Bachelor of Science

Botany

Syllabus

Faculty of Science

MAULANA AZAD UNIVERSITY, JODHPUR

B.Sc. Semester-I

Schemes for Internal Assessments and End Semester Examinations Semester-wise

Course	Subject	Code	Paper	CIA-I	CIA-II	ESE	Total
ELECTIVE COURSES	**Botany**	BSBO 111	Algae, Lichens and Bryophytes	10	10	80	100
		BSBO 112	Mycology, Microbiology and Phytopathology	10	10	80	100
		BSBO 121	**Botany Lab-I**	10	10	80	100
	Chemistry	BSCH 111	Inorganic Chemistry-I	10	10	80	100
		BSCH 112	Organic Chemistry-I	10	10	80	100
		BSCH 121	**Laboratory Course-I**	10	10	80	100
	Mathematics	BSMT 111	Algebra	10	10	80	100
		BSMT 112	Differential Calculus	10	10	80	100
		BSMT 113	Co-Ordinate Geometry in 2-Dimensions and 3-Dimensions	10	10	80	100
	Physics	BSPH 111	Mechanics	10	10	80	100
		BSPH 112	Electromagnetics	10	10	80	100
		BSPH 121	**Physics Lab-I**	10	10	80	100
	Zoology	BSZO 111	Taxonomy of Lower Non Chordate	10	10	80	100
		BSZO 112	Cytology and Genetics-I	10	10	80	100
		BSZO 121	**Zoology Lab-I**	10	10	80	100
	Public Health	PHLT 111	Human Biology	10	10	80	100
		PHLT 112	Introduction to Public Health	10	10	80	100
		PHLT 121	**Human Biology and First Aid Lab**	10	10	80	100
Core Courses	**Compulsory Paper**	**BHN 131**	**General Hindi**	**10**	**10**	**80**	**100***
		BEN 131	**General English**	**10**	**10**	**80**	**100***

B.Sc. Semester-II

Schemes for Internal Assessments and End Semester Examinations Semester-wise

Course	Subject	Code	Paper	CIA-I	CIA-II	ESE	Total
ELECTIVE COURSES	**Botany**	BSBO 211	Pteridophytes	10	10	80	100
		BSBO 212	Gymnosperms and Palaeobotany	10	10	80	100
		BSBO 221	**Botany Lab-II**	10	10	80	100
	Chemistry	BSCH 211	Physical Chemistry-I	10	10	80	100
		BSCH 212	Organic Chemistry-II	10	10	80	100
		BSCH 221	**Laboratory course-II**	10	10	80	100
	Mathematics	BSMT 211	Differential Equations	10	10	80	100
		BSMT 212	Integral and Vector Calculus	10	10	80	100
		BSMT 213	Co-ordinate Geometry in 3-Dimensions	10	10	80	100
	Physics	BSPH 211	Optics	10	10	80	100
		BSPH 212	Waves and Oscillations	10	10	80	100
		BSPH 221	**Physics Lab-II**	10	10	80	100
	Zoology	BSZO 211	Evolution and Biology of Higher Non Chordate	10	10	80	100
		BSZO 212	Molecular Biology and Genetics II	10	10	80	100
		BSZO 221	**Zoology Lab-II**	10	10	80	100
	Public Health	PHLT 211	Epidemiology	10	10	80	100
		PHLT 212	Biostatistics and Computer Applications	10	10	80	100
		PHLT 221	**Epidemiology and Biostatistics Lab**	10	10	80	100
Core Courses	**Compulsory Paper**	**BES 231**	**Environmental Studies**	**10**	**10**	**80**	**100***

B.Sc. Semester-III

Schemes for Internal Assessments and End Semester Examinations Semester-wise

Course	Subject	Code	Paper	CIA-I	CIA-II	ESE	Total
ELECTIVE COURSES	**Botany**	BSBO 311	Anatomy of Angiosperms, Economic Botany and Ethnobotany	10	10	80	100
		BSBO 312	Cell and Molecular Biology	10	10	80	100
		BSBO 321	**Botany Lab-III**	10	10	80	100
	Chemistry	BSCH 311	Inorganic Chemistry-II	10	10	80	100
		BSCH 312	Physical Chemistry-II	10	10	80	100
		BSCH 321	**Laboratory Course-III**	10	10	80	100
	Mathematics	BSMT 311	Partial Differential Equation and Laplace Transform	10	10	80	100
		BSMT 312	Numerical Analysis	10	10	80	100
		BSMT 313	Dynamics of a Particle	10	10	80	100
	Physics	BSPH 311	Statistical and Thermal Physics	10	10	80	100
		BSPH 312	Electronic Devices and Circuits	10	10	80	100
		BSPH 321	**Physics Lab-III**	10	10	80	100
	Zoology	BSZO 311	Biology of Chordates	10	10	80	100
		BSZO 312	Immunology & Microbiology	10	10	80	100
		BSZO 321	**Zoology Lab-III**	10	10	80	100
	Public Health	PHLT 311	Determination of Health and Disease	10	10	80	100
		PHLT 312	Essentials of Demography	10	10	80	100
		PHLT 321	**Demography Lab.**	10	10	80	100

B.Sc. Semester-IV

Schemes for Internal Assessments and End Semester Examinations Semester-wise

Course	Subject	Code	Paper	CIA-I	CIA-II	ESE	Total
ELECTIVE COURSES	**Botany**	BSBO 411	Taxonomy and Embryology of Angiosperms	10	10	80	100
		BSBO 412	Cytogenetics, Genetics, Plant Breeding, Evolution and Biostatistics	10	10	80	100
		BSBO 421	**Botany Lab-IV**	10	10	80	100
	Chemistry	BSCH 411	Inorganic Chemistry-III	10	10	80	100
		BSCH 412	Organic Chemistry-III	10	10	80	100
		BSCH 421	**Laboratory Course-IV**	10	10	80	100
	Mathematics	BSMT 411	Optimization Techniques	10	10	80	100
		BSMT 412	Abstract Algebra	10	10	80	100
		BSMT 413	Statics	10	10	80	100
	Physics	BSPH 411	Electrodynamics	10	10	80	100
		BSPH 412	Quantum Mechanics	10	10	80	100
		BSPH 421	**Physics Lab-IV**	10	10	80	100
	Zoology	BSZO 411	Comparative Anatomy of Chordates	10	10	80	100
		BSZO 412	Animal Embryology	10	10	80	100
		BSZO 421	**Zoology Lab-IV**	10	10	80	100
	Public Health	PHLT 411	Fundamentals of Epidemiology	10	10	80	100
		PHLT 412	Biostatistics And Research Methods	10	10	80	100
		PHLT 421	**Epidemiology and Biostatstics Lab**	10	10	80	100

B.Sc. Semester-V

Schemes for Internal Assessments and End Semester Examinations Semester-wise

Course	Subject	Code	Paper	CIA-I	CIA-II	ESE	Total
ELECTIVE COURSES	**Botany**	BSBO 511	Plant Physiology and Biochemistry	10	10	80	100
		BSBO 512	Plant Tissue Culture	10	10	80	100
		BSBO 521	**Botany Lab-V**	10	10	80	100
	Chemistry	BSCH 511	Organic Chemistry-IV	10	10	80	100
		BSCH 512	Physical Chemistry-III	10	10	80	100
		BSCH 521	**Laboratory Course-V**	10	10	80	100
	Mathematics	BSMT 511	Metric and Vector Spaces	10	10	80	100
		BSMT 512	Complex Analysis	10	10	80	100
		BSMT 513	Hydrostatics	10	10	80	100
	Physics	BSPH 511	Atomic and Molecular Spectroscopy and Laser Physics	10	10	80	100
		BSPH 512	Solid State Physics	10	10	80	100
		BSPH 521	**Physics Lab-V**	10	10	80	100
	Zoology	BSZO 511	Animal Physiology	10	10	80	100
		BSZO 512	Ecology	10	10	80	100
		BSZO 521	**Zoology Lab-V**	10	10	80	100
	Public Health	PHLT 511	Epidemiology of Communicable and Non Communicable Diseases	10	10	80	100
		PHLT 512	Health Care Systems	10	10	80	100
		PHLT 521	**Health Care System Lab**	10	10	80	100

B.Sc. Semester-VI

Schemes for Internal Assessments and End Semester Examinations Semester-wise

Course	Subject	Code	Paper	CIA-I	CIA-II	ESE	Total
ELECTIVE COURSES	**Botany**	BSBO 611	Ecology and Environmental Biology	10	10	80	100
		BSBO 612	Recombinant DNA Technology	10	10	80	100
		BSBO 621	**Botany Lab-VI**	10	10	80	100
	Chemistry	BSCH 611	Inorganic Chemistry-IV	10	10	80	100
		BSCH 612	Physical Chemistry-IV	10	10	80	100
		BSCH 621	**Laboratory Course-VI**	10	10	80	100
	Mathematics	BSMT 611	Discrete Mathematics	10	10	80	100
		BSMT 612	Real Analysis	10	10	80	100
		BSMT 613	Computer Oriented Numerical Analysis	10	10	80	100
	Physics	BSPH 611	Nuclear Physics	10	10	80	100
		BSPH 612	Analog and Digital Electronics	10	10	80	100
		BSPH 621	**Physics Lab-VI**	10	10	80	100
	Zoology	BSZO 611	Biodiversity and Ethology	10	10	80	100
		BSZO 612	Applied Zoology	10	10	80	100
		BSZO 621	**Zoology Lab-VI**	10	10	80	100
	Public Health	PHLT 611	Health Education and Health Promotion and Communication	10	10	80	100
		PHLT 612	Global Health	10	10	80	100
		PHLT 621	**Field Project**	10	10	80	100

B.Sc. Botany

Schemes for Internal Assessments and End Semester Examinations Semester-wise

Semester	Subject	Code	Paper	CIA-I	CIA-II	ESE	Total
I Sem.	**Core Subjects**	BSBO 111	Algae, Lichens and Bryophytes	10	10	80	100
		BSBO 112	Mycology, Microbiology and Phytopathology	10	10	80	100
		BSBO 121	**Botany Lab-I**	10	10	80	100
	Compulsory Paper	**BHN131/ BEN131**	**Samanya Hindi/ General English**	**10**	**10**	**80**	**100***
II Sem.	**Core Subjects**	BSBO 211	Pteridophytes	10	10	80	100
		BSBO 212	Gymnosperms and Palaeobotany	10	10	80	100
		BSBO 221	**Botany Lab-II**	10	10	80	100
	Compulsory Paper	**BES 231**	**Environmental Studies**	**10**	**10**	**80**	**100***
III Sem.	**Core Subjects**	BSBO 311	Anatomy of Angiosperms, Economic Botany and Ethnobotany	10	10	80	100
		BSBO 312	Cell and Molecular Biology	10	10	80	100
		BSBO 321	**Botany Lab-III**	10	10	80	100
IV Sem.	**Core Subjects**	BSBO 411	Taxonomy and Embryology of Angiosperms	10	10	80	100
		BSBO 412	Cytogenetics, Genetics, Plant Breeding, Evolution and Biostatistics	10	10	80	100
		BSBO 421	**Botany Lab-IV**	10	10	80	100
V Sem.	**Core Subjects**	BSBO 511	Plant Physiology and Biochemistry	10	10	80	100
		BSBO 512	Plant Tissue Culture	10	10	80	100
		BSBO 521	**Botany Lab-V**	10	10	80	100
VI Sem.	**Core Subjects**	BSBO 611	Ecology and Environmental Biology	10	10	80	100
		BSBO 612	Recombinant DNA Technology	10	10	80	100
		BSBO 621	**Botany Lab-VI**	10	10	80	100

Semester-I		
BSBO 111: Algae, Lichens and Bryophytes		**45 Hrs**
इकाई Unit	**पाठ्यक्रम सामग्री Course Content**	**Hours/ Unit**
I	General characters of Algae: Variety of habitats, Range of thallus structure, Structure of typical algal cell, Modes of reproduction, types of life cycle. Classification of algae: outline of Fritsch's classification, recent advances. Economic importance of Algae. Important features of Chlorophyceace. Structure and life cycle of *Volvox*, *Oedogonium* and *Coleochaete*.	09
II	Important features of Charophyceace. Structure and life cycle of *Chara.* Important features of Xanthophyceae. Structure and life cycle of *Vaucheria*. . Important features of Phaeophyceace. Structure and life cycle of *Ectocarpus* and *Sargassum*.	09
III	Important Features and life history of Rhodophyceae. Structure and life cycle of *Polysiphonia*. Lichens: Morphology and structure of the two components; biological, ecological and economic importance. Vegetative multiplication methods with special reference to *Parmelia* and *Usnea*.	09
IV	Bryophytes: General characters, alternation of generations and Classification. Characters and Classification of Hepaticopsida. Morphology and life history of *Riccia, Marchantia* and *Plagiochasma*.	09
V	Characters and classification of Anthocerotopsida and Bryopsida. Morphology and life history of *Anthoceros* and *Sphagnum*.	09

RECOMMENDED READINGS

- Puri, P. Bryophytes, Atmaram and Sons, Delhi, Lucknow.
- Singh, V., Pande, P.C. and Jain, D.K. A Text Book of Botany, Rastogi and Co., Meerut.
- Vashistha, B.R. Botany for Degree Students (Algae), S. Chand and Co. Ltd., New Delhi.
- Vashistha, B.R. Botany for Degree Students (Bryophyta), S. Chand and Co. Ltd., New Delhi.
- Ghemawat, M.S., Kapoor, J.N. and Narayan, H.S. A text book of Algae, Ramesh Book Depot, Jaipur.
- Kumar, H.D. Introductory Phycology, Affiliated East–West Press, Ltd., New York.
- Gilbert, M.S. Cryptogamic Botany, Vol. I and II (2nd Ed.), Tata McGraw Hill, Publishing Co. Ltd., New Delhi.
- Pandey, S.N. and Trivedi, P.S. A Text Book of Botany, Volume I, Vikas Pub. House Pvt. Ltd., New Delhi.

Semester-I		
BSBO 112: Mycology, Microbiology and Phytopathology		**45 Hrs**
इकाई Unit	**पाठ्यक्रम सामग्री Course Content**	**Hours/ Unit**
I	General characters, classification and economic importance of fungi. Important features and life history of Mastigomycotina- *Albugo,* Zygomycotina- *Rhizopus,* Ascomycotina - *Saccharomyces* and *Aspergillus*	09
II	Important features and life history of Basidiomycotina- *Ustilago, Puccinia, Agaricus*. Cultivation of mushrooms. Deuteromycotina- *Alternaria.*	09
III	Viruses: Chemical and physical nature, structure, multiplication and transmission of plant viruses. Tobacco mosaic virus and Yellow vein mosaic virus disease. General account of AIDS.	09
IV	Bacteria - Structure, nutrition, cell division, reproduction and economic importance. Cyanobacteria- Life history of *Nostoc* and *Oscillatoria.* Role of Blue green algae in nitrogen fixation. General account and biology of mycoplasma and phytoplasma.	09
V	Principles of plant pathology. Koch's postulates. Basics of plant – microbes interaction. Causes and symptoms, diseases cycle and control measures of Green ear disease of bajra, Loose smut of wheat, Black rust of wheat, Citrus canker, Little leaf of brinjal. A brief account of principles of plant protection.	09

RECOMMENDED READINGS

- Sharma, P.D. Microbiology and Plant Pathology, Rastogi Publ. Meerut.
- Singh, V., Padey, P.C. and Jain, D.K. A text book of Botany. Rastogi Publication. Meerut
- Mehrotra, R.S. and Aneja, K.R.: An introduction to mycology, New Age International Publishers.
- Dubey, H.C. Fungi Rastogi Publication, Meerut.
- Vashihsta, B.R. and Sinha A.K. Botany for Degree student Fungi, S. Chand and Co., New Delhi.
- Pelczer, Chan and Krieg. Microbiology, McGraw Hill Book Co.,London.
- Bilgrami, K.S. and Dubey, H.C. A Text Book of Modern Plant Pathology, Vikas Publ House, New Delhi.
- Kaushik, P. Microbiology, Emkay Publication.
- Madahar, C.L. Introduction to plant viruses. S. Chand and Co. Ltd. New Delhi.
- Alexopoulous, C.J. and Mims. Introductory Mycology. John Wiley and Sons, New York.
- Pathak, V.N. Fundamentals of Plant Pathology. Agro Botanica.

Semester-I

BSBO 121: Practical - Botany Lab-I	**45 Hrs**

- **Microscopic preparation and study of following**
  i. Algae: *Volvox, Oedogonium, Coleochaete, Chara, Vaucheria, Ectocarpus, Sargassum* and *Polysiphonia.* (Material-A)
  ii. Bryophyte: *Riccia, Marchantia, Plagiochasma, Anthoceros* and *Sphagnum.* (Material-B)
  iii. Lichens: External morphology of different types.
  iv. Fungi: *Albugo, Rhizopus, Saccharomyces, Aspergillus, Ustilago (Teleutospores), Puccinia, Agaricus* and *Alternaria.* (Material-C)

- **Microbiology**
  i. Disease symptoms caused by Tobacco mosaic virus and Yellow vein mosaic virus.
  ii. Bacteria: Gram's staining of bacteria. *Nostoc, Oscillatoria* and Root Nodule. (Material-D)
  iii. Preparation of nutrient medium for Bacteria and their culture- demonstration.

- **Plant pathology:** Study of symptoms of following diseases (specimen or photographs):
  i. Green ear disease of Bajra
  ii. Loose smut of wheat
  iii. Citrus canker
  iv. Black rust of wheat
  v. Little leaf of brinjal.

RECOMMENDED READINGS

Semester-II		
BSBO 211: Pteridophytes		**45 Hrs**
इकाई Unit	**पाठ्यक्रम सामग्री Course Content**	**Hours/ Unit**
I	General characters, life cycle pattern, affinities of Pteridophytes and classification of Pteridophytes. Important Characteristics of Psilopsida, Lycopsida, Sphenopsida and Pteropsida. Climate change and economic importance of Pteridophytes. Stelar Systems in Pteridophyta.	09
II	Occurrence, structure of vegetative and reproductive parts and life history of *Psilotum* and *Lycopodium.*	09
III	Occurrence, structure of vegetative and reproductive parts and life history of *Selaginella*. Heterospory and origin of seed habit.	09
IV	Occurrence, structure of vegetative and reproductive parts and life history of *Equisetum* and *Adiantum.*	09
V	Occurrence, structure of vegetative and reproductive parts and life history of *Marsilea* and *Azolla.*	09

RECOMMENDED READINGS

- Singh, V., Pande, P.C. and Jain, D. K.: A Text Book of Botany, Rastogi and Co., Meerut.
- Pandey, S.N., Mishra, S.P., Trivedi, P.S. A Text Book of Botany Vol. II, Vikas Pub. House Pvt. Ltd., New Delhi.
- Sharma, O.P.: Pteridophytes, Today and tomorrow Publication.
- Sarabhai, R.C. and Saxena, R.C.: A text book of Botany, Rastogi and Co., Meerut.
- Vashista, P.C.: Pteridophytes, S.Chand and Co., New Delhi.
- Rashid, A.: An introduction to Pteridophytes. Vikas Publishing House Pvt Ltd, India.
- Parihar N.S.: Biology and Morphology of Pteridophytes. Central Book Depot, Allahabad.
- Gifford, E.M. and Foster, A.S.: Morphology and Evolution of Vascular Plants, W.H. Freeman and Company, New York.

Semester-II		
BSBO 212: Gymnosperms and Palaeobotany		**45 Hrs**
इकाई Unit	**पाठ्यक्रम सामग्री Course Content**	**Hours/ Unit**
I	Characteristics of seed plants. General features of Gymnosperms and their classification. Affinities of Gymnosperms with Pteridophytes and Angiosperms. Economic importance of Gymnosperms.	09
II	*Cycas*: Morphology of vegetative and reproductive parts. Anatomy of root, stem, leaf and reproductive parts. Reproduction and life cycle.	09
III	*Pinus*: Morphology of vegetative and reproductive parts. Anatomy of root, stem, leaf and reproductive parts. Reproduction and life cycle.	09
IV	*Ephedra*: Morphology of vegetative and reproductive parts. Anatomy of root, stem, leaf and reproductive parts. Reproduction and life cycle.	09
V	Geological time scale, fossilization and types of fossils. Techniques for fossil study. Primitive land plants: *Rhynia*. Fossil Pteridophytes – *Lepidodendron*. Fossil Gymnosperms - *Williamsonia*.	09

RECOMMENDED READINGS

- Singh, V., Pande, P.C. and Jain, D. K.: A Text Book of Botany, Rastogi and Co., Meerut.
- Pandey, S.N., Mishra, S.P., Trivedi, P.S. A Text Book of Botany Vol. II, Vikas Pub. House Pvt. Ltd., New Delhi.
- Sporne, K.R. : The Morphology of Gymnonsperms, B.I. Publ. Pvt., Bombay, Calcutta, Delhi.
- Wilson, N.S. And Rothewall, G.W. : Palaeobotany and evolution of Plants, (2nd ed.), Cambridge University Press, U.K.
- Bhatnagar, S.P. and Moitra, A. Gymnosperms.New Age international limited,New Delhi.
- Gifford, E.M. and Foster, A.S.: Morphology and Evolution of Vascular Plants, W.H. Freeman and Company, New York.
- Stewart, W.M. Paleobotany and the evolution of plants. Cambridge University Press, Cambridge.
- Andrews, H.N.: Studies in Palaeobotany. John Wiley & Sons Inc.
- Arnold, C. A.: An Introduction to Palaeobotany. McGraw Hill Book Company, New York.
- Taylor , T. N. Palaeobotany : An Introduction to Fossil plant Biology . Mc Graw-Hill Book Co. Inc. , New York .

Semester-II

BSBO 221: Practical - Botany Lab-II **45 Hrs**

- **PTERIDOPHYTES: (Material A- Vegetative Part, Material B- Reproductive Part)**
  1. *Psilotum* - External morphology (show photographs / specimen).
  2. *Lycopodium* - External morphology,T.S. of stem and L.S. of cone.
  3. *Selaginella* - External morphology,T.S. of stem and L.S. of cone.
  4. *Equisetum* - External morphology,stem (internode) and L.S of cone.
  5. *Marsilea* - External morphology, rhizome, petiole and sporocarp (H.L.S. /V.T.S. /V.L.S.).
  6. *Adiantum* - External morphology and sporophyll (T.S.).
  7. *Azolla* - External morphology

- **GYMNOSPERMS: (Material C- Vegetative Part, Material D- Reproductive Part)**
  1. Cycas: External morphology, T.S. of normal root (slide only), coralloid root, rachis and leaflet, specimens of micro and megasporophylls.
  2. Pinus: External morphology, T.S. of needle, stem (slide only), W.M. of pollen grains, specimens and slides of male and female cones.
  3. Ephedra: External morphology, T.S. of stem, mounting of male and female reproductive parts.

- **Plant pathology:** Study of symptoms of following diseases (specimen or photographs):
  i. Green ear disease of Bajra
  ii. Loose smut of wheat
  iii. Citrus canker
  iv. Black rust of wheat
  v. Little leaf of brinjal.

RECOMMENDED READINGS

Semester-III		
BSBO 311: Anatomy of Angiosperms, Economic Botany and Ethnobotany		**45 Hrs**
इकाई Unit	**पाठ्यक्रम सामग्री Course Content**	**Hours/ Unit**
I	Anatomy of Angiosperms: Root system; Root apical meristem; differentiation of primary and secondary tissues and their roles; structural modification for storage, respiration, reproduction and for interaction with microbes.	09
II	Shoot system : The shoot apical meristem and its histological organization; vascularization of primary shoot in monocotyledons and dicotyledons; cambium and its functions; differentiation of secondary xylem, characteristics of growth rings, sapwood and heart wood ; differentiation of secondary phloem-structure, function relationship; Periderm.	09
III	Abnormal structure in stem: primary anomalous in Dicot and Monocot stem; Secondary growth in *Dracaena* Stem; Abnormal origin and activity of cambium in Dicot stem. Leaf: Internal structure in relation to photosynthesis and water loss; adaptations to water stress; senescence and abscission.	09
IV	Economic Botany: Food plants: Rice, wheat, sugarcane.Fibers: Cotton.Vegetable oils: Groundnut, mustard and coconut. General account of sources of firewood, timber and bamboos. Beverages: Tea and coffee; Rubber.	09
V	Spices and Condiments: General account. Medicinal plants with special reference to Rajasthan: *Aloe, Asparagus, Commiphora, Boswellia, Pedalium, Zizyphus, Haloxylon, Tribulus, Vitex and Withania*. Ethnobotany: Introduction, Methods of Ethnobotanical studies, and knowledge of aboriginals in Rajasthan.	09

RECOMMENDED READINGS

- Singh, V., Pande, P.C. and Jain, D. K.: A Text Book of Botany Angiosperms, Rastogi Publications, Meerut.
- Pandey, B. P.: A Text Book of Botany Angiosperms, S. chand & company Ltd. Ram nagar, new Delhi.
- Cutter, E.G.: Plant Anatomy: Experiment and Interpretation, Part II. Organs, Edward Arnold, London.
- Esau, K.: Anatomy of Seed Plants, John Wiley & Sons, New York.
- Fahn, A.: Plant Anatomy, , Pergamon Press, Oxford.
- Mauseth, J.D.: Plant Anatomy, the Benjamin/Cummings Publ. Company Inc., Menloe Park, California, USA.
- Kocchar, S.L.: Economic Botany in Tropics, Mac-Millan India Ltd., New Delhi.
- Sambamurthy, A.V.S.S. and Subramanyam, N.S.: A Text book of Economic Botany, Wiley Eastern Ltd., New York.
- Sharma, O.P.: Hill's Economic Botany (Late Dr. A.F. Hill, Adapted by O.P. Sharma), Tata McGraw Hill Co., Ltd., New Delhi.
- Simposon, B.B. and Conner-Ororzaly, M.: Economic Botany Plants in Our World, McGraw Hill, New York.
- Jain, S.K and V. Mudgal: A Handbook of Ethnobotany BSMPS publication
- Jain, S.K: Manual of Ethnobotany, 2nd Edition, Scientific Publisher

Semester-III		
BSBO 312: Cell and Molecular Biology		**45 Hrs**
इकाई Unit	**पाठ्यक्रम सामग्री Course Content**	**Hours/ Unit**
I	Cell theory. Prokaryotic and eukaryotic cell. Cell organization: structure of a plant cell, cell wall, plasmodesmata, plasma membrane. Mitosis, Meiosis and cell cycle regulation.	09
II	Structure and function of cell organelles: Plastid, Mitochondria, Endoplasmic reticulum, Golgi body, Ribosomes, Peroxisomes, Vacuoles. Nucleus: Structure, nuclear pore complex, nucleolus and chromatin network.	09
III	DNA the genetic material: Structure and different forms of DNA, Replication of DNA: Mode of replication, Enzymes and proteins involved, Replication fork, Leading and lagging strand, Okazaki fragments. Differences between prokaryotic and eukaryotic DNA replication. DNA damage and repair mechanisms.	09
IV	Gene: definition and structure (Promoter, coding sequences, terminator). Prokaryotic and eukaryotic transcription: Transcriptional factors and machinery, RNA polymerases, regulatory elements and mechanism of transcription -formation of initiation complex, elongation, and termination, RNA processing (brief account).	09
V	Translation: Prokaryotic translation- translational machinery, aminoacylation of tRNA, aminoacyl tRNA synthetase, formation of initiation complex, elongation and termination of translation. Regulation of gene expression in prokaryotes (operon concept) and basics of gene expression in eukaryotes.	09

RECOMMENDED READINGS

- Krishnamurthy, K.V.: Methods in Cell Wall Cytochemistry. CRC Press, Boca Raton,Florida.
- De, D.N.: Plant Cell Vacuoles: An Introduction. CSIRO Publication, Collingwood, Australia.
- Kleinsmith, L.J. and Kish, V.M.: Principles of Cell and Molecular Biology. Harper Collins College Publishers, New York, USA.
- Hall, J.L. and Moore, A.L.: Isolation of Membranes and Organelles from Plant Cells. Academic Press, London, UK.
- Harris, N. and Oparka, K.J.: Plant Cell Biology: A Practical Approach. IRL Press, at Oxford University Press, Oxford, U.K.
- Gunning, B.E.S. and Steer, M.W.: Plant Cell Biology: Structure and Function. Jones and Bartlett Publishers. Boston, Massachusetts.
- Karp, G.: Cells and Molecular Biology: Concepts and Experiments. John Wiley &Sons, Inc., U.S.A.
- Lewin, B.: Gene X. Oxford University Press, NewYork, USA.
- Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K. and Watson, J.D.: Molecular Biology of the Cell. Garland Publishing, lnc., New York.
- Buchanan, B.B., Gruissem, W., and Jones, R.L.: Biochemistry and Molecular Biology of Plants, American Society of Plant Physiologists, Maryland, USA.
- Gupta P.K..: A Textbook of cell and Molecular Biology, Rastogi Publications, Meerut
- Paolella: Introduction to molecular biology. Tata McGraw Hill.

Semester-III

BSBO 321: Practical - Botany Lab-III **45 Hrs**

- **Anatomy: (Material-A)**
  1. Dicot Stem: Sunflower, *Nyctanthes, Bignonia, Salvadora* and *Boerhaavia*.
  2. Monocot Stem: *Dracaena*.
  3. Dicot Root: *Tinospora*
  4. Monocot Root: Maize
  5. Dicot Leaf: *Nerium*
  6. Monocot Leaf: Maize.

- **Economic Botany: (Material-B)**

  Purity and identification test (with principle, diagram, etc.):
  1. Purity test of Haldi, Mustard oil, Hing, Katha and Coriander powder.
  2. Test for starch in Wheat & Rice (from pre-soaked grains) and potato.
  3. Test for Cellulose in cotton and filter paper.
  4. Test for lignin in coir and matchstick.
  5. Test for fats & oils in seeds of Groundnut, Mustard and Sunflower.

- **Cell Biology: (Material-C & D)**
  1. Study of various stages of mitosis in onion root tip.
  2. Study of cell wall using suitable chemicals.

- **Spots:**
  1. Slide of any anatomy plant material.
  2. Different types of stomata and thickening in xylem vessels (slides/photographs).
  3. Medicinal plants / Ethnobotany specimens:
     i. Medicinal plants: *Aloe, Asparagus, Commiphora, Tribulus* and *Withania .*
     ii. Ethnobotany: *Abrus, Leptadenia, Calotropis* and *Crotalaria*.
  4. Economic botany: Wheat, Sugarcane, Cotton, Jute, Groundnut, Mustard, Cloves, Cardamom, Black pepper, Tea leaves & Rubber.
  5. Slides/Models/Photographs/Drawings: Cell structure and Cell organelles: Plasmodesmata, Plasma lemma, Chloroplast, Mitochondria, Nucleus, Nuclear Pore Complex, Peroxisome, Chromosome, DNA-Physical and Chemical properties.

RECOMMENDED READINGS

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Semester-IV		
BSBO 411: Taxonomy and Embryology of Angiosperms		**45 Hrs**
इकाई Unit	**पाठ्यक्रम सामग्री Course Content**	**Hours/ Unit**
I	Angiosperms: Origin and Evolution, Angiosperm Taxonomy- Alpha, Omega and Holotaxonomy, Taxonomic Literature, Botanical Nomenclature, Principles and Rules, Taxonomic Ranks, Type Concept, Principle of Priority. Classification of Angiosperms –Natural, Artificial and Phylogenetic, Salient Features of Systems proposed by Bentham and Hooker, Engler and Prantl and Hutchinson.	09
II	Flower- Modified Shoot, Structure and Development of Flower, Inflorescence-Types of inflorescence. Major Contributions of cytology, molecular biology, phytochemistry and taximetrics to taxonomy. Diversity of Flowering Plants as illustrated by members of families – Ranunculaceae, Papaveraceae, Caryophyllaceae, Apiaceae.	09
III	Diversity of Flowering Plants as illustrated by members of families: Asteraceae, Acanthaceae, Apocynaceae, Asclepiadaceae, Scrophulariaceae, Lamiaceae, Euphorbiaceae and Poaceae.	09
IV	Structure of Anther, Microsporogenesis, Tapetum-Types and Function, Development of Male Gametophyte, Structure of Pollen Grains, Types of Ovules, Megasporogenesis, Structure and Development of Female Gametophyte (Embryo sac), Types of Embryo Sacs-Monosporic, Bisporic and Tetrasporic, Pollen Pistil Interaction, Self Incompatibilty, Fertilization, Double Fertilization, Significance of Double Fertilization. A brief account of Genomic Imprinting.	09
V	Development of Monocot and Dicot Embryo, Endosperm: Types of Endosperm, Endosperm Haustoria, Polyembryony, Induced Polyembryony, Apomixis, A brief account of Genomic Imprinting. Brief Account of Experimental Embryology – Haploid Culture, Ovary Culture, Endosperm Culture, Parthenogenesis and Parthenocarpy.	09

RECOMMENDED READINGS

- Singh, V., Pandey, P.C. and Jain, D.K. Angiosperms. Rastogi Pub., Meerut.
- Bhandari, M.M. Flora of Indian Desert, Scientific Publisher, Jodhpur
- Bhojwani, S.S. and Bhatnagar, S.P.: The Embryology of Angiosperms, 4th Revised and enlarged edition, Vikas Publ., New Delhi.
- Davis, P.H. and Heywood, V.H.: Principles of Angiosperm Taxonomy, Oliver and Boyd, London.
- Jeffery, C.: An Introduction to Plant Taxonomy, Cambridge University Press, Cambridge, London.
- Jones, S.D. Jr. and Suchsinger, A.E.: Plant Systematics. McGraw- Hill Book Co., New York.
- Maheshwari, P.: An Introduction to the Embryology of Angiosperms. New Delhi.
- Sharma, O.P. Taxonomy: Tata McGraw Hill Pub. Company Ltd., New Delhi
- Singh, Gurcharan. Plant Systematics: Theory and Practices, Oxford and IBH Pvt. Ltd., New Delhi,
- Trivedi, P.C., Sharma, N. and Sharma, J.L., Structure, Development and Reproduction in Flowering Plants, Ramesh Book Depot, Jaipur.
- V.N. Nair: Taxonomy of Angiosperms. TMH Publishing Company Limited, New Delhi.
- V.V. Sivrajan: Introduction to the Principles of Plant Taxonomy, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Semester-IV		
BSBO 412: Cytogenetics, Genetics, Plant Breeding, Evolution and Biostatistics		**45 Hrs**
इकाई Unit	**पाठ्यक्रम सामग्री Course Content**	**Hours/ Unit**
I	**Cytogenetics:** Chromatin organization: Organization and structure of chromosomes, concept of nucleosomes, types of chromosomes: Special types of chromosome (Polytene and lampbrush) and sex chromosomes. Chromosome aberrations: Structural aberrations: deletion, duplication, translocation, inversion: Numerical aberrations: aneuploidy and polyploidy.	09
II	**Genetics:** Nature of inheritance: Laws of Mendelian inheritance, Mono and Dihybrid cross, test cross, back cross, exceptions of mendels law: incomplete dominance, codominance, multiple alleles, Complementary interaction, supplementary interaction, Epistasis, duplicate gene, polygenic inheritance, Pleiotropy, maternal inheritance. Chromosome theory of inheritance, crossing-over, linkage.	09
III	**Plant breeding:** Origin of Agriculture, Centres of origin of crop plants and centres of Diversity, Domestication, Introduction, Selection, Clonal propagation, Hybridization, Mutation breeding, breeding work done on wheat.	09
IV	**Evolution:** origin of life (Haldane/A.I. Oparin Hypothesis), Lamarck theory, Darwin theory, Evidences of organic evolution, Natural selection, origin of species, Population genetics: Allele and genotype frequency, Hardy-Weinberg principle.	09
V	**Biostatistics:** Definition and Applications, Collection and representation of data (Tabular, graphical and diagrammatic representation), Mean (Arithmetic, geometric, harmonic mean), Median (for grouped and ungrouped data), Mode, Standard deviation: computation for grouped and ungrouped data, merits and demerits; Standard error.	09

RECOMMENDED READINGS

- Atherly, AG., Girton, JR and McDonald, J.F.: The Science of Genetics. Saunders, College Publishing, Fort Worth, USA.
- Burnham, C.R.: Discussions in Cytogenetics. Burgess Publishing Co. Minnesota.
- Hartl, D.L. and Jones, E.W.: Genetics: Principles and Analysis. Jones & Bartlett Publishers, Massachusetts, USA.
- Khush, G.S.: Cytogenetics of Aneuploids. Academic Press, NewYork, London.
- Russel,P.J.: Genetics(5thedition).The Benjamin/Cummings Publishing Company INd., USA.
- Snustad, D.P. and Simmons: Principles of Genetics. John Wiley & Sons Inc., USA.
- Chaudhary, H.K.: Elementary principles of plant Breeding, Oxford IBH Publishing New Delhi
- Gupta, P.K.: Cytology, Genetics, Evolution and plant Breeding, Rastogi Publications, Meerut.
- Singh B.D.: Textbook of plant Breeding, Kalyani Publishers, Ludhiana.
- Shukla, R.S. and Chandel, P.S.: Cytogenetics, Evolution and Plant Breeding. S. Chand Co. Ltd., New Delhi.
- Singh B.D.: Textbook of Genetics, Kalyani Publishers, Ludhiana.
- Sinha, U. And Sinha, S.: Cytogenetics, Plant Breeding and Evolution, Vikas Publishing House, New Delhi.
- Prasad S.: Elements of Biostatistics, Rastogi Publications, Meerut.

Semester-IV

BSBO 421: Practical - Botany Lab-IV **45 Hrs**

- **Taxonomy**

Description of following flowers in taxonomic sense:

1. **Ranunculaceae**: *Delphinium*
2. **Papaveraceae**: *Papaver*
3. **Caryophyllaceae**: *Dianthus, Saponaria*
4. **Apiaceae**: *Coriandrum*
5. **Asteracecae:** *Helianthus, Sonchus*
6. **Acanthceae**: *Adhatoda, Barleria*
7. **Apocynaceae:** *Catharanthus, Thevetia, Nerium*
8. **Asclepiadaceae**: *Calotropis*
9. **Scrophulariaceae**: *Antirrhinum, Linaria*
10. **Lamiaceae:** *Ocimum*
11. **Euphorbiaceae:** *Euphorbia pulchirrima*
12. **Poaceae**: *Triticum*

- **Embryology**

1. Germination of pollen in control and 5 % sucrose solution (10 plants of the campus)
2. Translator mounting: *Calotropis*
3. Study of Placentation : Axile, Free Central, Parietal, Marginal and Basal
4. Pollen stainability(1:1 Glycerin: Acetocarmine) in *Cassia fistula* and *Datura*
5. Structure of Ovule: Orthotropus, Anatropus, Campylotropus and Amphitropus (Slides/Photographs)

- **Genetics/Plant Breeding/Statistics**

1. Problems related to Mendel's law of dominance, segregation and independent assortment (Seed sample).
2. Problems related to Incomplete dominance, modified ratios and multiple alleles (Seed sample).
3. Problems related to linkage (Photographs).
4. Problems related to quantitative inheritance (Seed sample/Photographs).
5. Problems related to central tendency (Mean, Mode and Median- data sheet/plant material).
6. Demonstration of Emasculation techniques including bagging, tagging and labelling.
7. Demonstration of Pure line and Mass line selection (Photograph)

- **Plant pathology:** Study of symptoms of following diseases (specimen or photographs):

1. **Leaf:** Simple and compound
2. **Inflorescence:** Cyathium, Verticillaster and Umbel
3. **Fruits:** Pepo, Caryopsis, Cremocarp and Hesperidium
4. **Endosperm:** Coconut and Ruminate in Walnut and Sitafal
5. Chart showing Pure line and mass selection
6. Scientific contribution of Darwin, Lamarck, Hugo de vries, Vavilov and Mendel (Photographs with names)
7. Slides/Models/Photographs/Drawings: Chromosome structure (nucleiosome, solenoid model), lampbrush and polytene chromosome, Chromosomal aberrations- structural and numerical.

RECOMMENDED READINGS

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Semester-V		
BSBO 511: Plant Physiology and Biochemistry		**45 Hrs**
इकाई Unit	**पाठ्यक्रम सामग्री Course Content**	**Hours/ Unit**
I	Plant-water relations: Importance of water to plant life; structure & physical properties of water; diffusion and osmosis; absorption by roots, ascent of sap and transpiration Mineral nutrition: Role of Essential macro- and micro-elements and their deficiency symptoms Transport of organic substances: Source-sink relationship; Mechanism of phloem transport, factors affecting translocation	09
II	Photosynthesis: Photosynthetic pigments; absorption & action spectra, enhancement and red drop effect; concept of two photosystems; Z-scheme; photophosphorylation; Calvin cycle; C4 pathway; CAM pathway; photorespiration.	09
III	Respiration: Aerobic and anaerobic respiration; Glycolysis & Krebs cycle; electron transport mechanism (chemi – osmotic theory);oxidative phosphorylation; pentose phosphate pathway Basics of enzymology: Discovery, nomenclature, classification and characteristics of enzymes; concept of holoenzyme, apoenzyme, coenzyme and cofactors; mechanism of action; regulation of enzyme activity	09
IV	Nitrogen metabolism: Biological nitrogen fixation; nitrate reduction; importance of nitrate reductase and its regulation; ammonium assimilation Lipid metabolism: Saturated and unsaturated fatty acids, classification, structure and function of lipids; fatty acid biosynthesis; β-oxidation ; storage and mobilization of fatty acids	09
V	Growth and development: Definitions; phases of growth and development; plant hormones- auxins, gibberellins, cytokinins, abscisic acid and ethylene - discovery, physiological roles & mechanism of action; seed germination & dormancy; photoperiodism & vernalization; photomorphogenesis and skotomorphogenesis; phytochromes-their discovery, physiological role and mechanism of action	09

RECOMMENDED READINGS

- Dennis, D.T., Turpin, D.H., Lefebvre, D.D. and Layzell . Plant Metabolism, Longman, Essex, England
- Galston, A.W. Life processes in Plants, Scientific American Library, Springer-Verlag, New York, USA
- Hopkins, W.G. Introduction to plant physiology, John Wiley & Sons, Inc., New York, USA
- Lea, P.J. and Leegood, R.C. Plant Biochemistry and Molecular Biology, John Wiley & Sons, Chichester, England
- Mohr, H. and Schopfer, P. Plant Physiology, Springer-Verlag, Berlin, Germany
- Salisbury, F.B. and Ross, C.W. Plant Physiology, Wadsworth Publishing Co., California, USA,
- Srivastava, H.S. Plant Physiology, Rastogi Publication, Meerut
- Taiz, L. and Zeiger, E. Plant Physiology, Sinauer Associates, Inc. Publishers, Massachusetts, USA
- Amar Singh. Practical Plant Physiology, Kalyani Publishers, New Delhi
- Moore, T.C. Research Experiences in Plant Physiology: A Laboratory Manual, Springer-Verlag, Berlin
- Nifa, A.J. and Ballou, D.P. Fundamental Laboratory Approaches for Biochemistry and Biotechnology, Fitzrierald Science Press, Inc., Maryland, USA
- Wilson, K. and Goulding, K.H. A Biologists Guide to principles and techniques of Practical Biochemistry, Ed-ward Arnold, London
- Verma, V. Text book of plant physiology. Ane books, India.
- Sinha, R. K. Modern plant physiology. Narosa publishing house.
- Trivedi, P. C., Atreya, A and Pathak, K. Plant physiology, Biochemistry and Biotechnology. Ramesh Book Depot.

Semester-V		
BSBO 512: Plant Tissue Culture		**45 Hrs**
इकाई Unit	**पाठ्यक्रम सामग्री Course Content**	**Hours/ Unit**
I	**History of plant tissue culture:** Cell theory, Totipotency, Pleuripotency, Contribution of different scientist (Haberlandt, White, Skoog, Reinert, Vasil I. K., Guha and S.C. Maheshwari, Cocking, Murashige). **Basic technique and tools of plant tissue culture:** Sterilization, concept of clean area/aseptic condition, laminar air flow bench, growth room, green house. **Culture media**: Basic constituents of culture media (MS: Inorganic and organic nutrients, energy source, gelling agents, PGR's, pH).	09
II	**Micropropagation:** Definition, various stages of Micropropagation**:** Explant types and origin (in relation to establishment of different types of cultures), pretreatment of explants, surface sterilization of explants(types of chemicals, concentration used and duration of surface sterilization, establishment of cultures, Repeated transfer of explants, subculture of *In vitro* established cultures, rooting (*In vitro* and *ex vitro*) and hardening of plantlets. Methods of Micropropagation, Axillary bud culture, Adventitious shoot culture, shoot tip culture, Callus cultures: Initiation and maintenance, organogenesis, somatic embryogenesis.	09
III	**Protoplast culture technique:** source of protoplasts, isolation techniques, enzymes, osmoticum, purification of protoplasts, viability of protoplast and various culture techniques, culture medium, protoplast development: Cell wall formation, Growth, division and plant regeneration. **Somatic hybridization:** protoplast fusion. Identification and selection of hybrid cells, verification and characterization of somatic hybrids, Cybrids, Potential, problems and limitations of somatic hybridization.	09
IV	**Cell culture:** Types of suspension culture, growth measurement, synchronization of cells, techniques for single cell culture, selection of cells for higher yield, optimization of growth conditions, bioreactors for large scale culture, types of bioreactors, immobilization of cell culture, Hairy root cultures, Elicitations and biotransformation.	09
V	**Application and scope of plant tissue culture**: In forestry, floriculture, agriculture and biodiversity conservation. Production of virus - free plants, haploids, soma clonal variants and synthetic seeds. Cryopreservation: Raising aseptic cultures, addition of cryoprotectants, freezing, storage, thawing, and determination of viability, Retrieval of plants and its applications.	09

RECOMMENDED READINGS

- Beyl C. A. & Trigiano R. N.: Plant Propagation Concept & Laboratory Exercises, CRC press, Taylor & Francis Group.
- Lindsey K.:PlantTissueCultureManualSupplement7, Springer India Private Limited, New Delhi, India.
- Ravishankar G. A. and Venkataraman L. A.: Recent Advances in Biotechnological Applications of Plant Tissue and Cell Culture. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
- Ahuja M. R.; Micropropagation of Woody Plants. Kluwer Academic publishers, AHD ordrecht, The Netherlands.
- Razdan M. K.: Introduction to Plant Tissue Culture, Oxford & IBHPublishing Co. Pvt. Ltd. NewDelhi.
- Bhojwani S.S. and Razdan M. K.: Plant Tissue Culture: Theory and Practice, Elsevier Science
- Mather J. P. and Roberts P. E.:"Introduction to Cell and Tissue Culture: Theory and Technique "Springer.
- George E.F.: Plant Propagation by Tissue Culture: Volume1.The background,Springer.
- SinghB.D.: Biotechnology Expanding Horizon, Kalyani Publishers, Ludhiana.
- Chawla H. S.: Introduction to Plant Biotechnology, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
- Purohit,S.D.: Introduction to plant cell, tissue and organ culture. Prentice Hall.

Semester-V

BSBO 521: Practical - Botany Lab-V **45 Hrs**

- **Plant Physiology and Biochemistry**

Major Exercises

1. Determine osmotic potential by diffusion pressure deficit.
2. Determine Rf value of an unknown amio acid using paper chromatography.
3. Separate chlorophyll pigments by paper chromatography.

Minor Exercises

1. Demonstrate effect on membrane permeability by different temperature (room,hot water treatments)
2. Demonstrate effect on membrane permeability by different organic solvents (Ethanol, Methanol, Butanol).
3. Demonstrate opening and closing of Stomata (using distil water,sucrose and KCl, independently).
4. Demonstrate plasmolysis

Spots

1. Contribution of Scientist to Physiology and biochemistry: E. Munch, M. Calvin, H.P. Hatch and C.R. slack, E. Fischer, P. Mitchel, S.B. Hendricks and H.A. Borthwick.
2. Ripening of fruits.
3. IBA effect on rooting
4. Ethylene effect
5. Photomorphogenesis
6. Senescence
7. Chlorophyll separation
8. RQ
9. Protein structure: secondary (helix, sheets), tertiary and quaternary.
10. Root nodules.

- **Plant Tissue Culture Experiments**

1. Prepare culture medium (mentioning PGR and each constituents in mg/L) for induction of callus; surface sterilize and inoculate the given explant for culture initiation.
2. Prepare culture medium (mentioning PGR and each constituents in mg/L) for axillary shoots; surface sterilize and inoculate the given explant for culture initiation.
3. Prepare culture medium (mentioning PGR and each constituents in mg/L) for In vitro roots; surface sterilize and inoculate the given explant for culture initiation.
4. Prepare culture medium (mentioning PGR and each constituents in mg/L) for haploid culture; surface sterilize and inoculate the given explant for culture initiation.

Spots

1. Contribution of Scientist to Biotechnology: Gottlieb Haberlandt, Miller and Skoog.
2. Anther culture.
3. Synthetic seeds.
4. Protoplast
5. Somatic hybridization.
6. Tools and techniques: Laminar air flow bench, Autoclave, Bioreactor.
7. In Vitro Production: Shikonin; Diosgenin; Ephedrin; Vinca Alkaloids

RECOMMENDED READINGS

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Semester-VI		
BSBO 611: Ecology and Environmental Biology		**45 Hrs**
इकाई Unit	**पाठ्यक्रम सामग्री Course Content**	**Hours/ Unit**
I	Plants and Environment: Atmosphere (gaseous composition) water (properties of water cycle), Light (Global radiation, Photosynthetically active radiation), temperature, soil (development, soil profile, Physicochemical properties) and adaptation of plants to water, temperature, light and salinity.	09
II	Population ecology: Concept & Character, growth curve, biotic potential, ecotypes and ecads. Community ecology and succession: community characteristics Frequency, density, cover, life forms & biological spectrum. Succession: Concept, classification, model and mechanisms; examples (hydrosere and Xerosere).	09
III	Ecosystem: structure, abiotic and biotic components, food chain, Food web, ecological pyramids, energy flow, biogeochemical cycles of carbon, nitrogen and phosphorus.	09
IV	Productivity: Primary productivity, its measurements and Factors affecting primary productivity. Environmental biology of Indian Desert: Climate, vegetation Types, adaptive strategies of desert plants. Desertification: meaning, causes, critical issues. Biodiversity: Types of biodiversity and their conservation (*in situ, ex-situ*)	09
V	Pollution ecology; Definition, classification, Sources, effect and control measures of air, water and land Pollution. Green house effect, Acid rain, Eutrophication. Biogeographical regions of India.	09

RECOMMENDED READINGS

- Odum, E.P. : Basic ecology, Saunders Philadelphia
- Sharma, P.D. : Ecology and environment, Rastogi publications, Meerut
- Dash, M.C. : Fundamentals of ecology, Tata McGraw Hill publishing Co.LTD ,New Delhi
- Singh, J.S. , Singh S.P. and Gupta, S.R. : Ecology environment and Resource conservation, Anamaya publishers, New Delhi
- Shukla, R.S. and Chandel, P.S : A textbook of plant ecology, S. Chand & Company LTD. Ram Nagar, New Delhi
- Sen, D.N. Environment and plant life in Indian desert, Geobios International, Jodhpur.
- Kumar, H.D. General Ecology. Vikas publishing house, Pvt. New Delhi.

Semester-VI		
BSBO 612: Recombinant DNA Technology		**45 Hrs**
इकाई Unit	**पाठ्यक्रम सामग्री Course Content**	**Hours/ Unit**
I	**Basics of recombinant DNA Technology:** History and definition**,** source of desired gene, isolation of desired gene, restriction enzymes (types and their properties), Genomic and cDNA library**,** Gene cloning vectors: properties of an ideal vector, carrying capacity of vectors, types of vectors (pBR^{322}, pUC). Integration of gene into vector and Transformation**.** artificial chromosome (BAC, YAC). **Selection** of desired recombinant cells.	09
II	**Gene transfer methods in plants:** *Agrobacterium* mediated gene transfer in plants: Properties of *Agrobacterium*, types of *Agrobacterium*, molecular organization of Ti-plasmid (nopaline and octapine types), molecular organization of T-DNA, molecular biology of T-DNA transfer, integration of T- DNA into host cell**.** Direct method of gene transfer: Electroporation, chemical methods, biolistics, microinjection, macro injection. Marker genes: Reporter genes (e.g. Lux gene, GUS gene), Selectable markers (e.g. Antibiotic resistance markers, Herbicide resistance markers)	09
III	Transgenic Crops –Resistant to abiotic stress, Resistance to biotic stress (Insect resistance, virus resistance, disease resistance), herbicide resistance and transgenics for improved storage, flower colour, shape, male sterility, terminator seed, protein quality, vitamin and production of edible vaccines	09
IV	GMOs, Biosafety, Risk assessment, and Containment. Labelling of GMOs. IPR and Bioresources. Patent: requirement and process of patent. Copyright, geographical indicators, trade mark, farmer's and plant breeder's rights; bioethics	09
V	**Techniques:** Electrophoresis: Principle, types (Horizontal and Vertical Electrophoresis) and applications. DNA fingerprinting: Principle and applications. PCR: Principle, types and applications. Southern and Northern Blotting: principle, method and application. DNA sequencing (Chain termination method) principle, method and applications.	09

RECOMMENDED READINGS

- Singh B.D. Biotechnology Expanding Horizon, Kalyani Publishers, Ludhiana.
- Chawla H. S. Introduction to Plant Biotechnology, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
- GreeneJ. J. And Rao V. S.: Recombinant DNA–Principles and Methodologies. Marcel Dekker, New York.
- Primrose S. B. and Twyman R. M.: Principles of gene manipulation and genomics, Blackwell Science, Oxford.
- Hansen and Harper: Differentially expressed gene in plants, Taylor and Francis Ltd. London.
- Collins G. B. And Shepherd R. J.: Engineering plants for commercial products and applications, NYA cad. of Science Publishers.

Semester-VI

BSBO 621: Practical - Botany Lab-VI **45 Hrs**

- **Ecology and Environmental Biology**

Major Exercises

1. Determine frequency, density and abundance from quadrat sample sheet.
2. Determine Important Value Index from quadrat sample data.
3. Determine diversity indices from quadrat sample data.
4. Determine carbonate and bicarbonate from water samples
5. Determine chlorosity/salinity from water samples
6. Determine hardness from water samples
7. Determine dissolved oxygen content in water samples

Minor Exercises

1. Determine relative frequency quadrat sample data.
2. Determine relative density quadrat sample data.
3. Determine relative abundance quadrat sample data.
4. Determine soil texture
5. Qualitatively assess nitrate, nitrogen content in soil sample
6. Qualitatively assess available phosphorus content in soil sample
7. Determine water holding capacity of soil sample

Spots

1. *Opuntia*, *Euphorbia* – Xerophytes-Succulents
2. *Capparis*, *Calligonum*, *Leptadenia*, *Parkinsonia*- Xerophytes - True
3. *Atriplex*, *Chloris*- Halophytes – salt secreting
4. *Suaeda*, *Salsola* – Halophytes – salt accumulating
5. *Eichhornia*, *Nymphaea*, *Hydrilla*- Hydrophytes

- **Recombinant DNA Technology**

1. Isolation of plasmid DNA from given bacterial culture.
2. Detection of DNA by agarose gel electrophoresis,
3. Demonstrate the PCR.
4. Demonstrate restriction digestion.
5. Demonstrate transformation experiment.

Spots

1. Techniques: DNA finger printing, PCR, Electrophoreses, DNA Sequencing (Dideoxy method), microinjection, gene gun, electroporation, genomic and cDNA library.
2. Gene cloning vectors: BAC, YAC.
3. Ti plasmid (Crown gall)
4. GM Crops (golden rice, Bt cotton).

RECOMMENDED READINGS