॥ अंतरी पेटवू ज्ञानज्योत ॥

NORTH MAHARASHTRA UNIVERSITY, JALGAON

SYLLABUS FOR

T.Y.B.Sc. BOTANY

WITH EFFECT FROM JUNE, 2004

SYLLABUS FOR T.Y.B.Sc. BOTANY

WITH EFFECT FROM JUNE, 2004

(A) THEORY :

Paper - I	: Lower Cryptogams & Higher Cryptogams	
Paper – II	: Angiosperm Taxonomy, Embryology & Genetics and Plant Breeding	
Paper – III	: Environmental Botany and Plant Geography and Plant Phytochemistry	
Paper - V	: Computer - I and Horticulture	
Paper – VI	: Optional - (i)	Gardening & Botanical Techniques
Paper – VI	: Optional - (ii)	Plant Protection and Seed Technology & Seed Pathology
Paper - VI	: Optional-(iii)	Ethnobotany & Pharmacognosy and Medico-botany

(B) PRACTICALS :

Practical - I	: Based on Theory Paper I and VI (Optional Paper)
Practical – II	: Based on Theory Papers II and IV
Practical – III	: Based on Theory Papers III and V.

Note :- Four Practicals and one Viva per Course

PAPER-I (BOT 3.1)

LOWER CRYPTOGAMS AND HIGHER CRYPTOGAMS

FIRST TERM : LOWER CRYPTOGAMS

(Algae & Fungi) Total Periods : 52

			Periods	Marks
	ALGAE (Periods : 26)			
A)	Introduction		03	(02)
	A-1	General Characters, Classification upto classes giving reasons as per Prof.G.M.Smith.		
	A-2	Indian contribution to Algal research		
B)	Study of life history of			
	B-1	*Chara* with respect to :	04	(04)
		Systematic position, occurrence, structure of thallus, vegetative ad sexual reproduction, development of sex organs, fertilization, germination of oospore.		
	B-2	*Ectocarpus* with respect to :	04	(04)
		Systematic position, occurrence, structure of thallus, reproduction, alternation of generations (Life cycle with respect to *E.siliculosus*)		
	B-3	Batrachospermum with respect to :	04	(04)
		Systematic position, occurrence, structure of thallus, asexual and sexual reproduction, development and structure of sex organs, fertilization, post-fertilization changes, germination of oospore, alternation of generations.		

			Periods	Marks
C)	Range of Thallus in Algae :		04	(04)
	C-1	Unicellular thallus		
	C-2	Colonial thallus		
	C-3	Filamentous thallus		
	C-4	Siphonaceous thallus		
	C-5	Pseudoparenchymatous (Uniaxial and Multiaxial thallus)		
	C-6	Parenchymatous thallus		
D)	Origin and evolution of sex in Algae :		03	(03)
	D-1	Origin of gametes, Evidences of zoosporic origin of gametes.		
	D-2	Evolution of sex-Isogamy, anisogamy and oogamy.		
E)	Economic Importance of Algae :		04	(04)
	E-1	Role in Biotechnology (Biofertilizers, petroleum-Algae, Scp)		
	E-2	Role in Agriculture		
	E-3	Role in Industry		
	E-4	Role in food and fodder		
	E-5	Role in space travel		
	E-6	Role in sewage disposal		
	E-7	Role in petroleum and fuel gas		
	E-8	Role in water supplies		
	E-9	Role in Medicines		
	E-10	Parasitic algae		

FUNGI (Periods : 26)

		Periods	Marks
F)	Introduction	03	(02)
	F-1 General characters of fungi		
	F-2 Classifications (outline only) by :		
	a) Ainworth et.al. (1973)		
	b) Alexopoulos and Mims (1979)		
	c) Alexopoulos, Mims & Blackwell (1996)		
G)	Study of Myxomycetes with respect to :	03	(03)
	G-1 Thallus structure and types of plasmodia		
	G-2 Nutrition		
	G-3 Reproduction		
	a) Asexual and fruiting bodies		
	b) Sexual		
	G-4 Outline of life cycle with respect to Stemonitis		
H)	Study of Life History of *Albugo* with respect to :	03	(03)
	Systematic position, occurrence, structure of mycelium, asexual and sexual reproduction, outline of life cycle. Symptoms and control measures of white rust diseases.		
I)	Study of Life History of *Penicillium* with respect to :	04	(04)
	Systematic position, occurrence, structure of mycelium, asexual and sexual reproduction, outline of life cycle, economic importance of *Penicillium*.		

		Periods	Marks
J)	Study of Life History of *Puccinia graminis-tritici* (The black stem rust of wheat) with respect to :	05	(05)
	Systematic position, symptoms, five spore stages :		
	a) Pycnia and pycnospores (stermatia)		
	b) Aecia and aeciospores		
	c) Uredinia and Urednospores		
	d) Telia and Teliospores		
	e) Basidia and basidiospores		
	Control and forecasting measures, wheat rust problem in India.		
K)	Study of Deuteromycetes with respect to :	03	(03)
	Salient features, thallus sructure, reproduction and fruiting bodies, parasexuality and its significance.		
L)	Economic Importance of Fungi :	03	(03)
	L-1 Beneficial Aspects :		
	a) Role in Biotechnology		
	b) Role in Medicine		
	c) Role in food and animal feeds		
	d) Role in soil fertility		
	e) Role in research work (Genetic tools)		

		Periods	Marks
L-2	Harmful aspects :		
	a) Role in plant pathology		
	b) Role in man and animal pathology		
	c) Role in wood rotting		
	d) Role in food spoilage		
	e) Role in Mushroom poisoning		
	f) Role in Biodeterioration		
	g) Role in aircraft fuel tank fungi.		
M)	Lichens :	02	(02)
	General account with respect to occurrence, external and internal structure of thallus, classification, nature of association in a thallus, economic importance.		

SECOND TERM: HIGHER CRYPTOGAMS

(Bryophytes and Pteridophytes)

Total Periods : 52

		Periods	Marks
	BRYOPHYTES (Periods : 26)		
A)	Introduction	03	(02)
A-1	Salient features, classification upto classes giving reasons as per Prof.G.M.Smith		
A-2	Indian Work in Brophyta		
B)	Studies of Life History of Marchantia, Anthoceros and Polytrichum with respect to :	15	(15)
B-1	Systematic position, habit and habitat, occurrence, external and internal morphology of gametophytes, vegetative reproduction, sexual reproduction, position, structure of sex organs, fertilization, structure and development of sporophyte, dehiscence of capsule and dispersal of spores, structure and germination of spores.		
B-1	Affinities of *Anthoceros* and evolutionary features in its sporangium to be emphasized.		
C)	Evolution of Bryophytic Gametophyte according to the regressive and progressive theory.	03	(03)
D)	Evolution of Bryophytic sporophyte according to the theory of sterilization and the theory of reproduction.	03	(03)
E)	Biological and Economic importance of Bryophytes.	02	(02)

PTERIDOPHYTES (Periods : 26)

			Periods	Marks
F)	Introduction		03	(03)
	F-1	Salient features, classification upto classes with reasons as per Prof.G.M.Smith		
	F-2	Indian work in Pteridophyta :		
G)	Study of Life History of :			
	G-1	*Psilotum* with respect to :	04	(04)
		Systematic position, occurrence, distribution, external and internal morphology of sporophyte, vegetative reproduction, position, structure, dehiscence and morphological nature of sporangium (synangium), structure and germination of spores, structure of mature gametophyte (Prothallus), structure of mature sex organs, fertilization, development of embryo, alternation of generations.		
	G-2	*Lycopodium* with respect to :	06	(06)
		Systematic position, occurrence, distribution, external and internal morphology of sporophyte, vegetative reproduction, position, structure, development and dehiscence of sporangium, structure and germination of spores, development and structure of gametophyte, structure of sex organs, fertilization, development and structure of embryo, protocorm and its morphological nature, alternation of generation.		

			Periods	Marks
	G-3	*Marsilea* with respect to :	06	(06)
		Systematic position, habit and habitat, external and internal morphology of sporophyte, vegetative reproduction, external and internal morphology of sporocarp and its morphological nature, dehiscence of the sporocarp, structure of microspore and megaspore, structure of male and female gametophytes, fertilization, structure of embryo, alternation of generations.		
H)	Stelar Evolution :		03	(03)
		Concept, types and evolution of steles in Pteridophyta.		
I)	Heterospory and Seed Habit :		03	(03)
		Definition, origin, advantages, heterospory as precursor to seed habit.		
K)	Economic Importance of Pterodophytes.		01	(01)

PAPER - I

REFERENCE BOOKS

ALGAE

1. Bold, H.C. and M.J.M.Wynne (1978) Introduction to the Algae – Structure and Reproduction. Prentice Hall of India Pvt. Ltd. New Delhi.

2. Chapman, V.J. and D.J. Chapman (1979) The Algae, English Language Book Soc. & Mac Millons, London.

3. Ganguli, H.C. and Kar, A.K. (2001) College Botany Vol.II Books and Allied Press Ltd. Kolkata, India

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

5. Kumar, H.D. and H.N.Singh (1976) A Text Book of Algae. Affiliated East-West Press Ltd., New Delhi, India

6. Lee, R.E. (1989) Phycology Cambridge University Press, Cambridge.

7. Morris, I. (1968) An Introduction to the Algae. Hutchinson and Com. London.

8. Pandey, B.P. (1994) A Text Book of Botany – Algae. S.Chand and Com. Ltd., New Delhi, India.

9. Pandey, S.N., Trivedi, P.S. and S.P.Misra (1995) A Text Book of Algae, Vikas Pub. Hou.Pvt. Ltd. New Delhi, India.

10. Prescott, G.W. (1969) The Algae : A Review. Thomas Nelson and Press, London, U.K.

11. Round, F.E. (1965) The Biology of the Algae. Edward Arnold Pub. London, U.K.

12. Sharma, O.P. (1990) Text Book of Algae. Tata MacGraw Hill Pub. Co. Ltd. New Delhi, India.

13. Smith, G.M. (1955) Cryptogamic Botany Vol. I : Algae and Fungi. McGraw-Hill Book Co. New York, U.S.A.

1. Vashishta, B.R. (1995) Botany for Degree Students-Algae. S. Chand and Co. Ltd., New Delhi, India

FUNGI

2. Ahmadjian, V. and M.E. Hale (1973) The Lichens, Academic Press, New York, U.S.A.

3. Alexopoulos, C.J. and C.W. Mims (1979) Introductory Mycology, John Wiley, New York, U.S.A.

4. Alexopoulos, C.J., Mims, C.W. and M.Blackwell (1996) Introductory Mycology (4th Ed.) John Wiley and Sons Inc., New York, U.S.A.

5. Dube, H.C. (1990) An Introduction to Fungi. Vikas Pub. House Ltd. New Delhi, India.

6. Hale, M.E. (1983) The Biology of Lichens, Edward Arnold Publ. New Delhi, India.

7. Joshi, K.R. (1995) Opprtunistic Mycoses. Scientific Publishers, Jodhpur, India.

8. Mehrotra, R.S. and C.R.Aneja (1990) An Introduction to Mycology. Wiley Eastern Ltd., New Delhi, India.

9. Pandey, B.P. (1994) A Text Book of Botany-Fungi. S. Chand and Co. Ltd. New Delhi, India.

10. Sharma, P.D. (1998) The Fungi, Rastogi Pub., Meerut, India.

11. Sharma, O.P. (1990) Text Book of Fungi. Tata McGraw-Hill Pub.Co.Ltd. New Delhi, India.

12. Vashishta, B.R. (1995) Botany for Degree Students- Fungi. S.Chand and Comp. Ltd. New Delhi, India.

13. Vaidya, J.G. (1995) Biology of the Fungi. Satyajeet Prakashan, Pune, India.

14. Webster, J. (1980) Introduction to Fungi. Cambridge University Press, Cambridge.

BRYOPHYTA

15. Ganguli, H.G. and A.K.Kar (2001) College Botany Vol. II Books and Allied Press, Ltd. Kolkata, India

16. Pandey, B.P. (1995) A Text Book of Botany Bryophyta. S.Chand and Co. Ltd. New Delhi, india

17. Parihar, N.S. (1972) An Introduction to Embryophyta, Vol.I Bryophyta. Central Book Depot, Allahabad, India

18. Puri, P. (1985) Bryophyta : A Broad Perspective, Atma Ram and Sons, New Delhi, India.

19. Rashid, A. (1996) An Introduction to Bryophyta, Vikas Publ. House, Pvt. Ltd. New Delhi, India

20. Saxena A.K. and R.M.Sarabhai (1992) A Text Book of Botany. Vol.II, Embryophyta, Ratan Prakashan Mandir, Agra, India

21. Smith, G.M. (1955) Cryptoganic Botany, Vol.II. Bryophyta and Pteridophyta, McGraw-Hill Book Company, New York, USA

22. Udar, Ram and S.Chandra (1976). Bryoloty in India, Chronica Botanica, New Delhi, India

23. Vashishta, B.R. (1996) Botany (Part-III) Bryophyta. S.Chand and Co. Ltd. New Delhi, India

24. Watson, E.V. (1971) Structure and life of Bryophyta. Hutchinson University Lib. London, U.K.

PTERIDOPHYTA

25. Pandey, B.P. (1994). A Text Book of Botany – Pteridophyta, S. Chand and Co.Ltd. New Delhi, India

26. Pandey, S.N., Trivedi, P.S. and S.P.Misra (1995) A Text Book of Pterodophyta. Vikas Pub. Hou. Pvt.Ltd., New Delhi, India

27. Parihas, N.S. (1977). Biology and Morphology of Pteridophyta, Central Book Depot, Allahabad, India.

28. Rashid, A. (1966) An Introduction to Pteridophyta. Vikas Publishing House, New Delhi, India.

29. Saxena A.K. and R.M.Sarabhai (1992). Text Book of Botany-Vol. Ii Embryophyta. Ratan Prakashan Mandir, Agra, India.

30. Sporne, K.R. (1965) The Morphology of Pteridophytes. The Hutchinson Univ. Lib., London, U.K.

31. Sundara Rajan, S. (1995). Introduction to Pteridophyta, Wiley Eastern Limited, New Delhi, India.

32. Vashishta, P.C. (1994). Botany Pteridophyta. S. Chand and Co.Ltd. New Delhi, India.

PAPER-II (BOT 3.2)

ANGIOSPERM TAXONOMY, EMBRYOLOGY AND

GENETICS AND PLANT BREEDING

FIRST TERM : ANGIOSPERM TAXONOMY, EMBRYOLOGY

(Total Periods : 52)

			Periods	Marks
ANGIOSPERM TAXONOMY (Periods : 32)				
A)	Origin of Angiosperms :		05	(05)
	A-1	Age of Angiosperms		
	A-2	Probable Ancestors of Angiosperms :		
		a) Pteridosperms		
		b) Bennettitales		
		c) Gnetales		
B)	Systems of Plant Classifications :		05	(05)
	B-1	Concept of Pre-Darwinian and Post-Darwinian systems of Classification.		
	B-2	Pre-Darwinian systems – Linnean System		
	B-3	Post-Darwinian Systems – Assumptions, outline, merits and demerits of the following systems :		
		a) Hutchinson's System		
		b) Engler and Prantl's System		

		Periods	Marks
C)	Study of Angiospermic Families :	20	(18)

(*Sensu* Bentham and Hooker)

Study of families with respect to geographical distribution, vegetative and floral morphological features, and economic importance of the following :

1. Magnoliaceae
2. Capparidaceae
3. Zygophyllaceae
4. Combretaceae
5. Cucurbitaceae
6. Compositae (Asteraceae)
7. Ebenaceae
8. Asclepiadaceae
9. Convolvulaceae
10. Bignoniaceae
11. Amaranthaceae
12. Casuarinaceae
13. Orchidaceae
14. Scitaminae
15. Graminae (Poaceae)
16. Palmae (Arecaceae)

*N.B. a) Features of biological importance to be studied in : Convolvulaceae, Asclepiadaceae, Orchidaceae

b) Economic importance of at least four species with different uses from each families to be studied.

c) Phylogeny and interrelationships to be studied in case of Magnoliaceae, Compositae, Casuarinaceae, Graminae and Orchidaceae.

		Periods	Marks
D)	Botanical Gardens :	02	(02)

D-1 Definition and functions of botanic gardens

D-2 Botanical features of the following :

a) Indian Botanic Garden, Calcutta (India)

b) Royal Botanic Garden, Kew (England)

EMBRYOLOGY (Periods : 20)

		Periods	Marks
E)	Definition and Scope	01	(02)
F)	Study of Microsporangium :	06	(06)

F-1 Structure and functions of tetrasporangiate anther.

F-2 Microsporogenesis – Successive and simultaneous types

F-3 Types of pollen tetrads

F-4 Structure and germination of pollen grains, male gametophyte development.

		Periods	Marks
G)	Study of Megasporangim (Ovule)	05	(05)

G-1 Structure of ovule.

G-2 Types of ovules – Orthotropus, anatropus, hemi-anatropus, amphitropus, campylotropus and circinotropus.

G-3 Megasporogenesis

G-4 Types of megaspore tetrads

G-5 Structure, development and organization of embryosac in :

a) Monosporic (Polygonum) type

b) Biosporic (Allium) type

c) Tetrasporic (Peperomia) type

		Periods	Marks
H)	*Pollination and Fertilization :*	*02*	*(02)*
	H-1 Pollination types :		
	Anemophily, Entamophily and Hydrophily		
	H-2 Fertilization :		
	Porogamy. Mesogamy and Chalazogamy.		
	H-3 Double fertilization :		
	Syngamy and triple fusion.		
I)	Study of Endosperms :	02	(02)
	I-1 Types of endosperm – Nuclear. Cellular and Helobial.		
J)	Study of Embryos :	04	(04)
	J-1 Structure and development of dicot embryo (*Capsella*)		
	J-2 Structure and development of monocot embryo (Sagittaria)		
	J-3 Polyembryony – Definition and Types		

SECOND TERM : GENETICS AND PLANT BREEDING

(Total Periods : 52)

		Periods	Marks
	GENETICS (Periods : 26)		
A)	Introduction, scope and importance of the subject with reference to Nobel Laureates in Genetics.	01	(01)
B)	Mendel's Laws and beginning of Genetics :	06	(06)
	B-1 An overview of 3:1 & 9:3:3:1 ratios		
	B-2 Neo-Mendalian inheritance :		
	a) 9:6:1 Supplementary factor		
	b) 9:7 Complimentary factor		
	c) 13:3 Epistasis		
	B-3 Multiple alleles : Concept. characters and example		
	e.g. a) Blood groups, b) Nicotiana		
C)	Linkage and Crossing Over :	07	(07)
	C-1 Discovery, concept of linkage		
	C-2 Detection of linkage from F2 data and test cross.		
	C-3 Crossing over – concept and types (single and double)		
	C-4 Chromosome mapping by three point test cross.		
	C-5 Molecular basis of crossing over (Hollidays model)		
D)	Chromosome :	08	(07)
	D-1 Prokaryotic chromosomal organization e.g. TMV Bacteria		

		Periods	Marks
D-2	Eukaryotic C.O.		
D-3	Chromosomal aberrations – Concept and Types		
	a) Structural		
	b) Numerical		
D-4	Chromosomal abnormalities with respect to human diseases		
E)	Gene Mutation :	04	(04)
E-1	Concept and types		
E-2	Listing of mutagenic agents		
E-3	U.V. irradiation		
E-4	DNA repair – Photo reactivation		

PLANT BREEDING (Periods : 26)

		Periods	Marks
F)	Introduction :	01	(01)
	Aims, objectives, scope and importance		
G)	Introduction and Acclimatization :	05	(05)
G-1	Centers of origin of crop plants (N.I. Vavilov's Concept)		
G-2	Definition, objectives, advantages and disadvantages of introduction, concept of quarantine.		
G-3	Germplasm collection		
G-4	Plant introduction agencies in India.		
H)	Selection :	05	(05)

H-1	Definition, procedure, merits and demerits of following:		
	a) Pure line selection – Self pollinated crops.		
	b) Mass selection – Cross Pollinated Crops		
	c) Clonal selection– Asexually propogated crops.		
I)	Hybridization :	06	(05)
I-1	Definition, objectives, procedure, merits and demerits		
I-2	Methods of hybridization :		
	a) Single cross method		
	b) Double cross method		
	c) Pedigree method		
	d) Back cross method.		
J)	Heterosis :	03	(03)
J-1	Definition and concept		
J-2	Dominance and over dominance hypothesis		
J-3	Application and limitation		
K)	Mutation Breeding :	02	(02)
K-1	Definition and procedure		
K-2	Ganuma gardens		
K-3	Achievements		
L)	Polyploidy :	02	(02)
L-1	Role of polyploidy in Evolution of New species		
	e.g. Wheat, Rhaphanobrassica, Nicotiana and any other example.		

M) *Evolution :* *02* *(02)*

M-1 Definition and concept

M-2 Brief account on classical theory and synthetic theory of evolution (Pre-Darwinism, Darwinism and Post-Darwinism concept).

PAPER-II

REFERENCE BOOKS

ANGIOSPERM TAXONOMY

1. Heywood, V.H. and Moore, D.M. (Eds.) (1984) Current Concepts in Plant Taxonomy, Academic Press, London, U.K.

2. Jeffrey, C.E. (1982) An Introduction to Plant Taxonomy, Cambridge University Press, Cambridge, London, U.K.

3. Lawrence, G.H.M. (1951) Taxonomy of Vascular Plants. McMillan, New York, U.S.A.

4. Naik, V.N. (1985) Taxonomy of Angiosperms. Tata McGraw-Hill Publ. Co.Ltd., New Delhi, India.

5. Sharma, O.P.(1993) Plant Taxonomy, Tata McGraw Hill. Publ.Co.Ltd. New Delhi, India.

6. Singh, V. (1993) Taxonomy of Angiosperms Rastogi Publication, Meerut (U.P.) India.

9. Singh, V., Pande, P.C. and D.K.Jain (1994). A Text Book of Botany : Angiosperms. Rastogi Publications, Meerut (U.P.), India.

10. Singh, M.P., Nayar, M.P. and R.P.Roy (1994). Text Book of Forest Taxonomy, Anmol Publ. P. (Ltd.) New Delhi, India.

11. Subramanayam, N.S. (1997) Modern Plant Taxonomy, Vikas Publ. House, New Delhi, India.

EMBRYOLOGY

1. Bhojwani, S.S. and S.P.Bhatnagar (2000) The Embryology of Angiosperms (Rev.Ed.) Vikas Publ. House (P.) Ltd. New Delhi, India.

2. Johri, B.M. (1984) Embryology of Angiosperms, Springer-Verlag, Berlin, Germany.

3. Maheshwari, P. (1950) An Introduction to Embryology of Angiosperms. McGraw Hill Book Co., New York, U.S.A.

4. Raghvan, V. (1986). Embryogenesis in Angiosperms : A Developmental And Experimental Study, Cambridge Univ. Press, New York, U.S.A.

5. Raghvan, V. (1997) Molecular Biology of Flowering Plants, Cambridge University Press, Cambridge, New York, U.S.A.

6. Raghvan, V. (2000) Developmental Biology of Floweriing Plants, Springer-Verlag, New York, U.S.A.

GENETICS AND PLANT BREEDING

1. Agrawal, R.L. (1998). Fundamentals of Plant Breeding and Hybrid Seed Production, Oxford and IBH Publishing Co. New Delhi, India.

1. Burns, G.W. (1996). Science of Genetics, Macmillan Publishing Co. New York, U.S.A.

2. Chaudhary, H.K. (2001). Plant Breeding, Theory and Practice, Oxford IBH (P.) Ltd, New Delhi, India

3. Dnyansagar, V.R. (1996). Cytogenetics (TMH India), New Delhi, India.

4. Gardner, E.J. (1996) Principles of Genetics, (5th Ed.) John Wiley, New York, U.S.A.

5. Gupta, P.K. (1994). Genetics, Rastogi Publications, Meerut, India.

6. Gupta, P.K. (1995) Cytogenetics, Rastogi Publications, Meerut, India.

7. Gupta, P.K. (1998) Genetics, Plant Breeding and Evolution. Rastogi Publications, Meerut, India.

8. Lewin Benjamin (2000). Gene-VII. John Wiley and Sons, New York, U.S.A.

9. Powar, C.B. (1999). Genetics Vol. I and II. Himalaya Publications, Mumbai, India.

10. Sarin, C. (1995). Genetics (TMH India), New Delhi, India.

11. Sharma, J.R. (1984). Principles And Practice of Flowering Plants. Tata McGraw Hill Publishing Co. (Ltd.) New Delhi, India.

12. Siingh, B.D. (1996) Plant Breeding, Kalyani Publishers.

13 Sinha U. and Sinha Sunita (1995) Cytogenetics, Plant breeding and Evolution.

14 Strickberger, M.W. (2000). Genetics, Macmillan Publishing Co. New York, U.S.A.

PAPER-III (BOT 3.3)

ENVIRONMENTAL BOTANY, PLANT GEOGRAPHY AND PLANT PHYSIOLOGY, PHYTOCHEMISTRY

FIRST TERM : ENVIRONMENTAL BOTANY, PLANT GEOGRAPHY

(Total Periods : 52)

		Periods	Marks
	ENVIRONMENTAL BOTANY (Periods : 43)		
A)	Introduction :	04	(03)
	A-1 Scope and importance (emphasis be given on impact of development on environment)		
	A-2 Subdivisions of environment : Lithosphere, hydrosphere, atmosphere, stratosphere and Biosphere.		
B)	Phytosociology :		
	B-1 Introduction, definition	04	(04)
	B-2 Qualitative characters – Physiognamy, Phenology, Periodicity, aspection and stratification		
	B-3 Quantitative characters – Density, frequency, abundance		
	B-4 Frequency diagram and Raunkiaer's law of frequency.		
C)	Environmental Productivity :	03	(03)
	C-1 Introduction, concept		
	C-2 Gross and Net Productivity		

		Periods	Marks
	C-3 Primary and Secondary productivity		
	C-4 Energy flow in an ecosystem (Box and Pipe Model)		
D)	Natural Resources and Their Conservation	08	(07)
	D-1 Resources – Introduction		
	D-2 Types of resources – Classified on the basis of		
	a) Continual utility		
	b) Origin		
	c) Utility		
	D-3 Necessity of Conservation		
	D-4 Biodiversity		
	D-5 *In situ* and *ex-situ* conservation		
E)	Wild Life Management :	06	(06)
	E-1 Wild life management in India.		
	E-2 Indian Board of Wild Life (IBWL)		
	E-3 Protected Areas Network (Conservation of Biological Diversity)		
	a) National Park		
	b) Santuaries		
	c) Biosphere reserve		
F)	Energy Conservation :	06	(06)
	F-1 Sources of energy		
	F-2 Conventional and Non-conventional energy		

			Periods	Marks
	F-3	Conventional sources of energy : Coal, oil, natural gas, thermal power, firewood, hydropower, nuclear power		
	F-4	Non-conventional sources of energy : Solar energy, wind energy, Tidal energy, Biomass based energy.		
	F-5	Prospective alternatives for energy :		
		a) Petroplants		
		b) Biogas		
G)	*Environmental Pollution :*		08	(08)
	G-1	Causes of Air, Water and Soil Pollution		
	G-2	Hazardous effect of air, water and soil pollution		
	G-3	Green house effect		
	G-4	Remedial measures for air, water and soil pollution		
H)	Bioremediation :		04	(04)
	H-1	Introduction		
	H-2	Need and Scope of Bioremediation		
	H-3	Phytoremediation :		
		a) Recovery of heavy metals from soil		
		b) Reclainmation of industrial waste and Municipal waste water		

PLANT GEOGRAPHY (Periods : 09)

I)	I-1	Main Botanical Regions of India.	04	(04)
	I-2	Detailed study of vegetational types in Maharashtra		

		Periods	Marks
	[illegible] Indicators :	02	(02)
	[illegible]oduction		
	[illegible]icators of soil pH, altitude, water, minerals. [illegible]s and pollution.		
	[illegible]s of following two ecologists :	02	(02)
	a) S.C.Pandey		
	b) E.P.Odum		
	c) R.Mishra		
	[illegible]ism :	01	(01)
	Causes, Types		

SECOND TERM : PLANT PHYSIOLOGY AND PHYTOCHEMISTRY

(Total Periods : 52)

			Periods	Marks
	PLANT PHYSIOLOGY (Periods : 30)			
A)	Mineral Nutrition :		07	(07)
	A-1	Introduction		
	A-2	Macro and Micro elements		
	A-3	Techniques used for assessing essentiality of an element :		
		a) Sand Culture		
		b) Solution Culture		
	A-4	Occurrence, role, functions and deficiency symptoms of N, P, K, S, Ca, Mg, Fe, Mn, Zn, Cu, MO.		

		Periods	Marks
		07	(07)

B) Phytosynthesis :

B-1 Photosynthetic apparatus – Ultrastructure of the chlorolast.

B-2 Ligiu-reaction (Hill reaction). Two pigment system, cyclic and non-cyclic photophosphorylation, Red Drop Emerson Effect

B-3 Dark Reaction :

a) C3 Pathway (Calvin Cycle)

b) C4 (HSK) Pathway

c) CAM Pathway

d) Comparison between C3 and C4 Plants

e) Significance of Photosynthesis.

		08	(07)

C) Respiration :

C-1 Respiration as an energy releasing process

C-2 Respiratory substrate and respiratory quotient

C-3 Mechanism of respiration :

a) Glycolysis, Kreb's cycle

b) Respiratory chain (ETS). Terminal oxidation

c) PP Pathway

d) Balance Sheet of ATP Generation

e) Anaerobic respiration

f) Pasteur's effect

g) Factors affecting respiration

h) Biolumenescence

		Periods	Marks
D)	Fat Metabolism :	04	(04)
	D-1 Fatty acid synthesis		
	D-2 Glycerol synthesis		
	D-3 □ and □ oxidation		
E)	Plant Growth Harmons :		
	E-1 Introduction	04	(04)
	E-2 General account, occurrence and practical applications of Auxins, Gibbrellin and Kinins		
	E-3 Growth inhibitors.		

PHYTOCHEMISTRY (Periods : 22)

F)	Phytochemistry :	04	(04)
	F-1 Introduction		
	F-2 Plants as organic laboratories		
	F-3 Primary and secondary metabolites		
	F-4 Factors affecting concentration of metabolites.		
G)	Carbohydrates :	04	(04)
	G-1 Introduction		
	G-2 Classification		
	G-3 Sources and uses of :		
	a) Glucose		
	b) Fructose		
	c) Starch		
H)	Proteins :	04	(04)
	H-1 Introduction		
	H-2 Types of proteins and their distribution in plants.		

		Periods	Marks
	H-3 Properties and uses.		
I)	Lipids :	05	(05)
	I-1 Introduction		
	I-2 Classification :		
	a) Simple lipids (Natural fats and Waxes)		
	b) Compound (Phospholipids and Glycolipids)		
	c) Derived lipids (Fatty acids and Glycerol)		
	I-3 Sources, Chemical Composition and Uses of :		
	a) Groundnut oil		
	b) Soyabean oil		
	I-4 Functions of lipids in plants.		
	I-5 Uses of lipids		
J)	*Alkaloids :*	05	(04)
	J-1 Introduction		
	J-2 Definition, properties and functions.		
	J-3 Classification based on pharmacological action.		
	J-4 Sources, properties and uses of :		
	a) Nicotine		
	b) Solasodin		
	c) Viscicine		

PAPER-III

REFERENCE BOOKS

ENVIRONMENTAL BOTANY, PLANTS GEOGRAPHY

[illegible] K.C. (1996) Environmental Biology, Agro-Botanical [illegible], Bikaner.

[illegible] R.S. (1988) A Text Book of Plant Ecology, Students Friends [illegible], India.

[illegible] R.S. (1990) Environmental and Pollution. Students' Friends [illegible] India.

[illegible] Standard Methods for the Examination of Water and Waste [illegible] American Public Health Association, Washington, D.C.

[illegible] Arumugam, N. (1996) Concepts of Ecology (7th Ed.) Saras Publication, Kanyakumari, India.

7 Chapman, J.L. and Reiss, M.J. (1998) Ecology : Principles and Applications. Cambridge University Press. Cambridge.

8 Dash, M.C. (1993) Fundamentals of Ecology. Tata McGraw Hill Publishing Co. Ltd., New Delhi, India.

9 Heywood, V.H. and Watson, R.T. (1995) Global Biodiversity Assessment, Cambridge University Press, Cambridge.

10 Hill, M.K.(1997) Understanding Environmental Pollution, Cambridge University Press Cambridge.

11 Kapur, P. and Govil, S.R. (2000) Experimental Plant Ecology. S.K.Jain for CBS Publishers and Distributors, New Delhi, India.

12 Kothari, A. (1997) Understanding Biodiversity : Life Sustainability and *Equity*. *Orient Longman.*

13 Krebs, C.J. (1989) *Ecological Methodoloty. Harper and Row*, New York, USA.

14 Kumar, H.D. (1996) Modern Concepts of Ecology (4th Ed.) Vikas Publishing House (P.) Ltd., New Delhi.

15 Kumar, H.D. (1997) General Ecology, Vikas Publishing House (P.) Ltd., New Delhi, India.

16 Moore, P.W. and Chapman, S.B. (1986) Methods in Plant Ecology. Blackwell Scientific Publications.

17 Odum, E.P. (1983) Basic Ecology, Saunders, Philadelphia.

18 Odum, E.P. (1996) Fundamentals of Ecology, Natraj Publishers, Dehra Dun, India.

19 Saxena, M.M. (1990) Applied Environmental Biology (Resource and Management) Agro-Botanical Publishers, Bikaner, India.

20 Swaminathan, M.S. and Kocchar, S.L. (Eds.) (1989) Plants and Society. Macmillan Publications Ltd. London, U.K.

[redacted] P.R. (1999) Encyclopaedia of World Environment Vol. I and V. [redacted] Publishing Corporation, New Delhi, India.

PLANT PHYSIOLOGY, PHYTOCHEMISTRY

1 Amar Singh (1977) Practical Plant Physiology. Kalyani Publishers, New Delhi, India.

2 Bajracharya, D. (1999) Experiments in Plant Physiology : A Laboratory Manual, Narosa Publishing House, New Delhi, India.

3 Daniel, M. (1991) Methods in Plant Chemistry And Economic Botany, Kalyani Publishers, Ludhiana, India.

4 Daniel, M. and S.D. Sabnis (1990) A Phytochemical Approach to Economic Botany. Kalyani Publishers, Ludhiana, India.

5 Harborne, T.C. (1981) Phytochemical Methods : A Guide To Modern Techniques of Plant Analysis. Chapman and Hall, London, U.K.

6 Hopkins, W.G. (1985) Introduction to Plant Physiology, John Wiley and Sons. Incl. New York, U.S.A.

7 Jain, V.K. (1997) Fundamentals of Plant Physiology. Atmaram & Sons. New Delhi, India.

8 Mukherjee, S. and A.K. Ghose (1996). Plant Physiology, Vikas Publishing House, New Delhi, India.

9 Pandey. S.N. and B.L.Sinha (1994) Plant Physiology. Vikas Publishing House. New Delhi, India.

10 Sarabhai. B.P. (1995). Elements of Plant Physiology. Anmol Publications, New Delhi, India.

11 Verma, V. (1984) Introduction To Plant Physiology. Emkey Publications, New Delhi, India.

PAPER-IV (BOT 3.4)

MOLECULAR BIOLOGY AND BIOTECHNOLOGY

FIRST TERM : MOLECULAR BIOLOGY

(Total Periods : 52)

MOLECULAR BIOLOGY (Periods : 52)

		Periods	Marks
A)	Introduction :	01	(04)
	A-1 History, scope and importance		
B)	Molecular Organization of Cell :	14	(10)
	B-1 Cell wall – Ultrastructure		
	B-2 Plasma membrare – Fluid Mosaic Model		
	B-3 Cytoplasm		
	B-4 Nucleus-Ultrastructure (Prokaryotic and Eukaryotic)		

		Periods	Marks
	B-5 Ribosomes – Types		
	B-6 Lysosome		
	B-7 Golgi Complex		
	B-8 Mitochondria-Ultrastructure		
	B-9 Chloroplast-Ultrastructure & Photosynthetic pigments		
	B-10 Endoplasmic reticulum		
C)	Cell Cycle and Cell division	06	(06)
D)	Nucleic Acids :	08	(08)
	D-1 Molecular Model of DNA Structure (Watson & Crick Model)		
	D-2 Forms of DNA : A-DNA, B-DNA, Z-DNA		
	D-3 Molecular structure of RNA		
	D-4 Types of RNA:r-RNA, m-RNA, t-RNA		
	D-5 Two dimensional structure of t-RNA		
E)	DNA Replication :	08	(08)
	E-1 Types of replication		
	E-2 Meselson's and Stahl's experiment		
	E-3 Mechanism of replication		
	a) Origin of replication		
	b) Strand unwinding		
	c) DNA template		
	d) RNA primer		
	e) Formation of replicating forks		
	f) Okazaki fragments		
	Enzymes involved in DNA replication		

		Periods	Marks
		06	(06)

F) Gene Regulation :

F-1 Introduction

F-2 Gene regulation in prokaryotes

a) Operon concept – Structural genes, promoter sequence, regulator sequence, operator sequence.

b) Inducible and repressible operon

F-3 Lac operon in E.Coli & Tryptophan electron system

G) Genetic Code and Protein Synthesis : 09 (08)

G-1 Concept, properties and coding dictionary

G-2 Central dogma (Main principle) of protein synthesis

G-3 Components involved in protein synthesis

Mechanism of protein synthesis :

a) Transcription

b) Translation

SECOND TERM – BIOTECHNOLOGY

(Total Periods : 52)

	Periods	Marks

BIOTECHNOLOGY (Periods : 52)

A) Introduction : 03 (04)

A-1 Scope and importance

A-2 Biotechnology in India

B) Equipments : Principle, Working and Uses 06 (06)

	Periods	Marks

B-1 Autoclave

B-2 Laminar Air Flow/Inoculation Chamber

B-3 PH Meter

B-4 Centrifuge

B-5 Colorimeter

B-6 Spectrophotometer

B-7 Nephelometer

C) Plant Tissue Culture : 08 (08)

C-1 Concept of Totipotency

C-2 Tissue culture media composition (Murashige and Skoog medium)

C-3 Tissue culture laboratory plan and requirements

C-4 Applications of tissue culture

C-5 Callus culture

C-6 Embryo culture

C-7 Micropropogation

C-8 Protoplast culture

D) Fermentation Technology : 06 (06)

D-1 Microbes involved substrates, Fermentation process product recovery and uses of the following :

a) Citric Acid

b) Vinegar

c) Vitamins (B-complex)

E) Single cell Protein : 04 (04)

E-1 Advantages of SCP

		Periods	Marks
E-2	Microorganisms used in SCP		
E-3	Production of SCP, spirulina and yeast		
E-4	Nutritional value of SCP		
F)	Biological Nitrogen Fixation :		
F-1	Mechanism of nitrogen fixation		
F-2	Non-symbiotic nitrogen fixation		
F-3	Nif, nod and Hup-genes		
F-4	Symbiotic nitrogen fixation		
F-5	Root nodule development in Leguminous plants		
F-6	Rhizobia and Root nodules		
G)	Biomass and Bioenergy :	08	(08)
G-1	Biomass as a source of energy		
G-2	Composition of Biomass		
G-3	Biomass convertion into energy		
G-4	Non-biological methods		
G-5	Biogas production		
G-6	Biofuels		
G-7	Petrocrops		
H)	Genetic Engineering :	10	(08)
H-1	History and development of genetic engineering-Milstones		
H-2	Outlines of procedure		
H-3	Isolation of gene of interest		
H-4	Agrobacterian tumefeciens vectors (Octopine & Nopalin Plasmids)		

		Periods	Marks
H-5	Insertion of isolated gene into the vector		
H-6	Transfer of r-DNA into the host cell		
H-7	Selection of transformed cell		
H-8	Benefits and bio-hazards		

PAPER- IV

REFERENCE BOOKS

MOLECULAR BIOLOGY

1. Darlington, and La Cour (1976) The Handling of Chromosomes, 6th Ed. George Allen and Unwin Ltd., London, U.K.

2 De Robertis and De Robertis (1998) Cell and Molecular Biology 8th Ed. B.I. Waverly Pvt. (Ltd.), New Delhi, India

3 Drid. R.V. and Otte A.P. (1997) Nuclear Organizaation. Chromatin Structure and Gen. Expression, Oxfort University Press, Oxford.

4 Gupta, P.K. (1989) Cytology, Genetics and Evolution 5th Ed. Rastogi Publ. New Delhi, India.

5 Gupta, P.K. (1999) A Text Book of Cell and Molecular Biology, Rastogi Publication, Meerut.

6 Lewin B. (1985) Genes I-IV, John Villey and Sons, New York, U.S.A.

7 Lewin B. (2000) Genes-VII, Oxfort University Press, New York, U.S.A.

8 Prasad and Prasad (1994) Outlines of Microtechniques, Emkay Publ. New Delhi, India.

9 Sharma. A.K. and Sharma A. (1999) Plant Chromoses : Analysis. Manipulation and Engineering, Harwood Academic Publishers, Australia.

10 Sharma. Arun and Sharma Archana (1972) Chromosome Techniques, Theory and Practice, University Park Press, Butteroworths, London, U.K.

11 Sundararajan, S., Cell and Molecular Biology, Anmol Publ. Pvt. Ltd. Delhi.

12 Smith. J.E. (1996) Biotechnology. Cambridge University Press, Cambridge.

13 Rao, B.H. Harshitha, D. and Rao K.R.S. (1999). Advanced Biotechnology. Discovery Publ. House, New Delhi, India.

14 Jogdand, S.N. (2001) Advances in Biotechnology. Himalaya Publishing House, Mumbai, India.

15 Chhatwal, G.R. (1998) Textbook of Biotechnology. Anmol Publications, New Delhi, India.

BIOTECHNOLOGY

1 Aneja, K.R. (1996) Experiments in Microbiology, Plant Pathology, Tissue Culture and Mushroom Cultivation, Wishwa Prakashan, New Delhi, India.

2 Bhojwani S.S. and Razdan M.K. (1983). Plant Tissue Culture. Theory and Practice, Elserir Science Publ., Amsterdam.

3 Casida, L.E. (1991) Industrial microbiology, Wiley Eastern Ltd. New Delhi, India.

4 Dubey, R.C. (1995) A Text Book of Biotechnology, S. Chand and Co. Ltd. New Delhi, India.

5 Evans D.A. and et.al. (1983) Handbook of Plant Cell Culture. Vol. 1-3, McMillan, New Delhi, India.

6 Gupta, P.K. (1999). Elements of Biotechnology. Rastogi Publ. Meerut, India.

7 Jogdand, S.N. (1993) Advances in Biotechnology. Himalaya Publ. House, New Delhi. India.

8 Kumar, U. (2000). Methods in Plant Tissue Culture, Agrobios. Jodhpur. India.

9 Purohit, S.S. (2003). Agricultural Biotechnology, Agrobias, Jodhpur, India.

10 Smith, J.E. (1996). Biotechnology, Cambridge University Press, Cambridge.

11 Swaminathan, M.S. (1991) Biotechnology in Agriculture, McMillan, Madras, India.

PAPER-V (BOT 3.5)

COMPUTER AND HORTICULTURE

FIRST TERM : COMPUTER

(Total Periods : 52)

		Periods	Marks
	COMPUTER (Periods : 52)		
A)	Introduction :	03	(02)
A-1	History of computers		
A-2	What is computer ?		
A-3	Generation of computers :		
	a) Speed		
	b) Storage		
	c) Accuracy		
	d) Versatility		
	e) Diligence		
B)	Application of Computers :	02	(02)
	a) Data Processing		
	b) Word Processing		
	c) Desk-top Publishing		
	d) Data-base management		
	e) Scientific research		
C)	Classification of Computers :	04	(04)
	On the basis of type, purpose and capacity		

		Periods	Marks
C-1	According to type :		
	a) Analog computer		
	b) Digital		
	c) Hybrid		
C-2	According to purpose :		
	a) General Purpose Computer		
	b) Special Purpose Computer		
C-3	According to capacity (speed and memory) of computer :		
	a) Micro Computer		
	b) Mini Computer		
	c) Mainframe Computer		
	d) Super Computer		
D	Basic Structure of Computer System :	04	(04)
D-1	Input Device :		
	a) Keyboard		
	b) Mouse		
	c) Scanner		
	d) Floppy disk		
	e) Compact disk		
	f) Hard disk		
D-2	Central Processing Unit (CPU)		
	a) Memory Unit		
	b) Arithmetic/logic unit		
	c) Control unit		

		Periods	Marks
D-3	Output device :		
	a) Monitor		
	b) Printer		
	c) Plotter		
	d) Floppy Disk		
	e) Magnetic tape		
	f) Hard disk		
D-4	Voice output device :		
	a) Stereo speakers		
	b) Head phones		
E	Primary Storage Unit :	02	(02)
E-1	Read only memory (ROM)		
	i. Programmable ROM (PROM)		
	ii. Erasable Programmable ROM (EPROM)		
	iii. Electricity erasable programmable ROM (EEPROM)		
E-2	Random Access Memory (RAM)		
F	Secondary Storage Device :	02	(02)
	i. Floppy disk		
	ii. Hard disk		
	iii. CD ROM WORM (Write once read many)		
G	Computer System :	02	(02)
G-1	Hardware		
G-2	Software		

		Periods	Marks
H	Virus and Vaccine :	03	(03)
H-1	What is computer virus ?		
H-2	Types of viruses		
H-3	Classification of viruses		
H-4	How does virus work and spread ?		
H-5	Anti Virus software		
H-6	How to avoid the virus attacks ?		
I	Internet :	04	(04)
I-1	What is iinternet ?		
I-2	Uses of internet		
I-3	Internet services		
I-4	E-mail :		
	i. Requirements		
	ii. E-mail account		
	iii. Sending your e-mail message		
	iv. Receiving and Reading a message		
	v. Advantages and disadvantages of E-mail		
J)	Introduction to Window-98 :	06	(06)
J-1	What is Window-98		
J-2	History		
J-3	Parts of Standard Windows		
J-4	Icon the Desktop		
J-5	Components of the start menu		
O-10	Animation		

			Periods	Marks
	J-6	Disk organization		
		a) Windows explorer		
		b) Explorer window		
		c) Creating Folders		
		d) Finding files and folders		
		e) Opening files and folders & folders files and folders		
		f) Renaming files		
		g) Copying and moving		
		h) Deleting files and folders		
	J-7	Customizing windows with the control panel :		
		a) Display setting		
		b) Regional Setting		
		c) Date and Time Setting		
		d) Setting sound events		
		e) Printing basics		
K)	Windows Accessories :		04	(04)
	K-1	Calculator		
	K-2	Notepad		
	K-3	Wordpad		
	K-4	Paint		
	K-5	Microsoft binder		
L)	MS-Word :		06	(05)
	L-1	What is word processing?		
	L-2	What is Microsoft-word?		
	L-3	Details of word window?		

			Periods	Marks
	L-4	Text selection		
	L-5	File commands		
	L-6	Edit commands		
	L-7	View menu		
	L-8	Insert menu		
	L-9	Formatting		
	L-10	Bullets and numbering		
M	M-1	Tables	2	(02)
	M-2	Proofing and automation		
N	MS-Excel :		2	(02)
	N-1	Introduction		
	N-2	What is a spread sheet ?		
	N-3	What is Microsoft excel ?		
	N-4	Details of Excel window		
	N-5	Detail applications of Botany		
O	MS-Powerpoint :		6	(05)
	O-1	Starting powerpoint		
	O-2	Details of the powerpoint window		
	O-3	File Commands		
	O-4	Working with text		
	O-5	Design		
	O-6	Clipart		
	O-7	Drawing tools		
	O-8	Views		
	O-9	Special effects		

		Periods	Marks
G-2	Differences between training and pruning		
G-3	Objectives of training and pruning		
G-4	Advantages of training and pruning.		
H)	Pomology :	01	(01)
H-1	Introduction, scope and importance.		
I)	Bahar Treatment :	02	(02)
I-1	Definition and importance		
I-2	Types of Bahar –		
	a) Ambe bahar		
	b) Mrig bahar		
	c) Hasth bahar		
J)	Fruits and Vegetable preservation :	08	(07)
J-1	Introduction, scope and importance		
J-2	Methods of preservation		
J-3	Temporary preservation		
	a) Aseptic		
	b) Low temperature treatment		
	c) Exclusion of moisture		
	d) Use of mild antiseptic		
	e) Pasteurization		
J-4	Permanent Preservation :		
	a) Sterilization and processing – use of Sugar, Salt, Vinegar or Chemicals		
	b) Drying		
	c) Fermentation		
	d) Ionizing radiations		
J-5	Canning and bottling of fruits and vegetables		

		Periods	Marks
J-6	Preparation of preserved products :		
	a) Mix fruit Jam		
	b) Wood apple or guava jelly		
	c) Lemon/orange squash		
	d) Tomato ketchup		
K)	Fertigation Technique :	03	(03)
K-1	Introduction		
K-2	Present status		
K-3	Importance of fertigation		
K-4	Types of fertilizers to be used		
K-5	Methodology		
L)	Polyhouse and Greenhouse Technology with reference to ornamental horticulture :	06	(06)
L-1	Scope and importance		
L-2	Types of structures		
	a) Green house		
	b) Conservatory		
	c) Polyhouse		
	d) Glasshouse		
	e) Plastic tunnels		
	f) Other structure (cold frame, hot belts, mist house)		
L-3	Construction of the various structures-Material, requirement and cost.		
L-4	Crops grown under these structures :		
	a) Vegetables		
	b) Ornamentals		
M)	Post harvest management of fruits, vegetable and flowers.	11	(10)

SECOND TERM : HORTICULTURE

(Total Periods : 52)

		Periods	Marks
	HORTICULTURE (Periods : 52)		
A)	Introduction :	04	(03)
	A-1 Definition		
	A-2 Scope and importance		
	A-3 Different branches of Horticulture		
	a) Pomoculture		
	b) Olericulture		
	c) Floriculture		
	d) Ornamental horticulture		
	e) Landscape gardening		
B)	Propogation of Horticulture Plants :	04	(04)
	B-1 Sexual reproduction :		
	a) Merits and demerits		
	b) Selection of seeds		
	c) Pre-germination treatment		
	d) Sowing of seeds		
	e) Transplantiing of seedlings		
	B-2 Asexual reproduction (Vegetative) : Merits and Demerit		
C)	Cutting :	02	(02)

		Periods	Marks
	C-1 Definition		
	C-2 Advantages and Disadvantages		
	C-3 Types of Cuttings :		
	a) Stem cuttings : Herbaceous, Semi hardwood, Hardwood and Soft wood.		
	b) Root rutting		
	c) Leaf cutting		
D)	Layering :	02	(02)
	D-1 Definition		
	D-2 Advantages		
	D-3 Types of layering :		
	a) Simple layering		
	b) Air layering or Gootee		
E)	Grafting :	03	(03)
	E-1 Types of grafting :		
	a. Whip grafting		
	b. Tounge grafting		
	c. Bark grafting		
	d. Splice approach grafting		
F)	Budding :	03	(03)
	E-1 Types of budding		
	a) 'T' or shield budding		
	b) Patch budding		
G)	Training and Pruning of Plants :	03	(03)
	G-1 Definition		

		Periods	Marks
M-1	Introduction, Definition		
M-2	Maturity harvesting and handling in relation to shelf and quality of fruits, vegetables and flowers.		
M-3	Harvest and Maturity indices with reference to :		
	a) Fruits – Mango, Banana and Grapes		
	b) Vegetables – Tomato, spinach / Fenugreek, Potato/ onion		
	c) Flowers – Chrysanthemum,Tuberose, Mogra		
M-4	Factors responsible for maturity ripening and deterioration		
M-5	Methods of hastening and Delay in ripening		
M-6	Methods of precooling, grading, packing, storage and transport of fruits, vegetables and flowers.		

PAPER- V

REFERENCE BOOKS

COMPUTER

1. Dixit, Manish (2002) Internet : An Introduction. Tata McGraw Hill Publishing Co. Ltd. New Delhi, India.

2 Sharon Crowford and Nail J. Solkind (1998) ABC's of Window-98. BPB Publications, New Delhi India.

Sinha, R.K. (1990) Computer Fundamentals. BPB Publications. New Delhi, India.

Rajaram, V. (2001) Fundamentals of Computers. Prentice Hall of India, New Delhi, India.

Timothy J. O'Leary and Linda I. O'Leary (2002) Computing Essentials. Tata McGraw Hill Publishing Co. Ltd., New Delhi, India.

VIPRO –Technical Term : Using MS Office-2000.

MS-Office 2000. PBP Publications, New Delhi, India.

HORTICULTURE

Bal. J.S. (1997) Fruit Growing, Kalyani Publishers, Ludhiana, India.

Bose. T. (1996) Fruits-Tropical and Subtropical. Nayaprokash, Calcutta, India.

3 Hortmann, H.T. and D.E. Kester (1989). Plant Propagation : Principles and Practice, Prentice Hall of India. (P.) Ltd., New Delhi, India.

4 Gordharlal, Siddappa, G.S. and G.L. Tandon (1998) Preservation of Fruits and Vegetables. ICAR, New Delhi, India.

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

6 Vishnu, Swarup (1997). Ornamental Horticulture. Macmillan Ltd. New Delhi, India.

PAPER-VI : OPTIONAL (I) (BOT 3.6)

GARDENING AND BOTANICAL TECHNIQUES

FIRST TERM : GARDENING

(Total Periods : 52)

		Periods	Marks
	GARDENING (Periods : 52)		
A)	Introduction :	02	(02)
A-1	Landscapping – Landscape designing		
A-2	Types of Garden :		
	a) Formal garden		
	b) Informal garden		
	c) Botanical garden		
	d) Terrace garden		
A-3	Importance of Garden :		
	a) Aesthetic		
	b) Academic		
	c) Economic		
B)	Garden Planning :	06	(06)
B-1	Consideration of following in planning :		
	Originality in planning, colour scheme, fragrance, privacy, beauty, comfort, flexibility.		
B-2	Study of physical, structural and biological features of gardens such as :		
	a) Fences		
	b) Hedges and edges		
	c) Path and avenues		
	d) Rockery		
	e) Water garden		
	f) Lawns		
	g) Arches and Pargolas		
	h) Green-house		
C)	Soil Management :	04	(04)
C-1	Soil : Nature and types		

		Periods	Marks
C-2	Manures :		
	b) Bulky organic manures – leaf mould, compost and composting, Farm Yard Manure (FYM), Vermi compost.		
	c) Concentrated organic manure – liquid manure		
C-3	Fertilizers		
C-4	Irrigation techniques		
C-5	Agrochemicals :		
	Insecticides, pesticides, fungicides etc.		
D)	Garden Tools and Implements :	03	(03)
D-1	Implements – sickle, trawel, rake, hoe, secateurs, pruning sheers, grafting and budding knife.		
D-2	Use and maintenance of following :		
	a) Mower		
	b) Sprayer		
	c) Duster		
	d) Grafting and budding knife.		
E)	Indoor Gardening :	04	(04)
E-1	House plants for indoor gardening		
E-2	Characters of indoor plants		
E-3	Hanging baskets		
E-4	Maintenance of indoor plants		

		Periods	Marks
F)	Pot Culture :	04	(04)
	F-1 Containers		
	F-2 Selection of plants		
	F-3 Potting and repotting		
	F-4 Maintenance and care		
	F-5 Importance		
G)	Bonsai :	04	(04)
	G-1 Principle		
	G-2 Containers		
	G-3 Selection of plants		
	G-4 Techniques		
	G-5 Styles		
	G-6 Maintenance		
H)	Hydroponics :	04	(04)
	H-1 Principle		
	H-2 Container		
	H-3 Culture medium		
	H-4 Selection of plants		
	H-5 Techniques		
	H-6 Maintenance		
	H-7 Importance		

(58)

	Periods	Marks
Pot Culture :	04	(04)
F-1 Containers		
F-2 Selection of plants		
F-3 Potting and repotting		
F-4 Maintenance and care		
F-5 Importance		
Bonsai :	04	(04)
G-1 Principle		
G-2 Containers		
G-3 Selection of plants		
G-4 Techniques		
G-5 Styles		
G-6 Maintenance		
Hydroponics :	04	(04)
H-1 Principle		
H-2 Container		
H-3 Culture medium		
H-4 Selection of plants		
H-5 Techniques		
H-6 Maintenance		
H-7 Importance		

		Periods	Marks
I)	Study of Ornamental Plants :	08	(08)
	With reference to selection, cultivation practices, maintenance and care with at least 3 examples each of :		
	b) Annuals b) Shrubs		
	a) Climbers d) Trees		
J)	Topiary :	03	(03)
	J-1 Introduction		
	J-2 Suitable plants		
	J-3 Methods/Training		
	J-4 Importance		
K)	Rockery :	03	(03)
	K-1 Selection of site		
	K-2 Design, construction and preparation		
	K-3 Selection of plants		
	K-4 Maintenance and care		
L)	Lawns :	04	(03)
	L-1 Preparation of soil		
	L-2 Selection of grasses :		
	L-3 Planting methods		
	L-4 Maintenance and aftercare		
	L-5 Importance		
M)	General account of pests and diseases in garden	03	(03)
	plants with respect to :		

		Periods	Marks
M-1	Pathogen		
M-2	Host		
M-3	Symptoms and damage done		
M-4	Control measures		

SECOND TERM : BOTANICAL TECHNIQUES

(Total Periods : 52)

		Periods	Marks
	BOTANICAL TECHNIQUES (Periods : 52)		
	Introduction :	02	(02)
A-1	Scope and importance		
	Study of Different Instruments :	09	(08)
B-1	Microtome (Rotary)		
B-2	Camera lucida and Micrometry		
B-3	Stereoscopic binocular microscope		
B-4	Phase-contract microscope		
B-5	Electron microscope		
B-6	Plain photometer		
	Killing and Fixing of Material :	04	(04)
C-1	Collection of specimen		
C-2	Fixation types		
C-2	Techniques of fixing		
	Stains and staining :	05	(05)
D-1	Theory of Staining		

		Periods	Marks
	D-2 Type of stains		
	D-3 Staining : (i) Bacterial (ii) Fungal (iii) Cytological (iv) Anatomical		
	D-4 Temporary and permanent double stained preparation of free hand section.		
E)	Microtomy :	08	(08)
	E-1 Washing		
	E-2 Dehydration		
	E-3 Cleaning		
	E-4 Infiltration		
	E-5 Embedding		
	E-6 Sectioning		
	E-7 Mounting of ribbon		
	E-8 Staining		
F)	Cultural Techniques :	08	(08)
	F-1 Concept of mixed and pure culture		
	F-2 Glassware – Types		
	F-3 Sterilization Methods for glassware and media like Dry heat and Steam sterilization		
	F-4 Nutritional requirements for various organisms		
	F-5 Common media used for cultivation of Algae, Fungi and Bacteria e.g. De's medium and any other algal medium for algae PDA and Czapek Dox Agar for Fungi Nutrient Agar MacConkeys Agar for Bacteria		

		Periods	Marks
	F-6 Source of Inoculum for Algae, Fungi and Bacteria		
	F-7 Enrichment and Isolation method a. Streak methods b. Spread plate c. Pour plate/dilution method d. Slide culture		
	Whole mounts, Cytological methods and Maceration :	06	(06)
	G-1 Permanent whole mounts – Museum specimens		
	G-2 Cytological methods: (i) Smears (ii) Squash (iii) Making of smear and squash permanent		
	G-3 Maceration techniques		
	Solutions :	04	(04)
	H-1 True solution		
	H-2 Preparation of solutions : (i) Percent solution (ii) Molar solution (iii) Normal solution		
	H-3 Dilute solution of acids		

			Periods	Marks
	H-4	Preparation of buffer e.g. Phosphate buffer		
I)	Chromatography :		06	(06)
	I-1	Introduction		
	I-2	Types :		
		(i) Paper chromatography I. (a) Unidirectional – Ascending and descending, (b) Two dimensional.		
		(ii) Thin layer chromatography – Plate and column		
	I-3	Procedure for preparation of paper chromatogram and thin layer chromatogram		
	I-4	RF Value		

PAPER- VI

REFERENCE BOOKS

(OPTIONAL-I) GARDENING AND BOTANICAL TECHNIQUES

1 Alex Laurie and Ries V.C. (2003) Floriculture : Fundamentals and Practices.

2 Ancja, K.R. (1996) Experiments in Microbiology, Plant Pathology, Tissue Culture and Mushroom Cultivation (IInd Ed.) Wishwa Prakashan, New Delhi, India.

3 Bose, T.K. and Mukherjee, D. (1997) (Ed.) Percy Lancaster's Gardening In India. Oxford and IBH Publ. (P.) Ltd., New Delhi, India.

Day, S.C. (2003) A Art of Miniature Plant Culture. Agrobias, Jodhpur, India.

Dej, S.C. (2003) Complete Home Gardening. Agrobias, Jodhpur, India.

Dhopte, A.M. (2003) Principles and Techniques for Plant Scientists, Agrobios, Jodhpur, India.

Dwivedi, J.N. and R.B.Singh (1990). Essentials of Plant Techniques. Scientific Publishers, Jodhpur, India.

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

Modi, H.A. (1996) Elementary Microbiology Vol.V. Ekta Prakashan, Ahmadabad, India.

Stanier, R.Y. Ingrahaan, J.L., Whalis, M.L. and P.R.Painter (1993). General Microbiology (5th Ed.) The Macmillan Press Ltd., London. U.K.

PAPER-VI : OPTIONAL (II) (BOT 3.6)
PLANT PROTECTION AND SEED TECHNOLOGY, SEED PATHOLOGY

FIRST TERM : PLANT PROTECTION

(Total Periods : 52)

		Periods	Marks
	PLANT PROTECTION (Periods : 52)		
A)	Introduction :	04	(04)
A-1	Scope and importance		
A-2	Historical account of plant pathology with reference to the work of the following pathologists : Theophrastus, Prevost, De-Bary, Butler, Mundkar, K.C.Mehta, Robert Koch.		
B)	Terminology :	03	(03)
	Definitions : Disease, Pathogen, Host, Parasite, Hyperparasite, Inoculum, Penetration, Infection, Pathogenesis, Pathogenecity, Etiology, Incubation period, Disease cycle, Symptoms, Epidemology, Disease development.		
C)	Causes of Plant diseases :	04	(04)
C-1	Animate causes – A brief survey of diseases caused by Bacteria, Fungi, Algae, Nematodes and Mycoplasma.		
C-2	Inanimate causes – A brief survey of diseases caused by deficiency of minerals, adverse climate conditions, chemical injuries by atmospheric pollutants, faulty application of fungicides and insecticides.		

		Periods	Marks
Symptoms and Damage :		03	(03)
	Various symptoms of plant diseases alongwith the kind of damage done.		
Development of Diseases (Pathogenesis) :		04	(04)
	Introduction, inoculum potential, infection landing of inoculum on the host, modes of penetration, mechanism of penetration – Indirect penetration and direct penetration.		
Study of following diseases with respect to causal organism, symptoms and control measures :		14	(12)
F-1	Animate Diseases :		
	a) Viral diseases : TMV/PXV		
	b) Bacterial diseases : Citrus canker		
	c) Fungal diseases :		
	i. Damping of seedling		
	ii. Powdery mildew of Grape/ Teak/ Sisso		
	iii. Bunchy top of Banana		
	iv. Ergot of Bajara		
	v. Loose smut of wheat		
	vi. Tikka disease of Groundnut		
	vii. Red rot of sugarcane		
	d) Mycoplasma diseases : Little leaf of Brinjal		
	e) Nematodal diseases : Root knot of vegetables		

		Periods	Marks
G)	General Principles of Disease Control :	04	(04)
G-1	Preventive therapy		
i.	Avoidance of the Pathogen		
ii.	Exclusion of inoculum		
iii.	Eradication		
iv.	Protection		
v.	Disease resistance		
G-2	Curative therapy		
H)	Legal Control :	02	(02)
H-1	Introduction		
H-2	Plant Quarantine - Definition, limitations and importance		
I)	Biological Control :	03	(03)
I-1	Introduction		
I-2	Biological control and biostatic control processes :		
i.	Organic amendment of soil		
ii.	Predaceous fungi		
I-3	Antibiosis, competition		
J)	Chemical Control :	08	(08)
J-1	Classification of chemicals according to their :		
i.	Mode of action :		
	Systematic, eradicants, protectants		
ii.	Nature of pathogen against which used.		

		Periods	Marks
J-2	Chemicals used in plant diseases control, mode of action and uses :		
i.	Sulphur : Inorganic–'S' Powder, Lime sulphur; Organic : Dithiocarbemates		
ii.	Copper : Bordeaux mixture, Burgundy mixture, Copper oxychloride		
iii.	Mercury : Inorganic–HgCl2, Mercuruschoride Organic – Ceresan, Agrosan, Aresan		
iv.	Heterocyclic nitrogen compounds : Captan, Glycodin		
v.	Antibiotics : Streptomycin, Tetracyclin, Griseofulvin		
K)	Control Through Disease Resistance :	03	(03)
K-1	Disease, escape, tolerance and disease resistance.		
K-2	Development of resistant varieties :		
i.	Selection		
ii.	Hybridization		
iii.	Mutation		

SECOND TERM : SEED TECHNOLOGY AND SEED PATHOLOGY

(Total Periods : 52)

		Periods	Marks
	SEED TECHNOLOGY (Periods : 34)		
A)	Seed :	02	(02)
A-1	Definition		
A-2	Development of seed		
A-3	Functions of parts of seed		

		Periods	Marks
B)	Seed Technology :	02	(02)
	B-1 Definition		
	B-2 Role and goals of seed technology in crop production		
C)	Seed Dormancy :	04	(03)
	C-1 Causes of seed dormancy		
	C-2 Methods of breaking the seed dormancy		
D)	Principles of Quality Seed Production :	04	(04)
	D-1 Seed purity – Genetic purity		
	D-2 Stage of Seed Multiplication		
E)	Methods of seed production :	02	(02)
	E-1 Isolation		
	E-2 Seed inspection		
	E-3 Roguing		
F)	Seed Law and Seed Certification :	03	(03)
	F-1 Seed certification agency-Structure, role and duties.		
G)	Methods of seed production :	04	(04)
	G-1 In self pollinated, cross pollinated and cross pollinates crops		
H)	Types of cultivators, varietal characters, role of producer, seed production agencies.	04	(04)
I)	Seed viability and vigour test	02	(02)
J)	Harvesting, drying, processing, seed sampling, seed testing, purity analysis.	02	(02)
K)	Seed Deterioration :	02	(02)

	Periods	Marks
K-1 Causes and remedial measures.		
Seed storage, pest and diseases of seed, seed aging.	01	(01)
Marketing agencies, planning and economics of seed production.	02	(02)

SEED PATHOLOGY : (Periods – 18)

Seed Pathology :	03	(03)
N-1 Introduction		
N-2 Significance of seed borne diseases.		
Types of micro-organism associated with seeds and diseases caused by them.	04	(04)
Location of seed borne inoculum and seed infection :	04	(04)
P-1 Factors affecting the seed infection		
P-2 Longivity of seed borne diseases.		
Control of seed borne pathogens.	03	(03)
Quarantine and post-entry quarantine.	04	(03)

PAPER- VI

REFERENCE BOOKS

(OPTIONAL-II) PLANT PROTECTION

Agrios. G.N. (1997) Plant Pathology Academic Press, London, U.K.

Bilgrami, H.S. and Dube, H.C. (1976), Modern Plant. Pathology, Vikas Publishing House, Pvt. Ltd, New Delhi.

3 Butler, E.J. (1973). Fungi and Plant Diseases in Plants. Thacker Spink & Co. Calcutta, India.

4 Kamat, M.N. (1969). Introductory Plant Pathology, Prakash Printing Press, Poona, India.

5 Mehrotra, R.K. (1994). Plant Pathology. International Pub. House New Delhi, India.

6 Gangulee, H.C. and A.K.Kar (2001). College Botany. Vol-Ii. Books and Allied (P.)Ltd. Calcutta, India.

7 Malhotra, K.S. (1980). Plant Pathology, Tata McGraw Hill Publ. Co.Ltd. New Delhi, India.

8 Nene, Y.L. (1991) Fungicides In Plant Diseases Control, Oxford and IBIF Pub. Com. New Delhi, India.

9 Pathak, V.N. (1972). Essentials of Plant Pathology, Prakash Pub. House, Jaipur, India.

10 Pathak, V.N., Khatri N.K. Pathak Manish (1996), Fundamentals of Plant Pathology. Agro Botanical Pub. Bikaner, India.

11 Rangaswami, G. (1973), Diseases of Crop Plants In India. Prentice Hall of India, Pvt. Ltd., New Delhi. India.

12 Robertis, Boothroyd (1972). Fundamental of Plant Pathology. Toppan Co. Ltd. Tokyo. Japan.

Singh, R.S. (1996) Plant Pathology, Oxford and IBH Pub. Co. New Delhi, India.

Singh, R.S. (1990) Plant Diseases (6th Ed.) Oxford and IBH Pub. Co. New Delhi, India.

(OPTIONAL-II) SEED TECHNOLOGY AND SEED PATHOLOGY

Agrawal, V.K. and Sinclair, J.B. (1987) Principles of Seed Pathology. Vol. I and III CBS Pub. New Delhi, India.

Agrawal, P.K. & Dadlani M. (1987), Techniques in Seed Science and Technology, South Asian Publishers, New Delhi, India.

Agrawal V.K. and Nene Y.L. (1985) Seed Born Diseases of Field Crops and their control. Indian Council of Agricultural Research, New Delhi. India.

Agrawal R.L. (1980) Seed Technology. Oxford and IBH Publication Co. New Delhi, India.

D.Suryanarayan (1978). Seed Pathology. Vikas Publishing House Pvt. Ltd. Bombay, India.

Mukadam D.S. and Gangawane L.V. (1982) Methods In Experimental Plant Pathology. Botany Dept. Marathwada University, Aurangabad. India.

Neergard (1977) Seed Pathology Vol.I MacMillan Press Ltd. London, U.K.

8 Nema, N.P. (1986). Principles of Seed Certification and Testing. Allied Publishers, New Delhi, India.

PAPER-VI : OPTIONAL (III) (BOT 3.6)

ETHNOBOTANY, PHARMACOGNOCY AND MEDICOBOTANY

FIRST TERM : ETHNOBOTANY

(Total Periods : 52)

		Periods	Marks
	ETHNOBOTANY (Periods : 52)		
A)	Ethnobotany : An Organized Science :	03	(03)
	A-1 Introduction, definition and scope		
	A-2 Man and plant relationship : Concrete and abstract		
	A-3 Comparison of Ethnobotany and Economic Botany		
	A-4 Landmarks of Indian Ethnobotany		
	A-5 Sub-disciplines of ethnobotany		
B)	Methods in Ethnobotanical Studies :	03	(03)
	B-1 Ethnobotanical field work		
	B-2 Herbaria as an aid to ethnobotanical study		
	B-3 Ethnobotanical study with the help of literature		
	B-4 Archeological remains		
C)	Ethnology of Tribes in North Maharashtra :	04	(04)
	(i) Pawara (ii) Bhil (iii) Kokani (iv) Mavachi		
	(v) Thakur (vi) Warli (vii) Katkari (viii) Mahadeokoli		

		Periods	Marks
	Study of Ethnobotany of Plants from Indian Region Used Against :	14	(12)
D-1	Human Diseases : w.r.t. botanical name of plants, family, part used, mode of preparation and administration of medicine people or tribe using for the following :		
	a) Cough, cold, whooping cough, lung's and bronchial problems		
	b) Headache, body-ache, earache, toothache, arthritis and rhumatism.		
	c) Fever		
	d) Stomach problems : indigestion, constipation, acidity, worms, vomiting and dysentery.		
	e) Eye problems : Improving eye sight and curing diseases.		
	f) Healing wound . Cuts, bites, bruises, sprains, fracture.		
	g) Skin diseases : Boils, burns, scars, pustules, sores, piles, dry skin etc.		
	h) Kidney stone		
	i) Diabetes		
	j) Antifertility agents		
	k) Contraceptives		
	l) Antivenom		
D-2	Veterinary Diseases :		
	a) Diarrhoea and dysentery		
	b) Fevers		
	c) Foot diseases		
	d) Skin diseases		
	e) Maggot's infected sores		
	f) Yoke galls		
	g) Galactogogue		
	h) Normal delivery		
	i) Bone fracture		
	j) Mouth infection		
	k) Appetite		

		Periods	Marks
E)	Ethnobotany and its role in conservation of native plants as a genetic resource : (Study with characters and uses)	03	(03)
	E-1 Rice		
	E-2 Maize		
	E-3 Finger Millets		
	E-4 Cucurbits		
F)	Monographic Studies :	06	(06)
	F-1 Monographic studies based on Individual plants :		
	a) *Piper betel* (Betelvine)		
	b) *Madhuca longifolia* (Mahua)		
	c) *Bahaunia vahlii* ( )		
	F-2 Monographic studies based on ethnic groups :		
	a) Ethnobotany of Mikirs of India		
	b) Ethnobotany of the Monopas of Kameg District of Arunachal Pradesh		
G)	Abstract Relationship : w.r.t. plant/parts used, family, people/tribe concerned with themes and quotations of the following :	08	(08)
	a) Folk songs f) Sacred groves		
	b) Folk proverbs g) Scared plants		
	c) Folk stories h) Ethnobeliefs		
	d) Plants used in Festivals i) Woman and tree motifs		
	e) Plants motifits j) Floral motifs		
H)	Plants and parts used citing for miscellaneous purposes citing people using:	08	(08)

		Periods	Marks
H-1	House and hut construction :		
	a) Doors and Windows		
	b) Walls		
	c) Roofs		
	d) Thatching		
	e) Furniture		
H-2	Fish stupefying		
H-3	Tooth brush		
H-4	Basketery		
H-5	Food plants and beverages		
H-6	Toys		
H-7	Musical instrument		
H-8	Agricultural instrument		
H-9	Fencing		
Beyond Inventorying :		03	(03)
I-1	Indigenous Biotechnology :		
	a) Ranu tablet		
	b) Leather technology in relation to reptile skin technology		
I-2	Jagery extraction		
I-3	Bioprospecting and Ethnobotany		
I-4	Kitchen gardens		

SECOND TERM : PHARMACOGNOSY AND MEDICOBOTANY

(Total Periods : 52)

		Periods	Marks
	PHARMACOGNOSY (Periods : 26)		
A)	Introduction and History of Pharmacognosy :	04	(04)
	A-1 Definition and scope		
	A-2 Important system of medicine		
	A-3 Organized and unorganized crude drug's and drug accessories		
B)	Classification of Plant Drugs :	05	(04)
	B-1 Taxonomical, morphological, chemical, therapeutic and alphabetical		
	B-2 Chemical nature of crude drug :		
	B-3 Concept of therapeutic active chemical constituents.		
C)	Cultivation, Collection and Processing of Plant Drug.	05	(05)
	C-1 Methods and factors affecting the cultivation		
	C-2 Collection, harvesting, drying and storage of crude drugs.		
D)	Morphology, distribution, botanical characterization of drug constituents, chemical tests and uses of the following drugs :	10	(10)
	D-1 Root drug :		
	Asparagus racemosus (Shatavari)		
	Withania somnifera (Ashwagandha)		
	D-2 Rhizome :		
	Zingiber officinale (Adrak)		
	Curcuma domestica (Halad)		

		Periods	Marks
	D-3 Stem drug :		
	Holarrhena pubescens (Dudh kuda)		
	Terminalia arjuna (Arjun sadada)		
	D-4 Wood drug :		
	Tinospora cordifolia (Gulvel)		
	Santalum album (Chandan)		
	D-5 Leaf drug :		
	Adathoda zeylanica (Adulsa)		
	Aloe vera (Korpad)		
	D-6 Fruit drug :		
	Terminalia bellerica (Behada)		
	Terminalia chebula (Hirda)		
	D-7 Entire plant :		
	Ocimum sanctum (Tulasi)		
	Achyranthes aspera (Aghada)		
	Quantitative microscopy of drugs, stomatal index, vein and veinlet, terminations of the following :	02	(02)
	a) *Datura innoxia / Datura metel* (Datura)		
	b) *Boerrhara diffusa* (Ramrataka)		
	c) *Tinospora cordifolia* (Gulvel)		
	MEDICOBOTANY (Periods : 26)		
	Introduction: History of age-old medicinal and aromatic plants.	02	(02)
	Medicinal uses of common house-hold and "Grandmaa's Pouch"	06	(06)

6 Jain, S.K. (1996) Ethnobiology In Human Welfare. Deep Publication. New Delhi, India.

7 Jain, S.K., B.K.Sinha and R.C. Gupta (1991) Notable Plants in Ethnomedicine In India, Deep Publication, New Delhi, India.

8 Joshi P. (1995) Ethnobotany of Primitive Tribes In Rajasthan, Printwell, Jaipur, India.

9 Martin, G.J. (1995) Ethnobotany : A Methods Manual. Chapman and Hall, London, U.K.

10 Saklani, A. and S.K. Jain (1994) Cross Cultural Ethnobotany of North East India, New Delhi, India.

11 Singh, V.and R.P.Pandey (1998) Ethnobotany of Rajasthan, Scientific Publishers, Jodhpur, India.

12 Sinha, Rajiv, K and S.Sinha (2001) Ethnobiology. Surabhi Publications, Jaipur. India.

13 Maheshwari, J.K. (1996). Ethnobotany In South Asia. Scientific Publishers, Jodhpur, India.

14 Swaminathan, M.S. and Kocchar, S.L. (Eds.) (1989) Plants and Society, MacMillan Publications, Ltd. London, U.K.

15 Sambamurthy, A.V.S.S. and Subramanyam. N.S. (1989). A Text Book of Economic Botany, Wikes Eastern Ltd., New Delhi, India.

PHARMACOGNOSY AND MEDICO-BOTANY

Bhattacharjee S.K. (1988) Handbook of Medicinal Plants, Pointer Publishers, Jaipur, India.

Gokhale, S.B. (1979). Text book of Pharmacognosy. Jai Publishing House, Jalgaon, India.

Kaushik Purushottam and Dhiman, A.K. (2000). Medicinal Plants and Raw Drugs of India, Bishen Singh Mahendra Pal Singh, Dehra Dun, India.

Khanna, Girija (1993). All About Herbal Remedies. Vikas Publishing House (P.) Ltd., New Delhi, India.

Kurian, J.C. (1999) Plants That Heal. Oriental Watchman Publishing House, Pune, India.

Shah, C.B. and Quadri J.S. (1990) Text Book of Pharmacognosy. B.S. Singh Prakashan, Ahmedabad, India.

Thakur, R.S., Puri, H.S. and Husain, A. (1989). Major Medicinal Plants of India. Central Institute of Medicinal And Aromatic Plants. CSIR, Lucknow, India.

Trease, G.E. and Evans, W.C. (1978). Pharmacognosy (iith Ed.) Bailliene Tindall, London, U.K.

Wallis, T.E. (1985) Textbook of Pharmacognosy (5th Ed.) CBS Publishers and Distributors. New Delhi, India.

10 Gokhale S.B., Kokate, C.K. and Purohit. A.P. (1996). Text Book of Pharmacognosy. Nirali Prakashan, Pune, India.

11 *Nadkarni, A.K. (1972) Indian Materia Medica, Popular Book Depot.* Bombay, India.

12 Tylar, V.E., Brady L.R. and Robber, J.R. (1976) Pharmacognosy, Balliere Tindall, Calcutta, India.

PRACTICAL-I (BOT 3.7)

ED ON THEORY PAPERS (PAPER I & VI)

ER –I : LOWER CRYPTOGAMS & HIGHER CRYPTOGAMS

Practicals

Study of life cycles of *Chara.*

Study of life cycle of *Ectocarpus.*

Study of life cycle of *Batrachospermum.*

Study of range of thallus structure in algae with the help of material/permanent slides :

a) Unicellular thallus – *Chlamadomonos, Chlorella.*

b) Colonial thallus – *Pandorina, Eudorina, Volvox, Hydrodictyon*

c) Filamentous thallus – *Pithophora, Chaetophora, Coleochaetea, Stigeoclonium, Drapanaldia, Drapanaldiopsis, Fritscheilla.*

d) Siphonaceous thallus – *Vaucheria, Caulerpa*

e) Pseudoparenchymatous (uniaxial/multiaxial) thallus – *Batrachospermum, Polysiphonia.*

f) Parenchymatous thallus – *Ulva, Enteromorpha*

Study of life cycle of *Albugo* with the help of material and parmanent slides.

Study of life cycle of *Penicillium* sps. With the help of Culture material/preserved material/permanent slides.

a) Mycelial structure

b) Conidial phase

c) Parmanent slide of perfect stage

8 Study of life cycle of *Puccinia graminis-tritici* with the help of material and permanent slides.

9 Study of Myxomycetes, Deuteromyetes and Lichens (any two forms from each group)

10 Study of life cycle of *Marchantia*.

11 Study of life cycle of *Anthoceros*.

12 Study of life cycle of *Polytrichum*.

13 Study of life cycle of *Psilotum* (P.S. and Specimens)

14 Study of life cycle of *Lycopodium*.

15 Study of life cycle of *Marsilea*.

16 Study of stellar evolution in pteridophyta with the help of material or permanent slides.

Note : Study tour is compulsory. Students are expected to submit at least five specimens of each group. (Algae, Fungi, Bryophyta and Pteridophyta) alongwith tour report.

PRACTICAL – I

PAPER-VI : OPTIONAL (I) GARDENING AND BOTANICAL TECHNIQUES

17 a) Techniques of pot culture.

b) Observation, listing and uses of various garden tools.

18 Preparation and aftercare of a Bonsai.

19 Study of different indoor plants and preparation of :
a) Hanging basket
b) Moss-stick

20 Study of botanical instruments (Any four) as per theory.

21,22,23 Microtomy of any suitable material.

24 b) Maceration of vascular tissues.

c) Permanent preparation of "Smear" or "Squash".

a) Report of visit to a garden is compulsory

b) Submission of prepared Bonsai/Hanging Basket/Moss-Stick.

c) Submission of slides : (i) Microtomy (2 slides)
(ii) Squash/Smear (2 slides)

PRACTICAL – I

PAPER-VI : OPTIONAL (II) PLANT PROTECTION, SEED TECHNOLOGY AND SEED PATHOLOGY

19 Study of the following plant diseases with reference to the causal organism, symptoms, nature of damage done and control measures (any three) :

b) Powdary mildew.

c) Whip smut of sugarcane

d) Citrus canker

e) Tikka disease of groundnut

f) Tobacco mosaic virus

g) Red rot of sugarcane

h) Root knot of vegetables.

Preparation of Bordeaux mixture/Burgondy mixture and application on diseased plant and observation of its effects.

Seed-Ungerminated seed :

a) Examination by microscopy

b) Examination of suspension obtained from washing of seed.

Seed – Germination test – Maize, Groundnut

Seed viability test

24 Detection of seed microflora

Note : Student should submit at lest five diseased specimens alongwith the report of field trip at the time of practical examination.

PRACTICAL-I

PAPER-VI : OPTIONAL (III) : ETHNOBOTANY, PHARMACOGNOSY AND MEDICOBOTANY

Practical 17 to 24

Pract. No.

17 to 20 Study of the following plants with reference to their vernacular names, botanical names, family, plant parts used, uses, mode of preparation and administration from local area with the help of plants or their parts or specimens.

A) Food Plants :

i. Tubers :
   b) *Dioscorea bulbifera* (Kadu Kand)
   c) *Pueraria tuberosa* (Bhui kohala)

ii. Leaves :
   b) *Chenopodium murale* (Chil)
   c) *Amaranthus spinosa* (Kateri Matola)
   d) *Amaranthus viridis* (Matla)
   e) *Rivea hypocrateriformis* (Phangola)

iii. Fruits :
   a) *Diospyros melanoxylon* (Tembrun)
   b) *Morinda pubescens* (Al. Ali)
   c) *Meyna laxiflora* (Aliv)

iv. Seeds :
   a) *Indigofera glandulosa* (Zhunja)
   b) *Sterculia urens* (Kadai)
   c) *Holoptelea integrifolia* (Papada)

B) Beverages :

Flowers : *Madhuca longifolia* (Mahu)

C) Oil yielding :

Seeds : *Madhuca longifolia* (Mahu, Tolambi)

D) Fiber yielding :

Stem : *Helicteres isora* (Murud Sheng)

E) Bidi Wraper :

Leaves : a) *Diospyros melanoxylon* (Tendu)
b) *Bauhinia malabaricum* (Kustya)

F) Tooth Brush :

Stem : a) *Pongamia pinnata* (Karanj)
b) *Cassia auriculata* (Avali)
c) *Acacia nilotica* (Babul)
d) *Azadirachta indica* (Neem)

G) Gum yielding :

b) *Anogeiossus latifolia* (Dhawada)
c) *Sterculia urens* (Kadai)

H) Fish Poison :

Stem Bark : a) *Holoptelea integrifolia* (Papada)
b) *Lannea coromandelica* (Modhal)

I) Cloth washing :

Fruits : a) *Balanites aegyptiaca* (Hingenbet)

J) Ethnomedicine :

i. Anti-dysentery :
   a) Fruit – *Helicteris isora* (Murud sheng)
   b) Fruit – *Cassia fistula* (Bahava)
   c) Stem Bark – *Holarrhena pubescens* (Kuda)

ii. Skin diseases :
   a) Seed oil – *Psoralea corylifolia* (Bavachi)
   b) Fruit – *Pongamia pinnata* (Karanj)
   c) Stem Bark – *Azadirachta indica* (Neem)

iii. Bronchitis and Asthma :
   a) Leaves – *Achyranthes aspera* (Aghada)
   b) Fruit – *Solanum virginianum* (Bhuiringni)
   c) Fruit – *Terminalia bellerica* (Behada)

iv. Rheumatism :
   a) Leaves – *Vitex negundo* (Nirgudi)
   b) Leaves – *Cassia auriculata* (Awali)
   a) Stem Bark – *Azadirachta indica* (Neem)

v. Tonic in Anaemic condition :
   a) Stem – *Tinospora cordifolia* (Gulvel)
   b) Root tuber – *Chlorophytum borivilianum* (Safed Musali)
   c) Root tuber – *Asparagus racemosus* (Shatavari)

vi. Miscellaneous :
   Household utensils :
   a) Fruit – *Lagenaria siceraria* (Dhudhi)
   Musical Instruments :
   b) Stem – *Bambusa arundinacea* (Bamboo) or *Bambusa vulgaris* (Kath-Bamboo)

21 Microscopic and Macroscopic characters for recognizing drug plant :

Botanical source, Character, T.S. of Leaf, Types of trichome, and stomatal index based on plants as per theory syllabus.

Distribution, Characteristics of powder constituents, chemical tests and use of drugs of :

i. Root - *Asparagus racemosus* (Shatavari)
ii. Rhizome – *Zingiber officinale* (Adrak)
iii. Fruit – *Terminalia bellerica* (Behada)
iv. Stem – *Santalum album* (Chandan)
v. Leaf – *Aloe vera* (Korpad)
vi. Stem bark – *Holarrhena pubescens* (Dudh kuda)

MEDICOBOTANY

(A) Preparation of following drugs : (Any two)
   ii. Triphla Churna
   iii. Kumari Asav
   iv. Gutti

(B) Preparation of perfumes (Any two)
   ii. Rosha/Lemon grass (Any one)
   iii. Pudina
   iv. Jasmine

(C) Study of common house-hold medicine as per theory syllabus :
   i. *Ocimum sanctum* (Tulasi)
   ii. *Cyperus rotundus* (Nagarmotha)
   iii. *Allium sativum* (Garlic)
   iv. *Trachyspermum ammi* (Ajwan)

Study tour in tribal area is compulsory. Students have to submit at least five specimens of ethnobotanical importance.

PRACTICAL-II (BOT 3.8)

BASED ON THEORY PAPERS – II & IV

ANGIOSPERM TAXONOMY, EMBRYOLOGY, GENETICS AND PLANT BREEDING

Pract. No.	Practicals
1 to 6	Study of any 12 families as per theory syllabus with reference to vegetative and floral features, floral diagrams and formulae.
7 to 8	Identification of plants with the help of following any suitable floras :

a) The Flora of The Presidency of Bombay – T.Cooke. (1958) Bishen Singh Mahendra Pal Singh, Dehradun.

b) The Flora of Gujarath – G.L.Shah (1978)

S.P.University, Vallabh Vidyanagar

c) Flora of Nasik District – P.Laxminarsimhan and B.D.Sharma (1991) B.S.I. Calcutta

d) Flora of Dhule and Nandurbar Districts –D.A.Patil (2003) Bishen Singh Mahendra Pal Singh, Dehradun.

e) Flora of Akola District – S.Y.Kamble, S.G.Pradhan (1988) B.S.I. Calcutta

f) Flora of Maharathwada Vol.I-II – Naik V.N. (1998)

Amrut Prakashan. Aurangabad (M.S.)

g) Flora of Maharashtra State, Dicotyledons. Vol. I and II – Singh, N.P. and S.Karthikeyn (2000) B.S.I. Calcutta.

a) Flora of Maharashtra State, Monocotyledons – Sharma B.D., Karthikeyan, S. and N.P.Shingh (1996).

B.S.I., Calcutta

9 Preparation of artificial indented/bracketed keys based on vegetative and floral characters.

0 Study of morphological peculiarities of the following :

a) Inflorescence in Compositae.

b) Gynostegium in Asclepiadaceae

c) Pollinia in Asclepiadaceae

d) *Cuscuta* – Haustoria (P.S. or Specimen)

e) Stem - axis in *Casuarina*

f) Orchid flower/Velamen tissue (P.S. or Specimen)

g) Flower of *Canna*

h) Florets in Graminae

1 Study of the following with the help of permanent slides :

a) T.S. of Microsporangium

b) Types of ovules

c) Adult dicot. embryo

2 Dissecting and mounting of adult embryos from locally available materials.

PAPER-IV : MOLECULAR BIOLOGY AND BIOTECHNOLOGY

5 Principle, working and uses of following equipments :

a) Autoclave

b) Inoculation chamber/laminar air flow

c) pH meter

Principle, working and uses of following equipments.

a) Centrifuge

b) Colorimeter

c) Spectrophotometer

15 Extraction and detection of DNA from plant material.

16 Detection of Mitochondria using Janus green stain.

17 Study of Mitosis by preparing squash of onion root tips.

18 Study of Meiosis by smear preparation

19 Preparation of MS Medium

20 Callus culture from Carrot cambial explant.

21 Embryo culture of Maize

22 Micropropagation of any one economically important plant.

23 to 24 Citric acid Fermentation and bioassay.

OR

Penicillin extraction and detection

Note :

1. Botanical excursion of long duration to an area other than their own is compulsory.
2. Submission of at least 15 identified herbarium specimens prepared by the candidates alongwith tour report.

PRACTICAL-III (BOT 3.9)

BASED ON THEORY PAPERS – III & V

ENVIRONMENTAL BOTANY, PLANT GEOGRAPHY, PLANT PHYSIOLOGY AND PHYTOCHEMISTRY

ENVIRONMENTAL BOTANY, PLANT GEOGRAPHY

Practicals

To determine the minimum size of the quadrate by species area curve method.

To study the community by quadrate method by determining frequency, density and abundance of different species present in the community.

To compare the chemical characteristics (moisture content, carbonate content, nitrate content and pH) of given soil sample.

Measurement of water quality based on hardness, total alkalinity, total solids and total dissolved solids in water samples.

Demonstration, working and uses of any three of the following ecological instruments :

a) Cup anemometer

b) Hair hygrometer

c) Soil thermometer

d) Minimum and maximum thermometer

e) Dry and wet bulb thermometer

Qualitative assessment of the microelements in the plant ash (P, K, Mg, Mn, Ca, Na)

7 Extraction and separation of leaf pigments by paper chromatography.

8 Determination of RQ value of fatty and starchy seeds.

9 Study of lipase activity in germinating seeds.

10 Test for proteins-Biuret, Xanthoprotein, Million's Reaction.

11 Chromatographic detection of sugars present in fruits.

12 Test for tannins and alkaloids present in plants.

COMPUTER (SELECT ANY 6 PRACTICALS)

13 Demonstration of booting and familiarity of peripheral devices.

14 DOS Commands – Dir, Type, Copy, Rename, Print, Date, Time. MD, CD, RD, Format and Disk copy.

15 To create an application letter using 'MS-WORD'.

16 Drawing with draw tool bars using 'MS-WORD'.

17 Create various types of charts using 'Excel'.

18 Introduction to internet surfing.

19 To create a slide using a 'Power-Point'.

20 To create e-mail ID and access the e-mail.

HORTICULTURE

21 Layering : (a) Simple layering, (b) Gootee

22 Budding : (a) T-budding, (b) Patch budding

23 Preparation of Fruit Jam

24 Preparation of Gauva/Wood apple Jelly.

25 Preparation of Lemon/Orange Squash.

26 Preparation of Tomato Ketchup.

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