ADIKAVI NANNAYA UNIVERSITY
DEPARTMENT OF BOTANY

SYLLABUS

2016 – 17 ADMITTED BATCH

ADIKAVI NANNYA UNIVERSITY, RAJAHMUNDRY

All PG BoS meeting on 8th July 2016, Venue: Seminar hall

SYNOPTIC NOTE

1) BoS meeting for all PG Courses with effect from 2016-17 admitted batches
2) Syllabi last revised in 2012-13
3) There are about 25 different courses
4) The syllabus is proposed to be revised in accordance to the emerging concepts, industry and market needs

Proposed Guidelines:

5) All Arts and Commerce courses will have 5 subjects in each of the four semesters, with 100 marks for each paper totaling up to 2000 marks.
6) For science courses there will be four theories for each of the four semesters, for 100 marks each and four practical papers for 50 mark each, all of which totals up to 2400 marks. An additional 100 marks are allotted for project dissertation and presentation in all PG courses [except MBA/MCA/MA(SW) and M.Tech]. Thus the grand total for the science courses is 2500 marks
7) Out of 100 marks for each subject, 75 marks (75%) in each paper are assigned for Semester End Examinations and 25 marks (25%) for internal / continuous assessment for all PG courses.
8) Every subject will have 4 - 5 periods of class per week with 5 credits
9) Every subject paper will have four units of syllabus in PG courses except MBA, which will have five units of syllabus for each subject
10) Semester end examination question paper has two sections, viz. section A with four essay questions, with internal choice a) or b) - one question from each unit of syllabus; section B has eight short answer questions, two from each unit of syllabus, with choice to answer any five.

    For MBA the question paper consist of 3 sections; viz. section 'A' has 8 short answer questions, with a choice to answer any five for 20 marks. Section 'B' consist of 5 long answer question with internal choice; one question from each unit of syllabus for 40 marks and section 'C' is case study with no choice for 15 marks.
11) For all PG courses including MBA, the brake up for 25 marks (25 %) of internal examination / continuous assessment is as follows;

a) 15 marks for written examination; two written examinations are to be conducted and an average of both examinations is considered for awarding final score
b) 5 marks for attendance
c) 5 marks for assignment preparation and presentation
(The proportionate may be followed for 50 marks paper / practical)

12) There will be project work for all PG courses except MBA, MCA, M.Tech and MA (Social work) for 100 marks (50 marks for dissertation and 50 marks for presentation and viva-voice. The project fieldwork is to be done during summer vacation i.e. after II semester and before III semester. Dissertation should be submitted by the student to the respective department during 2nd year study and presentation and viva-voce examination is to be held after IV semester examination. The project presentation and vive-voce examination is conducted by external examiner, for affiliation colleges where University teachers will be external examiner and for University Department external examiner from other university is to be invited. MCA / MBA /M.Tech/ MA (SW) will continue the extant system. The external examiner TA / DA and remuneration will be borne by the respective College / Department strictly as per the approved norms to be notified from time to time.

13) There may be comprehensive Viva-Voce at the end of every semester being conducted by all subject teachers, together assigning suitable credit from internal marks to be taken. This is intending to prepare and boost the student interview facing skills and comprehension of subject. This is proposed for PG courses.

ADIKAVI NANNAYA UNIVERSITY, RAJAMAHENDRAVARAM

M.Sc Botany - Course Structure

Paper Code	Title of the paper	L	T	P	Total (hrs)/ week	Duration Of Exam(hrs)	Max. Marks	Internal marks	Total Marks	Credits
SEMESTER - I										
Theory										
Core Paper 101	Biology and Diversity of Algae and Bryophytes	4	1	3	8	3	75	25	100	4
Core Paper 102	Biology and Diversity of Viruses, Bacteria and Fungi	4	1	3	8	3	75	25	100	4
Core Paper 103	Cell Biology of Plants	4	1	3	8	3	75	25	100	4
Core Paper 104	Cytology and Cytogenetics	4	1	3	8	3	75	25	100	4
Practicals										
Practicals 105	Biology and Diversity of Algae and Bryophytes					3	38	12	50	2
Practicals 106	Biology and Diversity of Viruses, Bacteria and Fungi					3	38	12	50	2
Practicals 107	Cell Biology of Plants					3	38	12	50	2
Practicals 108	Cytology and Cytogenetics					3	38	12	50	2
						Total Marks and Credits for I Semester			**600**	**24**
SEMESTER - II										
Theory										
Core Paper 201	Genetics	4	1	3	8	3	75	25	100	4
Core Paper 202	Molecular Biology of Plants	4	1	3	8	3	75	25	100	4
Core Paper 203	Biology and Diversity of Pteridophytes and Gymnosperms	4	1	3	8	3	75	25	100	4
Core Paper 204	Plant Cell, Tissue and Organ Culture	4	1	3	8	3	75	25	100	4
Practicals										
Practicals 205	Genetics					3	38	12	50	2
Practicals 206	Molecular Biology of Plants					3	38	12	50	2
Practicals 207	Biology and Diversity of Pteridophytes and Gymnosperms					3	38	12	50	2
Practicals 208	Plant Cell, Tissue and Organ Culture					3	38	12	50	2
						Total Marks and Credits for II Semester			**600**	**24**

Paper Code	Title of the paper	L	T	P	Total (hrs)/ week	Duration Of Exam(hrs)	Max. Marks	Internal marks	Total Marks	Credits
SEMESTER - III										
Theory										
Core Paper 301	Taxonomy of Angiosperms and Plant resource Utilization	4	1	3	8	3	75	25	100	4
Core Paper 302	Plant Development and Reproduction	4	1	3	8	3	75	25	100	4
Core Paper 303	Plant Ecology, Biodiversity and Conservation	4	1	3	8	3	75	25	100	4
Core Paper 304	Plant Physiology	4	1	3	8	3	75	25	100	4
Practicals										
Practicals 305	Taxonomy of Angiosperms and Plant resource Utilization					3	38	12	50	2
Practicals 306	Plant Development and Reproduction					3	38	12	50	2
Practicals 307	Plant Ecology, Biodiversity and Conservation					3	38	12	50	2
Practicals 308	Plant Physiology					3	38	12	50	2
Total Marks and Credits for III Semester									**600**	**24**
SEMESTER - IV										
Theory										
Core Paper 401	Genetic Engineering of Plants and Microbes	4	1	3	8	3	75	25	100	4
Core Paper 402	Evolution and Plant Breeding	4	1	3	8	3	75	25	100	4
Core Paper 403	Ecology and Environmental Biology	4	1	3	8	3	75	25	100	4
Core Paper 404	Plant metabolism	4	1	3	8	3	75	25	100	4
Practicals										
Practicals 405	Genetic Engineering of Plants and Microbes					3	38	12	50	2
Practicals 406	Evolution and Plant Breeding					3	38	12	50	2
Practicals 407	Ecology and Environmental Biology					3	38	12	50	2
Practicals 408	Plant metabolism					3	38	12	50	2
Project Presentation 409									100	4
Total Marks and Credits for IV Semester									**700**	**28**
Grand Total Marks and Credits for I,II,III & IV Semesters					**2500**	**100**				

L : Lecture hours; **T** : Tutorial hours; **P** : Practical hours

Scheme of Examination at the end of each semester

Theory Pass Minimum : 40 %

Practical Pass Minimum : 50 % (External 19 / 38 M & Internal 0 / 12 M = Total marks must be 25)

Aggregate : 50 %

SEMESTER - I

PAPER CODE: 101: BIOLOGY AND DIVERSITY OF ALGAE AND BRYOPHYTES

Theory

Algae

General account and criteria used in the classification of Algae with special reference to Fritsch system of classification.

General account on Structure and Reproduction of Chlorophyceae, Xanthophyceae, Bacillariophyceae, Phaeophyceae, Rhodophyceae and Myxophyceae.

UNIT- II

Economic importance of Algae, Single cell protein culture (Spirulina and Chlorella)

Cultivation of economically important seaweeds—*Porphyra, Gracillaria, Gelidium*.

Bryophytes

Morphology, Structure, Reproduction and Life history, Distribution, Classification and General account of Marchantiales, Jungermanniales, Anthocerotales.

Morphology, structure, reproduction and life history, distribution, classification, General account of Sphagnales, Funariales and Polytrichales.

Economic and ecological importance of Bryophytes.

Suggested Laboratory Exercises

1 Examination of vegetative and reproductive morphology of Chlophyceae members.

2 Examination of Thallus structure and reproductive bodies of Xanthophyceae, Bacillariophyceae and Phaeophyceae members.

3 Examination of external and internal structure and reproductive organs of Rhodophyceae and Cyanophyceae members.

4 Field work to get acquaintance with locally available algae.

Bryophytes

1 An examination of the external and internal structure and reproductive organs of the genera, *Riccia, Targionia,, Plagiochasma, Marchantia, Pellia, Porella, Anthoceras, Notothylus, Sphagnum, Funaria, Polytrichum.*

Suggested Readings & Text Books

1 Bold, H.C and Wyne.M.J. 1978. Introduction to the algae

2 Chapman, V.J.1962. The Algae

3 Graham, J.E, Lee W. Wilcox & L.E.Graham 2008. *Algae*. 2nd ed. Bejamin Cummings

4 Fritsch,F.E.1945. The structure and reproduction of Algae Vols. 1& II. Cambridge University Press, London

5 Kumar, H.D.1988.Introductory Phycology

6 Kashyap, S. 1929. Liverworts of the Western Himalayas and Punjab Plains Part I and Part II.

7 Lewin,R.A. 1962. Physiology and Biochemistry of Algae

8 Morris, I 1967. An Introduction to the Algae

9 Presscot, G.W. 1969. The Algae- a review

10 Bernard Goffinet & A. Jonathan Shaw. 2008. *Bryophyte Biology*. 2nd ed. Cambridge

11 Parihar, N.S. 1991. Bryophyta

12 Puri,P. 1980. Bryophytes

13 Round, E.E. 1986. The Biology of Algae

14 Round, E.E. 1962. Ecology of algae

15 Smith, G.M. 1955. Cryptogamic Botany Vol. II

Chopra, R.N. & P.K.Kumar, 1988. *Biology of Bryophytes*. Wiley Eastern.

PAPER CODE: 102: BIOLOGY AND DIVERSITY OF VIRUSES, BACTERIA AND FUNGI

Theory

UNIT - I

General account of Archaebacteria, Eubacteria and Cyanobacteria. Ultrastructure of Bacteria, Nutritional types (autotrophs and heterotrophs), Growth of Bacteria, Reproduction in Bacteria (transformation, transduction and conjugation) Economic importance.

UNIT – II

Ultrastructure and Chemistry of viruses, Isolation and purification of viruses, Replication and transmission of Viruses.

Mycoplasma like organisms and their role in carrying plant diseases. Diseases caused by Plant Viruses.

UNIT - III

Recent trends in Fungal classification, Ultrastructure of Fungal cell and Thallus organization in Fungi.

General account of Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina.

UNIT - IV

Reproduction in Fungi : Vegetative, Asexual and Sexual. Heterothallism, Heterokaryosis and Parasexuality.

Nutrition of Fungi : Saprobic, biotrophic, and symbiotic. Phylogeny of fungi

Fungi in industry, medicine and as food and as biocontrol agents. Mushroom cultivation

Suggested Laboratory Exercises

1. Morphological study of *Stemonitis, Saprolegnia, Mucor, Morchella, Aspergillus, Agaricus, Cyathus, Synchitrium, Helminthosporium*

2.Symptomotology of some diseased specimens – White rust, Powdery mildew, Green ear of Bajra, Rust of Wheat, Rust of Linseed, Tikka disease of ground nut, Red rot of sugarcane, Blast of rice, Citrus canker, and Tobacco mosaic disease.

3. Sterilization methods

4Preparation of media and stains

5. Gram staining of bacteria

Suggested Readings & Text Books

01. Kaursethi I and Surinder KW 2011. **Text Book of Fungi and their Allies.** Macmillan publishers, New Delhi, India.

02. Ram Reddy S & Reddy SM 2007. **Essentials of Virology.** Scientific publishers, Jodhpur, India.

03. Sharma K 2005. **Manual of Microbiology Tools and Techniques.** Ane Book, New Delhi, India.

04. Matthew RH 2004. **Plant virology.** 4th edition. Academic press an imprint of Elsevier, California, USA.

05. Prescott *et al.* 2003. **Microbiology**. McGraw Hill Education, New York.

06. Aneja KR 2003. **Experiments in Microbiology, Plant pathology and Biotechnology**. New Age International publishers, New Delhi.

07. Verma HN 2003. **Basics of plant Virology.** IBH publishing co. Pvt. Ltd., New Delhi.

08. Mehrotra KS and Aneja KR 2003. **An Introduction to Mycology**. New Age International Publishers, New Delhi.

09. Sullia SB and Shantharam S 2001. **General Microbiology**. Oxford and IBH publishing Co. Pvt. Ltd, New Delhi.

10. Reddy SM and Ram Reddy S 2000. **Microbiology a Laboratory Manual**. BSC Publishers and Distributors, Hyderabad.

11. Flint SJ, Enquist LW, Krug RM, Racaniello VR, Skalka AM 2000. **Principles of Virology, Molecular Biology, Pathogenesis and Control.** ASM press, Washington DC.

12. Rao AS 1999. **Introduction to Microbiology**. Prentice Hall of India Pvt. Ltd., Delhi.

13. Paul S 1995. **Bacteria in Biology, Biotechnology and Medicine**. 5th edition. John Wiley and son Ltd., UK.

14. Pelczar, Chan and Krieg 1993. **Microbiology.** 5th edition. McGraw Hill Education, New York.

15. *Stainer* RT, Ingraham JL, Wheelis ML and Painter PR 1987. ***General Microbiology***. 5th Edition. Macmillan, London.

16. Smith KM 1968. **Plant viruses**. Elsevier, New York.

17. Rangaswamy G 1962. **Bacterial Plant disease in India**. Asia Publishing House, Bombay.

18. Agrios, G.N. 2005. *Plant pathology*. 5th ed. Academic press.

19. Allen T. Bull.2004. *Microbial diversity and Bioprospecting*. ASM Press, Washington.

20. Brock, T.D. & Madigan. 1991. *Biology of Microorganisms*. Prentice-Hall.

21. Dube, R.C. & D.K.Maheswari 2005. *Microbiology*. S.Chand & Co. Ltd., New Delhi.

22. Gilbert, O.L.2000. *Lichens*. Collins New Naturalist.

23. Ainsworth, G.C. Sparrow, F.K. and Susman, A.S. 1973. The Fungi-An advances treatise, Vol. I to VIB.

24. Alexopoulus, C.J. Mims, C.W. and Blackwel, M. 1996. Introductory Mycology, John Wiley & Sons Inc.

25. Ananthanarayanan, R. and Dayaram Panikar, C.K. 1998. A textbook of Microbiology, VI edition Orient Longman

26. Carpenter, 1977. Microbiology

27. Clifton, A. 1958. Introduction to the Bacteria, McGraw-Hill Book Co. New York

28. Landecker, E.M. 1972. Fundamentals of the Fungi

29. Mehrota, R.S. and Aneja, R.S. 1998. An introduction to microbiology, Prentice Hall of India Pvt.Ltd., New Delhi.

PAPER CODE: 103: CELL BIOLOGY OF PLANTS

Theory

UNIT - I

The Cell theory : Origin and development of cell biology as a separate branch. Structure and organization of Prokaryotic and Eukaryotic cells. Specialized cell types.

Chemical Foundation: Macromolecules - Structure, shape and information. Non- covalent interactions in relation to function of Nucleic acids and Proteins. Biochemical energetics **:** Laws of thermodynamics as applicable to biological systems.

UNIT – II

Cell wall: Structure and functions, Cell wall architecture, Biogenesis and Growth.

Plasmodesmata : Structure and function, Plasmodesmata in comparison with gap junctions of animal cells.

Plasma membrane: Structure, models and functions, ATPases, Receptors, Carriers, Channels and Pumps. Vacuole structure and function, Vacuolar ATPases, Transporters.

Cytoskeleton: Microtubules and Microfilaments, their role in cell division and motility; Intermediate filaments role in providing strength.

UNIT - III

Chloroplast and Mitochondria **:** Structure and function, Genome organization, Nucleo-cytoplasmic interactions, RNA editing.

Other organelles **:** Structure and functions of Endoplasmic reticulum, Golgi apparatus, Lysosomes, Ribosomes, Microbodies and Peroxisomes.

UNIT - IV

Tools in cell Biology I - Microscopy : Working principles of Light Microscopy, Scanning Electron Microscopy, Transmission Electron Microscopy, STEM**.** Preparation of specimens for Microscopy **:** Freeze fracture and Freeze etching techniques.

Tools in Cell Biology II- Subcellular fractionation - Principles of centrifugation. Spectroscopic techniques: principles and applications of UV- visible, ESR, Nuclear Magnetic Resonance, Spectrofluorimetry, Circular Dichroism (CD).

Suggested Laboratory Exercises

1 Staining techniques – Study of mitosis using acetocarmine.

2 Isolation of mitochondria and the activity of its marker enzyme, Succinate dehydrogenase (SDM).

3 Isolation of chloroplasts and photographs SDS – PAGE technique and photographs - profile of proteins to demonstrate (2) the two subunits of Rubisco.

4 Isolation of nuclei and identification of histones by SDS-PAGE technique.

5 Fluorescence staining with FDA for cell viability and wall staining with calcofluor.

6 Immunofluorescence technique –observation of cytoskeleton.

7 Demonstration Photographs of SEM and TEM.

Suggested Readings & Text Books

1 Alberts B, Breyer D, Hopkin K, Johnson AD, Lewis J, Raff M, Roberts K and Watter P 2014. **Essential Cell Biology.** 4thEdition. Garland publishers, New York.

2 Sharp D, Ploppe G and Sikorski E 2014. **Lewin's Cells.** 3rd Edition. Viva Books, New Delhi.

3 Cooper GM, Hausman RE 2013. **The Cell – A Molecular Approach**. 6th Edition. Sinauer Associates, Incorporated, USA.

4 Karp G 2013. **Cell and Molecular Biology – Concepts and Experiments.** 7th Edition. Wiley Global Education, USA

5 McLennan A, Bates A, Turner P, White M 2013. **Bios Instant Notes in Molecular Biology.** 4th Edition. Garland publishers, New York.

6 Cowling G, Allen T 2011. **The Cell. A very Short Introduction**. Oxford University Press, USA.

7 Alberts B, Johnson A, Lewis J, Raff M, Roberts K, Walker P 2007. **Molecular Biology of the Cell.** 5th Edition. Garland publishers, New York.

8 Schaffer SW 2007. **Mitochondria: The Dynamic Organelle.** 1st Edition. Springer Verlag.

9 Wilson J, Hunt T 2007. **Molecular Biology of the Cell** 5th edition**. The Problems Book.** 2nd Edition. Garland publishers, New York.

10 Celis JE (ed) 2006. **Cell Biology–A Laboratory Hand Book.** 3rd Edition. Elsevier, USA.

11 Lodish H, Berk A, Kaiser CA, Kreiger M, Scott P M, Bretcher A, Ploegh H, Matsudaira P. 2004. **Molecular Cell Biology.** 5th edition. W. H. Freemanand Company, New York.

12 Alberts, B. Bray D. Lewis J. Ralf, M.Roberts, K. and Watson, J.D. 1999: Molecular Biology of the Cell, Garland Publishing Inc., New York.

13 De, D.N. 2000: Plant Cell Vacuoles. An Introduction. CSIRO Publication. Collingwood, Australia.

14 C.J. Avers 1986: Molecular Cell Biology. Addison Wesley Publishing Company.

15 Lodish, Berk A, Zipursky, S.L. Matsdaira P, Baltimore D and Darnell, J. 2000; Molecular Ce11 Biology (4th Edition) W.H. Freeman and Co., New York, USA.

16 Krishna Murthy, K.V. 2000: Methods in cell wall cytochemistry CPC Press, Boca Raton, Florida.

17 Kleinsmith, L.J. and Kish, V.M. 1995: Principles of Cell and Molecular Biology (2nd Edition) Harper Collins College Publishes, New York, USA.

PAPER CODE: 104: CYTOLOGY AND CYTOGENETICS

Theory

UNIT - I

Nucleus – Structure of nuclear membrane, Nuclear pore complex; Chromosome structure, molecular organization of chromatin, centromeres and telomeres; Special types of chromosomes (lampbrush, Polytene)

Chromosome identification - Karyotype analysis; Chromosome banding techniques; Flow cytometry and confocal microscopy in karyotype analysis; computer assisted karyotype analysis – chromosome micro-dissection and micro-cloning.

UNIT - II

Chromosomal structural aberrations – Origin, meiosis and breeding behavior of duplications, deficiencies and inversions and interchanges; types of inversions. Robertsonian translocations; Basic concept of Complex translocation heterozygotes

Chromosomal numerical aberrations I – Classification of numerical aberrations; Aneuploids– Trisomics (Primary, Secondary, Tertiary), Monsosomic and nullisomics – meiotic behavior and chromosome mapping

UNIT - III

Chromosomal numerical aberration II – Polyploids – Origin and production of auto and allopolyploids; Meiosis in autotetraploid ; Genome analysis in *Tobacco*, wheat and *Arabidopsis*

Nuclear DNA content – C-value paradox, hyperchromicity, Cot curves and significance- Molecular organization of nuclear genome

UNIT - IV

Cell Cycle and its regulation – check points, cyclins and cyclin dependent kinases, experimental control of cell division

Apoptosis - mechanism and significance; Initiation of cancer at cellular level – proto oncogenes and oncogenes

Suggested Laboratory Exercises

01. Observation and identification of meiotic stages.
02. Preparation of karyotypes and construction of idiograms
03. Observation of slides/photographs showing structural and numerical aberrations and chromosome banding.

Suggested Readings & Text Books

1 Singh RJ. 2014. **Plant Cytogenetics.** 2nd Edition.CRC Press, India
2 David M. Prescott. Cells. 1988. Jones and Bartlett Publ. Boston.
3 Gupta, P.K. 1995. Cytogenetics. Rastogi & Company, Meerut.
4 Pierce BA. 2013. **Genetics: A Conceptual Approach.** 5th Edition. W. H. Freeman, California.
5 Swanson, Merz and Young. Cytogenetics. Prentice Hall. India.
6 Sybenga, J. 1973. General Cytogenetics. North Hall and American Elsevier.

C. B. Powar. 1992. Cell Biology. Himalaya Publishers, New Delhi

Ajoy Paul. 2015. Text Book of Cell and Molecular Biology. Books and Allied Pvt, Ltd

De Robertis E.D.P and E.M.F. De Robertis. Cell and Molecular Biology 2001. CBS Publishers and Distributors.

Darnell, Lodish and Baltimore: Molecular Biology, Scientific American Books, New York

Bass H and Birchler J. 2011. **Plant cytogenetics: Genome structure and chromosome Functio** Springer, New York

SEMESTER – II
PAPER CODE: 201: GENETICS

Theory

UNIT - I

Concept of Genetic markers and their types – application of probability Laws of Mendelian principles. Chi-square testing for goodness of fit.

Allelic and gene interactions; Multiple allelism – Penetrance and expressivity – Pleiotropism, pseudoalleles, phenocopies

UNIT - II

Gene mapping methods based on test-cross and F_2 progenies; LOD score analysis; Tetrad analysis and its significance; somatic cell genetics and its use in mapping; correlation of genetic and physical maps; Sex-linked inheritance, sex-influenced and sex- limited characters

Recombination and its molecular mechanism; role of rec A,B,C,D enzymes; Holliday's model

UNIT - III

Mutations – types – molecular basis; site-directed mutagenesis – DNA damage and repair mechanisms; examples of inherited defects in DNA repair.

Multigene families and their organization and significance; Transposable elements in pro-and eukaryotes, Mechanism of transposition; significance of transposable elements

UNIT - IV

Mapping in bacteria and phages – methods using conjugation; Transformation and transduction; Fine structure analysis of gene - Benzer's work; concept of gene; Nature and variant forms of eukaryotic genes

Maternal inheritance – Distinction between nuclear and cytoplasmic types of inheritances-Distinction - Genetics of mitochondrial and chloroplast characters; Male sterility, types and significance

Suggested Laboratory Exercises

01. Observation of types of chlorophyll mutants.

02. Problems in Mendelian Genetics, Gene interactions and Epistasis,
Probability Laws and Chi-Square test
Chromosome Mapping and Tetrad Analysis

Suggested Readings & Text Books

01. William K, Cummings S, Spencer MR and Charlotte A. 2013. **Essentials of Genetics.** Pearson Books, Delhi.

02. Griffiths, A.J.F., Miller, H.T., Suzuki, Lewontin, Gelbart Intd. Genetic analysis, H.F. Freeman and Co.

03. Hartl, D.L. and Jones, E.W. 1998. Genetics: Principles and Analysis (4th edition) Jones and Bartlett Publishers, Massachusetts, USA.

04. Karp, G. 1999. Cells and Molecular Biology: concepts and Experiments. Hohn Wiley & Sons Inc. USA.

05. Lewin, B. 2000. Gene VII. Oxford University Press, New York, USA.

06. Lewis, R. 1997. Human Genetics: Concepts and Applications, WCB Mc Graw Hill, USA.

07. Malacinski, G.M. and Freifelder, D. 1998. Essentials of Molecular Biology (3rd edition). Jones and Bartlet Publishers Inc. London.

08. Russel PJ. 2009. **Genetics–A Molecular Approach.** 3rd Edition**.** Pearson Benjamin Cummings, San Francisco, USA.

09. Snustad, D.P. and Simons, M.J., 2000. Principles of Genetics John Wiley and Sons Inc., USA.

Brooker R. 2008. **Genetics, Analysis and Principles.** 3rdedition**.** McGraw Hill Science.

PAPER CODE: 202: MOLECULAR BIOLOGY OF PLANTS

Theory

UNIT - I

Composition and structure of Biomolecules: Carbohydrates, Lipids and Proteins (Ramachandran plot, domains, motifs and folds).

Nucleic acids, DNA structure and duplex model. A, B and Z forms of DNA. Types of small RNAs – Si RNA, micro RNA and catalytic RNA

UNIT - II

DNA replication, Semi-conservative, Semi-discontinuous and uni and bi directional mode of replication. RNA Priming, Enzymes for DNA replication Helicases, SSBs, Topoisomerases and Polymerases. Mechanism of DNA replication. Rolling circle and Theta mode of replication. Replication of ends of chromosomes

Transcription Promoters, Activators, Transcription factors and Mechanism of Transcription in Prokaryotes and Eukaryotes. Post Transcriptional modifications.

UNIT - III

Translation : Structure of tRNA, Ribosome as a Translation factory, Genetic code,Mechanism of Translation - Initiation, elongation and termination. Post translational modifications

Protein sorting and targeting of proteins into Chloroplasts, Mitochondria, Vacuoles and Peroxisomes. Protein trafficking.

UNIT – IV

Regulation of gene expression in Prokaryotes. Basic models: Lac, Arabinose and Tryp operons. Positive and Negative controls. Regulation in Viruses : Lytic and Lysogenic cycle.

Regulation of gene expression in Eukaryotes. Britten Davidson model. Role of chromatin in gene expression. DNA methylation. Temporal and spatial regulation. Gene silencing

Suggested Laboratory Exercises

01. Isolation of DNA from Onion bulbs/Banana

02. Isolation of DNA using CTAB method

03. Biochemical Tests of Carbohydrates, Proteins and Fats in the plant cells

04. Assignments on problems related to DNA replication, Transcription, Translation and Gene regulation

05. Electrophoresis of seed proteins

Suggested Readings & Text Books

01. Alberts, B, D. Bray, J. Lewis, M. Raff, K. Roberts and J.D.Watson. 2004. *Molecular Biology of the Cell Garland Publishing,* New York and London

02 Fritsch, E.F. and J. Sambrook.1992.*Molecular cloning: Laboratory Manual.* Maniatis, Cold Spring Harber Laboratory, New York).

03 George M. Malacinski & D.Freifeilder 2005. *Essentials of Molecular Biology.*

04 **04**. Schecleif, R.F. and P.C. Wensik 1991. *Practical Methods in Molecular Biology* Springer-Verlag.

05. Walker, J. and W. Castra. 1992. *Techniques in Molecular Biology*.Goom Helns, London.

06. Buchaman B.B., Gruissem, W ans Jones R.I. 2000. Biochemistry and Molecular Biology of plants: American Societies of plant physiologists, Maryland, U.S.A.

07. Gupta, P.K. 2002. Cell and Molecular Biology, 3rd Edition, Rastogi Publications, Shivaji Road, Meerut, India.

08. Glick, B.R. and Thompson J.E. 1932. Methods in Plant Molecular Biology and Biotechnology, CRC Press, Boc Raton Florida.

09. Lodish, B.A, Zipursky S.L, Matsdaira P, Baltimore D. and Darnell J. 2000. Molecular Cell Biology (4th edition). W.H. Freeman & co. New York, USA.

10. Lewin B, 2000. Genes VII Oxford University Press, New York.

11. Shaw, C.H. 1998. Plant Molecular Biology. A practical approach, IRL Press, Oxford.

12. R F Weaver 1999, Molecular Biology, WCB McGraw-Hill.

13. . Raghavan V. 1997. **Molecular Biology of Flowering plants.** Cambridge University press, New York, USA.

PAPER CODE: 203: BIOLOGY AND DIVERSITY OF PTERIDOPHYTES AND GYMNOSPERMS

Theory

Pteridophytes

UNIT - I

General characters and classification of Pteridophytes.

Salient features and classification of Psilophytosida (*Rhynia*), Psilotopsida (*Psilotum*), Lycopsida, (*Lycopodium*) Sphenopsida (*Equisetum*) and Pteropsida (*Pteris*).

UNIT - II

Origin and phylogeny of pteridophytes - Telome theory, Stelar Evolution, Heterospory and seed habit. Economic importance of Pteridophytes

Gymnosperms

UNIT - III

General account and classification of Gymnosperms

Geological periods, fossil formation and their types

General account of Pteridospermales, Bennettitales, Pentoxylales, Cordaitales

UNIT - IV

Structure and Reproduction of living Gymnosperms: Cycadales, Coniferales and Gnetales; their economic importance

Suggested Laboratory Exercises

Pteridophytes

01. Examination of the external features, anatomy and reproductive structures of *Psilotum, Lycopodium, Selaginella, Isoetes, Equisetum, Adiantum, Salvinia* and *Azolla.*

Observations of the slides of the following fossil plants: *Rhynia, Lepidodendron, Lepidocarpon, Miadesmia, Sphenophyllum, Calamites.*

Gymnosperms

02. Examination of the external features, anatomy (TS, TLS&RLS) and reproductive structures of *Ginkgo, Pinus, Cupressus, Cryptomeria, Araucaria, Ephedra* & *Gnetum*.

Study of fossil gymnosperms from prepared slides. Lyginopteris, Lagenostoma, Medullosa, Triganocarpus, Conostoma, Heterangium, Cordaites

Suggested Readings & Text Books

1. Arnold, C.A. 1974. An introduction to Paleobotany, New York
2. Agashe, S.N. 1995. *Palaeobotany*. Oxford & IBH, New Delhi.

3. Bhatnagar, S.P. & Alok Mitra 1997. *Gymnosperms*. New Age Int. (P) Ltd.
4. Charles C. Beck and Charles B. Beck (Ed.). 1988. *Origin and Evolution of Gymnosperms.* CUP.
5. Kramer, K.U., P. S. Green & Erich Gvtz. 2008. *Pteridophytes and Gymnosperms.* Springer.
6. Sambamurty AVSS. 2005. *A Textbook of Bryophytes, Pteridophytes, Gymnosperms and Paleobotany.* Ik International Pvt Ltd.
7. Vashista, P.C. 2005. *Gymnosperms*.S. Chand & Co, New Delhi.
8. Vashista, P.C. 2005. *Pteridophyta.* Rev. ed. By Sinha & Anil, S. Chand & Co, New Delhi.
9. Saxena P and Pathak C. 2012. **A Text Book of Pteridophyta.**, Wisdom Press, New Delhi.
10. Chamberlain, C.J. 1935. Gymnosperms structure and evolution, University of Chicago Press
11. Coulter, J.M. and Chamberlain, C.J. Morphology of Gymnosperms, Central Book Depot, Allahabad
12. Evans, A.J. 1936. Morphology of Vascular Plants (Lower groups) McGraw Hill Book Company, New York
13. Maheswari, P. and Vasil, V. Genetum CSIR (Monographs)
14. Parihar, N.S. 1996. Biology and Morphology of Pteridophytes, Central Book Depot, Allahabad
15. Sporne, K.R. 1962. The Morphology of Pteridophytes, Hutchinson University Library

PAPER CODE: 204: PLANT CELL, TISSUE AND ORGAN CULTURE

Theory

UNIT - I

Plant Cell and Tissue culture: Introduction, history, scope, Basic concepts of tissue culture: Tissue culture cycle, types of cultures. Concept of cellular differentiation, totipotency.

Culture media – composition and effects of media components; Phytohormones – effects in tissue culture; sterilization methods.

UNIT - II

Pathways of regeneration – biochemical and molecular aspects of tissue culture cycle.

Organogenesis and adventative embryogenesis, Fundamental aspects of morphogenesis, somatic embryogenesis. Methods of androgenic and gynogenic haploid production-dihaploids and application in agriculture embryo rescue.

UNIT - III

Cell culture: Establishment, plating efficiency, induction and selection of mutants. Production of secondary metabolites/natural products.

Somatic hybridization: protoplast isolation, fusion and culture, hybrid selection and regeneration, possibilities, achievements, limitations, merits and demerits and protoplasts in genetic transformation.

UNIT - IV

Applications of Plant tissue culture: Clonal propagation, Artificial seeds and its applications, Somaclonal variation and its applications.

Technique and applications of Cryopreservation and Germplasm storage.

Suggested Laboratory Exercises

01. General out lay of PTC laboratory
02. Preparation of media
03. Callus induction – Carrot
04. Clonal propagation through meristem cultures
05. Embryo culture – Ground nut
06. Anther culture – Datura/ Tobacco
07. Establishment of cell cultures and determination of growth pattern
08. Determination of Plating efficiencies of cell culture
09. Protoplast isolation and culture
10. Protoplast fusion
11. Observation of different developmental stages of somatic embryo in embryogenic callus
12. Artificial seed preparation

Suggested Readings & Text Books

01 Vasil IK and Thorpe TA. 1994. **Plant Cell and Tissue Culture.** Kluwer Academic Publishers, Dordrecht, Netherlands.

02 Kalyan Kumar De. 1997. *Plant Tissue Culture*. NCB Agency, Kolkata.

03 Pullaiah, T. 2009. Plant Tissue Culture. Scientific Publishers, Jodhpur.

04 Razdan, M.K. 2003. *An Introduction to Plant Tissue Culture*. Oxford & IBH, New Delhi

05. Bhojwani, S.S. and Razdan, M.K. 1996. Plant tissue culture: Theory and Practice (a revised edition) Elsevier Science Publishers, New York, USA

06. Bhojwani, S.S. 1990. Plant Tissue Culture: Applications and Limitations. Elsevier Science Publishers, New York, USA.

07. Callow, J.A. Ford-Lloyd, B.V. and Newbury, H.J. 1997. Biotechnology and Plant Genetic Resources: Conservation and use. CAB International, UK, Oxon

08. Collin, H.A. and Edwards, S. 1998. Plant Cell Culture, Bioscientific Publishers, Oxford, UK

09. Jain, S.M. Sopory, S.K. and Velleux, R.E. 1996. In Vitro Haploid production in Higher Plants, Volumes 1-5. Fundamental aspects and Methods Kluwer Publishers, Dordrechi, the Netherlands.

10. Kartha, K.K. 1985. Cryopreservation of Plant Cells and Organs CRC Press, Boca Roton, Florida, USA

11. Raghavan, V. 1986. Embryogenesis in Angiosperms: A Developmental and Experimental Study. Cambridge University Press, New York, USA

12. Raghavan, V. 1997. Molecular Biology of Flowering plants, Cambridge University press, New York, USA

13. Vasil, I.K. and Thorpe, T.A. 1994. Plant Cell and Tissue Culture. Kluwer Academic Publishers. The Netherlands

SEMESTER – III

PAPER CODE: 301: TAXONOMY OF ANGIOSPERMS AND PLANT RESOURCE UTILIZATION

Theory

Taxonomy of Angiosperms

UNIT-I

Taxonomic hierarchy, species, genus, family and other categories; Principles used in assessing relationship delimitation of taxa and attribution of rank; Species concepts
Nomenclature and ICBN Rules

UNIT - II

Systems of angiosperm classification: Phenetic versus phylogenetic system; Cladistics in taxonomy; relative merits and demerits of major systems of classification Takhtajan, Cronquist, Thorne and Dahlgren, APG system, α, and ω taxonomy

UNIT – III

Brief analysis of evolutionary tendencies: Ranales (Magnoliaceae, Nympheaeceae), Rosales (Fabaceae, Apiaceae), Centrospermae(Caryophyllaceae, Nyctaginaceae) Tubiflorae (Asteraceae, Lamiaceae) Amentiferae (Casuarinaceae,), Helobiales (Najadaceae, Anismataceae), Liliflorae (Liliaceae, Amaryllidaceae), Glumiflorae(Poaceae, Cyperaceae).
Modern trends in Taxonomy: Embryology, Palynology, Microanatomy, Cytology, Phytochemistry.

Plant Resources Utilization and Diversity

UNIT - IV

Origin, Evolution, Botany and uses of

1. Food Crops : Rice, Sugarcane, Maize
2. Pulses : Red gram, Black gram
3. Fibre Crops : Cotton, Sunhemp
4. Medicinal and aromatic crops : *Catheranthus, Withania, Cymbopogan*
5. Oil yielding crops : Groundnut, Castor, *Brassica*

Suggested Laboratory Exercises

Taxonomy of Angiosperms & Plant Resources Utilization and Diversity

01. Description of a Taxa /Species from representative and locally available families
02. Description of various species of a genus: Preparation of key character at genus level
03. Preparation of key characters and use of keys at family level
04. Field trips: Compilation of field notes and preparation of herbarium wild or cultivated
05. Training in using floras and herbaria for identification of specimens wild and cultivated
06. Taxonomic description of the following cultivated Crops

1. Food crops : Rice, Maize
2. Pluses : Red gram, Black gram
3. Fiber crops : Cotton, Sunhemp
4. Oil yielding : Groundnut , Castor, *Brassica*
5. Medicinal & Aromatic : *Catheranthus, Eucalyptus*

Suggested Readings & Text Books

Taxonomy of Angiosperms

01 Cole, A.J. 1969. Numerical Taxonomy, Academic Pree, London

02 Davis, P.H. and Heywood, V.H. 1973. Principles of Angiosperms Taxonomy. Robert E Kreiger Pub. Co., New York

03 Harrison, H.J. 1971. New concepts in Flowering Plant Taxonomy, Hieman Educational Books Ltd., London

04 Simpson MG. 2006. **Plant Systematics**. Elsevier Academic Press, California, USA

05 Heywood, V.H. and Moore, D.M. 1984. Current concepts in Plant Taxonomy, Academic Press, London

06 Nordenstam BEI, Lazily G and Kassas M. 2000. **Plant systematic for 2nd Century.** Portland Press Ltd., London.

07 Jones, S.B. Jr. and Luchsinger, A.E. 1986. Plant Systematics (2 nd Edition) McGraw Hill Book Co., New York

08 Angiosperm Phylogeny Group website. 2012. consult www.apgweb.

09 Heywood, V.H., RK Brummitt, A. Culham, O. Seberg 2007. *Flowering Plant Families of the World.* Firefly books Ltd. New York.

10 Judd, W.S, Christopher S. Campbell, Elizabeth A. Kellogg, Peter F. Stevens, and Michael J. Donoghue. 2007. *Plant Systematics: A Phylogenetic Approach*, 3rd ed. Sinauer.

11 Lawrence, G.H.M 1951. *Taxonomy of vascular plants.* McMillan, New York.

12 Simpson, Michael G. 2006. *Plant Systematics*. Elseiver& Academic Press.

13 Sivarajan, V.V.1991. *Introduction to principles of Plant Taxonomy.* Oxford & IBH.

Plant Resources Utilization and Diversity

01. Baker, H.G. 1978. Plants and Civilization (3rd Edition) C.A. Wadsworth, Belmont Chrispeels, M.J. and Sadava, D. 1977. Plants, Food and People. W.H. Freeman and Co., San Francisco

02. Cinway, G. 1999. The Doubly Green Revolution. Food for All in the 21st Century, Penguin Books.

03. Council of Scientific & Industrial Research 1986. The useful plants of India. Publications and Information Directorate. CSIR, New Delhi

04. Council of Scientific & Industrial Research (1948-1976). The Wealth of India. A Dictionary of Indian Raw materials and Industrial products, New Delhi, Raw materials I - XII Revised Vol. I-III (1985-1992) supplement (2000).

05. Pinstrup – Anderson, P. et al. 1999. World Food Prospects: Critical Issues for the Early 21st Century. International Food Policy Research Institute, Washington, D.C., USA.

06. Paroda, R.S. and Arora, R.K. 1991. Plant Genetic Resources Conservation and Management. IPGRI (Publication) South Asia Office, C/o. NBPGR Pusa Campus, New Delhi

PAPER CODE: 302: PLANT DEVELOPMENT AND REPRODUCTION

Theory

Plant Development

UNIT - I

Tissues: Simple and complex tissues. Epidermis- stomata, trichomes. Secretory cells

Shoot Development : Organization of the shoot Apical meristem [SAM]; cytological and molecular analysis of SAM. Leaf Growth and Differentiation: Differentiation of epidermis and mesophyll.

UNIT - II

Root Development: Organization of root apical meristem [RAM], Tissue differentiation; Lateral roots and root hairs, Root microbe interactions.

Cambium: Structure, cell types and development of vascular cambium, Cork cambium - structure of its derivatives; bark. Anomalous secondary growth in dicot and monocot stems

Vascular Tissue Development: development and structure of Primary Xylem, Primary Phloem, Secondary Xylem, Secondary Phloem

Reproduction

UNIT - III

Male Gametophyte: Structure of anther; microsporogenesis; Types and role of tapetum; pollen development, Sperm dimorphism; Pollen embryo sacs.

Female Gametophyte: Types of Ovule, development of Ovule, Megasporogenesis, Types of Embryo sacs, Organisation of Embryo sac ; ultra structure of the embryo sac cells.

Pollination, Pollen-pistil interaction: Structure of pistil; pollen-stigma interactions; self-incompatability, different methods to overcome self-incompatability.

UNIT - IV

Fertilization: Pollen germination; pollen tube growth and guidance; Entry of pollen tube into the embryo sac; pollen tube discharge, syngamy and triple fusion; polyspermy and hetero fertilization.

Post-fertilization events: Endosperm development; Types of Endosperm; Functions; Endosperm and embryo relationships, Embryo development: Johanson and Soueges system types. Polyembryony; Apomixis; Parthenocarpy, Seed dormancy.

Suggested Laboratory Exercises

Plant Development

01. Microscopic studies of Leaf Anatomy: *Nerium, Maize* observation of trichomes, glands. Study of C_3 and C_4 plant anatomy

02. Study of Stomatal types and determination of Stomatal frequency and Stomatal Index

03. Study of wood anatomy, macerations and sections, T.S., T.L.S. and R.L.S

04. Study of anomalous growth of stems: *Aristolochia, Achyranthes, Bignonia, Boerhaavia, Leptodenia* and *Dracaena*

Reproduction

01. Study of microsporogenesis and gametogenesis in anthers

02. Tests for pollen viability using stains and in vitro germination

03. Slide preparation of Embryo sac

04. Slide preparation of nuclear and cellular endosperm

05. Tests for Seed viability

Suggested Readings & Text BooksPlant Development

01. Bailey, J.D. and Black, M. 1994. Seeds: Physiology of development and Germination, Plenum Press, New York.

02. Fahn, A. 1982. Plant Anatomy. (3rd edition). Pergamon Press, Oxford
03. Fosket, D.E. 1004. Plant Growth and Development. A Molecular approach. Academic Press, San Diego
04. Howell, S.H. 1998. Molecular Genetics of Plant Development Cambridge University Press
05. Lyndon, R.F. 1990. Plant Development. The Cellular Basis. Uni Hyman, London
06. Mauseth, J.D. 1988. Plant Anatomy. Benjamin Cummings. California
07. Pullaiah, T., Naidu, K.C., Lakshminarayana, K and Hanumantha Rao, B. 2007. Plant Development. Regency Publications, New Delhi
08. Salisbury, F.B. and Ross, C.W. 1992. Plant Physiology (4th edition) Wordsworth Publishing, Belmont, Calfornia
09. Steeves, T.A. and Susses, I.M. 1989. Patterns in Plant Development (2nd edition), Cambridge University Press, Cambridge
10. Waisel, Y., Eshel, A. and Kafkaki, V. (eds) 1996. Plant Roots: the Hidden Hall (2nd edition). Marcel Dekker, New York

Reproduction

01. Johri, B.M 1984. *Embryology of Angiosperms* springer-Veriag. Berlin
02. Johri, B.M. 1981. *Experimental embryology of vascular plants*. Springer Verlag, Berlin
03. Maheshwari, P. 1980. An introduction to the Embryology of Angiosperms, Tata,mccrawin
04. Bhojwani, S.S and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4^{th} revised and enlarged edition) Vikas Publishing House, New Delhi
05. Leins, P., Tucker, S.C. and Endress. P.K. 1988. Aspects of Floral Development. J. Cramer, Germany
06. Procter, M. and Yeo, P. 1973. The Pollination of Flowers. William Collins Sons, London
07. Pulliah, T., Lakshminarayana, K and Hanumantha Rao, B., 2008. Plant Reproduction, Scientific Publishers, Jodhpur, India
08. Raghavan, V. 1997. Molecular Embryology of Flowering Plants. Cambridge University Press, Cambridge
09. Raghavan, V. 1999. Developmental Biology of Flowering Plants. Springer – Verlag, New York
10. Sedgely, M. and Griffin, A.R. 1989. Sexual Reproduction of Tree Crops, Academic Press, London
11. Shivanna, K.R. and Swahney, V.K. (Eds.) 1997. Pollen Biotechnology for Crop Production and Improvement. Cambridge University Press, Cambridge
12. Shivanna, K.R. and Rangaswamy, N.S. 1992. Pollen Biology, A Laboratory Manual. Springer-Verlag, Berlin
13. Shivanna, K.R. and Johri, B.M.1985. The Angiosperm Pollen Structure and Function, Wiley Eastern Ltd., New Delhi
14. The Plant Cell. Special Issue on Reproductive Biology of pants, Vol.5 (10) 1993. The American Society of Plant Physiologists, Rockville, Maryland, USA

PAPER CODE: 303: PLANT ECOLOGY, BIODIVERSITY AND CONSERVATION

Theory

UNIT - I

Ecology – A synthetic approach. Major biomes and Vegetational patterns of the World. Major Vegetational and Soil types of India.

Community ecology: Methods of study of plant communities, qualitative study of plants communities. Stratification of Life forms and physiognomy, normal biological spectrum.

UNIT - II

Quantitative study of plant communities, distribution pattern frequency, density, canopy, basal area and cover

Synthetic characters of Community, Similarity Index, general account of classification of communities

Population Ecology: Population structure, characteristics of population; population density, Natality, Mortality, Age distribution, Biotic potential, Population growth forms and curves. Population fluctuation and population dispersal

UNIT - III

Plant Biodiversity: Concept, Status in India, Utilization and concerns, World Centers of primary diversity of domesticated plants. The Indo Burmese Centre, plant introduction and secondary centers.

UNIT - IV

Principles of Conservation: Strategies for conservation, *in situ* conservation, protected areas in India- Biosphere reserves, wetlands, mangroves, conservation of wild biodiversity, strategies for conservation – *ex situ* conservation. Principles and practices. Botanical gardens, BSI, ICAR and CSIR.

Suggested Laboratory Exercises

1. study vegetation in the botanical gardens
2. To prepare life forms of local botanical gardens and prepare a biological spectrum
3. To determine the minimal size and number of quadrates required for reliable estimate of biomass in grass land
4. Quantitative analysis of vegetation: relative frequency, density, relative density, basal area and IVI
5. To estimate rate of Carbon dioxide evolution from different soils using soda lime or alkali absorption method
6. Scientific visits:

A protected areas or Biosphere reserve or national park or sanctuary

A wetland, Mangrove, NBPGR (National Bureau of Plant Genetic Resources – New Delhi)

BSI, CSIR Laboratories, FRI and Tropical Botanical Gardens

Suggested Readings & Text Books

01. APHA – Standard Methods for the Examination of Water and Waste Water. American Public Health Association, Washington, DC

02. Frankel, OH. Brown, A.H.D. & Burdon, J.J. 1995. The conservation of Plant Diversity, Cambridge University Press, Cambridge, UK

03. Krebs, C.J. 1989. Ecological Methodology. Harper and Row, New York, USA

04. Ludwig, J.A. and Reynolds, J.F. 1988. Statistical Ecology. Wiley, New York

05. Magurran, A.E. 1988. Ecological Diversity and its measurement. Chapman and Hall, London

06. Moore, P.W. and Chapman, S.B. 1986. Methods in Plant Ecology Blackwell Scientific Publication
07. Molles, M.C. 2005. Ecology-concepts and applications. Mc GrawHill. Boston
08. Muller – Dombois, DD. And Ellenberg, R. 1974. Aims and Methods of Vegetation Ecology, Wiley, New York

09. Begon Michael, Colin Townsend & John L. Harper. 2005. Ecology, From Individuals to Ecosystems. 4th ed.Black well Publishing, Oxford.
10. Odum.E.P. & Gary W.Barrett. 2005. Ecology.Tomson Brooks/Cole, Singapore.
11. Sokal, R.R. and Rohit, F.J.1995. Biometry. W.H. Freeman & Co., San Francisco
12. Cunningham, W.P. & M.A.Cunningham 2007. Principles of Environmental Science-Inquiry and applications. Tata Mc GrawHill Pub.New Delhi.
13. Heywood, V.M. and Watson, R.T. 1985. **Global Biodiversity Assessment**, Cambridge Univ. Press, Cambridge.
14. Ricklefs, R,E. &Gary L. Miller. 2000.*Ecology*. 4th ed. W.H. Freeman and Company. New York
15. Richard T. Wight 2005. Environmental Scence. 9th ed. Pearson Prentice Hall. New Delhi.
16. Given, D.R.. 1995. Principles and practice of plant conservation. Timber Press, Oregon
17. Jensen, John R. 2007. Remote Sensing of the Environment: An Earth Resource Perspective.PHI.
18. Krishnamurthy, K.V. 2004. *Advanced Textbook On Biodiversity: Principles And Practice*. Oxford
19. Sabins, F.F.2007. Remote Sensing-principles and interpretation. 3rded. Waveland Press Inc

PAPER CODE: 304: PLANT PHYSIOLOGY

Theory

UNIT - I

Plant water Relations: Thermodynamic concepts of plant water relations, free energy and chemical, osmotic and water potential, active and passive absorption of water, stomatal physiology and stomatal opening and closing, Soil-plant-atmosphere-continuum concept (SPAC) and mechanism of water transport

Mineral Nutrition: Passive and active uptake of ions, translocation of minerals in plants, essential elements, their functions and symptoms of mineral deficiency, importance of foliar nutrition and use of chelates in agriculture, root microbe interactions in facilitating nutrient uptake and mechanism of assimilation

UNIT - II

The physiology of flowering: Phytochrome structure, photochemical and biochemical properties and role in photomorphogenesis, photoperiodism and its significance, mechanisms of floral induction, role of vernalization, morphological, biochemical and metabolic changes accompanying seed germination, causes and methods of breaking seed dormancy

UNIT - III

Plant growth regulators and Elicitors: Biosynthesis, physiological effects and mechanism of action auxins, gibberellins, cytokinins, ethylene, abscisic acid, brassinosteroids, polyamines, jasmonic acid and salicylic acid, role in agri-horticulture, and hormone receptors

UNIT - IV

Stress Physiology: Plant responses to biotic and abiotic stress, mechanisms of biotic and abiotic stress tolerance, water deficit and drought resistance, salinity stress, metal toxicity, heat stress and oxidative stress

Suggested Laboratory Exercises

01. Effects of high and low temperatures on the permeability of the cytoplasmic membranes
02. Determination of suction force in transpiration
03. Stomatal frequency and Stomatal index of leaves
04. Rate of transpiration in leaves by Cobalt chloride paper method
05. Mechanism of opening and closing of stomata

Suggested Readings & Text Books

01. Sinha SK 2014.**A text book of Plant Physiology.** Centrum Press, New Delhi.
02. Seema Yadav 2014. **Plant Physiology.** SBW publishers, New Delhi.
03. Heribert H and Kazuo S (eds) 2010. **Plant responses to abiotic stress. Series Topics in Current Genetics, Vol 4.** Springer, Berlin.
04. Philip Stewart and Schine Gobig 2011. Plant Physiology. CRC Press.
05. Moore TC. 2011. **Biochemistry and Physiology of Plant Hormones**. Springer, New York.
06. Mohr H and Schopfer P. 1995. **Plant Physiology**. Springer-Verlag, New York.
07. Witham FH and Devlin RM. 1986. **Plant Physiology.** CBS Publishers and Distributors, Bangalore.
08. Wilkins MD. 1987. **Advanced Plant Physiology**. English Language Book Society, Longman Scientific and Technical, Harlow, UK.
09. Ting IP. 1982. **Plant Physiology**. Addison-Wesley, Reading, MA.

10. Murthy HNK. 1981. **Plant growth substances including applications in Agriculture**. Tata McGraw Hill Publishing Company Ltd., New Delhi.

11. Kramer PM and Kozlowski TT. 1980. **Physiology of Woody Plants**. Academic Press, New York.

12. Hillman WS. 1963. **Physiology of Flowering.** Holt, Reinhart and Winston, New York.

13. Kocchar and Gujral. 2012. Comprehensive Plant Physiology. McMilan Pub.

14. Salisbury F. B. & C. W. Ross 1992 *Plant Physiology*. 4 th Edn. Wadsworth Publishing Co., Belmout, California.

15. Wiltmer, C.M. & M. Fricker. 1996. *Stomata*. 2nd Ed. Chapman Hall. U. K.

16. Audus, L.J. 1972. Plant Growth Substances, Volume 1. Chemistry and Physiology. Leonard Hill, UK

17. Bewley, J.D. and Black, M. 1982. Physiology and Biochemistry of seed in relation to germination and dormancy. Volume 1& 2, Springer – Verlag, Berlin

18. Devlin, R.M. and Witham, F.H. 1986. Plant Physiology

19. Davies, P.J. (Ed) 1987. Plant hormones and their role in Plant Growth and Development. Mertinus Nijh off Publishers, The Netherlands

20. Epstein, E. 1972. Mineral nutrition of plants, Principles and prospectus, John Willey&Sons, INC, New York

21. Frank Boyer Salisbury, Cleon Ross. Plant Physiology, 5th Edition.

22. Hess, D. 1974. Plant Physiology

23. Hewit, E.J. and T.A. Smith, 1975. Plant Mineral Nutrition

24. Hooykaas, P.J.J., Hall, M.A. and Libbenga, K.R. (Eds.) 1999. Biochemistry and Molecular Biology of Plant Hormones, Elsevier, Amsterdam, The Netherlands

25. Hopkins, W.G. 1995. Introduction to Plant Physiology. John Wiley & Sons Including New York, USA

26. Hopkins, W.G. 2009. Introduction to Plant Physiology. John Wiley & Sons Including New York, US, 4th Edition.

27. Konrad Mengel, Ernest A. Kirkby, Harald Kosegarten, Thomas Appel. Principles of Plant Nutrition, 5th Edition

28. Khan, A.A. 1982. The Physiology and Biochemistry of Seed Development, Dormancy and Germination. Elsevier, Amsterdam, The Netherlands

29. H.N. Krishna Murthy. 1981. Plant growth substances including applications in Agriculture. Tata McGraw – Hill Publishing Company Ltd

30. Irwin P. Ting, Plant Physiology, 1982, Addison-Wesley Publishing Company.

31. Leopold, A.C. 1964. Plant growth and development. Mc Graw Hill Book Company, Inc, New York.

32. Meyer, A.M. and A. Poljakoff Mayber. 1975. The germination of Seeds

33. Noggle, G.R. and G.J. Fritz. 1991. Introductory plant physiology (2nd edition) Prentice hall of India Limited

34. Salisbury, F.B. and Ross, C.W. 1992. Plant Physiology (4th edition). Wordsworth Publishing Company, Belmont, California, USA

35. Slayter, R.O. 1967. Plant Water Relationships. Academic Press, New York

36. Sutcliffe, J.F. 1962. Mineral slats absorption in plants, Bergamen, Press, Oxford, London

37. Taiz, L. and Zeiger, E. 1998. Plant Physiology (2nd edition). Sinauer Associates including Publishers, Massachusetts, USA

38. Thomas and Vince – Prue, D. 1997. PhotoPeriodism in Plants (2nd edition). Academic Press, Sandeigo, USA

39. Wilkins, M.D. 1987. Advanced Plant Physiology. English Language Book Society, Longman

40. Wisthoff, P. 1998. Molecular Plant Development from Gene to Plant. Oxford University Press, Oxford, UK

SEMESTER – IV

PAPER CODE: 401: GENETIC ENGINEERING OF PLANTS AND MICROBES

Theory

UNIT – I

Basics of rDNA technology: Restriction enzymes: Types, Nomenclature, Mechanism of action: Methodology of rDNA molecule synthesis: Polylinkers. Vectors: Features and types: Cloning vectors - Plasmids, Viral DNA, Cosmids, Artificial chromosomes - Bacterial and Yeast artificial chromosomes(BACs and YACs); Expression vectors

Bacterial transformation, *In-vitro* packaging, Recognition of transformants: Antibiotic resistance, Lac Z gene based selection. Genomic library, cDNA library

UNIT - II

Blotting techniques: Southern, Northern and Western blotting, Properties of radio isotopes. Carbon, Phosphorus and Sulphur: *In–situ* Hybridization: Radioactive and non–radioactive probes: Enzyme and fluorescence detection methods (FISH), Types and Applications of PCR technique. DNA sequencing: Basic principle of Sanger's method, sequencing genomes Automated DNA sequencing, High throughput DNA sequencing; Sequencing genomes: Whole genome, Shot gun sequencing.

UNIT - III

DNA fingerprinting: RFLP; RAPD, AFLP; Chromosome mapping, Restriction maps and Genetic markers, QTL mapping analysis; Introgression of useful traits using DNA markers. Microarray and its applications

Methods of gene transfer in plants: Physical and Biological methods. *Agrobacterium* mediated: Binary and co integrative vector based. Chloroplast transformation.

UNIT - IV

Transgenic plants: Fungal, Bacterial, Viral and Insect tolerant (BT and proteinase inhibitors) transgenics. Herbicide tolerate, Abiotic stress tolerate, Male sterility: Barnase-Barstar.

Quality improvement: Golden rice, Late ripening tomatoes (Flavr Savr)

Genetic improvement of industrially important microbes as Biopesticides, Biofertilizers and Antibiotics

Applications of Bioinformatics in Genetic engineering and their importance. IPRs, Ethical and Environmental issues

Suggested Laboratory Exercises

01. Isolation of plasmid DNA
02. Bacterial transformation and identification of transformation
03. Restriction enzyme digestion and gel electrophoresis
04. Genetic engineering assignments

Suggested Readings & Text Books

01. Glick BR, Pasternak JJ and Patten CL. 2010. **Molecular Biotechnology Principles and Applications of rDNA.** ASM Press, USA.

02. Attwood TK, Smith DJP and Phukan S. 2009. **Introduction to Bioinformatics**. Pearson Education Ltd., UK.

03. Watson JD. 2007. **Recombinant DNA: Genes and Genomes: A short course**. W. H. Freeman, USA.

04. Lewin B. 2004. **Genes VIIII**. Pearson Prentice Hall, New Jersey.

05. Balasubramanian, D. 2005. *Concepts of Biotechnology* New edition.
06. .Old and S.B. Primrose. 2002. *Principles of Gene Manipulation* by Blackwell, Oxford.
07. Brown, T.A. 2002. *Gene cloning – DNA Analysis* – Blackwell, London.
08. Davies, J.A. and WS Reznikoff. 1992. *Milestones in Biotechnology.*
09. Glick and Pasternock 2002. *Molecular Biotechnology*, Panima
10. Mickloss, D.A. and GA Freyer 1990. *DNA Science. A first Course in Recombinant Technology,* Cold Spring Harbor Laboratory Press, New York.
11. Primrose, S.B. 1994. *Molecular Biotechnology* (2nd Edn), Blackwell Scietific Pub. Oxford.
12. Sambrook, J., E. Frisch and T. Maniatis 2000. *Molecular Cloning: Laboratory manual ,* Cold Spring Harbor Laboratory Press New York.
13. Satyanarayana U. 2005 *Biotechnology*.
14. Glick BR, Pasternak JJ and Patten CL. 2010. **Molecular Biotechnology Principles and Applications of rDNA.** ASM Press, USA
15. Benjamin Lewin , Genes X 2004 Pearson Prentice Hall International Edition
16. Channarayappa, Molecular Biotechnology Principles and practices 2006 University
17. Chawla, H S. 2002. Introduction to Plant Biotechnology Oxford and I B H Publlishers
18. Primrose, S B and RM Twyman 2006. Principles of Genome Analysis and genomics Blackwell publishers
19. Sateesh, M K. 2008.Bioethics and Biosafety I K International

PAPER CODE: 402: EVOLUTION AND PLANT BREEDING

Theory

UNIT - I

Origin of life and Unicellular evolution – Origin of basic biological molecules – abiotic synthesis of monomers and polymers – Concept of Oparin and Haldane, Evolution of prokaryotes and eukaryotes.

Theories of organic evolution – Darwinism, Synthetic theory, Phyletic gradualism, Punctuated equilibrium; Molecular evolution – Concepts of neutral evolution, molecular divergence and molecular clocks – protein and nucleotide sequence analysis; gene duplication and divergence

UNIT – II

Natural Selection; Reproductive isolation – types and species concept; Hardy Weinberg equilibrium and applications

Polygenic inheritance, heritability and its measurements

UNIT - III

Origin of cultivated plants; evolution of wheat and maize; Plant introduction, Germplasm banks.

Methods of breeding self and cross pollinated plants; breeding of vegetatively propagated crops; Heterosis and Hybrid Vigour – genetic basis and significance

UNIT - IV

Biostatistical Methods: Basic concept of Parametric and non-parametric methods; - Graphical representation, measures of central tendency and dispersion; Probability distributions (Binomial, Poisson and Normal distributions); types of error, levels of significance, t-test, X^2 – test, ANOVA.

Suggested Laboratory Exercises

01. Assignment containing problems on topics mentioned in the theory syllabus
02. Floral biology
03. Pollination mechanisms
04. Breeding techniques of Rice, Maize, Sorghum, Bajra, Brassica, Chilli and Solanum

Suggested Readings & Text Books

01. Allard, R.W. 1961: Principles of Plant Breeding
02. Briggs and Knowles, Introduction to Plant Breeding
03. Jones & Wilkins – Variation and adaptation in plant species. Heinemann Educational Books Ltd., London
04. James L Brew Baker, Agricultural Genetics, Foundation of Modern Genetics Series
05. Kenneth J Frey, Breeding, Univ. Press, Ames, Iora
06. Poehiman and Borthakur, 1981. Breeding Asian field crops
07. Stebbins, J.L. – Chromosomal evolution in Higher Plants. Edward Arnold Publishers Ltd., London
08. Singh, B.D.: Plant Breeding
09. Stickberger, M.W., Genetics, Macmillan Company, New York

PAPER CODE: 403: ECOLOGY AND ENVIRONMENTAL BIOLOGY

Theory
UNIT - I

Ecosystem organization: Structure and functions of Ecosystem, Management, Stability, Complexity, Dynamics, Homeostasis (Forest, Grassland, Freshwater, Ecosystems) Ecological efficiencies, Energy Dynamics, Trophic organization, Energy flow pathways
Litter falls and decomposition (mechanism, substrate quality and climate factors). Global biogeochemical cycles of C, N, P, S and H_2O.

UNIT - II
The role of biodiversity in Ecosystem functions and stability, speciation and extinction, IUCN categories of threat, distribution and global patterns of terrestrial bio-diversity
Air, Water and Soil pollution; kinds, sources, quality parameters, effects on plants and ecosystems.

UNIT - III
Ecosystem stability: Concept (resistance and resilience) ecological perturbations (Material and anthropogenic) and their impact on plants and ecosystems
Environmental impact assessments. Ecosystem restoration. Primary production and estimation.

UNIT – IV
Climate change: Greenhouse gases (CO_2, CH_4, NO_2, CFCS sources trends and role) Ozone layer, Ozone hole and consequences of climate change (CO_2, fertilization, global warming, sea level rise, UV radiation)
Composition of soil. Factors affecting soil formation and soil profile (Laterization podosolization, gleixation, mineralization and soil classification, soil water, soil solution). Soil organic matter or humus and soil organisms

Suggested Laboratory Exercises

01. Estimation of Carbon footprint in the campus
02. Estimation of biomass of crop plants
03. Estimation of Chlorophyll
04. Determination of leaf area index
05. To determine the water holding capacity of soil moisture content

Suggested Readings & Text Books

01. Cunningham, W.P. & M.A.Cunningham 2007. Principles of Environmental Science-Inquiry and applications. Tata Mc GrawHill Pub.New Delhi
02. Dash, M.C.2009. Fundementals of Ecology. Tata Mc GrawHill Pub.New Delhi
03. Horpes and Row, N.Y; Batra, N.K. & Sharma, K.K. 1990. A Treatise on Plant Ecology. Pradeep Publications
04. Molles, M.C. 2005. Ecology-concepts and applications. Mc GrawHill. Boston
05. Odum.E.P. & Gary W.Barrett. 2005. *Ecology*.Tomson Brooks/Cole, Singapore
06. Misra, K. C. D.N. Rao, R.S; Ambasht and Mukherjee. Ecology study of ecosystems
07. Odum, E.P. 1971. Fundamentals of Ecology (3rd Edition), Saunders & Co., Philadelphia
08. Sharma, P.D. 2001. Ecology and Environment
09. Sharma, P.D. 2nd Edition, Environmental Ecology

PAPER CODE: 404: PLANT METABOLISM

Theory

UNIT - I

Fundamental of Enzymology: General aspects, allosteric mechanism, regulatory and active sites, isozymes, mechanism of enzyme action, kinetics of enzymatic catalysis, Michaelis-Menten Equation and its significance

Signal transduction: Receptors and G protein, Phospholipid signaling, role of cyclic nucleotides, Calium-calmodulin cascade, diversity in protein kinases and phosphatases, Two-component sensor-regulator system in bacteria and plants, source sensing mechanism

UNIT - II

Photochemistry and Photosynthesis: General concepts and historical back ground, evolution of photosynthetic apparatus, Redox reactions, photosynthetic pigments and light harvesting complexes, photooxidation of water, mechanisms of electron and proton transport, structure, synthesis and function of ATP, Carbon assimilation-the Calvin cycle, photorespiration and its significance, C_4 cycle and CAM pathway, biosynthesis of starch and sucrose, physiological and ecological considerations

UNIT - III

Respiration and Lipid metabolism : Plant respiration, glycolysis, TCA cycle, electron transport and ATP synthesis, pentose phosphate pathway, glyoxylate cycle, alternative oxidase system, structure and function of lipids, fatty acid biosynthesis of membrane lipids, structural lipids and storage lipids and their catabolism

UNIT - IV

Nitrogen fixation and nitrogen metabolism: Biological nitrogen fixation, nodule formation and nod factors, biosynthesis of amino acids and proteins, mechanism of nitrate uptake and reduction, ammonium assimilation, sulphate uptake, transport and assimilation

Suggested Laboratory Exercises

01. Determination of amylase activity
02. Extraction and separation of chloroplast pigments by paper chromatographic method
03. Determine chlorophyll a / chlorophyll b contents in C_3 and C_4 plants by spectrophotometric method
04. Determination of catalase activity
05. Demonstration of Polyphenol oxidase
06. Determination of reducing sugars
07. Estimation of free acids in *Bryophyllum* in terms of milliequivalents of NaOH
08. Extraction and estimation of seed proteins depending upon the solubility
09. SDS – PAGE for soluble proteins extracted from the given plant materials
10. Separation of amino acids and carbohydrates through two dimensional chromatographic method

Suggested Readings & Text Books

01. Bob B. Buchanan, Wilhelm Gruissem, and Russell L. Jones. 2002. Biochemistry and molecular biology of Plants
02. Devlin, R.M. and Witham, F.H. 1986. Plant Physiology
03. Frank Boyer Salisbury, Cleon Ross. Plant Physiology, 5th Edition.
04. Hess, D. 1974. Plant Physiology
05. Hopkins, W.G. 1995. Introduction to Plant Physiology. John Wiley & Sons Including New

York, USA

06. Hopkins, W.G. 2009. Introduction to Plant Physiology. John Wiley & Sons Including New York, USA, 4th Edition.

07. Irwin P. Ting, Plant Physiology, 1982, Addison-Wesley Publishing Company.

08. Lehninger, A.L. 1982. Principles of Biochemistry, Worth, New York

09. Noggle, G.R. and G.J. Fritz. 1991. Introductory plant physiology (2nd edition) Prentice hall of India Limited

10. Postgate John, R. 1975. The physiology and genetics of Nitrogen fixation, Plennum, Press, London

11. Postgate John, R. 1982. the fundamentals of Nitrogen fixation, Cambridge Univ., Press, Cambridge.

12. Salisbury, F.B. and Ross, C.W. 1992. Plant Physiology (4th edition). Wordsworth Publishing Company, California, USA

13. Subba Rao, N.S. 1979. recent Advances in Biological Nitrogen Fixation, Pub., Oxford&IBH publishing Co., New delhi

14. Stryer, L. 1995. Biochemistry 4th Edition, W.H. Freeman, New York

15. Taiz, L. and Zeiger, E. 1998. Plant Physiology (2nd edition). Sinauer Associates including Publishers, Massachusetts, USA

16. Stumpt, P.K. and Conn, E.E. 1980. Bi0ochemistry of Plants . Lipids, Vol-4, Acad., Press, New York.

17. Wilkins, M.D. 1987. Advanced Plant Physiology. English Language Book Society, Longman

18. Wisthoff, P. 1998. Molecular Plant Development from Gene to Plant. Oxford University Press, Oxford, UK

19. Govindjee, ed. 1982-83. *Photosynthesis.* Vol. I & II. Academic Press Inc. New York

20. Dennis, D.T. D. B. Layzell, D. D. Lefebyre & D. Turpin. 1997. *Plant Metabolism*. 2nd Ed. Addison-Wesely Pub Co. New York.

21. Raghavendra, S.. 1988. *Photosynthesis*; A Comprehensive Treatise. Cambridge University Press, Cambridge, U. K.

Model Paper
M.Sc., Botany: Semester – I
PAPER CODE: 101: BIOLOGY AND DIVERSITY OF ALGAE AND BRYOPHYTES
(With Effective from 2016-2017 Admitted Batch)

Time: Three Hours **Maximum Marks: 75**

Section A

Answer all Questions **(15 x 4 = 60)**

1. (a). Elaborate on the thallus diversity in Algae

   OR

   (b). Criteria used in classification of Algae with special reference to Fritsch classification
2. (a). Economic Importance of Algae

   OR

   (b). Cultivation of Red algae
3. (a). Detail the development of Antheridium, Archegonium in the order Jungermanniales

   OR

   (b). Give a general account of Anthocerotales
4. (a). Economic Importance and Ecological role of Sphagnum

   OR

   (b). Evolution of Sporophyte in Bryophytes

Section B

Answer any five Questions **5x3=15**

5. Types of reserve food in algae
6. Myxophycean characteristics
7. Sea weeds
8. Algal blooms
9. Thallus types in Marchantiales
10. Pellia capsule
11. Leaf structure in Polytrichum
12. Protonema of Sphagnales and Bryales

Model Paper

M.Sc., Botany: Semester – I

PAPER CODE: 102: BIOLOGY AND DIVERSITY OF VIRUSES, BACTERIA AND FUNGI

(With Effective from 2016-2017 Admitted Batch)

Time: Three Hours **Maximum Marks: 75**

Section A

Answer all Questions **(15 x 4 = 60)**

1. (a) Explain the general characteristics of Archaebacteria & Cyanobacteria.

OR

(b) Describe the Reproduction in Bacteria

2. (a) What are Mycoplasmas? Write any four plant diseases caused by them with control measures?

OR

(b) Give an account on Transmission of viruses

3. (a) What are the criteria for fungal classification ? Write a brief account of Ainsworth classification.

OR

(b) Write an essay on general characteristics of Mastigomycotina

4. (a) Give a detailed account on Mushroom cultivation.

OR

(b) Discuss on various modes of Asexual and Sexual Reproduction in Fungi

Section – B

Answer any FIVE (5 x 3 = 15 Marks)

5. Growth of bacteria

6. Nutritional types in bacteria

7. Isolation of viruses

8. Tobacco mosaic virus

9. Ultra structure of fungal cell

10. Important characteristics of Basidiomycotina

11. Heterothallism

12. Phylogenic trends in Fungi

Model Paper
M.Sc., Botany: Semester – I
PAPER CODE: 103: CELL BIOLOGY OF PLANTS
(With Effective from 2016-2017 Admitted Batch)

Time: Three Hours **Maximum Marks: 75**

Section A

Answer all Questions **(15 x 4 = 60)**

1. (a) Describe the Non covalent interactions in relation to function of Nucleic acids and Proteins

   OR

   (b) Write about the structure and organization of Prokaryotic and Eukaryotic Cells.

2. (a) Give an account of different models of Plasma membrane, which model is more appropriate and why?

   OR

   (b) What is cytoskeleton? Explain in detail about the role of microtubules in motility and cell division.

3. (a) Write in detail about Genome organization of mitochondria and its function.

   OR

   (b) Give an account on structure and function of Golgi apparatus.

4. (a) Write in detail about principles, methodology and application of ESR and NMR.

   OR

   (b) Explain the working principles of Light Microscopy, SEM and TEM.

Section – B

Answer any FIVE (5 x 3 = 15 Marks)

5. Specialized Cell types
6. Laws of Thermodynamics as applicable to biological systems
7. Structure and function of Plasmodesmata
8. Vacuole structure and function
9. Lysosomes
10. RNA editing
11. Freeze fracture Technique
12. Circular Dichroism

Model Paper
M.Sc., Botany: Semester – I
PAPER CODE: 104: CYTOLOGY AND CYTOGENETICS
(With Effective from 2016-2017 Admitted Batch)

Time: Three Hours **Maximum Marks: 75**

Section A

Answer all Questions **(15 x 4 = 60)**

1. (a). Explain the molecular organization of centromeres and telomeres

or

(b). Give an account of chromosome banding and its applications

2. (a). Give a brief account of chromosomal structural aberrations and explain their meiotic behavior

Or

(b). Elaborate on Aneuploids and their significance in human genetics

3. (a). Give a brief account of the origin and production of autopolyploids

Or

(b). Give an account on molecular organization of nuclear genome

4. (a). Write briefly about cell cycle and its regulation

Or

(b). Write about the mechanism of apoptosis giving its significance

Section B

Answer any five Questions **5x3=15**

5. Karyotype

6. Polytene chromosome

7. Robertsonian translocation

8. Trisomics

9. C value paradox

10. Arabidopsis

11. Cyclins and cdks

12. Differentiate Proto-oncogenes and Oncogenes

Model Paper
M.Sc., Botany: Semester – II
PAPER CODE: 201: GENETICS
(With effect from 2016-2017 admitted batch)

Time: Three Hours **Maximum Marks: 75**

Section A

Answer all Questions **(15 x 4 = 60)**

1. (a). What are genetic markers and elaborate on their types

   Or

   (b). Explain multiple allelic inheritance and its significance
2. (a). Write about tetrad analysis and its significance

   Or

   (b). What is Recombination and its molecular mechanism
3. (a). Discuss the DNA damage and repair mechanisms

   Or

   (b). Describe the organization and importance of Multigene families
4. (a). Describe the genetic basis of mitochondrial and chloroplast related characters

   Or

   (b). What are the different methods of gene mapping in bacteriophages

Section B

Answer any five Questions **5x3=15**

5. Chi square test
6. Penetrance and Expressivity
7. Three point test cross
8. Holliday model
9. Site directed Mutagenesis
10. Transposons
11. Maternal inheritance
12. Male sterility

Model Paper
M.Sc., Botany: Semester – II
PAPER CODE: 202: MOLECULAR BIOLOGY OF PLANTS
(With Effective from 2016-2017 Admitted Batch)

Time: Three Hours **Maximum Marks: 75**

SECTION – A

Answer ALL questions. **(15 x 4 = 60 Marks)**

1. (a) Describe the composition and structure of Proteins.

   OR

   (b) Give detailed account on composition and structure of DNA.

2. (a) Describe the mechanism of DNA Replication.

   OR

   (b) Explain the process and enzymes involved in Transcription and post transcription activities.

3. (a) Describe the mechanism of Translation.

   OR

   (b) What is meant by Protein sorting? Discuss the process of targeting of proteins into chloroplasts.

4. (a) Give a critical account on regulation of gene expression in Eukaryotes.

   OR

   (b) Write an essay on regulation of gene expression with special reference to Lac & Tryp operons.

Section – B

Answer any FIVE (5 x 3 = 15 Marks)

5. Ramachandran plot
6. Micro RNA
7. Okazaki fragments
8. Replication of ends of Chromosomes
9. Structure of tRNA
10. Protein trafficking
11. Gene silencing
12. Lytic and Lysogenic cycle

Model Paper

M. Sc Botany Semester II

PAPER CODE 203: BIOLOGY AND DIVERSITY OF PTERIDOPHYTES AND GYMNOSPERMS

Time : Three Hours **Maximum Marks: 75**

Section A

Answer all Questions **15x4=60**

1. (a). Describe salient features and classification of Pteridophyta

   Or

   (b). Differentiate between Lycopsida and Sphenopsida
2. (a).Discuss the significance of Heterospory and seed habit

   Or

   (b). Give an account of Evolutionary trends in Pteridophyta
3. (a). Discuss the significance of Geological Time Scale

   Or

   (b). Give an account of Pteridospermales
4. (a). Describe the structure and reproduction in Gnetales

   Or

   (b). Give economic importance of Gymnosperms

Section B

Answer any Five **5x3=15**

5. Rhynia

6. Pteropsida

7. Telome theory

8. Lepidocarpon

9. Lyginopteris

10. Types of fossilization

11. Ephedra

12. Ovule in Gymnosperms

Model Paper
M.Sc., Botany: Semester – II
PAPER CODE: 204: PLANT CELL, TISSUE AND ORGAN CULTURE
(With Effective from 2016-2017 Admitted Batch)

Time: Three Hours **Maximum Marks: 75**

SECTION – A

Answer ALL questions (15 x 4 = 60 Marks)

1. (a) Give an account on various Phytoharmones and their role in plant growth and development.

   OR

   (b) Write in detail about Tissue culture cycle and add a note on composition and effects of media components.

2. (a) Describe biochemical & molecular aspects of Tissue culture cycle.

   OR

   (b) Describe the methods of Androgenic & Gynogenic haploid production.

3. (a)What are secondary metabolites ? Enumerate the secondary metabolites of plant origin and state their importance.

   OR

   (b) What is Somatic hydridisation ? Give its achievements and limitations.

4. (a) Give an account of Somaclonal variations and its applications.

   OR

   (b) Elucidate the method of Clonal Propagation and give its importance.

Section – B

Answer any FIVE (5 x 3 = 15 Marks)

5. Sterilization methods
6. Totipotency
7. Embryo rescue
8. Somatic Embryogenesis
9. Plating efficiency
10. Protoplasts in genetic transformation
11. Cryopreservation
12. Germplasm storage.

Model Paper

M. Sc Botany Semester III

PAPER CODE 301: TAXONOMY OF ANGIOSPERMS AND PLANT RESOURCE UTILISATION

Time : Three Hours **Maximum Marks: 75**

Section A

Answer all Questions **15x4=60**

1. (a). Discuss the different Species Concept

   Or

   (b). Give an account of International Code of Nomenclature
2. (a). What is APG System of classification. Discuss about its significance

   Or

   (b). Discuss Cronquist's classification with its merits and demerits
3. (a). Elaborate on the evolutionary tendencies in Tubiflorae

   Or

   (b). Discuss on the role of Phytochemistry in Taxonomy
4. (a). Explain the origin, evolution and cultivation of Rice

   Or

   (b). Give an account of cultivation practices in oil yielding crops with an example

Section B

Answer any Five **5x3=15**

5. Taxonomic hierarchies
6. Nomenclature
7. Cladistic analysis
8. α Taxonomy
9. Amentiferae
10. Microanatomy
11. Indian Cotton
12. Withania

Model Paper

M. Sc Botany Semester III

PAPER CODE 302: PLANT DEVELOPMENT AND REPRODUCTION

Time : Three Hours **Maximum Marks: 75**

Section A

Answer all Questions **(15 x 4 = 60)**

1. (a) Describe in brief on the Complex tissues you have studied with neat diagrams.

OR

(b) Give a concise account of Leaf growth & differentiation.

2. (a) Write an account of the anomalous secondary growth in dicots with suitable examples.

OR

(b) Describe the structural variations met within the secondary phloem in dicots.

3.(a) Write an essay on the ultra structure of Tapetum and its functions

OR

(b) Give an illustrated account of the different types of Tetrasporic Embryo sacs you have Studied

4. (a) Write in detail about the process of Fertilization

OR

(b) Give an account on development of Embryo as per Johansen's system.

Section B

Answer any FIVE (5 x 3 = 15 Marks)

5 . Secretory cells

6. SAM

7. Bark.

8. Root microbe interactions

9. Pollen Embryo Sacs.

10. Pollen Stigma interactions.

11.Poly Embryony.

12. Seed dormancy.

Model Paper
M. Sc Botany Semester III
PAPER CODE 303: PLANT ECOLOGY, BIODIVERSITY AND CONSERVATION

Time : Three Hours **Maximum Marks: 75**

Section A

Answer all Questions **15x4=60**

1. (a). Give an account of Major Biomes of the World

   Or

   (b). Discuss the different methods employed to study a plant community
2. (a). What are different quantitative characters used to characterize a plant community

   Or

   (b). Detail the Population structure and characteristics
3. (a). Define biodiversity and discuss on the importance of its studies

   Or

   (b).Discuss about the World centres of domesticated plants
4. (a). Distinguish between the different strategies of Conservation

   Or

   (b). What are the principles and practices of Botanical Gardens and ICAR

Section B

Answer any Five **5x3=15**

5. Soil types
6. Biological spectrum
7. Clements' classification of community
8. Population Age structure
9. Secondary centres
10. Poaceae
11. Biosphere Reserves
12. BSI

Model Paper
M. Sc Botany Semester III
PAPER CODE 304: PLANT PHYSIOLOGY

Time : Three Hours **Maximum Marks: 75**

Section A

Answer all Questions **(15 x 4 = 60)**

1.(a) Write a detected account on SPAC.

OR

(b) Describe the mechanism of Mineral ion uptake by plants.

2.(a) What is Phyto chrome? Discuss its structure and role in the physiology of flowering.

OR

(b) Describe the types of Seed dormancy and its relieving methods.

3.(a) Describe the biosynthesis of Gibberellins and their physiological effects in plants.

OR

(b) What is Brassinosteroid? Discuss the biosynthetic pathway of Brassinosteroids.

4.(a) Different Biotic and abiotic stress and explain the effects of various stresses on morphological, anatomical and bio chemical changes in plants.

OR

(b) What are plant responses to Water stress? Explain the mechanisms of drought tolerance in plants.

SECTION B

Answer any FIVE (5 x 3 = 15 Marks)

5. Stomatal physiology.
6. Root microbe interactions.
7. Photoperiodism.
8. Vernalization.
9. Elicitors
10. Harmone receptors
11. Heat stress
12. Salinity stress

Model Paper

M. Sc Botany Semester IV

PAPER CODE 401: GENETIC ENGINEERING OF PLANTS AND MICROBES

Time : Three Hours **Maximum Marks: 75**

Section A

Answer all Questions **15x4=60**

1. (a) What are Restriction enzymes? What is their role in rDNA technology?

OR

(b) What is Bacterial transformation? Discuss how to recognize transformation.

2. (a) Distinguish between Northern and Southern blotting techniques.

OR

(b) Write down the types and applications of PCR techniques.

3. (a) What is Microarray Technique? Explain the principles and applications.

OR

(b) Describe the methods of Gene transfer in plants.

4. (a) What are Transgenic plants? Discuss the Fungal and Insect tolerant transgenic.

OR

(b) Give an account of applications of Bioinformatics in Genetic Engineering and their importance.

Section – B

Answer any Five **(5 x 3 = 15 Marks)**

5. BAC s

6. cDNA LIBRARY

7. FISH

8. Basic principle of Sangers method

9. RFLP

10. Chloroplast transformation.

11. Barnase – Barstar

12. Golden Rice

Model Paper
M. Sc Botany Semester IV
PAPER CODE 402: EVOLUTION AND PLANT BREEDING

Time : Three Hours **Maximum Marks: 75**

Section A

Answer all Questions **15x4=60**

1. (a). Explain molecular evolution

   Or

   (b). Discuss the evolution of Prokaryotes and Eukaryotes
2. (a). What is Natural selection. Discuss

   Or

   (b). Describe Polygenic Inheritance
3. (a). Give an account of origin of cultivated plants

   Or

   (b). Discuss in detail Heterosis and Hybrid Vigour
4. (a). Differentiate between Binomial and Normal distribution with sample data

   Or

   (b). Explain Regression and Correlation in detail

Section B

Answer any Five **5x3=15**

5. Oparin and Handane concept
6. Neutral evolution
7. Hardy – Weinberg law
8. Heritability Measurement
9. Germplasm banks
10. Plant Introduction
11. Measures of Central Tendancy
12. ANOVA

Model Paper
M. Sc Botany Semester IV

PAPER CODE 403: ECOLOGY AND ENVIRONMENTAL BIOLOGY

Time : Three Hours **Maximum Marks: 75**

Section A

Answer all Questions **15x4=60**

1. (a). Give a brief account of structure and function of an Ecosystem

   Or

   (b). Discuss the importance of Bio-geochemical cycles
2. (a). Describe the role of biodiversity in function and stability of Ecosystem

   Or

   (b). Enumerate the types and sources of Pollution and its effect on Ecosystem
3. (a). Discuss on the impact of Ecological perturbations on plants and ecosystem,

   Or

   (b). What are the different methods employed to estimate Primary Productivity
4. (a). Importance of Green house gases in Climate change

   Or

   (b). Elaborate on the factors affecting soil formation

Section B

Answer any Five **5x3=15**

5. Homeostasis
6. Litterfall & decomposition
7. IUCN Categories of threat
8. Air Pollution
9. Ecosystem Restoration
10. Environmental Impact Assessment
11. CO_2 fertilization
12. Humus

Model Paper

M. Sc Botany Semester IV

PAPER CODE 404: PLANT METABOLISM

Time : Three Hours **Maximum Marks: 75**

SECTION – A

Answer ALL questions (15 x 4 = 60 Marks)

1. (a) Describe Michaelis – Menten equation and Write down its significance.

   OR

   (b) Write about signal transduction in higher plants.
2. (a) Describe the mechanisms of electron and proton transport structure, synthesis & function of ATP.

   OR

   (b) Write a detailed account on C3, C4 and CAM plants in relation to physiological and Ecological considerations
3. (a) Describe Glycolysis and TCA cycle.

   OR

   (b) Give an account on structure & function of storage and membrane lipids.
4. (a) What is diazotrophication and write a detailed account on symbiotic Nitrogen fixation.

   OR

   (b) Describe the mechanism of sulphate uptake, transport and assimilation.

Section – B

Answer any FIVE (5 x 3 = 15 Marks)

5. Allosteric enzymes
6. Calcium – Calmodulin cascade.
7. Photosynthetic pigmention.
8. Photo oxidation of water.
9. Pentose phosphate pathway.
10. Structural lipids.
11. Biosynthesis of Amino Acids.
12. Nod factors