M.Sc., **Agricultural Biotechnology**

**(**For The Academic Year **2020 - 2021** Only)

|  |  |
| --- | --- |
| **1st Semester- Theory.** | |
| Core Paper 101 | Cell Biology |
| Core Paper 102 | Genomes and Genes |
| Core Paper 103 | Basics of Agriculture and Plant Breeding |
| Core Paper 104 | Molecular Biology |
| **Practical** |  |
| Practical Paper 101 | Corresponding to Paper 101 &102 |
| Practical Paper 102 | Corresponding to Paper 103 &104 |

|  |
| --- |
| **M.Sc. Agricultural Biotechnology** |
| **Semester-I** |
| **Paper Code -101: Cell Biology** |
| **Unit-I** |
| Structural organization of plant cell, specialized plant cell types, Chemical foundation, Biochemical energetics. Cell Wall: Structure, organization, growth and functions of cell wall. Plasma membrane: Structure, models and functions, ATpases, Ion Carriers, Channels, Pumps, Transporters. Plasmodesmata: structure, functions, gap junctions |
| **Unit-II** |
| Plant vacuole: Structure and function, tonoplast membrane, Atpases, transporters and storage  organelle |
| **Unit-III** |
| Cell organelles I: Mitochondria and Chloroplasts structure and function, genome organization  and biogenesis. Cell organelles II: Structure and function of microbodies, golgi apparatus, lysosomes and endoplasmic reticulum |
| **Unit-IV** |
| Cytoskeleton: Organization and role of microtubules and micro filaments during cell division,  cellular movements, intermediate filaments. Labelled antibody technique for visualizing cytoskeleton |
| **Assignment** |
| Cell division and cell cycle: mitosis and meiosis, Phases in cell cycle, Genetic regulation of  cell cycle |
| **Suggested Laboratory Exercises** |
| Karyotype analysis and idiogram preparation: *Allium* and *Vicia* or other material with  symmetric and Asymmetric karyotypes |
| Feulgen staining of chromosomes |
| Computer assisted chromosome analysis |
| Meiosis in diploids-*Maize, Allium* |
| Meiosis in structural heterozygotes |
| Meiosis in trisomics and polyploids |
| Pictures of Images under Phase contrast, Flourescence microscopy and TEM (with different  processing techniques), SEM |
| **Suggested Books** |
| Lodish, H, Berk A, Z, Pursky, SL Matsudiara P.Baltimore, D a d Darnel, J 2000: Molecular  cell Biology (4th edition) W.H. Freeman & Co., Newyork, USA. |
| Buchman, B B, Gruissem, W and Jones R.L (2000): Eiochemistry and Molecular Biology of plants, American Society of plant, Physiologists Maryland, USA. |
| Kelinsuith, L.J. and Kish V M 1995 Principles of Cell and Molecular Biology 2nd edition, Harper Collins college publishers, Newyork, USA. |
| Rost T et al 1998 Plant Biology Wadsworth Publishing Co., California, USA. |
| Molecular Biology of the Cell (2002) IV Edition, Bruce Alberts, Alexander Johnson, Julian  Lewis, Martin Raff, Keith Roberts, Peter Walter, Garland Science Taylor and Francis group. |

|  |
| --- |
| **M.Sc. Agricultural Biotechnology** |
| **Semester-I** |
| **Paper Code -102: Genomes and Genes** |
| **Unit-I** |
| Chromatin structure, Molecular organization of Centromers and telomers, nucleolus, r RNA genes eu-and heterochromatin |
| **Unit-II** |
| Karyotype analysis, computer assisted chromosome analysis; chromosome banding;  in situ hybridization |
| **Unit-III** |
| Genome organization – C-Value paradox, Cot curves & significance; Chromosome behaviour: Chromosome pairing and breeding behaviour in (i) Structural heterozygotes, (ii) Trisomics, monosomics and nullisomics (iii) haploids and  (iv) Auto polyploids |
| **Unit-IV** |
| Allopolyploids; genome analysis in tobacco, wheat, Bressica and cotton; Concept of Genetic makers; gene interaction, multiple allelism, pleiotropism and multiple factor inheritance |
| **Assignment** |
| Genetic, Chromosomal and Molecular map construction; Extra nuclear inheritance, male sterility and applications. |
| **Suggested Laboratory Exercises** |
| Assignments on gene interaction, Multiple factor and multiple allelic inheritance and  construction of genetic and chromosomal maps |
| Isolation of nuclei, Chloroplasts and mitochondria |
| Isolation of Plant DNA & quantification by spectrophotometric method |
| Histone separation by SDS – PAGE |
| Special cell types. |
| In situ Hybridization – FISH & GISH |
| **Suggested Books** |
| Sinnott, L.C. Dunn & Bodzhasky : Principles of Genetics. |
| SRB Edger & Ower : General Genetics |
| E.W. Burns : Genetics |
| G.S. Khush: Cytogenetics of Aneuploids. |
| Griffiths, A.F. Miller, H. Suzuki, Lewontin Gelbart: Introduction to Genetic Analysis. |

|  |
| --- |
| **M.Sc. Agricultural Biotechnology** |
| **Semester-I** |
| **Paper Code -103: Basics of Agriculture and Plant Breeding** |
| **Unit-I** |
| Plant breeding: History, Objectives, Activities, Important achievements and Undesirable consequences; Organizations for crop improvement in India: ICAR, Agricultural universities, Central institutes for crop improvements, All India coordinated programmes |
| **Unit-II** |
| Plant Introduction, domestication and acclimatization; Principles and methods of breeding  self pollinated crops: Mass selection, Pureline selection, Pedigree method, Bulk method, Backcross method, Multiline varieties. |
| **Unit-III** |
| Principles and methods of breeding of cross pollinated plants: Selection, Recurrent selection,  synthetic varieties, Hydbridization. Heterosis – Genetic and Molecular basis. |
| **Unit-IV** |
| Breeding vegetatively propagated crops: Clonal selection, Hybridization. Apomixis types and its role in breeding; Mutations – Molecular basis and use in crop improvement. Polyploidy in crop improvement. |
| **Assignment** |
| Origin evolution and cultivation practices of the following major crop plants:  (a) Wheat (b) Maize (c) Rice (d)*Sorghum*  (e) Sugarcane (f) Cotton (g) Tobacco (h) Turmeric |
| **Suggested Laboratory Exercises** |
| Demonstration of emasculation, bagging, pollination and selfing in hybridization |
| Pollen stainability |
| Pollination mechanism in *Maize* |
| Pollination mechanism in *Sorghum* |
| Pollination mechanism in Bajra |
| Pollination mechanism in Cotton |
| Pollination mechanism Chilli |
| Pollination mechanism in *Solanum* |
| Pollination mechanism in Wheat |
| Pollination mechanism in Tobacco |
| Identification of hybrids by morphology |
| **Suggested Books** |
| Sinnott, L.C. Dunn & Bodzhasky : Principles of Genetics |
| SRB Edger & Ower : General Genetics |
| E.W. Burns: Genetics |
| Griffiths, A.J.F. Miller, H.J. Suzuki J, Lewontin Gelbart : Introduction to Genetic Analysis |
| G.S. Khush: Cytogenetics of Aneuiploids |
| Sharma, A.K. & Sharma A: Chromosome Techniques |
| C.R. Burnham: Discussions in Cytogenetics |
| Poehmau & Borthakur 1981: Breeding Asian Field Crops |
| Singh, BD: Plant Breeding |
| Allard, R.W. 1961: Principles of Plant Breeding |
| James L. Brewbaker: Agricultural Genetics |
| Briggs & Knowles: Introduction to Plant Breeding |
| **M.Sc. Agricultural Biotechnology** |
| **Semester-I** |
| **Paper Code -104: Molecular Biology** |
| **Unit-I** |
| DNA structure: A, B, Z forms of DNA. Organization of the eukaryotic gene. Promoter and terminator sequences. Split gene |
| **Unit-II** |
| Modern concept of the gene: Overlapping genes. Nested genes. Repeated genes. Polyprotein gene. Assorted gene. Transposons: Types and mechanism of transpositation. Molecular basis  of mutations |
| **Unit-III** |
| DNA replication: Semi conservative replication, uni and bi directional replication, Enzymes of replication, RNA priming and primosome complex. Mechanism of DNA replication in prokaryotes and eukaryotes. Telomerases and replication at the ends. DNA damage and repair: Photoreactivation, excision repair, recombinational repair, SOS and adoptive response  and regulation |
| **Unit-IV** |
| Expression of DNA: Transcription in pro and eukaryotes, Transcription factors, mRNA processing in eukaryotes, splicesome. tRNA structure and function. Structure of ribosome in relation to its function as a protein manufacturing factory. Translation in pro-and eukaryotes. Genetic code. Post translational modifications and protein trafficking |
| **Assignment** |
| Regulation of gene expression: In Bacteria: Lac and Try operons. Positive and negative control. In Eukaryotes: Cis and Trans factors. Temporal and spatial regulation of gene expression. Signal transduction: G proteins, transmembrane proteins. Role of DNA methylation in gene expression. Role of chromatin structure in gene expression |
| **Suggested Laboratory Exercises** |
| Isolation of genomic DNA |
| Separation of DNA fragments by Agarose gel electrophoresis |
| Southern blotting technique |
| Amplification of DNA by PCR |
| Gene expression in bacteria |
| Cloning of green fluorescent protein |
| Bacterial transformation and identification of transformants |
| Assignments on the topics mentioned in the syllabus |
| **Suggested Books** |
| Buchaman B. B., Gruissem, W and Jones R.I. 2000. Biochemistry and Molecular Biology of  Plants: American Societies of Plant Physiologists, Maryland, U.S.A |
| Lewin B, 2000. Genes IX Oxford University Press, New York |
| R.F. Weavor, 1999. Molecular Biology, WCB Mc Graw Hill |
| Glick, B.R. and Thompson J.E. 1992. Methods in Plant Molecular Biology and  Biotechnology, CRC Press, Boc Raton Florida |
| Shaw, C.H. 1998. Plant Molecular Biology. A practical approach, IRL Press, Oxford |
| Lodish, Berk A, Zipursky, S.L., Matsdaira, P. Baltimore, D. and Damell, . 2000. Molecular Cell Biology (4th edition). W.H. Freeman & Co. New York, U.S.A |