LATE KU. DURGA K. BANMERU SCIENCE COLLEGE, LONAR
DEPARTMENT OF BOTANY

Syllabus for B.Sc. Botany

1. BOTANY

There shall be following paper and practical for B. Sc. Part – I Semester one examination. The syllabus is based on six theory periods and six practical periods per week (Total 75 – 80 theory sessions and 25 practical sessions per complete semester). There shall be one compulsory paper of 3 hours duration, in theory as stated below and practical examination extending for 4 hours. Every examinee shall offer the following paper of 100 marks (out of which 80 marks will be for written examination and 20 marks for internal assessment) and practical examination of 50 marks. Candidates are required to pass separately in theory and practical examination.

1. Paper – 1 Marks
a. Theory - 80
b. Internal Assessment - 20
2. Practical - 50

Total 150 Marks

1S – BOTANY

Diversity & Applications of Microbes and Cryptogams

UNIT-I : Plant Diversity (15)

1.1 Introduction to Plant Kingdom: Cryptogams
1.2 Diversity of plants with respect to habitat, form, nutrition and ecological status
1.3 General Account of Viruses and structure of TMV and HIV
1.4 Bacteria: structure, Nutrition and reproduction
1.5 Role of microbes in Agriculture, Medicine and Industries

UNIT-II: Algae (15)

2.1. Classification according to F. E. Fritsch and G. M. Smith up to classes
2.2. General characters of algae with reference to Habitat, Thallus organization, Pigmentation, Reserve food and Reproduction
2.3. General characters of following classes with special reference to examples mentioned –
2.3.1. Chlorophyta - Oedogonium
2.3.2. Charophyta – Chara (Thallus structure and reproduction)
2.3.3. Phaeophyta – Sargassum (Thallus structure and reproduction)
2.3.4. Rhodophyta – Batrachospermum

UNIT-III : Fungi (15)

3.1 General characteristics of following classes with special reference to examples mentioned –
3.1.1. Mastigomycotina : Albugo (Cystopus)
3.1.2. Ascomycotina : Aspergillus
3.1.3. Basidiomycotina : Puccinia graminis-tritici
3.1.4. Deuteromycotina : General characters
3.2 Lichen-Types & Economic importance

Unit-IV : Bryophyte (15)

4.1. General characters, thallus organization and life cycle of–
1.1.1. Hepaticopsida – Marchantia
1.1.2. Bryopsida – Funaria

4.2. Evolution of sporophyte in bryophytes
4.3. Affinities of bryophytes with algae and pteridophytes
4.4. Brief Account on some Indian Bryologist.

Unit-V : Pteridophyte (15)

5.1. Pteridophytes as First Vascular Plants.
5.2. General characters of the following classes with special reference to examples mentioned –
5.2.1. Sphenopsida – Equisetum
5.2.2. Filicopsida – Marsilea
5.3. Stele types in pteridophytes
5.4 Heterospory and Seed Habit in Pteridophytes

Unit-VI : Application of Microbes Cryptogams (15)

6.1. Economic Importance of Algae with special reference to Food, Industries, Agriculture and Harmful aspects
6.2. Mycorrhiza – Types and Application
6.3. Role of Fungi in Industries, Medicine, Food & Agriculture
6.4. Plant Diseases –
6.4.1. Viral – TMV
6.4.2. Bacteria – Black arm of cotton (Xanthomonos malvacearum)
6.4.3. Fungal – Tikka disease of groundnut (Cercospora sps.)

LABORATORY EXERCISE :

I. ALGAE

Preparation of temporary mount, identification with reason of following algal materialsedogonium,
Hydrodictyon, Chara, Vaucheria, Ectocarpus, Sargassum, Batrachospermum

II. FUNGI AND PLANT PATHOLOGY

(1) Study of following genera Albugo, Uncinula, Penicillium, Agaricus, Puccinia, Cercospora
(2) Study of Crustose, Fruticose & Foliose Lichen
(3) Study of symptoms of fungal, viral, bacterial and Mycoplasmal diseases
(4) Collection of fungal specimen & infected plant part from local region
(6) Demonstration of Mushroom Cultivation Technology

III. BRYOPHYTES

Study of external and anatomy features of vegetative and reproductive parts of following genera – Marchantia, Anthoceros, Funaria, Polytrichum and Sphagnum

IV. PTERIDOPHYTES

Study of Pteridophyte external and anatomy features of vegetative and reproductive parts of following genera –Lycopodium, Equisetum, Osmunda, Selaginella, Adiantum, Marsilea and any one fossil specimen

Note: 1. Omit the details of development of sex organs and sporophyte.
2. Botanical excursion (Two local and one outside the state is compulsory)
3. Common algal, fugal, pathological, bryophytic and pteridophytic collection and excursion report must be submitted at the time of practical examination.

BOOKS RECOMMENDED

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

2. Gangulee, H. C. and Kar, A.K. (2001). College Botany Vol. II. Books and Allied Press Ltd. Kolkata.
3. Krushnamurthy, K. V. (2007). An advanced Text Book on Biodiversity: Principles and Practice. Oxford and IBH Publishing Kumar, H.D. (1988).
Introductory Phycology. Affiliated East-West Pres Ltd. New Delhi.
4. Kumar, H. D. and Singh, H.N. (1976). A Text Book of Algae. Affiliated East-West Pres Ltd. New Delhi.
5. Mehrotra, R. S. and Aneja, C.R. (1990). An Introduction To Mycology, Wiley Eastern Ltd. NewDelhi.
6. Pandey, B.P. (1994). A Text Book of Botany-Algae. S.Chand and Co. Ltd. New Delhi.
7. Pandey, S.N. and Trivedi, P.S. (1997). A Text Book of Botany Vol. II , Vikas Publishing House (P.) Ltd. New Delhi.
8. Pandey, S.N. and Trivedi, P.S. (1997). A Text Book of Botany Vol. I , Vikas Publishing House (P.) Ltd. New Delhi.
9. Pandey, S.N., Trivedi, P.S. and Mishra, S.P. (1995). A Text Book of Alage, Vikas Publishing House (P.) Ltd. New Delhi.
10. Parihar, N.S. (1977). Biology and Morphology of Pteridophytes. Central Book Depot, Allahabad.
11. Parihar, N.S. (1984). An Introduction To Embryophyta Vol. I Bryophyta. Central Book Depot, Allahabad
12. Rashid, A. (1996). An Introduction To Bryophyta. Vikas Publishing House Ltd. New Delhi.
13. Saxena, A.K. and Sarbhai, R.M.(1992). A Text Book of Botany Vol.II Embryophyta. Ratan Prakashan Mandir, Agra.
14. Sharma, O.P. (1989). A Text Book of Fungi. Tata Mc Graw-hill Publishing Company Limited, New Delhi.
15. Sharma, O.P. (1990). A Text Book of Algae. Tata Mc Graw-hill Publishing Company Limited, New Delhi.
16. Smith, G.M. (1995). Cryptogamic Botany. Vol. II (Bryophytes and Pteridophytes). Mc Graw-Hill Book Company, New York and London.
17. Sporne, K.R. (1995). The Morphology of Pteridophyta. The Hutchinson University Library, London, U.K.
18. Varma, P. S. and Agrawal, V. K. (2000). Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand and Company (P.) Ltd. New Delhi.
19. Vashistha, B.R. (1997). Botany For Degree Students-Bryophyta. S. Chand and company (P.) Ltd. New Delhi.
20. Vashistha, P.C. (1984). Pteridophytes. S. Chand and company (P.) Ltd. New Delhi.
21. Sharma, P.D. (1998). The Fungi. Rastogi Publications, Merrut.
22. Smith, G.M. (1995). Cryptogamic Botany. Vol. I (Algae and Fungi). McGraw-Hill Book Company, New York and London.
23. Vashistha, B.R. (1995). Botany for Degree Students-Algae. S. Chand and Company (P.) Ltd. New Delhi.24. Vashistha, B.R. (1995). Botany for Degree Students-Fungi (9th Ed.) S. Chand and company (P.) Ltd. New Delhi. 7
25. Pandey Dr.B.P., Botany for Degree Students, S.Chand & Co. Ltd. New Delhi.
26. Modern Practical Botany Volume-I, Dr.P.B.Pandey, S.Chand Pub., N. D.

27. Modern Practical Botany Volume-II, Dr.P.B.Pandey, S.Chand Pub., N. D.
28. Modern Practical Botany Volume-III, Dr.P.B.Pandey,S.Chand Pub., N. D.
29. A Text Book of Botany – Diversity of Microbes and Cryaptogams (2013), Dr.N.H.Shahare, Dr.A.U.Pachkhede, Dr.D.V.Hande, Dr.S.H.Kanherkar, Sh.R.S.Dhande, Dr.D.S.Talwankar, Published by
Nabh Prakashan, Amravati.

B. Sc. I : Semester – I
Practical Schedule
Time : 4 hours Marks : 50

Q1: Temporary mount and identification of given algal form (any one) 10
Q2: Temporary mount and identification of given fungal form (any one) 10
Q3: Salient features and identification of bryophytic material 05
Q4: Salient features and identification of pteridophytic material 05
Q5: Spotting (Algae, Fungi, Bryophyte, Pteridophyte, Pathology) 10
Q6: Viva-voce and Practical Record 05
Q7: Excursion Report 05

BOTANY
2S – BOTANY

Gymnosperm, Morphology of Angiosperms and Utilization of Plants

UNIT-I : Palaeobotany (15)

1.1. Process of plant fossilization and types of fossils
1.2. Geological Time Scale
1.3. Fossil Gymnosperms
1.3.1. Pteridospermales: Lyginopteris oldhamia
1.3.2. Bennettitales: Bennittites

UNIT-II : Gymnosperms (15)

2.1. Classification according to D. D. Pant
2.2. General account: morphology, anatomy, life cycle and taxonomic position of Pinus and Gnetum
2.3. Affinities with pteridophytes and angiosperms
2.4. Economic importance of Gymnosperms

UNIT-III : Morphology (15)

3.1. Diversity in Plants habits – Annual, biannual,perennials
3.2. Roots – Types of root : tap and adventitious,modification of root : for food storage, respiration, and supports.
3.3. Stem – Types of Stem, Characteristic features, branching, modification of Stem – Underground
and aerial
3.4. Leaf – Parts of leaf, types of leaves – simple and compound; Phyllotaxy; Venation; Stipule. Modification of leaves

UNIT-IV : Morphology (15)

4.1. Inflorescences – Types: Racemose, Cymose and Special.
4.2. Flower – Flower as modified shoot; Structure of flower – Calyx, Corolla, Androecium and Gynoecium. Placentation; Types of Pollination.

UNIT-V : Morphology and Utilization of Plants (15)
5.1. Fruits – Morphological types
5.2. Utilization of Plants
5.2.1. Food Plants – Wheat, Potato – Morphology, varieties and economic importance.
5.2.2. Fiber Plant – Morphology, varieties and economic importance of Cotton.
5.2.3. Oil yielding Plant – Morphology, Varieties and economic importance of Ground nut.
UNIT-VI :Utilization of Plants (15)
6.1. Spices–General account and economic importance of Black pepper, Clove, Cinnamon and Cardamom
6.2. General account and sources of firewood, timber and Bamboos.
6.3. Essential oils – General account, economic importance of Eucalyptus.
6.4. Pharmacognosy and Phytochemistry with respect to following medicinal plants –
6.4.1. Aloe vera
6.4.2. Adathoda vasica
6.4.3. Asparagus racemosa
6.4.4. Azadirachta indica
6.4.5. Catharanthus roseus
6.4.6. Chlorophytum borivillianum
6.4.7. Emblica officinalis
6.4.8. Ocimum sanctum
6.4.9. Rauwolfia serpentine
6.4.10. Vitex negundo
6.4.11. Withania somnifera
LABORATORY EXERCISE
I. Gymnosperms: Morphology and anatomy of the following members – a. Pinus b Gnetum
II. Preparation of double stained permanent mount of Pinus stem, needle and Gnetum stem and leaf.
III. Study of fossil slides of Lyginopteris and Bennettites
IV. Detailed morphological study of types of root, stem and leaf with its modifications
V. Forms of corolla
VI. Types of placentation
VII. Morphology of fruits
VIII. Morphology of plant parts used and medicinal plants prescribed in syllabi
IX. Utilization of plants: Spices, fiber yielding plants and food plants prescribed in syllabi
BOOKS RECOMMENDED
1) A.C. Dutta : Text Book of Botany.
2) Andrews A.N. : Studies in Paleobotany.
3) Arnold C.A. : Introduction of Paleobotany.
4) Bhatnagar S.P. and Moitra A., 1996 : Gymnosperms, New Age International Limited, New Delhi.
5) Bhojwani & Bhatnagar : Embryology of Angiosperms.
6) Coulter M.J. & Chamberlain C.J. : Morphology of Gymnosperms.
7) Cutter E.G., 1971 : Plant Anatomy Experiment and Interpretation Part-II, Organs, Edward Arnold, London.

8) Cutter, E.G. 1969 : Part-I, Cells and tissues, Edward, Arnold, London.
9) Davis P.H., and Heywood V.H., 1993 : Principles of Angiosperm Taxonomy: Oliver and Boyd, London.
10) Eames E.J. : Morphology of vascular Plants.
11) Gangulee & Kar : College Botany Vol.II
12) Gangulee Das and Dutta : College Botany, Vol.I
13) Giford E.M. and Foster A.S., 1988 : Morphology and Evolution of Vascular Plants, W.H. Freeman & Company, New York.
14) Hartmann H.T. and Kestler D.E., 1976 : Plant Propagation Principles and practices, 3rd edition, prentice Hall of India Pvt.Ltd. New Delhi.
15) Heyhood V.H. and Moore D.M. (Eds) 1984 : Current concepts in plant Taxonomy. Academic Press, London.
16) Jeffrey C., 1982 : An introduction to Plant Taxonomy, Cambridge University Press, Cambridge, London.
17) Maheshwari P. : Introduction of Embryology of Angiosperms.
18) Pande B.P. : A Text Book of Angiosperms.
19) Proctor M. and Yeop, 1973 : The Pollination of Flowers, William Collins Sons, London.
20) Radford A.E., 1986 : Fundamentals of Plant Systematics, Harper and Row, New York.
21) Rendle A.B. : Classification of flowering plants, Vol.I & Vol.II.
22) S. Sundar Rajan : College Botany, Vol.II & Vol.III.
23) Saxena and Sarabhai : A Text Book of Botany, Vol.II
24) Sharma O.P. : Gymnosperms.
25) Shukla & Mishra : Paleobotany.
26) Singh and Jain : Taxonomy of Angiosperms.
27) Singh, 4. 1999, Plant Systematics - Theory and Practices, Oxford and IBH Pvt. Ltd., New Delhi.
28) Sporne K.R. : Morphology of Gymnosperms.
29) Sporne K.R., 1965: The Morphology of Gymnosperms, Hutchinson
& Company, (Publisher) Ltd. London.
30) Stace C.A., 1989: Plant Taxonomy and Biosystematics (2nd Edition) Edward Arnold, London.
31) Stewart W.N., 1983 : Paleobotany and Evolution of Plants, Cambridge
University Press, Cambridge.
32) Thomas P., 2000 : Trees - Their natural history, Cambridge University Press, Cambridge.
33) Trivedi B.S. & Sharma B.B. : Introductory Taxonomy.
34) Tyagi & Kshetrapal : Taxonomy of Angiosperms.
35) Vasistha P.C. : Gymnosperms.
36) Vasistha P.C. : Taxonomy of Angiosperms.
37) Vyas Purohit Garg : A Text Book of Gymnosperms.
38) Walton : An Introduction & Study of fossil.
39) Modern Practical Botany, Volume-I, Dr.P.B.Pande, S.Chand Pub., N.W.
40) Modern Practical Botany, Volume-II, Dr.P.B.Pande, S.Chand Pub., N.W.
41) Modern Practical Botany, Volume-III, Dr.P.B.Pande, S.Chand Pub., N.W.

42) A Text Book of Botany –Paleobotany, Gymnosperms, Morphology and Utilization of Plants (2014), Dr.P.W.Deotare, Dr.M.A.Shahezad, Dr.Mrs.U.G.Malode, Dr.U.S.Patil, Dr.Mrs.P.S.Kokate, Dr.Mrs.S.P.Khodke, Published by Nabh Prakashan, Amravati.
43) Morphology of Angiosperms and Utilization of Plants, Dr.Shubhangi Ingole, Published by Paygun Publishers, Amravati.

Semester – II
Practical Schedule
Time : 4 hours Marks : 50

Q1. Preparation of double stained permanent mount of given Gymnospermic material and identification with reasons 10 Marks
Q2. Comments on given Morphological specimens 12 Marks
i. Root ii. Stem iii. Leaf iv. Inflorescence v. Flower vi. Fruit
Q3. Comment on given medicinal plant with reference to morphology,part used and medicinal importance (Any two) 10 Marks
Q4. Spotting (02 marks each) 08 Marks
a) Palaeobotany b) Gymnosperms c) Utilization of Plant (food, fibers, spices) (2 Materials)
Q5. Practical record 5 Q6. Viva voce and Excursion report 5 Marks

B.Sc. II yr Sem III BOTANY
3S- BOTANY
ANGIOSPERM SYSTEMATICS, ANATOMY & EMBRYOLOGY

UNITI : Angiosperm Systematics and Biodiversity.
1.1Angiosperms: Origin and Evolution **(Pteridospermean and Bennititalean Theory)**
1.2 Botanical Nomenclature: Principles of rules, Taxonomic Ranks, Type concept, Valid publication.
1.3 Herbarium – Concept & significance, Royal Botanical , Kolkata.
1.4 Concept of biodiversity, Ex situ and In situ conservation
1.5 Concept & importance of Biodiversity.

UNIT II: Angiosperm Systematics
2.1 Systems of Classification: Bentham and Hooker's System, Engler and Prantle's system.
2.2 Systematic studies & economic importance of following Families Dicotyledons (Polypetalae) : Malvaceae, Brassicaceae, Leguminosae, Apiaceae,

UNIT III: Angiosperm Systematics
3.1 Systematic studies & economic importance of following Families
Dicotyledons (Gamopetalae): Asteraceae, Asclepiadaceae, Apocynaceae, Solanaceae, , Lamiaceae.
3.2 Dicotyledons (Monoclamydeae): Euphorbiaceae.
3.3 Monocotyledons: Liliaceae, Poaceae.

UNIT IV: Anatomy
4.1 Types of Tissues: Meristematic – Types of meristems Permanent – Simple and complex.
4.2 Characteristics of growth rings, Sapwood and heartwood.
4.3 Anatomy of root: Primary structure in dicot and monocot root, normal secondary growth in dicot root.

UNIT V: Anatomy
5.1 Anatomy of stem: Primary structure in monocot and dicot stem, normal secondary growth in dicot stem.
5.2 Anomalies in primary structure in *Boerhhavia* stem, secondary structure in *Bignonia* and *Dracaena* stem.
5.3 Leaf Anatomy: Internal structure in *Nerium* and *Maize* leaf.
UNIT VI : Embryology
5.1Microsporangium, microsporogenesis, development of male gametophyte.
5.2Megasporangium, types of ovules, megasporogenesis, development of female gametophyte (monosporic, Bisporic & tetrasporic).
5.3 Double fertilization and triple fusion.
5.4 Embryo – Classification of embryo.
5.5 Endosperm types & significance, Suspended animation
LABORATORY EXERCISES
1) Embryology of Angiosperms:
i) Observation of wide range of flowers available in the locality and methods of their pollination.
ii) Study through permanent slides of T.S. of anthers, microsporogenesis, L.S. of ovule, types of endosperms and embryo of Capsella .
iii) Mounting of T.S. of anthers, Pollen grains and pollinia.
2) Anatomy of angiosperms : Preparation of double stained slides of root, stem and leaves of angiosperms mentioned in the syllabus.
3) Taxonomy : Description of ten plants belonging to different families in technical language and identifiction upto family level.
4) Long and short excursion is essential
Note : Field tour reports should be supported by exhaustive field notes and photographic representation of plant species studied
Brassiacaceae- *Brassica,* **Malvaceae**- *Hibiscus, Sida, Malvastrum,* **Fabaceae**- *Crotalaria, Indigifera, Tephrosia,* **Caesalpinoidae**- *Caesalpinea, Cassia,* **Mimosoidae**- *Prosopis, Acasia,* **Apiaceae**-*Corindrum,* **Apocynaceae**- *Vinca, Thevetia,* **Asclepiadaceae**- *Cryptostegia,Calatropis,* **Solanaceae**- *Datura, Solanum, Withania,* **Euphorbiacea**- *Croton, Jatropha, Euphorbia,* , **Lamiaceae**-*Oscimum, Hyptis,* **Asteraceae**- *Tridax, Lagasca*
Verbanaceae – *Lantana, Clerodendron*

PRACTICAL EXAMINATION
Time;- 5 Hours Max. Marks- 50
Q. 1 Preparation of double stained permanent micropreperation of given angiospermic Material Identification with reasons 10 Marks
Q. 2 Description of given angiospermic plant in technical language, identification up to family, floral formula, floral diagram (two Plants) 20 Marks
Q. 3 Spotting (taxonomy-1, anatomy-2, Embryology-2) 10 Marks
Q. 4 Class record, Excursion report with plant photographic submission 06 Marks
Q. 5 Submission of micropreperation and viva voce 04 Marks
Books Recommended :
1) **A.C.Dutta** : Text Book of Botany.

2) **Andrews A.N**. : Studies in Paleobotany.
3) **Arnold C.A**. : Introduction of Paleobotany.
4) **Bhojwani & Bhatnagar** : Embryology of Angiosperms.
5) **Chandurkar** : Plant Anatomy
6) **Cutter E.G**., 1971 : Plant Anatomy Experiment and Interpretation Part-II, Organs, Edward Arnold, London.
7) **Davis P.H**., and Heywood V.H., 1993 : Principles of Angiosperm Taxonomy : Oliver and Boyd, London.
8) **Eames E.J**. : Morphology of vascular Plants. edition, prentice Hall of India Pvt.Ltd. New Delhi.
9) **Esau K**. : 1977, Anatomy of seed plant, 2nd Edition, John Wiley and Sons, New York.
10) **Gangulee & Kar** : College Botany Vol.II
11) **Gangulee Das and Dutta** : College Botany, Vol.I
12) **Giford E.M. and Foster A.S**., 1988 : Morphology and Evolution of Vascular Plants, W.H. Freeman & Company, New York.
13) **Hartmann H.T. and Kestler D.E**., 1976 : Plant Propagation Principles and practices, 3rd
14) **Heyhood V.H. and Moore D.M**. (Eds) 1984 : Current concepts in plant Taxonomy. Academic Press, London.
15) **Jeffrey C**., 1982 : An introduction to Plant Taxonomy, Cambridge University Press, Cambridge, London.
16) **Maheshwari P**. : Introduction of Embryology of Angiosperms.
17) **Pande B.P**. : A Text Book of Angiosperms.
18) **Radford A.E**., 1986 : Fundamentals of Plant Systematics, Harper and Row, New York.
19) **Rendle A.B.** : Classification of flowering plants, Vol.I & Vol.II.
20) **S.Sundar Rajan** : College Botany, Vol.II & Vol.III.
21) **Shukla & Mishra** : Paleobotany.
22) **Singh and Jain** : Plant Anatomy.
23) **Singh and Jain** : Taxonomy of Angiosperms.
24) **Singh**, 4. 1999, Plant Systematics - Theory and Practices, Oxford and IBH Pvt. Ltd., New Delhi.
25) **Stace C.A**., 1989. : Plant Taxonomy and Biosystematics (2nd Edition) Edward Arnold, London.
26) **Stewart W.N**., 1983 : Paleobotany and Evolution of Plants, Cambridge University Press, **Cambridge. Cutter, E.G**. 1969 : Part-I, Cells and tissues, Edward, Arnold, London.
27) **Trivedi B.S**. & Sharma B.B. : Introductory Taxonomy.
28) **Tyagi & Kshetrapal** : Taxonomy of Angiosperms.
29) **Vasistha P.C**. : Plant Anatomy.
30) **Vasistha P.C**. : Taxonomy of Angiosperms.
31) **Walton** : An Introduction & Study of fossil.
32) Modern Practical Botany, Volume-I, Dr.B.P.Pande, S.Chand Publication, New Delhi.
33) Modern Practical Botany, Volume-II, Dr.B.P.Pande, S.Chand Publication, New Delhi.
34) Modern Practical Botany, Volume-III, Dr.B.P.Pande, S.Chand Publication, New Delhi.

LATE KU. DURGA K. BANMERU SCIENCE COLLEGE, LONAR

DEPARTMENT OF BOTANY

B.Sc. II Sem IV
4S- BOTANY
CELL BIOLOGY, GENETICS AND BIOCHEMISTRY

Unit – I : Cell Biology
1.1 Cell concept – Prokaryotic and Eukaryotic cell
1.2 Cell wall –Structure and Functions
1.3 Plasma membrane –Structure (models) and Functions
1.4 Nucleus – Ultra structure (nuclear membrane, nuclear pore complex and nucleolus) and functions
1.5 Chloroplast- Structure and Functions

Unit–II : Cell Biology Structure and functions of-
2.1 Endoplasmic Reticulum
2.2 Golgi complex
2.3 Vacuole
2.4 Ribosome
2.5 Perixysome
2.6 Mitochondria
2.7 Cell cycle: Mitosis and Meiosis

Unit – III : Genetics
3.1 Chromosome- Morphology, Types, Centromere & Telomere
3.2 Chromosomal aberrations –
3.2.1 Structural aberrations: Deletion, Duplication, Inversion and Translocation
3.2.2 Numerical aberrations: Euploidy and aneuploidy

Unit–IV: Genetics
4.1 Mendellism: Mendel's law of Dominance, Segregations and Independent assortment, Incomplete dominance
4.2 Interaction of genes- Complimentary, Supplementary and Epistasis
4.3 Problems based on Mendelism and Interaction of Genes

Unit – V Genetics
5.1 Linkage – Concept, Types and theories
5.2 Crossing over: Concept, Types and theories
5.3 Gene mutations- Spontaneous and Induced
5.4 Extra-nuclear Genome- Mitchondrial DNA and Chloroplast DNA

Unit – VI Biochemistry
6.1 Nomenclature of Enzymes
6.2 Characteristics of Enzymes
6.3 Concept of holoenzymes, coenzymes and cofactors
6.4 Theories for Mechanism of action of Enzymes
6.5 Structure and functions Carbohydrates: Monosaccharides (Glucose), Disaccharides (Galactose) and Polysaccharides (Starch)

PRACTICAL :

I Cell Biology (Any Two)
1. Isolation of mitochondria from plants
2. Isolation of chloroplast

3. Squash preparation for the study of various stages of mitosis
4. Smear preparation for the study of various stages of meiosis.

II Genetics

1. To prove Mendel's Monohybrid ratio.
2. To prove Mendel's Dihybrid ratio.
3. Problems based on Interaction of genes

III Biochemistry

1. To study the enzyme activity of catalase.
2. To demonstrate test for glucose in grapes, & sucrose in cane sugar / beet root.
3. To demonstrate test for protein.
4. To demonstrate the lipid test in oily seeds.
5. To demonstrate the test for starch / cellulose.
6. To demonstrate the activity of enzyme amylase from germinating Wheat grains.

B. Sc. II : Semester – IV
Practical Schedule

Time : 4 hours Marks : 50

Q.1 : Squash/Smear preparation for study of Mitosis/Meiosis stages 10 Marks
Q.2 : Genetics : To perform given experiment 10 Marks
Q.3 : Genetics problem 05 Marks
Q.4 : Biochemistry : To perform given test (Any Two) 10Marks
Q.5 : Spotting 05 Marks
Q.6 : Class record and viva-voce 10Marks

Suggested Readings :

1) **Ahluwalia K.B** 2005 (First Edition). Genetics. New Age International Private Ltd. Publishers, New Delhi.
2) **Buchanan B.B, Gruissem W. and Jones R.L** (2000). Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists Maryland, USA.
3) **Dalela & Verma** : Cytology.
4) **Darnell J.** 2000. Molecular Cell Biology (Fourth Edition). W.H. Freeman and Company, New USA.
5) **De-Robertis** EDP : Cell Biology.
6) **Devi P**.2008-Principle and Methods of plant Molecular Biology, Biochemistry and Genetics Agrobios, Jodhpur, India.
7) **Gardner and Simmons Snustad** 2005 (Eighth Edition). Principles of Genetics, John Wiley and Sons, Singapore.
8) **Gerald Karp** 1999 Cell and Molecular Biology- Concept and Expts. John Wiley and Scne Ine., USA.
9) **Gupta P.K** (1995) Genetics and Cytogenetics. Rastogi Publications, Meerut.
10) **Leninger A.C** (1987). Principles of Biochmistry, CBS Publishers and Distributers (Indian Reprint)
11) **Lodish Etal** 2004 (Fifth Edition). Molecular Cell Biology, W H Freeman and company, New York.

12) **Moore T.C.** 1989. Biochemistry and Physiology of Plant Hormones Springer – Verlag, New York, USA.
13) **P.S.Verma & Agrawal V.K.** : T.B. of Cytology.
14) **Pawar C.B** 2003 (First Edition). Genetics Vol. I and II. Himalaya Publishing House, Mumbai.
15) **Powar C.B** 2005 (Third Edition). Cell Biology, Himalaya Publishing, Mumbai.
16) **Roy S.C and KKDe** 2005 (Second Edition). Cell Biology, New central Book Agency Private Ltd., Kolkata.
17) **Sharma J.R** 1994 Principles and practices of Plant Breeding.
18) **Shrivastav H.N.** - Cell Biology and Genetics – New Millenium Edition - Pradip's.
19) **Singh B.D** 2004. Genetics. Kalyani Publication, Ludhiana.
20) **Strickberger** 2005. (Third Edition). Genetics. Prentice Hall of India Pvt. Ltd., New Delhi.
21) **Veerbala Rastogi** : Introduction to cytology.
22) **Verma P.S and Agarwal V.K** 2006 Cell Biology, Genetics, Molecular Biology, Evolution, Ecology. S.Chand and Company, New Delhi.
23) **Verma P.S. and Agarwal V.K.(**1991**)**, Genetics. S Chand Comp. Ltd. Ramnagar, New Delhi.
24) **Verma S.K. and Mohit Verma** 2007. A.T.B of Plant Physiology, Biochemistry and Biotechnology, S.Chand Publications.
25) **Verma S.K. and Verma Mohit** (2007). A.T.B of Plant Physiology, Biochemistry and Biotechnology, S.Chand Publications.
26) Modern Practical Botany, Volume-I, Dr.B.P.Pande, S.Chand Publication, New Delhi.
27) Modern Practical Botany, Volume-II, Dr.B.P.Pande, S.Chand Publication, New Delhi.
28) Modern Practical Botany, Volume-III, Dr.B.P.Pande, S.Chand

B.Sc. III Year, Semester-V
BOTANY

The examination in Botany of fifth Semester shall compriseof one theory paper, internal assessment and practical examination.Theory Paper will be of 3 Hrs. duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of 4 hours duration and carry 50 marks. The following syllabi is prescribed on the basis of six lecturers per week and 6 practical periods per batch per week. Each theory paper has been divided into 6 units. There shall be one question in every unit with internal choice for each of 12 marks & one compulsory question covering all the syllabus of Semester-V (8 marks).

5S - BOTANY
PLANT PHYSIOLOGY AND ECOLOGY

Unit - I: Plant Water Relations

1.1 Importance of water to plant life. Imbibition , Diffusion,Osmosis, Plasmolysis.
1.2 Active and passive Absorption of water.
1.3 Ascent of sap - Root Pressure and Transpiration Pull Theory.
1.4 Transpiration - Types of transpiration, Stomatal movements, Mechanism of transpiration (Starch) sugar hypothesis), Significance. Antitranspirant, Guttation.
1.5 Mineral uptake - Active uptake - Career Concept, Passive up take – Ion Exchange.

Unit - II: Metabolism-

2.1 Photosynthesis - Introduction, Role of Light, Photosynthetic Apparatus and Pigments, Two Pigment Systems, Photophosphorylation, C3 and C4 cycle, CAM Pathway.
2.2 Respiration - Introduction, Mitochondria as a Respiratory centre, Types of Respiration - Aerobic and
Anaerobic, Mechanism of aerobic respiration- Glycolysis, Kreb cycle, Electron transport system and Chemiosmotic ATP generation, Respiratory Quotient.

Unit - III: Metabolism and growth

3.1 Nitrogen Metabolism- Sources of nitrogen, Symbiotic nitrogen fixation, Role of Nitrate reductase.
3.2 Growth - Phases of growth, Growth curve, Physiological role of growth hormones (Auxins, Gibberellins, Cytokinins, Abscisic acid, and Ethylene).
3.3 Physiology of Senescence and Abscission.

Unit – IV: Plant responses

4.1 Photoperiodism - Concept of Florigen, Role of Phytochrome,
4.2 Vernalization- Concept and Significance.
4.3 Plant movement- Tropic (Phototropic and Geotropic) and Nastic (Epinasty, Hyponasty and Seismonasty)
4.4 Stress physiology- Concept, Types of stress, Water and Salinity stress.

Unit – V: Ecology and Environment:

5.1 Concept of environment, Concept and scope of ecology.
5.2 Ecological factors- Climatic- Light, Temperature and Water.
5.3 Atmosphere and its composition.
5.4 Edaphic factor- Process of soil formation, soil profile, soil biota and their role.
5.5 Ecological Adaptations - Morphological and Anatomical adaptation in Hydrophytes, and Xerophytes.

Unit – VI: Ecosystem:

6.1 Population Ecology- Natality and Mortality, Community characteristics – Frequency, Density and
Abundance
6.2 Ecological Succession - Hydrosere and Xerosere
6.3 Ecosystem – Definition, Structure and Function, Food chain, Food web, Energy flow model (Single channel model)
6.4 Types of Ecosystem- Pond ecosystem, Desert ecosystem.

LABORATORY EXERCISE :

Plant Physiology: Major experiment (Any Seven)

1. To study the effect of temperature and organic solvent on permeability of plasma membrane.
2. To study osmotic pressure of cell sap by plasmolytic method.
3. To determine water potential of plant tissue.
4. To determine the path of water (ascent of sap)
5. To determine the rate of transpiration by Ganongs photometer.
6. To determine rate of photosynthesis under varying quality of light and CO_2 concentration.
7. To study the rate of photosynthesis in terrestrial plants with the help of Ganongs Photosynthometer.

8. Separation of chloroplast pigments by paper chromatography/ solvent extraction method.
9. Separation of amino acids by paper chromatography method.
10. To determine R.Q. using different substrates.
11. To determine the rate of respiration by Ganongs respirometer.
12. To study antagonism of salts.
13. To study phenomenon of adsorption.
14. To study effect of IAA and Gibberellins on seed germination.
15. Test for secondary metabolites- Alkaloid, Phenolics, Tannin, Flavonoids and Lignin
16. To study Endo and Exo-osmosis by egg membrane osmoscope

Plant Physiology: Minor experiment- (Any Three)

1. To demonstrate fermentation.
2. To demonstrate exo and endosmosis
3. To demonstrate transpiration by Bell jar.
4. To demonstrate light is necessary for photosynthesis
5. To demonstrate anaerobic respiration in germinating seeds.
6. To demonstrate the evolution of CO2 in respiration.
7. To demonstrate the phenomenon of nastic movement with help of *Mimosa pudica* / or *Biophytum sensitivum.*

Ecology: Major experiment (Any Three)

1. Study of morphological and anatomical adaptations in hydrophytes – *Hydrilla, Eichhornia, Typha, Vallisneria* and *Nymphaea* (any two)

Study of morphological and anatomical adaptations in xerophytes -*Asparagus, Nerium, Casuarina, Euphorbia, Cycas, Opuntia* (any two)

3. Study of community characterstics by quadrat method.
4. Determination of water holding capacity of different soils.
5. To determine the texture of different soils by sieve method.

Ecology: Minor experiment (Any Two)

1. To determine the porosity of soil.
2. To determine the transparency and temperature of water bodies.
3. Estimation of salinity of different water samples
4. Determination of pH of different soils and water samples by pH papers/ pH meter.
5. Study of meteorological instruments -Rain gauge, Hygrometer, Barometer

PRACTICAL EXAMINATION

Time: 4 Hours Marks: 50

Q. 1 - Physiology- major experiment-. 15
Q. 2 - Comment one Minor Physiology experiment- 5
Q. 3 - Ecology major experiment. 10
Q. 4 - Ecology minor experiment. 5
Q. 5 - Viva – voce 5
Q.6 - Class record. 5
Q. 7 - Co-curricular Activity Report 5

Co-curricular Activity Report" which mean the report on the activity Such as Study Tour, Industrial visit to Research Institute, Excursion Tour to be submitted by the students at the time of practical examination.

LATE KU. DURGA K. BANMERU SCIENCE COLLEGE, LONAR
DEPARTMENT OF BOTANY

Books Recommended:
Plant Physiology and Ecology:

1. Curtis & Clark. : Introduction of Plant Physiology.
2. H.N.Shrivastav. : Plant Physiology
3. Devlin R.M. : Plant Physiology
4. Salisbury F.B and Ross C.W. (1992).: Plant physiology (Fourth Edition) Wadsworth Publishing Company, California,USA.
5. William G. Hopkins. (1995): Introduction to Plant Physiology, Published by – John Wiley and Sons, Inc.
6. V.Verma : Plant Physiology Verlag, New York.Vol. II.
7. Mayer & Anderson.: Plant Physiology.
8. Lincoln Taiz and Eduardo Zeiger (2003). Plant Physiology (3rd edition), Published by Panima Publishing Corporation
9. Galston, A. W. 1989: Life processes in plants. Scientific American Library, Springer
10. Jain V.K.: Fundamental of plant Physiology. S. Chand Publication New Delhi.
11. Kocchar P.C.: Text Book of Plant Physiology.
12. Mohr, H. and Schopfer, P. 1995 : Plant Physiology 4th : Edition, Wordsworth
13. Moore, T.C. 1974: Research Experiences in Plant Physiology. A Laboratory Manual.
14. Mr./Mrs.Pillei : Plant Physiology New York, U.S.A.
15. P.S.Gill: Plant Physiology, S.Chand & Co. New Delhi, Edition - Pradip's, Botany
16. Purekar and Singh: Plant Physiology,
17. R. G. S. Bidwell (revised edn.)-Plant Physiology
18. Verma S.K. and Verma Mohit (2007). A.Text Book of Plant Physiology, Biochemistry and Biotechnology, S. Chand Publications.
19. Dennis D.T., Turpin, D.H. Lefebvre D.D. and Layzell D.B. (eds) 1997. Plant Metabolism (Second Edition) Longman, Essex, England.
20. Galstone A.W. 1989. Life processes in Plants. Scientific American Library, Springer Verlag, New York, USA..
21. Moore T.C. 1989. Biochemistry and Physiology of Plant Hormones Springer – Verlag, New York,USA.
22. Singhal G.S., Renger G., Sopory, S.K. Irrgang K.D and Govindjee 1999. Concept in Photobiology; Photosynthesis and Photomorphogenesis. Narosa Publishing House, New Delhi
23. Verma S.K. and Mohit Verma 2007. A.T.B of Plant Physiology, Biochemistry and Biotechnology, S. Chand Publications.
24. Ambasht. R.S. 1988.0 A Text Book of Plant Ecology Students FriendsCo.Varanasi.
25. Sharma P. D. 2003. Ecology and environment. Rastogi publication.
26. Botkin, D.B. and Keller, E.A. 2000. Environmental Plane (2nd edition).JohnWiley & Sons Inc. New York.
27. Chapman. J.L. and Reiss. M.J. 1995. Ecology: Principles and ApplicationsCambridge University Press. College Publishers, USA.
28. Cunningham.W.P. and Saifo S.W. 1997. Environmental Science: A Global Concern WCB. McGraw Hill.
29. Dash M.C. 1993. Fundamentals of Ecology. Tata McGraw Hill Publishing Co. Ltd., New Delhi.

30. Kumar.H.D. 1996. Modern Concepts of Ecology (3rd edition). Vikas Publishing House Pvt., Ltd. Delhi.
31. Kumar.H.D. 1997. General Ecology. Vikas Publishing Pvt. Ltd., Delhi.
32. Miller.W.R. and Donahue. R.L. 1992. Soils-An Introduction to Soil and Plant Growth (6th edition). Prentice Hall of India Pvt. Ltd., New Delhil.
33. Odum.E.P. 1996. Fundamentals of Ecology. Natraj Publishing, Dehradun.
34. Pickering.K.T. and Owen L.A. 1997. An Introduction to Global Environmental Issues (2nd edition). Butter and Tanner Ltd., Great Britain.
35. Smith L.R. and Mith T.M. 1998. Elements of Ecology. (4th edition). Animprint of Addison Wesley, Longman ink. California.
36. Smith.L.R. 1996. Ecology and Field Biology (5th edition). Harper Collns
37. Tyler. M.G. Jr. 1997. Environmental Science: Working with Earth
(6th edition). Wordsworth Publishing Co. 38. Weaver. J.E. and Clements. S.E. 1966. Plant Ecology. Tata
McGraw publishing Co. Ltd. Bombay.
39. Chaudhari M.A. and Gupta K.K. 2009. Practical plant physiology. New Central Book agency Ltd. Kolkata.
40. Bendre: Practical Botany for B.Sc.III year. Rastogi Publications, Meerut.

B.Sc. III Semester-VI
6S Botany

The examination in Botany of sixth Semester shall comprise of one theory paper, internal assessment and practical examination. Theory Paper will be of 3 Hrs. duration and carry 80 marks. The internal
assessment will carry 20 marks. The practical examination will be of 4 hours duration and carry 50 marks.
The following syllabi is prescribed on the basis of six lecturers per week and 6 practical periods per batch per week. Each theory paper has been divided into 6 units. There shall be one question in every unit with internal choice for each of 12 marks & one compulsory question covering all the syllabus of Semester-VI (8 marks).

SEMESTER VI – MOLECULAR BIOLOGY AND BIOTECHNOLOGY

Unit-I : DNA the genetic material :
1.1 Historical account – Giffith's Expt, Hershy and Chase Expt.
1.2 DNA– Chemical composition and Double Helical model,
1.3 DNA replication in Eukaryotes;
1.4 DNA Packaging - Nucleosome and Solenoid
1.5 Satellite, Repetitive DNA and Transposable element in plants (AC-DS system)

Unit-II : Gene Structure and Expression -
2.1 Concept of gene, Fine structure of Gene
2.2 Gene Expression – Central Dogma, Types of RNA, Genetic code, Ribosome as a translation machine
2.3 Transcription in Eukaryotes – Mechanism of Transcription and RNA Processing
2.4 Translation in Eukaryotes.
2.5 Endomembrane system (Flow of Peptide)

Unit – III : Regulation of Gene Expression
3.1 Regulation of Gene Expression in Prokaryotes – Operon concept with special reference to Lac Operon
3.2 Regulation of gene expression of Eukaryotes – Britton Davidson Model
3.3 Protein Folding Mechanism and Structure (Primary, Secondary, Tertiary and Quaternary)
3.4 Protein Sorting – Targeting to proteins to organelles
3.5 Protein Trafficking
Unit-IV : Genetic Engineering -
4.1 Tools and techniques of recombinant DNA technology,
4.2 Restriction Enzymes – Nomenclature and Types
4.3 Cloning vectors – Plasmids, Phages, Cosmids
4.4 Gene Source- Genomic and c-DNA library
4.5 Gene Transfer Techniques – Direct - (1) Chemical method, (2) Electroporation, (3) Gene gun method Indirect – Agrobacterium mediated gene transfer
4.6 Gene Amplification - _Polymerase Chain Reaction (PCR)
Unit-V : Plant Tissue Culture -
5.1 Basic aspects of plant tissue culture
5.2 Laboratory Requirement – Infrastructure, Instruments (laminar air flow, autoclave, growth chamber),
Culture Media (MS Media), Growth Hormone (Auxin, Cytokinin and Gibberellins) Sterilization Techniques
5.3 Tissue Culture Technique - Cellular totipotency, differentiation and morphogenesis; Callus Culture; Micro propagation
Unit-VI : Applications of Biotechnology -
6.1 Agriculture – Haploid plant production (Anther and Pollen Culture); Protoplast Culture and Somatic Hybridization; Transgenic Plant - BT Cotton, Synthetic seed. Salient achievements of crop biotechnology
6.2 Industry – Fermentation Technology- Bakery Products and Alcohol Productions.
6.3 Health Care – Edible Vaccines
6.4 Conservation – Cryopreservation, Genetically Modified Organisms: - Pros and Cons

LABORATORY EXERCISE

1) Molecular biology (Major) (Any One)
1. Isolation of DNA by crude method
2. Estimation of DNA by Diphenylamine method
3. Estimation of RNA by Orcinol method
2) Molecular biology (Minor) (Any One)
1. Demonstration of DNA Electrophoresis,
2. Demonstration of double helical model of DNA
3. Demonstration of AC-DS System in Maize kernel
4. Demonstration of Centrifugation
3) Biotechnology (Any Six)
1. Working Principle and application of Autoclave
2. Working Principle and application of Laminar Air Flow

3. Cleaning and Sterilization of Glassware
4. Sterilization of Explant
5. Inoculation of Explant
6. Demonstration of in vitro culture techniques – anther and pollen culture
7. Isolation of Protoplast by Mechanical Method
8. Isolation of Protoplast by Enzymatic Method
9. Demonstration of technique of Micropropogation
10. Preparation of Artificial Seed
11. Demonstration of hardening of tissue culture plant
12. Preparation of Tissue culture media
13. Pollen viability test.

Note: Visit to molecular biology, biotechnological research institute/ industry

PRACTICAL EXAMINATION

Time : 4 hours. Marks : 50

Que.1 : To perform given Molecular Biology experiment 15 Marks
Que.2 : Comment on minor molecular Biology Experiment05 Marks
Que.3 : To perform given Biotechnology experiment 15 Marks
Que.4 : Comment on any one Biotechnology Experiment 05 Marks
Que.5 : Visit report 05 Marks
Que.6 : Class record/ and viva-voce 05 Marks

1. Pradip's Botany Vol. V, Biochemistry and Biotechnology- New Millenium Edition
2. Alberts, B.Bray, D.Lewis, J.Raff, M.Roberts, K. and Watson, I.D. 1999. Molecular Biology of Cell - Garland Publishing Co. Inc New York, U.S.A.
3. Gupta, P.K. 1999 : A Text book of Cell and Molecular Biology, Rastogi Publication, Meerut, India.
4. Wolfe, S.L. 1993. Molecular and Cell Biology. Wordsworth Publishing Co., California, U.S.A.
5. Fakui, K. and Nakayama S. 1996. Plant Chromosomes. Laboratory Methods. CRC Press, Boca Raton, Florida.
6. Sharma, A.K. and Sharma, A. 1999. Plant Chromosomes : Analysis; Manipulation and Engineering. Harwood Academic Publishers, Australia.
7. Bhojwani, S.S. 1990. Plant Tissue Culture : Applications and Limitations, Elsevier Science Publishers, New York. U.S.A.
8. P.K.Gupta Biotechnology.
9. Lea, P.J. and Leegood, R.C. 1999. Plant Biochemistry and Molecular Biology. John Wiley & Sons, Chichester, England.
10. Old, R.W. and Primrose, S.B. 1989 : Principles of Gene Manipulation. Blackwell Scientific Publications, Oxford, U.K.
11. Vasil, I.K. and Thorpe, T.A. 1994. Plant Cell and Tissue culture, Kluwer Academic Publications, the Netherlands.
12. Devi, P. 2000. Principles and Methods of Plant Molecular Biology, Biochemistry and Genetics, Agrobios, Jodhpur, India.
13. Smith, R.H. 2000. Plant Tissue Culture; Techniques and Experiments. Academic Press, New York.

14. Satyanarayan- Biotechnology.
15. An introduction to industrial Microbiology- Dr. P.K. Sivakumaar & Dr. M.M. Joe & Dr. K. Sukesh- S. Chand publication.
16. Practical Biotechnology and plant tissue culture- Prof. Santosh Nagar & Dr. Madhavi Adhav- S. Chand Publication.
17. Modern practical Botany (Volume-III)- Dr. B.P.Pandey- S. Chand publication.
18. Molecular Biology and Biotechnology- K.G. Ramawat & Dr. Shaily Goyal- S. Chand publication.
19. Comprehensive Biotechnology- K.G. Ramawat & Shaily Goyal- S. Chand publication.
20. Botany for degree students - B.P. Pandey- S. Chand publication.
21. A Textbook of Biotechnology- R.C. Dubey- S. Chand publication