जननायक चंद्रशेखर विश्वविद्यालय, बलिया
Jananayak Chandrashekhar University, Ballia

(w.e.f. 2020-2021)

SYLLABUS STRUCTURE
B.Sc. (BOTANY)

JANNAYAK CHANDRASHEKHAR UNIVERSITY, BALLIA

Three Years Degree Course Syllabus for

BOTANY

(UNDER GRADUATE LEVEL-COMMON MINIMUM CURRICULUM)

(w.e.f. Session 2020-21)

B.Sc. (FIRST YEAR)	**Title of the Paper**	**MAX MARKS**
PAPER I	Diversity of Viruses, Bacteria & Fungi	100
PAPER II	Diversity of Algae, Lichens, & Bryophytes	100
PAPER III	Diversity of Pteridophytes & Gymnosperms and elementary Palaeobotany	100
PRACTICAL*	PRACTICAL EXAMINATION	100
TOTAL		400
B.Sc. (SECOND YEAR)		**MAX MARKS**
PAPER I	Diversity of Angiosperms: Systematics, Development & Reproduction	100
PAPER II	Cytology, Genetics, Evolution & Ecology	100
PAPER III	Plant Physiology and Biochemistry	100
PRACTICAL*	PRACTICAL EXAMINATION	100
TOTAL		400
B.Sc. (THIRD YEAR)		**MAX MARKS**
PAPER I	Plant Resource utilization, Palynology and Biostatistics	100
PAPER II	Molecular Biology and Biotechnology	100
PAPER III	Environmental Botany and Plant Pathology	100
PRACTICAL*	PRACTICAL EXAMINATION	100
TOTAL/G. Total		400/1200

Note: There will be 9 questions in each paper and candidate has to attempt only 5 questions. **Q.1** will carry short answers and will be **compulsory** based on units I - IV. **Two** questions will be set from **each unit**, out of which one question has to be attempted. Candidate must obtain minimum pass marks in Theory and Practical Examinations separately. * Based on papers I – III

Theory- All papers of 100 MM, each with following distribution of marks.

20- Internal assessment based on Project work/assignment/ activities/attendance.

80- Annual examination theory paper.

Practical-Practical in all three year of 100 marks, each with following distribution of marks-

20-Practical record and Viva-voce(held during annual practical exam)

80- Assessment of identification, evaluation and experimental skill during annual practical exam.

B.Sc. – I Botany (Paper-I)

Diversity of Viruses, Bacteria, & Fungi M.M. 100

Unit -I

History, nature and classification of Viruses, Bacteria. History of virology and bacteriology; prokaryotic and eukaryotic cell structure (bacteria, mycoplasma and yeast); structure, classification and nature of viruses; structure (gram positive and gram negative) and classification (based on cell structure) of bacteria.

Unit-II

Viruses: Symptoms of virus infection in plants; transmission of plant viruses; genome organisation, replication of plant virus (tobacco mosaic virus); structure and multiplication of Bacteriophages.

Unit- III

Bacteria: Nutritional types of bacteria (based on carbon and energy sources), metabolism in different nutritional types (basics only) and nitrogen cycle; bacterial genome and plasmids; bacterial cell division, variability in bacteria - mutation, principles of genetic recombination; techniques in sterilisation, bacterial culture and staining; economic importance.

Unit-IV

Fungi: History, nature and classification of Fungi. Thallus organisation and reproduction in fungi; economic importance of fungi.

The characteristics and life cycles of the following:

Mastigomycotina: *Albugo, Pythium*,; Ascomycotina: *Saccharomyces, Aspergillus; Ascobolus;* Basidiomycotina : *Ustilago, Puccinia, Polyporus, Agaricus*; Deuteromycotina: *Fusarium.*

Books- Theory

1. Singh, R.P. (2017). Microbiology. Kalyani Publishers, New Delhi
2. Sharma, P.D.(2016). Microbiology. Rastogi Publishers, Meerut, U.P.
3. Baveja, C.P.(2017).Text Book of Microbiology.Arya Publications, New Delhi.
4. Maheshwari,D.K, D.K.& Dubey,R.C.(2013).A Text Book of Microbiology.S.Chand & Co. N.Delhi.
5. Singh,V., Pande,P.C.& Jain,D.K.(2017).College Botany, Rastogi Publications, Meerut
6. Alexopoulus, C.J.,Mims,C.W. & Blackwel,M.(1996).Introductory Mycology.John Wiley & Sons,Inc., New York.
7. Singh, R.P.(2010).Fungi, Central Book Depot, Allahabad, U.P.
8. Vashistha,B.R., Sinha, A.K. & Kumar, A.(2016). Fungi, S.Chand & Co. Ltd., Delhi.
9. Mishra, S.R.(2010).Textbook of Mycology. Discovery Publishing House Pvt Ltd, New Delhi.
10. Hait, G.(2016).A Textbook of Mycology. New Central Book Agency, New Delhi.

Books-Practical

1. Bendre, A.M. & Kumar, A.(2017).A Text Book of Practical Botany-1, Rastogi Publications, Meerut.
2. Pandey, B.P. (2017).Modern Practical Botany-Vol. I, S. Chand & Co, Ltd., New Delhi.
3. Sharma, O.P.(2017). Practical Botany-I, Pragati Prakashan, Meerut.

B.Sc. – I Botany (Paper-II)

Diversity of Algae, Lichens, and Bryophytes M.M. 100

Unit-I

Algae & Lichens

General characters. Range of thallus organization, classification, ultrastructure of eukaryotic algal cell and cyanobacterial cell, economic importance of algae. Lichens, classification, thallus organization, reproduction, physiology and role in environmental pollution.

Unit-II

The characteristics features and life cycles of the following algal genera:- *Cyanophyta Microcystis, Oscillatoria :Chlorophyta Volvox, Hydrodictyon, Oedogonium, Coleochaete, Chara; Bacillariophyta Navicula; Xanthopyta Vaucheria; Phaeophyta; Ectocarpus Rhodophyta Polysiphonia, Coleochaete, Chara; Bacillariophyta Navicula; Xanthopyta Vaucheria; Phaeophyta; Ectocarpus Rhodophyta Polysiphonia*

Unit – III

Bryophytes

General characters, classification, reproduction and affinities of Bryophytes.

Gametophytic and sporophytic organization of following:

Bryopsida: *Pogonatum*; Anthocerotopsida: *Anthoceros*

Unit – IV

Gametophytic and sporophytic organization of Hepaticopsida : *Riccia, Marchantia*

Books-Theory

1. Smith, G.M.(1974). Cryptogamic Botany. Vol. I (Algae and Fungi). TMH publishing Company Ltd., New Delhi.
2. Kumar, H.D. (1988). Introductory Phycology. Affiliated East-West Press Ltd. New Delhi.
3. Vashistha,B.R., Sinha, A.K. & Kumar, A.(2016). Algae, S.Chand & Co.Ltd.,Delhi.
4. Smith, A.L. (1921). Lichens. Cambridge University, Cambridge.
5. Ahmadjian, V.& Hale, M.E.(1973). The Lichens. Academic Press, London.
6. Smith, G.M. (1955). Cryptogamic Botany. Vol. II (Bryophytes and Pteridophytes). TMH publishing Company Ltd., New Delhi.
7. Rashid, A. (2015). An Introduction to Bryophyta. Vikas Publishing House Pvt. Ltd., New Delhi.
8. Malhotra, M. & Pathak, C. (2012). A Text Book of Bryophyta. Wisdom Press, New Delhi.
9. Vashistha,B.R., Sinha, A.K. & Kumar, A.(2016). Bryophyta, S.Chand & Co.Ltd.,Delhi.
10. Sharma, O.P. (2016). Bryophyta. McGraw Hill Education (India) Private Limited, New Delhi.

B.Sc. – I Botany (Paper-III)

Diversity of Pteridophytes, Gymnosperms & Elementary Palaeobotany M.M. 100

Unit – I

Pteridophytes: General features, classification, stellar system and its evolution. Comparative study of morphology, anatomy, development, vegetative and reproductive systems of following: Lycopsida - *Lycopodium, Selaginella; Psilopsida- Rhynia*

Unit – II

General and comparative account of gametophytic and sprophytic system in Filicopsida - *Pteridium, Nephrolepis. Marsilea.* Heterospory and seed habit.

Unit – III

Gymnosperms: General characters, classification. Comparative study of morphology, anatomy, development of vegetative and reproductive parts in: Cycadales: *Cycas* and Coniferales – *Pinus*

Unit –IV

Study of morphology, anatomy, development and reproductive parts in: Gnetales – *Ephedra* Affinities and relationship of Gymnosperms, evolutionary significance. Elementary Palaeobotany: general account, types of fossils, methods of fossilization and geological time scale.

Books- Theory

1. Smith, G.M. (1955). Cryptogamic Botany. Vol. II (Bryophytes and Pteridophytes). TMH publishing Company Ltd., New Delhi.
2. Parihar, N.S. (1993). An Introduction to Embryophyta: Vol II-Pteridophyta. Central book Depot. Allahabad
3. Parihar, N.S. (1996). Biology and Morphology of Pteridophytes. Central book Depot. Allahabad
4. Rashid, A. (2015). An Introduction to Pteridophyta. Vikas Publishing House Pvt. Ltd., New Delhi.
5. Vashistha, B.R., Sinha, A.K. & Kumar, A.(2016). Pteridophyta, S.Chand & Co.Ltd., Delhi.
6. Coulter, J.M. & Chamberlain, C.J. (1978). Morphology of Gymnosperm. Central Book Depot. Allahabad
7. Bhatnagar, S.P. & Moitra, A. (2013). Gymnosperms. New Age International Publishers New Delhi.
8. Govil, C.M. (2014). Gymnosperms: Extinct and Extant. Krishna Prakashan Media (P) Ltd. Delhi
9. Vashistha, B.R., Sinha, A.K. & Kumar, A.(2016). Gymnosperms. S.Chand & Co.Ltd., Delhi
10. Stewart, W.N. & Rathwell, G.W. (1993). Palaeobotany and Evolution of Plants. Cambridge University Press.

B.Sc. – II Botany (Paper-I)

Diversity of Angiosperms: Systematics, Development & Reproduction M.M. 100

Unit – 1

Systematics:

Principles of classification, nomenclature; comparative study of different classification systems, viz.Linnaeus, Bentham & Hooker, Engler & Prantl, Hutchinson, and Cronquist. Herbarium techniques and important Botanic Gardens.

Unit – II

Taxonomic study of following families and their economic importance:

Dicots; Nymphaeaceae, Nelumbonaceae. Ranunculaceae, Malvaceae, Bombacaceae, Brassicaceae, Cucurbitaceac, Rosaceae, Leguminosacae, Myrtaceae, Rutaceae, Apiaceae, Apocynaceae, Solanaceae,Convolvulaceae, Cuscutaceae, crophulariaceae, Acanthaceae, Lamiaceae, Asteraceae, Rubiaceae, Euphorbiaceae, and maranthaceae.

Monocots: Cyperaceae, Poaceae, Arecaceae. Liliaceae.

Unit – III

External morphology of vegetative and floral parts; modifications – phyllodes, cladodes,and phylloclades. Meristems-kinds study of tissue system - epidermal, ground, and vascular. Anatomy of roots, stems, and leaves. Cambium - its function and anomalies in roots and stems.

Unit – IV

Structure and development of male and female gametophytes – microsporogenesis microgametogenesis, megasporogenesis, and megagametogenesis, embryo sac types. Double fertilization development of embryo, endosperm development and its morphological nature, apomixis and polyembryony.

Books- Theory

1. Davis, P.H. (2011). Principles of Angiosperm Taxonomy. Scientific Publishers, Jodhpur
2. Stace, C.A. (1989). Plant Taxonomy and Biosystematics. Edward Arnold Press, UK
3. Singh, V. (2010). Taxonomy. Rastogi Publication, Meerut.
4. Verma, B.K. (2011). Introduction to Taxonomy of Angiosperms. PHI Learning Private Limited, N.Delhi.
5. Subramanyam, N.S.(1996). Laboratory Manual of Plant Taxonomy. Vikas Publishing House Pvt. Ltd. New Delhi.
6. Esau, K. (2006). Anatomy of Seed Plants. Wiley
7. Roy, P. (2010). Plant Anatomy. New Central book Agency, New Delhi.
8. Pandey, B.P. (2001). Plant Anatomy. S.Chand & Company Ltd. New Delhi.
9. Dwivedi, J.N. & Singh, R.B. (1986). Anatomy of Angiosperms. Central book Depot, Allahabad.
10. Bhojwani, S.S., Bhatnagar, S.P. & Dantu, P.K. (2014). The Embryology of Angiosperm. Vikas Publishing House Pvt. Ltd., New Delhi.

Books-Practical

1. Bendre, A.M. & Kumar, A.(2017).A Text Book of Practical Botany-2, Rastogi Publications, Meerut.
2. Pandey, B.P. (2017).Modern Practical Botany-Vol. II, S. Chand & Co, Ltd., New Delhi.
3. Sharma, O.P.(2017). Practical Botany-II, Pragati Prakashan, Meerut.

B.Sc. – II Botany (Paper-II)

Cytology, Genetics, Evolution & Ecology M.M. 100

Unit – I

Cell structure, cell organelles, nucleus, chromosome structure, nucleosome and solenoid model, salivary gland, lampbrush and B chromosomes. Cell division – mitosis, meiosis; their significance, chromosomal aberrations

Unit- II

Genetics, laws of inheritance; gene interaction; linkage and; cytoplasmic inheritance; sex determination.

Unit-III

Mutation- spontaneous, induced mutations, molecular mechanism and evolutionary significance; polyploidy- origin, kinds and role in evolution. Evidences and theories of evolution.

Unit – IV

Ecology, relation with other disciplines. Plant types: Hydrophytes - *Hydrilla, Eichhorina, Nymphaea, Typha*. Xerophytes – *Nerium, Casuarina, Saccharum, Begonia*. Plant succession – xeroseres, hydroseres. Ecosystems - concept, basic types, components, & functioning.

Books Theory-

1. Powar, C.B. (2010). Cell Biology. Himalaya publishing house, Mumbai.
2. Verma, P.S. & Agarwal, V.K. (2016). Cell biology. S. Chand & Company Ltd., New Delhi
3. Rastogi, S.C. (2005). Cell Biology. New age Publishers, New Delhi
4. Strickberger, M.W. (2015). Genetics. Pearson Education, India
5. Gardner, E.J. ,Simmons, M.J. & Snustad, D.P. (2006). Principles of Genetics. Wiley
6. Gupta, P.K. (2009). Genetics. Rastogi Publishers, Meerut.
7. Odum,E.(1971). Fundamentals of Ecology. Saunders,Philaelphia
8. Chapman, J.L. & Reiss, M.J. (2003). Ecology: Principles and Applications. Cambridge University Press, London
9. Sharma,P.D.(2017).Ecology and Environment. Rastogi Publications, Meerut
10. Verma,V.(2011).Plant Ecology.Ane Books Pvt.Ltd.,New Delhi.
11. Gupta, P.K. (2017). Cytology, Genetics, Evolution & Ecology, Rastogi Publishers, Meerut

B.Sc. – II Botany (Paper-III)

Plant Physiology and Biochemistry **M.M. 100**

Unit - I

Plant and water relationship, colligative properties of water, free energy concept. Water uptake, conduction, transpiration, mechanism and its regulation by environmental variables. Mineral nutrition : Macro, and micronutrients, their role, deficiency and toxicity symptoms, plant culture practices, mechanism of ion uptake and translocation.

Unit - II

Photosynthesis and Chemosynthesis : photosynthetic pigments, O_2 evolution, photophosphorylation, CO_2 fixation - C3- C4 and CAM plants. Respiration : aerobic and anaerobic respiration, respiratory pathways glycolysis, krebs 'cycle, electron transport, oxidative phosphorylation, pentose phosphate pathway, photorespiration, cyanide resistant respiration. Lipid biosynthesis and its oxidation.

Unit - III

Nitrogen metabolism : atmospheric nitrogen fixation, nitrogen cycle, nitrogen assimilation, Growth: general aspects of phytohormones, inhibitors-auxins. kinetin, gibberellins, and ethylene: action and their application; photoperiodisin and vernalization. Germination, growth movements, parthenocarpy, abscission and senescence.

Unit - IV

Biomolecules : Classification, properties and biological role of carbohydrates, Protein and lipids. Chemistry of nucleic acids. Discovery and nomenclature. Characteristics of enzymes, concepts of holoenzyme, apoenzyme, coenzyme and cofactors. Regulation of enzyme activity, Mechanism of action.

Books Theory-

1. Salisbury,P.B. & Ross,C.W.(1992).Plant Physiology.Wadsworth Publishing,California.
2. Hopkins,W.G.(1995).Introduction to Plant Physiology.John Wiley & Sons,New York.
3. Pandey,S.N. & Sinha,B.K.(2016).Plant Physiology,Vikas Publishing House Pvt.Ltd,New Delhi.
4. Verma,S.K.& Verma,M.(2012).Plant Physiology,Biochemistry and Biotechnology.S.Chand & Company, Ltd.,New Delhi.
5. Noggle,G.R.&Fritz,G.J.(1986).Introductory Plant Physiology.Prentice-Hall of India Pvt Ltd,New Delhi.
6. Devlin,R.M.& Witham,F.H.(1986).Plant Physiology.CBS Publishers & Distributors,New Delhi.
7. Goodwin, T.W. & Mercer, E.I. (2003). Introduction to Plant biochemistry. CBS Publishers & Distributors Pvt. Ltd., New Delhi.
8. Conn, E.E., Stumpf, P.K., Bruening, G. & Doi, R.H. (2006). Outlines of Biochemistry. Wiley.
9. Lehninger, A.L. (2013). Biochemistry. Kalyani publishers, New Delhi.
10. Jain, J.L., Jain, S. & Jain, N. (2016). Fundamentals of Biochemistry. S. Chand & Company Ltd., New Delhi

B.Sc. – III Botany (Paper-I)

Plant Resource utilization, Palynology and Biostatistics **MM 100**

Unit I

Centres of diversity of plants and origin of crop plants. Domestication and introduction of crop plants. Concepts of sustainable development; cultivation, production and uses of - wheat, rice, legumes, sugarcane

Unit II

A general account of plants yielding oils, spices, and beverages. An account of major fiber, medicinal, petro, plants of Uttar Pradesh.

Unit III

Conservation of plants resources for agriculture and forestry. *In situ* conservation: sanctuaries, national parks, biosphere reserves, wetlands, mangroves. *Ex-situ* conservation: botanical gardens, field gene banks, seed banks, cryobanks.

Unit IV

An introductory knowledge to Palynology, morphology, viability and germination of pollens. Classification of data, mean, median and mode. Standard deviation, standard error, variance, co-relation, X2 test and experimental designs.

Books Theory-

1. Banerjee, P.K.(2007). Introduction to Biostatistics. Rastogi publication, Meerut.
2. Rastogi, V.B. (2015). Biostatistics. Meditech Publishers, New Delhi.
3. Ramakrishna, P. (2015). Biostatistics. Saras Publication, Kanyakumari
4. Prasad, S. (2009). Elements of Biostatistics. Rastogi Publication, Meerut
5. Gupta, P.K. (2017). Plant Resource utilization, Palynology and Biostatistics, Rastogi Publishers, Meerut

Books-Practical

1. Bendre, A.M. & Kumar, A.(2017).A Text Book of Practical Botany-3, Rastogi Publications, Meerut.
2. Pandey, B.P. (2017).Modern Practical Botany-Vol. III, S. Chand & Co, Ltd., New Delhi.
3. Sharma, O.P.(2017). Practical Botany- III. Pragati Prakashan, Meerut.

B.Sc. – III Botany (Paper-II)

Molecular Biology and Biotechnology **M.M. 100**

Unit – I

Nucleic acid as genetic material, nucleotides, structure of nucleic acids, properties of genetic code, codons assignments, chain initiation of codons mechanism of protein synthesis and its regulation.

Unit – II

Structure and properties polysaccharides, amino acids, proteins, vitamins and hormones; Enzymes: active sites, specificity, mechanisms, factors, general aspects of enzyme kinetics. Bioenergetics: Laws of thermodynamics, concept of Gibb's free energy, high energy compounds.

Unit – III

Replication of DNA in prokaryotes and eukaryotes, gene expression and regulation. Hormonal control and second messengers Ca-+, Cyclic AMP, IP3 etc.

Unit- IV

Introduction to biotechnology, recombinant DNA technology, plant tissue culture, methods of gene transfer, transgenic plants, biotechnology and healthcare, microbial and environmental biotechnology.

Books Theory-

1. Gupta, P.K. (2014). Cell and Molecular Biology. Rastogi Publications, Meerut.
2. Vidyavathi, N. & Chetan, D.M. (2009). Molecular biology. I.K.International Publishing House Pvt. Ltd., New Delhi.
3. De Robertis,E.D.P. & De Robertis, Jr. E.M.F. (1987). Cell and Molecular biology. Lea and Febiger, U. S.
4. Govil,C.M.,Aggarwal,A. & Sharma,J.(2017).Plant Biotechnology and Genetic Engineering. PHI Learning Pvt Ltd,Delhi.
5. Dube, R.C. (2014). A Text Book of Biotechnology. S. Chand & Company Ltd., New Delhi
6. Singh, B.D. (2012). Biotechnology. Kalyani Publishers, New Delhi.
7. Gupta, P.K. (2016). Plant Biotechnology. Rastogi Publications, Meerut.
8. Chawla,H.S.(2006).Introduction to Plant Biotechnology.Oxford & IBH Publishing Co.Pvt.Ltd.,N.Delhi.
9. Gupta, P.K. (2017). Molecular Biology and Biotechnology, Rastogi Publishers, Meerut

B.Sc. – III Botany (Paper-III)

Environmental Botany and Plant Pathology **M.M. 100**

Unit - I

Mineral resources of planet earth, Conservation of mineral resources. Soils; types, properties and various problem soils; water; the source of water, physico-chemical and biological properties of water. Sustainable management of water; energy resources in India; Forests: global forest wealth, importance of forests, deforestation.

Unit - II

Environmental pollution : air, water, soil, radioactive, thermal and noise pollutions, their sources, effects and control. (Greenhouse effect, ozone depletion and acid rain). CO2 enrichment and climate change.

Unit - III

Biodiversity and Phytogeography : biotic communities and populations, their characteristics and population dynamics. Natural vegetation of India, static and dynamic plant geography, basic principles governing geographical distribution of plants, endemism.

Unit - IV

Etiology of viral, bacterial, fungal and insect-pest diseases: mosaic diseases on tobacco, and cucumber, yellow vein mosaic of bhindi; citrus canker, potato scab, little leaf of brinjal; damping off of seedlings late blight of potato, red rot of sugarcane

Integrated pest disease management

Books Theory-

1. Odum,E.(1971). Fundamentals of Ecology. Saunders,Philaelphia
2. Chapman, J.L. & Reiss, M.J. (2003). Ecology: Principles and Applications. Cambridge University Press, London
3. Sharma,P.D.(2015).Environmental Botany and Plant Pathology.Rastogi Publications,Meerut.
4. Agrios,G.N.(2005).Plant Pathology.Academic Press,London.
5. Singh,R.S.(2009).Introduction to Principles of Plant Pathology.Oxford & IBH,New Delhi.
6. Pandey,B.P.(1982).Plant Pathology.S.Chand & Company Ltd.,New delhi.
7. Mehrotra,R.S.& Aggarwal,A.(2017).Plant Pathology.McGraw-Hill Education,New Delhi.
8. Singh,R.P.(2012).Plant Pathology.Kalyani Publishers,New Delhi.
9. Gupta, P.K. (2017). Environmental Botany and Plant Pathology, Rastogi Publishers, Meerut