridge, U.K.

22. HUTCHINSON, J. 1973. The Families of Flowering Plants.3rd Edition.Oxford University Press. Oxford.

23. JAIN, S.K. and R.R. RAO. 1977. A Handbook of Field and Herbarium Methods. Today and Tomorrow's Printers and Publishers, New Delhi.

24. JOHRI, B.M. 1994. Botany in India: History and Progress. Vol-I. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.

25. JONES, S.B., AND A.E. LUCHSINGER. 1987. Plant Systematics. 2nd Edition. McGraw-Hill Book Company. New York.

26. JUDD, W. S, C. S. CAMPBELL, E. A, KELLOG, P. F. STEVENS AND N. J. DONOGHUE. 2008. Plant Systematics. Sinauer Associates, INC,Publishers.Sunderland, Massachusetts, USA.

27. LAWRENCE, G.H.M. 1951. Taxonomy of Vascular Plants.The Macmillan Company. New York.

28. MABBERLEY, D.J. 2005. The Plant-Book, A portable dictionary of the vascular plants. Cambridge University Press, United Kingdom

29. MANILAL, K. S. AND M. S. MUKTESH KUMAR [ed.] 1998. A Handbook of Taxonomic Training. DST, New Delhi.

30. MINELLI, A. 1993. Biological Systematics: The State of the Art. London, Chapman & Hall.

31. MONDAL, A.K. 2005. Advanced Plant Taxonomy.New Central Book.Agency Pvt. Ltd. Kolkata.

32. MOORE, R., W.D. CLARK, K.R. STERN AND D. VODOPICH. 1995. Botany: Plant Diversity. Wm. C. Brown Publishers. London.

33. NAIK, V. N. 2000. Taxonomy of Angiosperms. Tata McGraw – Hill Publishing Company Limited, New Delhi.

34. Nair, P. K. K. 1966. Pollen morphology of Angiosperms.Periodical Expert Book Agency, New Delhi.

35. NAYAR, M.P., 1996. "Hot Spots" of Endemic plants of India, Nepal and Bhutan. Tropical Botanic Garden and Research Institute, Thiruvananthapuram, India.

36. NAYAR, M.P., AND R.K. SASTRY. 1987-1990. Red Data Book on Indian Plants.Vols.I - III.Botanical Survey of India. Howrah.

37. QUICKE, D. L. J. 1993. Principles and Techniques of Contemporary Taxonomy.Chapman and Hall. London.

38. RADFORD, A.E., W.C. DICKISON, J.R. MASSEY, AND C.R. BELL. 1974. Vascular Plant Systematics. Harper & Row. New York.

39. RAVEN, P.H., R.F. EVERT, AND S.E. EICHHON. 1992. Biology of Plants. 5th Edition.Worth Publishers. New York.

40. SANTAPAU, H. 1955. Botanical Collector's Manual. Botanical Survey of India.

41. SANTAPAU, H. AND H.A. HENRY. 1994. A dictionary of the flowering plants in India, CSRI, New Delhi.

42. SHARMA A. AND A. SHARMA. 1980. Chromosome Technique: Theory and Practices (3rd ed.) Butterworths, London.

43. SHIVANNA, K. R. AND N. S. RANGASWAMY. 1992. Pollen Biology- A Laboratory Manual. Springer-Verlag

44. SIMPSON, M. G. 2006. Plant Systematics. Elsevier Academic Press, California, USA.

45. SIMPSON, M.G. Plant Systematics. Elsevier Academic Press. Burlington, U.S.A.

46. SINGH, G. 2005. Plant Systematics – Theory and Practice. Oxford and YBH Publishing Co. Pvt. Ltd., New Delhi.

47. SIVARAJAN, V.V. 1989. Introduction to Principles of Plant Taxono¬my.Oxford and IBH Publishing Co. New Delhi.

48. SOLTIS, D. E., P. S. SOLTIS, P. K. ENDRESS AND M. W. CHASE. 2005. Phylogeny and Evolution of Angiosperms. Sinauer Associates, Inc, Massachusetts, USA.

49. STACE, C. A. 1989. Plant Taxonomy and Biosystematics. Edward Arnold, London.

50. STUESSY, T. F. 2002. Plant Taxonomy.Bishen Singh Mahendra Pal Singh, Dehra Dun, India.

51. SUBRAMANIAM, N. S. 1995. Modern Plant Taxonomy.Vikas Publishing House. New Delhi.

52. TAKHTAJAN, A. 1997.Diversity and Classification of Flowering Plants. Bishen Singh and Mahendra pal Singh, Dehra Dun, India.

53. TAYLOR, D. V. AND L. J. HICKEY. 1997. Flowering Plants: Origin, Evolution and Phylogeny. CBS Publishers & Distributers, New Delhi.

54. WILEY, E.O. 1981. Phylogenetics : The Theory and Practice of Phylogenetic Systematics. New York, John Wiley & Sons.

Course Code: BOT/DSE/UD/612

Course Name: Practical TAXONOMY OF ANGIOSPERMS – III

(Practical based on BOT/DSE/UD/611)

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. Assessment of taxonomic characters (a) analytical and synthetic characters, (b) qualitative and quantitative characters.
2. Study of different taxonomic features (a) stomata, (b) trichomes, (c) crystals, (d) pollen grains.
3. Describing new taxon, deposition of type, Latin diagnosis and abbreviations used in citations.
4. Detection of taxonomically important chemical compounds by various tests.
5. Detection of variations in a given population.
6. Exercises on nomenclature problems: Author citation, principle of priority, transfer of taxa, effective and valid publication etc.
7. Practicals based on numerical taxonomy/ cluster analysis.
8. Study of different types of ovules, placentations and evolutionary trends therein.
9. Study of following fossil angiosperm specimens: Palmoxylon, Enigmocarpon, Sahnianthus, Glossopteris with the help of slides/ specimens.
10. To identify family with the help of computerized Key.
11. Preparation and standardization of some simple Ayurvedic Drugs.

Course Code: BOT/DSE/UD/613

Course Name: ADVANCED PLANT PHYSIOLOGY AND BIOCHEMISTRY –III

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 water relations: molecular structure of water, water potential, Absorption of water by land plants, transpiration and its significance, physiology of stomatal movements, anti-transpirants.

Unit II Stress physiology: Biotic and abiotic environmental stresses, effect on plant metabolism and growth, high temperature stress, water stress, chilling stress, thermogenesis, salinity and salt stress, salt respiration, salinity and agriculture.

Unit III Seed germination, seedling growth, seed dormancy, light and temperature sensitive seeds, Biochemical changes associated with seed germination, Hormonal regulation, conditions for seed germination, Mobilization of reserve food material, longevity of seed and seed viability.

Unit IV Organic farming, mixed farming, crop rotation and inter-cropping, weed management and control, Herbicides, weed biomass as green manure, organic matter recycling and preparation of compost / vermicompost, Production of crop plants under organic and conventional farming system, Bio-fertilizers, Bio-methylation

Unit V Biostatistics: Collection and tabulation of data, Frequency distribution, normal curve, location, dispersion, normal distribution, tests of significance, t test, F test, chi square test, correlation and regression. Experimental designs, Analysis of data: RBD, LSD, Factorial and split plot RBD.

Suggested Reading:

1. Mukharji S and A. K. Ghosh. Plant Physiology - New Central Book Agency, Kolkatta.

2. Mertz, E. T. Elements Biochemistry Vakils, Fe Her and Simson Pvt Ltd, Bombay.

3. Fains, J. L. and Kilgour, G. L. Essentials of Biological Chemistry, Affiliated East - West Press, Pvt. Ltd., New Delhi.

4. Moat, A. G., Foster, J. W. and Spectok, M. P. Microbial Physiology, Wilesy Liss, A. John Wiley and Sons, Inc., Singapore.

5. Trevan, M. D., Botey, S., Goulding, K. H. and Stanburn, P.Biotechnology. The Biological principles. Tata Me Craw Hill Publishing Company Limited, New Delhi.

6. Salisbury. I. B. and Ross. C. W., Plant Physiology CBS Publishers andDistributors, Ncw Delhi.

7. Noggle, G. R. and Fritz, G. S. Introductory Plant Physiology. Printice Hall, USA.

8. Styter, R. O. Plant water relationship, Academic Press, New York.

9. Hess, D. Plant Physiology, Narosa Publishing House, New Delhi.

10. Devlin, R. M. and Hostan, F.H. Plant Physiology, CBS publishers and Distributors, New Delhi.

11. Mukhcrji, S. and Ghosh A. K., Plant Physiology, Tata Me Graw Hill Publishing Company Ltd., New Delhi.

12. Datta, C. S. Plant Physiology, Wiley Eastern Limited, New Age International Ltd., New Delhi.

13. Vaidya, V. G., Sahasrabuddhe, K. R. and Khupse, V. S. Crop production and field experimentation, Continental Prakashan, Pune - 30.

14. Mungikar, A.M. An Introduction for Biometry, Saraswati Printing Press, Aurangabad. 74

Course Code: BOT/DSE/UD/614

Course Name: Practical TAXONOMY OF ANGIOSPERMS – III

(Practical based on BOT/DSE/UD/613)

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. Determination of water potential.
2. Determination of relative water content (RWC).
3. Effect of growth regulators on seed germination.
4. Estimation of starch in fresh, germinating and germinated seed.
5. Estimation of glucose at various stage of seed germination.
6. Estimation of protein content during seed germination – Lawry's method, burette method
7. Estimation of non-protein nitrogen (NPN) content in germinating seeds,
8. Estimation of vitamin C in germinating seeds.
9. Accumulation of praline in normal and stressed plants.
10. Determination of seed viability.
11. Seed dormancy and breaking of seed dormancy by using physical, scanning, hot water, acid and PGRs.
12. Studies on effect of 2,4 - D on seed germination.
13. Measures of central value - mode, median, mean, range, standard deviation, mean deviation and coefficient of co-relation.
14. Frequency distribution - Graphic representation, frequency curve and Histogram.
15. Calculation of central value of dispersion in classified data,
16. Statistics in agricultural science - ANOVA for various field experimentation,
17. Correlation, regression and calculation of optimum economic use for fertilizers.

Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,

CHHATRAPATI SAMBHAJINAGAR

FACULTY OF SCIENCE & TECHNOLOGY

2 Years P. G. Programme in Science

(M. Sc.)

For Other Centers (Affiliated Colleges & Institutes)

As per National Education Policy – 2020

(To be implemented from Academic Year 2024 – 2025)

IV SEMESTER

Course structure and Curriculum

(Outcome Based Credit System)

Subject: BOTANY

(Effective from 2024 – 2025)

Prof. Dr. ARVIND S. DHABE
Chairman
Board of Studies in Botany,
Dr. Babasaheb Ambedkar Marathwada University,
Aurangabad - 431004

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,

CHHATRAATI SAMBHAJINAGAR - 431004

M. Sc. BOTANY SYLLABUS FOR UNIVERSITY DEPARTMENT

Illustrative Credit distribution structure for two years P. G. Programme with Multiple Entry and Exit option

Class: M. Sc. II year **ACADEMIC AUTONOMY** **Semester: IV**

Course code: BOT/MJ/UD/650

Course name: BIOPROSPECTING AND PLANT RESOURCE UTILIZATION

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: Bioprospecting: Definition, Introduction, Current practices in Bioprospecting for conservation of Biodiversity and Genetic resources.

Bioprospecting Act: Introduction, Phases of Bioprospecting, Exemption to Act. Fields of Bioprospecting.

Unit II: Marine Bioprospecting: Sources of marine planktons and their Bioprospecting, Isolation and cultivation of Marine bioresources, Isolation of Marine Yeast and its industrial applications, Bioactive chemicals from Seaweeds and their applications.

Unit III: Microbial Bioprospecting: Isolation of Microbial metabolites and their bio-activity. Endophytic microbial products as Antibiotics.

Unit IV: Origin, evolution, botany, cultivation and uses of Food, Fodder, Fibers, Oil yielding crops, wood and timber, Non-wood forest products (NWFPS): Bamboos, Gums, Dyes, Resins, Fruits etc.

Unit V: Botany, Chemistry, Properties and uses of Medicinal and Aromatic plants. Anti Covid – 19 and Immunity booster Herbs.

References

1. Anonymous 2000, "The Ayurvedic Formulary of India" - Part - II, Govt. of India Publication, New Delhi.

2. Arora, R.K. and Nayar, E.R. (1984), Wild relatives of crop plants in India, NBPGR Science MonographNo.7.

3. Baker, H.G. (1978), Plants and civilization. III Ed. (A. Wadsworth, Belmount).

4. Bole, P.V. and Vaghani, Y. (T986). Field guide to common Indian trees, Oxford University Press, Mumbai.

5. CSIR (1986), The useful plants of India Publication and Information directorate, CSIR, New Delhi.

6. CSIR (1948 - 1976) The wealth of India, CSIR, New Delhi

7. Daniel, M. 2006, "Medicinal Plants - Chemistry and Properties" Oxford &IBM Publishing Co. Pvt. Ltd. New Delhi.

8. Desai W. G. 1975, *"Aushadhi Sangraha"* Rajesh Publication, Pune.

9. Garde G. K. 2009, (Revised Edition) "Sort/7 *Vagbhat - Ashtanghridayam",* Rajesh Publication, Pune.

10. Jain S. K. 1991, "Dictionary of Indian Folk Medicine and Ethnobotany" Deep Publication, New Delhi.

11. Kameshwara Rao C. 2000, "Material for the Database of Medicinal Plants" Karnataka state Council for Science and Technology for the Department of Forests, Environment and Ecology, Govt of Karnataka Publication.

12. Kirtikar K. R. and Basu B. D. 2001(Reprint) "Indian Medicinal Plants" Oriental enterprises Uttaranchal.

13. Kocchar, S.L. (1998). Economic Botany of the tropics, II Edn. MacMillan India Ltd.

14. Manilal K. S. 2001, "Van Rheed's Hortus Malabaricus" English Edition. University of Kerala Publication.

15. Nadkarni K. M. 1976, (Revised Edition) " Indian Materia Medica" Popular Prakashan, Mumbai.

16. Sharma, O.P. (1996). Hills Economic Botany, Tata McGraw Hill co., Ltd., New Delhi

17. Swaminathan, M.S. and Kocchar, S.L. (Es.) (1989). Plants and Society, MacMillan Publication Ltd.,

18. Sharma 0. P. 1996, "Hills Economic Botany" Tata McGraw Hill Publication, New Delhi.

19. Thakur, R.S., Puri, H.S. and Husain, A. (1969). Major medicinal plants of India, Central Institute of medicinal and aromatic plants, Lucknow.

20. Yoganarasimhan S. N. 1996, "Medicinal Plants of India" vol. I. Karnataka. Interline Publication Pvt. Ltd. Bangalore.

Course code: BOT/MJ/UD/651

Course name: PHYTOCHEMISTRY AND PHARMACOGNOSY

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: Introduction Definition. History and scope of Pharmacognosy. Indigenous system of medicine: Ayurveda, Homeopathy, Unani, traditional Chinese Medicine, Naturopathy, Yoga and Siddha. Classification of drug of natural origin. Adulteration/Substitution and drug evaluation. Significance of Pharmacopeial standards.

UNIT II: Plant constituents Occurrence, distribution, classification, isolation, identification test and pharmaceutical applications: Plant metabolites

a) **Alkaloids**: definition, properties, classification, alkaloidal drugs – Daturastramonium, Atropabelladona, opium, Cinchona, tea, ergot, *Rauvolfia, Holarrhena, Catharanthus* – alkaloidal constituents, uses.
b) **Phenolic compounds** produced by plants: types, biological activity, drugs – *Senna*, *Aloe*, *Hypericum*, *Capsicum*.
c) **Steroidal compounds:** different types, biological activities
d) **Pharmaceutically important Carotenoids:** chemistry, types, apocarotenoids, bioactivities.
e) **Volatile oils:** composition, drugs – clove, Mentha, Eucalyptus, Foeniculum, Cinnamomum, citronella, Resins: chemistry, different types, uses
f) **Lipids**: fatty acids, nomenclature, fats, fixed oils, waxes Section

UNIT III: Therapeutic Uses of Plants and Drugs Occurrence, distribution, organoleptic evaluation, chemical constituents including tests wherever applicable and therapeutic efficacy of following categories of drugs.

(a) **Laxatives**: Aloes. Rhuburb. Castor Oil. Ispaghula.
(b) **Cardiotonic**- *Digitalis, Terminalia* Arjuna.

(c) **Carminatives** and G.I. regulators. Umbelliferous fruits, Coriander, Cardamom, Ginger, Black pepper, Asafoetida, Nutmeg and Clove.

(d) **Astringents**: *Catechu*

(e) **Drugs acting on nervous systems** - *Belladonna, Aconite, Withania somnifera, Ephedra* and *Opium*.

(f) Anti diabetics- *Pterocarpus, Gymnema sylvestre, Syzygium cumini*

(g) Aphrodisiacs: *Withania somnifera, Chlorophytum borivilianum, Asparagus racemosus*

UNIT IV: Industrial uses of Medicinal Plants Perfumes and flavorings agents- peppermint oil, Lemon oil, Orange oil, Lemon grass oil and Sandal wood. Pharmaceutical aids- honey. *Arachis* oil, Starch, Kaolin, Pectin, Olive oil, Lanolin, Bees wax, Acacia, Sodium alginate, Agar, Algal products SCP (*Chlorella* and *Spirulina*), Guargum and Gelatin. Miscellaneous- liquorice, Garlic, *Picrorhiza*, *Dioscorea*, Linseed, Shatavari, Shankhapushpi, Pyrethrum and Tobacco, *Ganoderma*, Medicinal mushrooms.

UNIT V: Crude Plant Drugs Collection and preparation of crude drug for the market as exemplified by *Ergot*, *Opium*, *Rauwolfia*, *Digitalis* and *Senna*. Gross anatomical studies of *Acorus, Asparagus, Bacopa, Cinnamon*, Clove, *Datura*, *Fennel*, *Ginger*, *Justicea adhatoda*, *Terminalia arjuna*, Withania,

References:

1. Anonymous 2000, "The Ayurvedic Formulary of India" - Part - ll, Govt. of India Publication, New Delhi.
2. Anonymous, "Upchar Paddhati aur Pathya" Baidyanath Publication.
3. Biren Shah and A.k. Seth 2010. Textbook of pharamcognosy and Phytochemistry. 8th Edn. Reed Elsevier India Pvt. Ltd.
4. Daniel, M. 2006, Medicinal Plants -Chemistry & Properties Oxford &IBM Pub Co. Pvt. Ltd. New Delhi.
5. Daniel M. & Denni Mammen (2016) Analytical Methods for Medicinal Plants and Economic Botany, Scientific Publishers, Jodhpur,
6. Desai W. G. 1975, "Aushadhi Sangraha" Rajesh Publication, Pune.

7. Garde G. K. 2009, (Revised Edition) "Sort/7 Vagbhat - Ashtanghridayam", Rajesh Publication, Pune.
8. Gokhale S. B.. 2008. Pharmacognosy, Pragati Books Pvt. Ltd.
9. Horborne. J.B. 1983. Phyto chemical methods. Chapman and Hall. London.
10. Jain S. K. 1991, "Dictionary of Indian Folk Medicine and Ethnobotany" Deep Publication, New Delhi.
11. Kameshwara Rao C. 2000, "Material for the Database of Medicinal Plants" Karnataka state Council for Science and Technology for the Dept. of Forests, Environment & Ecology, Govt of Karnataka Publication.
12. Kirtikar K. R. and Basu B. D. 2001(Reprint) "Indian Medicinal Plants" Oriental enterprises Uttaranchal.
13. Kokate. C. K. 2008. Pharmacognosy 53rd Edn. Nirali publisher.
14. Manilal K. S. 2001, "Van Rheed's Hortus Malabaricus" English Edition. University of Kerala Publication.
15. Mohammed Ali. 2019. Textbook of Pharmacognosy 2Edn. CBS Publisher.
16. Nadkarni K. M. 1976, (Revised Edition) "Indian Materia Medica" Popular Prakashan, Mumbai.
17. Pharmacopoeia of India. Govt. of India. Ministry of health 1955 and 1966.
18. Sharma 0. P. 1996, "Hills Economic Botany" Tata McGraw Hill Publication, New Delhi.
19. Trease. G. E. and Evanes W. C. 2009. Pharmacognosy. 16th Edn. Elsevier.
20. Wallis T. E. 2005. Textbook of Pharmacognosy, 5th Edn. CBS publishers.
21. Yoganarasimhan S.N.1996, Medicinal Plants of India vol.I. Karnataka. Interline Publ Pvt. Ltd. Bangalore.

Course code: BOT/MJ/UD/652

Course name: PANT PHYSIOLOGY AND METABOLISM

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. Plant water relations: Water Potential, Absorption and Transpiration, Stomatal Physiology, Active and passive transport of solutes, Phloem loading and unloading, source-sink relationship, Physiology of plants under water stress.

Unit II. Enzyme: Nomenclature, Properties and classification of enzymes, Mechanism of Enzyme action, regulation of enzyme action, isoenzymes.

Unit III. Photosynthesis: Light and dark reactions, pigments and mechanism of light absorption, Photosystem I and II, Emerson enhancement effect, C3, C4 and CAM pathways, significance of C4 and CAM pathways, photorespiration, Photo synthetic productivity.

Unit IV. Respiration: Glycolysis, TCA cycle and its role in synthesis of bio-molecules Mitochondrial electron transport, oxidative phosphorylation, Pentose phosphate pathway, cyanide resistance, Bioenergetics principles.

Unit V. Nitrogen Metabolism: Nitrification and denitrification, Nitrate assimilation, Biological nitrogen fixation, Biosynthesis of amino acids - reductive animation and transamination, Protein synthesis, classification of amino acids and proteins, amphoteric nature and zwitter ions, structure of proteins, protein denaturation, Isolation and purification of proteins.

Suggested Readings:

1. Plant physiology: Salisbury F.N. and C. W. Ross, CBS Publishers and Distributors, New Delhi.
2. Principles of Biochemistry, A. L. Lehninger, CBS Publishers and Distributors, New Delhi.
3. Plant physiology: Bidwell R. G. S., Mac Millan Publishers Co., New York.
4. Advnced plant physiology, Wilkins M. B., English Language Book Society, London.
5. Principles of plant physiology, Bormer, J. and Galston, A. W.
6. Introductory plant physiology, Noggle G. R. and Fritz, G.S., Prentice Hall, USA.
7. Plant Water Relationships, Slyter, R. O. Academic Press, New York.
8. Plant physiology, Hess D., Narosa Publishing House, New Delhi.
9. Elementary Biochemistry, Mertz, E. T. Vakils, Feller and simsons Pvt. Ltd. Mumbai.

10. Essentials of Biological Chemistry, Fairley, J. L. and Kilgon, G. L., Altilised Earr west Press Pvt. Ltd., New Delhi.
11. Plant physiology, Devlin, R. M. and Hostan, F. H., CBS Publishers and Distributors, New Delhi.
12. Plant Physiology, Datta S. C., Willey Eastern Limited, Culcutta.
13. Plant Physiology, Mukharji S. , A. K. Ghosh, New Central Book Agencies, Kolkatta.
14. An Introduction to Biometry, Mungikar A. M., Sarswati Printing Press, Aurangbad.
15. Biostatical Analysis, Mungikar A. M., SarswatiPrinting Press, Aurangabad.
16. Laboratory Manual in Biochemistry, Jayraman, J., New Age International Publishers, Mumbai.
17. Experiment in Plant Physiology, Bajrachrys D., Narosa Publishing House, New Delhi

Course code: BOT/MJ/UD/653

(Practical based on BOT/MJ/UD/650)

Course name: Practical BIOPROSPECTING AND PLANT RESOURCE UTILIZATION

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. Food Crops: Morphology, anatomy, micro-chemical test for stored material: Wheat, rice, maize, chickpea, potato, sweet potato, sugarcane,
2. Study of any five important crops used for fodder / forage purpose: Jowar, Bajra, lucerne, Maize etc.
3. Plant fibers: Cotton, jute, sun hemp, coir, silk cotton: Morphology microscopic study anatomy of whole fibers, using appropriate staining methods.
4. Medicinal and aromatic plants: At least 5 medicinal and 5 aromatic plants and their morphology, anatomy, phyto-chemistry.
5. Oil yielding crops: Mustard, groundnut, soybean, coconut, sunflower, castor: Morphology, microscopy of oil yielding tissue, test for oil, acid, Iodine numbers.
6. Gum, resin, tannin, dye yielding plants.
7. Fire wood and timber yielding plants.
8. Antioxidant assay – NO free radical scavenging assay.
9. Antigenotoxicity assay – MTT assay.
10. Antiviral activities of plants – SRB assay.
11. Scientific visits to laboratories / Industries / Research Institutes and field and submission of report.

Course code: BOT/MJ/UD/654

(Practical based on BOT/MJ/UD/651)

Course name: Practical PHYTOCHEMISTRY AND PHARMACOGNOSY

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. Phytochemical tests of common secondary metabolites – Tannins, Saponins, Alkaloids, Irridoids, Phenolics, Flavonoids etc.
2. Isolation of Phenolic compounds from plant materials.
3. Paper chromatography, Thin layer chromatography techniques used to confirm the chemical compounds.
4. Pharmacognostic procedures of Plant drug standardization: Morphology, Micromorphology, Anatomy, Palynology, Powder analysis, Maceration of medicinal plants mentioned in the syllabus.
5. Extraction of plant materials in the organic solvents by using Sauxhlet's apparatus.
6. Determination of Extractive values of the drugs in various solvents.
7. Determination of total Ash, acid soluble ash and acid insoluble ash.

Course code: BOT/MJ/UD/655

(Practical based on BOT/MJ/UD/652)

Course name: Practical PLANT PHYSIOLOGY AND METABOLISM

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. Separation of amino acids by paper and thin layer chromatography.
2. Chemical tests for proteins.
3. Estimation of proteins by Lawry's method.
4. Estimation of proteins by Biuret method.
5. Determination of Isoelectric point of Casein.
6. Determination of activity of nitrate reductase.
7. Immobilization of enzymes using sodium alginate.
8. Preparation of Leaf Protein Concentrate (LPC) by heat coagulation method.
9. Extraction/Estimation of crude fats using Sauxhlet's extractor.
10. Determination of Iodine number of fats and oils.
11. Determination of Saponification number of fats and oils.

Course Code: BOT/DSE/UD/656

Course Name: Practical GENETIC ENGINEERING AND BIOINFORMATICS - II

(Practical based on BOT/DSE/UD/657)

Course type: Major Mandatory Discipline Specific Course

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

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

1) Different file formats – Genebank, Genpept, FASTA, EMBL, NBRF/PIR, , PDB file format.
2) Entrez and Literature Searches. PubMed, PubMed central, OMIM / OMIA.
3) Primary sequence Databases- NCBI, EMBL, DDBJ.
4) Protein Structure Database– PDB.
5) Prediction of secondary structure of proteins.
6) Visualization of tertiary structure of proteins in Rasmol.
7) Accessing existing databases on www.
8) Sequence alignment – BLAST.
9) Homology search tools like BLAST and modeller.
10) Genomics- Genome databases, Annotation of genome, Perdition of ORFs
    dbSNP and other SNP related database .
11) GENSCAN and GeneMark.

Course code: BOT/DSE/UD/657

Course name: ADVANCED GENETICS -II

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. FUNDAMENTAL PROCESSES:

DNA replication: Overview, enzymes of replication, Replication apparatus, primosome and replisome, Replication mechanism, continuous and discontinuous DNA synthesis, supercoiling and termination of replication, Eukaryotic DNA replication.

Transcription: Central dogma, role of DNA in protein synthesis, RNA polymerase, mechanism of transcription, eukaryotic transcription, Post transcriptional modification of in RNA, mapping and poly acetylation, split gene, introns, exons and gene splicing, reverse transcription.

Genetic code: Triplet code, deciphering the code, degeneracy, Translation: ribosomes, chain initiation, elongation and termination. Inhibitors of protein synthesis.

UNIT II. REGULATION OF GENE EXPRESSION:

Prokaryotic operon model, lac operon inducible system, CAP proteins and catabolic repression, his operon repressible system, Lac-operon attenuation control. Post transcriptional control, feedback inhibition and protein degradation, Eukaryotes: short term regulation, heat shock proteins, hormonal regulation, DNA methylation, Heterochromatin and gene inactivation.

UNIT III. HUMAN GENETICS:

A. Human Genetics: Human Genome Project, Human karyotype, Pedigree analysis, amniocentesis, twins: identical or monozygotic twins, fraternal or dizygotic twins, genetic counseling.

B. In born errors of metabolism -

Syndromes associated with genetic disorders and their Karyotypes:

1. Single Gene disorders: Severe combined immunodeficiency, Sickle cell anaemia, phenylketonuria, Alkaptonuria, Maple syrup urine, Galatosemia, PTC tasters, brachydactyly, Huntington's chorea, tongue rolling etc.
2. Chromosomal disorders: Cri-Du-Chat syndrome, Down's syndrome, William's syndrome, Turner's syndrome, 47 XXY Klinifilter syndrome,

3. Multifactorial disorders: Alzheimer's disease, Breast/Ovarian cancer, Obesity, Hypothyroidism, Asthama, Heart disease, Hypertension, infertility etc.

UNIT IV. POPULATION GENETICS

Introduction, Gene Frequency, Genotype Frequency, Gene Pool, Hardy-Weinberg Law, Hardy-Weinberg Equilibrium, Migration, Mutation, Selection, Random Drift, Founder Principle.

UNIT V. CELL COMMUNICATION AND CELL SIGNALING

A) Host parasite interaction Recognition and entry processes of different pathogens like bacteria, viruses into animal and plant host cells, alteration of host cell behavior by pathogens, virus-induced cell transformation, pathogen-induced diseases in animals and plants, cell-cell fusion in both normal and abnormal cells.

B) Cell signaling Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, signal transduction pathways, second messengers, regulation of signaling pathways, bacterial and plant two-component systems, light signaling in plants, bacterial chemotaxis and quorum sensing.

Suggested Reading:

1. Snustad, P.D. and Simmons, MJ. 2000, Principles of Genetics, 2Qd Ed, John, Wiley and Sons, Inc., London.

2. Lewin, R. 1999, Human genetics, Concepts and applications. 3rd Ed, McGraw Hill, Dubuque, IA.

3. Lewin, B. 2000, Genes VII, Oxford University, New York.

4. Griffith, A.J.F., Miller, J.H. Suzuki, D.T. Lewontin, R.C. and Gilbert, .M, 2000. Introduction to genetic analysis, 5th Ed. W.H. Freeman, N. Y.

5. Lodish, H., Berk, A., Zipursky, S.L., Matsudaira, P., Baltimore, D. and Darnell, J. 2000. Molecular cell Biology, Freeman, W.H. and Co., N. Y.

6. Watson, J.D., Gilman, M., Witkowski, J. and Zoller, M. 1992, Recombinant DNA

W.H. Freeman and Co., N.Y. A.. c(Hi. (1994). Molecular Biology of cell, 3rd Ed. Garland

7. Albart A. et. al 1914 J.M.and Gingold, E.B. 1993, Molecular biology and Biotechnology, Royal Soc., Publications,

8. Ifftinaiin, R. 1991, Principles of Genetics, 3rd Ed. Win Brown, Dubuque, USA.

9. Brown J. A. 1992. Genetics, a molecular approach II Ed.

10. Tamarin, R. 1991 principls of Genetics III edition, Win brown , Duabuque, USA

11. Watson J. D. 1989. Molecular biology of the gene

12. Chaitanya, K. V. 2022, Diagnostics and Gene Therapy for Human Genetic Disorders, CRC Press,

13. Rosco, I., C. S. Dowenes, Genes in Medicines Molecular Biology of Human Genetic Disorders, Elsevier Netherlands.

14. Evelyn B. Kelly, 2013, Encyclopaedia of Human Genetic Diseases, ABC

15. Dhavendra Kumar, 2004, Genetic Disorders of Indian Subcontinent, Springer Netherlands.

16. James Wynbrandt, Mark D. Ludman, 2010, The encyclopaedia of Genetic disorders and Birth effects, Facts on File Incorporated.

17. Aubrey Milunsky, Jeff M. Milunsky, 2021, Genetic disorders and the Fetus diagnosis, Prevention and Treatment, Wiley Publisher.

18. Anne Gardner, Teresa Davies, 2009, Human Genetics, Scion Publisher

Course Code: BOT/DSE/UD/658

Course Name: Practical ADVANCED GENETICS - II

(Practical based on BOT/DSE/UD/657)

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. Agarose gel electrophoresis of DNA.
2. Isolation and quantification of total RNA and agarose gel electrophoresis.
3. Restriction and ligation reactions.
4. PCR amplification and RAPD marker.
5. Cytological effects of radiations and chemical mutagens in higher plants.
6. Human normal Karyotype
7. Human Karyotypes of Syndromes due to Genetic disorders
8. Phenotypic comparison of normal and syndromic individuals.

Course code: BOT/DSE/UD/659

Course name: MYCOLOGY AND PLANT PHYSIOLOGY - IV

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. Seed Pathology: Scope and importance; seed health testing; methods and procedures. Detection of seed borne-fungi, Bacteria and viruses. Contribution of Paul Neergaard, Storage fungi: Seed biodeterioration, Biochemical changes, Morphological abnormalities, loss in germiability, fungal pigment. Seed certification, Plant quarantine and Seed law. Control of Post-harvest spoilage of grains.

Unit II. Mycotoxins: Classifications of toxins, Fusaric acid, Lycomarasmin, Pirieularin, Alternaric acid, Tabtoxin, Phaseolotoxin, Victorin, Fusarium toxin and aflatoxins.

Unit III. Defense mechanism systems in plants Biochemical and physiological changes in plants due to infection, Preventive measures – physical, chemical and biochemical methods. Plant disease forecasting, postharvest pathology, Forest pathology and Aerobiology

Unit IV. Endophytic fungi

Endophytic fungi, beneficial interaction of endophytes with plants for growth and alleviation of stress condition. Secondary Metabolites.

Unit V. Introduction to Integrated Pest Management

IPM's definition and guiding principles; A historical perspective on pest control techniques; Significance of sustainable pest, Cost-benefit analysis of different pest management strategies; Socio-economic implications of pest control methods; Environmental impact assessment in IPM; Climate change and its impact on pest management; New technologies and innovations in IPM; Global perspectives on IPM implementation; Evaluation of toxicity of pesticides; Constrains and strategies in implementation of IPM; Validation of IPM.

Suggested Readings:

Anonymous, 2009. Handbook of Agriculture. Indian Council of Agricultural Research, New Delhi.

Singh S. S., 2013. Handbook of Agricultural Sciences, Kalyani Publishers, New Delhi

Anonymous, 2004. Seed Science and Technology: International Rules for Seed Testing. International Seed Testing Association, Switzerland

Rattan LalAgarwal, 1999. Seed Technology. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi

Vijaya Kumar A., V. Krishnasamy, P. Balamurugan, D. Kalavathi, K. Sivasubramaniam, P. Athimuthu, G. Selvaraj, H. Philip and C. Palanisamy, 2003. Quality Seed Production in Vegetables, Tamil Nadu Agricultural University, Coimbatore

Chaudhary P, Agri U, Chaudhary A, Kumar A, Kumar G. Endophytes and their potential in biotic stress management and crop production. Front Microbiol. 2022, 17;13:933017.

Giovannetti M, Salvioli di Fossalunga A, Stringlis IA, Proietti S and Fiorilli V, Unearthing soil-plant-microbiota crosstalk: Looking back to move forward. Front. Plant Sci. 2023, 13:1082752.

Imran Afzal, Zabta Khan Shinwari, Shomaila Sikandar, Shaheen Shahzad,Plant beneficial endophytic bacteria: Mechanisms, diversity, host range and genetic determinants, Microbiological Research, 221,2019,36-49.

Kamran M, Imran QM, Ahmed MB, Falak N, Khatoon A, Yun BW. Endophyte-Mediated Stress Tolerance in Plants: A Sustainable Strategy to Enhance Resilience and Assist Crop Improvement. Cells. 202219;11 (20):3292.

Kerchev, Pavel I., et al. "Plant responses to insect herbivory: interactions between photosynthesis, reactive oxygen species and hormonal signalling pathways." *Plant, cell & environment* 35.2 (2012): 441-453.

Lanfranco, L., Fiorilli, V., Gutjahr, C. Partner communication and role of nutrients in the *arbuscular mycorrhizal* symbiosis. New Phytol. 2018, 220 (4), 1031–1046.

Lanver, Daniel, et al. "*Ustilago maydis* effectors and their impact on virulence." *Nature Reviews Microbiology* 15.7 (2017): 409-421.

Li, Juan, Chenggang Zou, Jianping Xu, Xinglai Ji, XuemeiNiu, Jinkui Yang, Xiaowei Huang and Ke-Qin Zhang. "Molecular mechanisms of nematode-nematophagous microbe interactions: basis for biological control of plant-parasitic nematodes." Annual review of phytopathology 53, 2015: 67-95

Mukadam D.S., M. S. Patil, Ashok M Chavan, Anjali R. Patil (2006) 'The Illustrated of Fungi', Saraswati Printing Press, Aurangabad.

Shrikant B. Mane 2023, Practical Manual for Mycology and Plant Pathology, Apex publication, Jaipur.

Paul Neergaard. Seed Pathology, Volume 1 and Volume 2.

Jha D. K. 1995. A text Book on Seed Pathology. Vikas Publishing House, New Delhi.

Jha D. K. 1995. Laboratory Manual of Seed Pathology. Vikas Publishing House, New Delhi.

Mehrotra, R. S. Plant Pathology, Tata Mc Graw Hill Publication Co., Ltd., New Delhi.

Agrios, G. N. Plant Pathology, Academic Press, New York and London

Course Code: BOT/DSE/UD/658

Course Name: Practical MYCOLOGY AND PLANT PATHOLOGY - IV

(Practical based on BOT/DSE/UD/657)

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. Preparation of Media, stains and Isolation of Fungi and identification of Pathogen.
2. Detection of seed borne-fungi and Bacteria from different crops, soil, and infected plants.
3. Study the biochemical due to fungi.
4. Study impact of fungi on seed germination.
5. Isolation of entophytic fungi from plants
6. Screening of secondary metabolites from fungi
7. Production and assay of different toxins.
8. Screening of Mycotoxin bioassay
9. Extraction and estimation of pigments in healthy and diseased plants.
10. Evaluation of toxicity of pesticides
11. Collection, submission of diseased Seed samples and storage fungi (Five Samples Each).
12. Visit to any Seed industry/Processing Unit and submission of report.

Course code: BOT/DSE/UD/661

Course name: TAXONOMY OF ANGIOSPERMS - IV

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 Biosystematics: Aims, objectives and steps in biosystematic studies, biosystematic categories, importance of biosystematic studies.

UNIT-II: Numerical Taxonomy: Principles of taxometrics, operational taxonomic units, taxonomic characters, measuring resemblances, cluster analysis, classification.

UNIT-III: Use of computers in angiosperms taxonomy, GPS and its applications, GIS and its aplications. Use of computer data bases for identification of plants with the help of websites – www.plantsoftheworldonline.org, www.ipni.org, www.efloraofindia.com, https://www.biodiversitylibrary.org, www.kew.org

UNIT-IV: Phytogeography: World vegetation, theories of plant distribution, vicarious areas, centers of origin, theory of tolerance. Phytogeographical zones in India, Characteristic features of Flora of India. Hotspots in the world and in India.

UNIT-V: Study of the following orders as per the APG IV system: Rosales, Malvales, Myrtales, Solanales, Lamiales, Apiales and Asterales.

Suggested Reasing:

1. AHMEDULLAH, M., AND M.P. NAYAR. 1987. Endemic Plants of the Indian Region. Vol. I. Botanical Survey of India. Howrah.
2. BENSON, L.D. 1962. Plant Taxonomy: Methods and Principles. Ronald Press, New York.
3. BHOJWANI, S. S. AND BHATNAGAR, S. P. 1984. Embryology of Angiosperms.Vikas Publ. House, New Dehli.
4. BILGRAMI, K.S. AND J.V. DOGRA. 1990. Phyto Chemistry and Plant Taxonomy. New Delhi, CBS Publishers

5. CRONQUIST, A. 1968. The Evolution and Classification of Flowering Plants.Houghton Mifflin. Boston.
6. CRONQUIST, A. 1981. An Integrated System of Classification of Flowering Plants. Columbia University Press, New York.
7. CRONQUIST, A. 1988. The Evolution and Classification of Flowering Plants (2nd ed.) Allen Press, U.S.A.
8. DANIEL, M. 2009. Taxonomy: Evolution at work. Narosa Publishing House Pvt. Ltd. New Delhi.
9. DAVIS, P.H., AND V.H. HEYWOOD. 1965. Principles of Angiosperm Taxonomy. Oliver & Boyd. Edinburgh.
10. DAVIS, P.H., AND V.H. HEYWOOD. 1991. Principles of Angiosperm Taxonomy. Today and Tomorrow Publications, New Delhi
11. DOBSON, A.P.1996. Conservation and Biodiversity.Scientific American Library. New York, U.S.A.
12. ERDTMAN, G. 1952. Pollen Morphology and Plant Taxonomy Angiosperms. Almquist and Wiksell. Stockholm.
13. ERDTMAN, G. 1986. Pollen Morphology and Plant Taxonomy : Angiosperms An Introduction to Palynology. Netherland, E.J.Brill, Leiden.
14. FORMAN, L. AND D. BRIDSON. 1989. The Herbarium Handbook. Royal Botanic Gardens, Kew, U. K.
15. GRAHAM, L. E. 1993. Origin of Land Plants.John Wiley & Sons.Inc. New York.
16. GREUTER, W., (Ed.). 2007. International Code of Botanical Nomenclature. (VIENNA CODE). Koeltz Vesentific Books. Germany.
17. GROOMBRIDGE, B, (Ed.). 1992. Global Biodiversity: Status of The Earth's Living Resources. Chapman and Hall. London.
18. HENRY, A. N., M.CHANDRABOSE. 1980. An Aid to International Code of Botanical Nomenclature. Today & Tomorrow's Printers and Publishers. New Delhi.
19. HESLOP-HARRISON, J. 1953. New Concepts in Flowering Plant Taxonomy.Heinemann Ltd. London.

20. HEYWOOD, V. H. 1967. Plant Taxonomy. Edward Arnold Ltd. Great Britain.
21. HEYWOOD, V. H. 1995. Global Biodiversity Assessment.Cambridge University Press, Cambridge, U. K.
22. HUTCHINSON, J. 1973. The Families of Flowering Plants.3rd Edition.Oxford University Press. Oxford.
23. JAIN, S. K. and R.R. RAO. 1977. A Handbook of Field and Herbarium Methods. Today and Tomorrow's Printers and Publishers, New Delhi.
24. JOHRI, B.M. 1994. Botany in India: History and Progress. Vol-I. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
25. JONES, S. B., AND A. E. LUCHSINGER. 1987. Plant Systematics. 2nd Edition. McGraw-Hill Book Company. New York.
26. JUDD, W. S, C. S. CAMPBELL, E. A, KELLOG, P. F. STEVENS AND N. J. DONOGHUE. 2008. Plant Systematics. Sinauer Associates, INC,Publishers.Sunderland, Massachusetts, USA.
27. LAWRENCE, G.H.M. 1951. Taxonomy of Vascular Plants.The Macmillan Company. New York.
28. MABBERLEY, D. J. 2005. The Plant-Book, A portable dictionary of the vascular plants. Cambridge University Press, United Kingdom
29. MANILAL, K. S. AND M. S. MUKTESH KUMAR [ed.] 1998. A Handbook of Taxonomic Training. DST, New Delhi.
30. MINELLI, A. 1993. Biological Systematics: The State of the Art. London, Chapman & Hall.
31. MONDAL, A. K. 2005. Advanced Plant Taxonomy.New Central Book.Agency Pvt. Ltd. Kolkata.
32. MOORE, R., W. D. CLARK, K.R. STERN AND D. VODOPICH. 1995. Botany: Plant Diversity. Wm. C. Brown Publishers. London.
33. NAIK, V. N. 2000. Taxonomy of Angiosperms. Tata McGraw – Hill Publishing Company Limited, New Delhi.
34. Nair, P. K. K. 1966. Pollen morphology of Angiosperms.Periodical Expert Book Agency, New Delhi.

35. NAYAR, M. P., 1996. "Hot Spots" of Endemic plants of India, Nepal and Bhutan. Tropical Botanic Garden and Research Institute, Thiruvananthapuram, India.
36. NAYAR, M. P., AND R. K. SASTRY. 1987-1990. Red Data Book on Indian Plants.Vols.I - III.Botanical Survey of India. Howrah.
37. QUICKE, D. L. J. 1993. Principles and Techniques of Contemporary Taxonomy.Chapman and Hall. London.
38. RADFORD, A. E., W. C. DICKISON, J. R. MASSEY, AND C. R. BELL. 1974. Vascular Plant Systematics. Harper & Row. New York.
39. RAVEN, P. H., R. F. EVERT, AND S. E. EICHHON. 1992. Biology of Plants. 5th Edition.Worth Publishers. New York.
40. SANTAPAU, H. 1955. Botanical Collector's Manual. Botanical Survey of India.
41. SANTAPAU, H. AND H.A. HENRY. 1994. A dictionary of the flowering plants in India, CSRI, New Delhi.
42. SHARMA A. AND A. SHARMA. 1980. Chromosome Technique: Theory and Practices (3rd ed.) Butterworths, London.
43. SHIVANNA, K. R. AND N. S. RANGASWAMY. 1992. Pollen Biology- A Laboratory Manual. Springer-Verlag
44. SIMPSON, M. G. 2006. Plant Systematics. Elsevier Academic Press, California, USA.
45. SIMPSON, M.G. Plant Systematics. Elsevier Academic Press. Burlington, U.S.A.
46. SINGH, G. 2005. Plant Systematics – Theory and Practice. Oxford and YBH Publishing Co. Pvt. Ltd., New Delhi.
47. SIVARAJAN, V. V. 1989. Introduction to Principles of Plant Taxonomy. Oxford and IBH Publishing Co. New Delhi.
48. SOLTIS, D. E., P. S. SOLTIS, P. K. ENDRESS AND M. W. CHASE. 2005. Phylogeny and Evolution of Angiosperms. Sinauer Associates, Inc, Massachusetts, USA.
49. STACE, C. A. 1989. Plant Taxonomy and Biosystematics. Edward Arnold, London.
50. STUESSY, T. F. 2002. Plant Taxonomy.Bishen Singh Mahendra Pal Singh, Dehra Dun, India.
51. SUBRAMANIAM, N. S. 1995. Modern Plant Taxonomy.Vikas Publishing House. New Delhi.

52. TAKHTAJAN, A. 1997.Diversity and Classification of Flowering Plants. Bishen Singh and Mahendra pal Singh, Dehra Dun, India.
53. TAYLOR, D. V. AND L. J. HICKEY. 1997. Flowering Plants: Origin, Evolution and Phylogeny. CBS Publishers & Distributers, New Delhi.
54. Upen Deka, Tapan Dutta, 2023, Plant Ecology and Phytogeography, Asian Humanity Press
55. WILEY, E.O. 1981. Phylogenetics: The Theory and Practice of Phylogenetic Systematics. New York, John Wiley & Sons.
56. Yadav Swapnil, 2021, Ecology and Phytogeography, Mahaveer Publication

www.plantsoftheworldonline.org,

www.ipni.org,

www.efloraofindia.com,

https://www.biodiversitylibrary.org,

www.kew.org

Course Code: BOT/DSE/UD/662

Course Name: Practical TAXONOMY OF ANGIOSPERMS - IV

(Practical based on BOT/DSE/UD/657)

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. Assessment of taxonomic characters (a) analytical and synthetic characters, (b) qualitative and quantitative characters.
2. Study of different taxonomic features (a) stomata, (b) trichomes, (c) crystals, (d) pollen grains.
3. Describing new taxon, deposition of type, Latin diagnosis and abbreviations used in citations.
4. Detection of taxonomically important chemical compounds by various tests.
5. Detection of variations in a given population.
6. Exercises on nomenclature problems: Author citation, principle of priority, transfer of taxa, effective and valid publication etc.
7. Practicals based on numerical taxonomy/ cluster analysis.
8. Study of different types of ovules, placentations and evolutionary trends therein.
9. Study of following fossil angiosperm specimens: Palmoxylon, Enigmocarpon, Sahnianthus, Glossopteris with the help of slides/ specimens.
10. To identify family with the help of computerized Key.
11. Preparation and standardization of some simple Ayurvedic Drugs

Course code: BOT/DSE/UD/663

Course name: ADVANCED PLANT PHYSIOLOGY AND BIOCHEMISTRY - IV

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: Role of nucleic acids as carriers of genetic Information, transformation and transduction. Auto catalytic function of DNA-replication, Hetero catalytic functions -Transcription and translation, totipotency, differential gene activity and its regulation. Gene technology, Recombinant DNA, GM plants, Application of Gene technology in agriculture,

Unit II: Senescence and aging, cellular, tissue, organ and organism senescence, physiological changes

associated with senescence, Biological significance.

Unit-III: Microbial physiology, carbohydrate metabolism, energy production, substrate metabolism, utilization of sugar, starch, cellulose, pectin, hydro carbons, aromatic hydrocarbons and other compound, microbial biomass production, production of useful microbial metabolites -enzymes, organic acids, single cell protein, toxins, antibiotics, alcohol etc. Industrial microbiology.

Unit IV: Enzyme technology - Enzyme production, sources and uses of enzymes, microbial enzyme,

production, isolation and purification of enzymes, Applications of enzymes in various industrial processes, Immobilization of enzymes - techniques and advantages, Biocatalysis, Enzyme production and application.

Unit V: Productivity of crop plants, integrated fertilizer management, bio-fertilizers, productivity

potential and cultural practices for fiber plants (e.g. cotton), cereals (rice, wheat), millets (Sorghum, pearl millet), pulses (gram), oil seed crops (safflower, groundnut), commercial crops (sugarcane), vegetables, fodder crops (lucerne, hybrid Napier, maize).

Suggested Reading:

1. Mukharji S and A.K. Ghosh. Plant Physiology - New Central Book Agency, Kolkatta.

2. Mertz, E.T. Elements Biochemistry Vakils, Fe Her and Simson Pvt Ltd, Bombay.

3. Fains, J.L. and Kilgour, G.L. Essentials of Biological Chemistry, Affiliated East - West Press, Pvt. Ltd., New Delhi.

4. Moat, A.G., Foster, J.W. and Spectok, M.P. Microbial Physiology, Wilesy Liss, A. John Wiley and Sons, Inc., Singapore.

5. Trevan, M.D., Botey, S., Goulding, K.H. and Stanburn, P.Biotechnology. The Biological principles. Tata Me Craw Hill Publishing Company Limited, New Delhi.

6. Salisbury. I;.B. an<! Ross. C.W., Plant Physiology CBS Publishers andDistributors, Ncw Delhi.

7. Noggle, G.R. and Fritz, G.S. Introductory Plant Physiology. Printice Hall, USA.

8. Styter, R.O. Plant water relationship, Academic Press, New York.

9. Hess, D. Plant Physiology, Narosa Publishing House, New Delhi.

10. Devlin, R.M. and Hostan, F.H. Plant Physiology, CBS publishers and Distributors, New Delhi.

11. Mukhcrji, S. and Ghosh A.K. Plant Physiology, Tata Me Graw Hill Publishing Company Ltd., New Delhi.

12. Datta, C.S. Plant Physiology, Wiley Eastern Limited, New Age International Ltd., New Delhi.

13. Vaidya, V.G., Sahasrabuddhe, K.R. and Khupse, V.S. Crop production and field experimentation, Continental Prakashan, Pune - 30.

Course Code: BOT/DSE/UD/664

Course Name: Practical ADVANCED PLANT PHYSIOLOGY AND BIOCHEMISTRY - IV

(Practical based on BOT/DSE/UD/663)

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) Isolation and estimation of nucleic acids

2) Study of leaf senescence.

3) Changes in chlorophyll content in leaf discs during senescence.

4) Biochemical changes during leaf senescence - sugars, protein -nitrogen, non-protein nitrogen, etc.

5) Effect of PGRs on senescence.

6) Chemical changes associated with fruit ripening.

7) Growth of microbes (yeast, bacteria and fungi) on synthetic and biological media,

8) Assey and chemical tests for enzymes, organic acids, antibiotics, toxins etc.

9) Estimation of the activities of hydrolytic enzymes - amylase, lipase, protease, cellulose etc.

10) Estimation of alcohol content in fermented plant material.

11) Immobilization of enzymes with wax.

12) Activity of enzyme a - amylase, cellulose and protease under the influence of substrate concentrate,

13) Activity of enzyme a - amylase, cellulose and protease under the iniiueiv.ee of substrate Concentrate of enzymes.

14) Activity of enzyme - amylase, cellulos^1 and protease under the influence of substrate concentrate pH values,

15) Visit to the fields for studies on crop plants.

16) Estimation of protein in pulse seeds.

17) Estimation of starch in seeds.

18) Estimation of fat content in seeds,

Course code: BOT/DSE/UD/665

Course name: PLANT DIVERSITY AND CONSERVATION - IV

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: Ecological Aspects: Role of Ecological parameters, Concept of estimation of quadrat methods,density, abundance, frequency concept and estimation.

Unit II: RET Categorization: Impacts on Diversity depleting resources: Red data book, threatened species, RET, IUCN categories, and their impacts and challenge of plant biodiversity, global warmingimpact, and Species extinction.

Unit III: Adverse Human Impacts on Biodiversity: Habitat destruction, over harvesting, global climaticchange, desertification, environmental pollution, acid rain, eutrophication, invasive species in croplands and forest. Role of pollution control boards (CPCB & MPCB), Public awareness, NGOs and Industries in conservation.

Unit IV: Biodiversity Conservations: Causes and consequences of loss of Biodiversity, Biodiversity its commercial value campaign, awareness, Conservation: Ex-*situ* and in-*situ* conservation techniques (Biosphere Reserves, National parks, Wild life sanctuaries, Reserve forest, Sacred groves, Tissue culture, Botanical gardens, cryopreservation, gene and seed banks).

Unit V: Sustainable Development: Definition and concept of sustainability, Practical policy principle,management, natural resource conservation and sustainable development, Applications in organic manure - Bio-control agents – Phytoremediation, Phytoprospecting of medicinal plants in Pharmaceuticals, neutraceutical and cosmetic industries.

Suggested Reading:

1. Ambasht, R. A. (1990) A text book of Plant Ecology, Students Friends & Co., Varanasi.
2. Arvind Kumar. 2005. Biodiversity and Conservation. APH Publishers, New Delhi.
3. Benny Joseph (2005) Environmental Studies, Tata McGraw Hill Publishing Co., Ltd., New Delhi.
4. Chaudhuri, G.A. 2007. Endangered Medicinal Plants. Daya Publishing house. New Delhi.

5. Choudhary H.J., S.K.Murthy. Plant Diversity and Conservation in India. Bishen Singh Mahendra Pal SinghPublishers, Dehradun.
6. Conklin,A. R. Jr.(2004)Field Sampling:Principles & Practices in Environmental Analysis.CRC Press.
7. Fahey, T. J. and Knapp, A. K. (2007) Principles and Standards for Measuring PrimaryProduction.Oxford.
8. Frankel, O.H., Anthony Brown, H.D. and Jermy, Burdon, J. 1995. The conservation of PlantBiodiversity. University of Cambridge. USA.
9. Grant, W. E. and Swannack, T. M. (2008) Ecological Modeling. Blackwell.
10. Hawksworth. ,D.L and Bull, A.T. 2007. Plant Conservation and Biodiversity. Springer.
11. Koromondy, E. J. (2005) Concepts of Ecology.4th Ed. Prentice Hall of India, New Delhi.
12. Krishnamurthy, K.V.K. 2003. A text book of Biodiversity. Science Publishers, USA.
13. Muller, Dombosis, D. and H. Ellenberg (1974) Aims and methods of vegetation ecology, Wiley,New York.
14. Mungikar A. M. (2008) An Introduction to Biometry, Saraswati Printing Press, Aurangabad.
15. Mungikar, A. M. 2003. Biostatical Analysis. Saraswati Printing Press. Aurangabad.
16. Muthuchelian, K. 2012. Biodiversity Conservation and Management. Astral International Pvt. Ltd.New Delhi.
17. Muthuchelian, K. 2013. Perspectives in Plant Biodiversity. Astral International Pvt. Ltd. New Delhi.
18. Odum E. P. (1971) Fundamentals of Ecology, Saunders, Philadelphia.
19. Singh, M.P., Singh, B.S., and Soma Dey. 2002. Plant Biodiversity and taxonomy. Daya PublishingHouse, New Delhi.
20. Tandon, P., Abrol, Y.P. and Kumaria, S. 2007. Biodiversity and its Significance. I.K. InternationalPublications. New Delhi
21. Arvind Kumar. 2005. Biodiversity and Conservation. APH Publishers, New Delhi.
22. Choudhary H.J., S.K.Murthy Plant Diversity and Conservation in India. Bishen Singh

Mahendra PalSingh Publishers, Dehradun.

23. Cole, A.J. 1969 Numerical Taxonomy. Academic Press. London.
24. Daris, P.H, and Heywood,V.H. 1-973. Principles of Angiosperms'Taxonomy. Robert E.KriegerPub.Co.New York.
25. Frankel, O.H., Anthony Brown, H.D. and Jermy, Burdon, J. 1995. The conservation of Plant Biodiversity.University of Cambridge. USA.
26. Glover, D.M. and Hames, B.D. (Eds.) 1995. DNA cloning I: A practical approach, Core techniques, firstedition, TASIRL Press al Oxford University Press, Oxford.
27. Grant, V. 1971 Plant Speciation, Columbia, University Press, New York.
28. Grant, W.F. 1984. Plant Biosystematic , Academic Press, London.
29. 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 Pub Co, Inc. Memno Park, California.
30. Harrison, H.J. 1971 New concepts in Flowering Plant Taxonomy. Hieman Edu Book Ltd., London.
31. Hawksworth. ,D.L and Bull, A.T. 2007. Plant Conservation and Biodiversity. Springer.
32. Heslop-Harrison, J. 1967 Plant Taxonomy. English Language Book Soc. & Edward Arnold Pub. Ltd.
33. Jones, A.D. & Wilbins, A.D. 1971 Variations & Adaptions in Plant species. Hieman co. Edu Ltd. London
34. Krishnamurthy, K.V.K. 2003. A text book of Biodiversity. Science Publishers, USA.
35. Mungikar A. M. (2008) An Introduction to Biometry, Saraswati Printing Press, Aurangabad.
36. Mungikar, A. M. 2003. Biostatical Analysis. Saraswati Printing Press. Aurangabad.
37. Muthuchelian, K. 2012. Biodiversity Conservation & Management. Astral International Pvt. Ltd Delhi.
38. Muthuchelian, K. 2013. Perspectives in Plant Biodiversity. Astral International Pvt. Ltd. New Delhi.

39. Naik V. N. (1989) Taxonomy of Angiosperms, Tata McGraw Hill Co. Ltd. New Delhi
40. Naik V. N. (1998) Flora of Marathwada, AmrutPrakashan, Aurangabad.
41. Nair MNB (1998). Wood Anatomy and Major Uses of Wood, Faculty of Forestry, University of PutraMalaysia, Malaysia. 11
42. Parihar N. S. (1991) Bryophytes, Central Book Dept., Allahabad.
43. Radford, A.E. 1986 Fundamentals of Plant systematics. Harper & Raw Publicaations, U.S.A.
44. Sharma O. P. (2018), A text Book of Algae, Tata McGraw Hill, New Delhi
45. Shaw, C.H. (Ed.) 1988. Plant Molecular Biology: A Practical Approach. IRL Press, Oxford.
46. Shivanna K. R. (2003) Pollen Biology and Biotechnology, Science Publishers.
47. Shivanna, K.R. & John, B.M. (1985),The Angiosperm pollen stru & function, Willey Eastern Ltd., NewYork.
48. Shivanna, K.R. & Rangaswamy, N.S.1992, 'Pollen Biology: A laboratory manual, Springer Verlag, Berlin.
49. Smith G.M. (1950). The fresh water algae of the United states, McGrawIlill Hoc Co., New York.
50. Soibrig. O.T. &Solbrig D.J. 1979. Population Biology and Evolution. Addison Wesley Pub Co. Inc. U.S.A.
51. Stace,C.A. 1989. Plant Taxonomy and Biosystamatics (2nd Edition) Edward Arnold, London.
52. Stebbins, G.L. 1974 Flowering Plant- Evolution Above Species Level Edward Arnold Ltd,.'London.
53. Takhtajan A.L. 1997. Diversity and Classification of Flowering Plants. Columbia Univ Press, .New York.
54. Tandon, P., Abrol, Y.P. and Kumaria, S. 2007. Biodiversity and its Significance. I.K. InternationalPublications. New Delhi.
55. U.K.Heywood, V.H. & Moore, D.M. 1984 Current concepts in Plant Taxonomy, Acad

Press, London.

56. Woodland D.W. 1991. Contemporary Plant Systematics, Rentice Hall, New Jersey

Course Code: BOT/DSE/UD/666

Course Name: Practical BIODIVERSITY - IV

(Practical based on BOT/DSE/UD/665)

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. Qualitative structure of plant community using visual characters.
2. Demonstrate the gradual floristic change in two different types of adjacent plant communities.
3. Demonstrate the gradual change of abundance and frequency of different species in atransitional zone following the belt transect method.
4. Determine the ground cover flora of an area by quadrate sampling.
5. Determine the relative frequency of different herbaceous species growing in an area.
6. Determine the Importance Value Index for different species growing in herbaceous plantcommunity.
7. Study of biodiversity indices.
8. Study of plants for phytoremediation application.
9. Plants used in phytoprospecting Asparagus, Aloe, Ginger, Turmeric, Centella, Bacopa and etc.
10. Submission of Long Excursion report

Course code: BOT/DSE/UD/667

Course name: SEED TECHNOLOGY – IV

Seed Quality Testing, Seed Legislation and Certification.

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

- **Seed quality:** objectives, concept and components and their role in seed quality control; instruments, devices and tools used in seed testing. ISTA and its role in seed testing.
- **Seed Sampling**: definition, objectives, seed-lot and its size; types of samples; sampling devices.
- **Procedure of seed sampling;** sampling intensity; methods of preparing composite and submitted samples; sub-sampling techniques, dispatch, receipt and registration of submitted sample in the laboratory, sampling in the seed testing laboratory.

Unit II:

- **Physical purity analysis-**Definition of purity components, Procedure, ODV test, Reporting and results.
- **Moisture Testing** (1) By air oven method, (2) Moisture meters.
- **Tetrazolium test** - principles, procedure and evaluation. Grow-out test, Seed health,
- **Seed Vigor testing-** Principle, General procedure. reporting of seed testing results, factors affecting variability.

Unit III:

- **Seed Production and Release of new variety:** Seed as a basic input in Agriculture, Classes of Seeds- Nucleus, Breeder, Foundation and Certified Seeds.
- **Seed production Organization-** National Seed Corporation (NSC) and State seed Corporation (SSC).
- **Release of New Variety:** Introduction, Evaluation-Station Trial, Multi-location Trial, Identification of entries for release, Multiplication.

UNIT IV

- **Regulatory mechanisms of seed quality control-** organizations involved in seed quality control programmes.
- seed legislation and seed law enforcement as a mechanism of seed quality control; the Seed Act (1966), Seed Rules (1968), Seed (Control) Order 1983; National Seed Development Policy (1988); New Seed Bill-2004 etc.
- Introduction, objectives and relevance of plant quarantine, regulations and plant quarantine set up in India.

UNIT V

- **Seed Certification-** history, concept and objectives of seed certification; seed certification agency/organization and staff requirement.
- Legal status and phases of seed certification; formulation, revision and publication of seed certification standards.
- Indian Minimum Seed Certification Standards (I.M.S.C.S.)-general and specific crop standards including GM varieties, field and seed standards.
- planning and management of seed certification programmes-eligibility of a variety for certification, area assessment, cropping history of the seed field, multiplication system based on limited generation concept, isolation and land requirements etc.

References:

1. Agarwal, R.L. 1997. Seed Technology. Oxford & IBH. Anonymous. 1992.
2. Legislation on Seeds. NSC Ltd., Department of Agriculture and Cooperation, Ministry of Agriculture, New Delhi.
3. Nema, N.P. 1986. Principles of Seed Certification and Testing. Allied Publishers.
4. Tunwar, N.S. and Singh, S.N. 1988.
5. Indian Minimum Seed Certification Standards. CSCB, Ministry of Agriculture, New Delhi.
6. Agrawal, P.K. and Dadlani, M. 1992. Techniques in Seed Science and Technology. 2nd Ed. South Asian Publ.
7. Agrawal, P.K. (Ed.). 1993. Handbook of Seed Testing. Ministry of Agriculture, GOI, New Delhi.
8. Copland, L.O. and McDonald, M.B. 1996. Principles of Seed Science and Technology.
9. Kluwer. ISTA. 2006. Seed Testing Manual. ISTA, Switzerland.

Complied by Dr. Umesh P. Mogle

Course Code: BOT/DSE/UD/668

Course Name: Practical SEED TECHNOLOGY - IV

(Practical based on BOT/DSE/UD/667)

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 seed Sampling and Dividing Equipment's.
2. Study of germination Testing (Paper, Sand and Soil Method).
3. Study of Seed vigour testing by physical method.
4. Study of ODV test and Physical purity analysis.
5. Study of the quick viability (Tetrazolium test) of seeds, germination test and its analysis,
6. Study of draw the sampling entry in records, dividing and mixing.
7. Study of testing physical purity, germination and moisture;
8. Make a draft for seed certification agency (As per Indian Seed regulation Act) of a given seed sample.
9. Study of General procedure of seed certification, identification of weed and other crop seeds as per specific crops seed testing regulation.
10. Study of field inspection at different stages of a crop and observations recorded on contaminants and reporting of results.
11. Study of inspection and sampling at harvesting / threshing, processing and after processing for seed law enforcement;
12. Visits to regulatory seed testing laboratory, including plant quarantine lab and seed certification agency.