

PAPER-2A: PLANT MOLECULAR BIOLOGY

(DSE-2: ELECTIVE)

Theory: 4 Hours/Week; Credits: 4 Marks: 100 (Internal: 20; External: 80)
Practical: 3 Hours/Week Credits: 1 Marks: 25

UNIT-I

1. Nucleic acids: Carriers of genetic information, types of genetic material, DNA as the carrier of genetic information.
2. Structures of DNA: Salient features and Types of DNA, Organization of DNA in Prokaryotes. Mitochondrial and chloroplast DNA.
3. Structure of RNA: Structure and Types of RNA's (mRNA, rRNA and tRNA).

UNIT-II

4. Nucleosome, Chromatin structure- Euchromatin, Heterochromatin; Constitutive and Facultative heterochromatin.
5. Replication of DNA: Chemistry of DNA synthesis, general principles, Semi-conservative replication of DNA, replication of linear ds-DNA, replication of the 5' end of linear chromosome.
6. Central dogma and genetic code: Central Dogma (Adaptor hypothesis and discovery of mRNA template), salient features of Genetic code.

UNIT -III

7. Mechanism of Transcription: Transcription in prokaryotes and eukaryotes; Split genes- concept of introns and exons, removal of introns, eukaryotic mRNA processing (5' cap, 3' polyA tail).
8. RNA editing and mRNA transport.

UNIT -IV

9. Translation in prokaryotes: Ribosome structure and assembly, mRNA; Charging of tRNA, aminoacyl tRNA synthetases; Various steps in protein synthesis, proteins involved in initiation, elongation and termination of polypeptides; Fidelity of translation.
10. Transcriptional regulation in prokaryotes, Regulation of lactose metabolism (*Lac* operon) and tryptophan (*Trp* operon) synthesis in *E.coli*.

Sharma *Manoj* *B. Lakshmi* *SP*

Suggested Readings

1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (1991). Principles of Genetics, John Wiley & Sons, India. 8th edition.
2. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics, John Wiley & Sons Inc., India. 5th edition.
3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics. Benjamin Cummings, U.S.A. 10th edition.
4. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10th edition.
5. Watson J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M., Losick, R. (2007). Molecular Biology of the Gene, Pearson Benjamin Cummings, CSHL Press, New York, U.S.A. 6th edition.
6. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley and Sons Inc., U.S.A. 5th edition.
7. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. Benjamin Cummings. U.S.A. 9th edition.
8. Russell, P. J. (2010). iGenetics- A Molecular Approach. Benjamin Cummings, U.S.A. 3rd edition.
9. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10th edition.

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KAKATIYA UNIVERSITY - WARANGAL - TELANGANA
Under Graduate Courses (Under CBCS 2021 – 2022 onwards)
B.SC. BOTANY III YEAR
SEMESTER – VI

PAPER-2A: PLANT MOLECULAR BIOLOGY PRACTICAL
(DSE-2: ELECTIVE)

1. Isolation of genomic DNA from E.Coli.
2. DNA isolation from cauliflower head./tomato fruit
3. DNA estimation by diphenylamine reagent/UV Spectrophotometry.
4. Study of DNA replication mechanisms through photographs (Rolling circle, Theta replication and semi-discontinuous replication).
5. Study of structures of prokaryotic RNA polymerase and eukaryotic RNA polymerase II through photographs.
6. Photographs establishing nucleic acid as genetic material (Messelson and Stahl's, Avery et al, Griffith's, Hershey & Chase's and Fraenkel & Conrat's experiments)
7. Study of the following through photographs: Assembly of Spliceosome machinery; Splicing mechanism in group I & group II introns; Ribozyme and Alternative splicing.
8. Estimation of size of a DNA fragment after electrophoresis using DNA markers (through photographs).

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PAPER-2B: TISSUE CULTURE AND BIOTECHNOLOGY
(DSE-2: ELECTIVE)

Theory: 4 Hours/Week; Credits: 4 Marks: 100 (Internal: 20; External: 80)
Practical: 3 Hours/Week Credits: 1 Marks: 25

UNIT - I

1. Tissue culture: Introduction, sterilization procedures, explants, culture media- composition and preparation; Nutrients and hormone requirements. Micropropagation.
2. Organ culture: Totipotency, Induction of callus, Shoot, leaf culture, Anther culture, Ovule and Embryo culture.
3. Callus culture and isolation and fusion of protoplast culture
4. Organogenesis, Somatic and Zygotic embryogenesis

UNIT- II

5. Applications of tissue culture: Production of pathogen free plants and stress resistant plants, somaclonal variants and synthetic seeds.
6. Induction of hairy roots and its applications in production of secondary metabolites.
7. Haploidy and triploids, Cryopreservation and Germplasm Conservation.
8. Somatic hybrids and Cybrid

UNIT- III

9. Biotechnology: Introduction, history, scope and applications.
10. rDNA technology: Basic aspect of gene cloning, Enzymes used in gene cloning. Restriction enzymes, Ligases, Polymerases.
11. Gene cloning: Recombinant DNA, Bacterial Transformation and selection of recombinant clones, vectors- cloning vehicles (Plasmid, Cosmids, Bacteriophages, & Phasmids; Eukaryotic Vectors (YAC) Gene Construct; Applications of rDNA technology.

UNIT - IV:

10. Gene Libraries: construction of genomic and cDNA libraries, Polymerase Chain Reaction (PCR) and its applications.
11. Methods of gene transfer-*Agrobacterium* mediated Direct gene transfer by Electroporation, Microinjection, Microprojectile bombardment.

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12. Application of transgenics in improvement of crop productivity and quality traits. Pest resistant transgenic crops (Bt-cotton & Bt-brinjal); herbicide resistant plants (Roundup Ready soybean); crops with quality traits (Flavr Savr tomato, Golden rice).

References:

1. Balasubramanian, D., C. F. A. Bryce, K. Dharmalingam, J. Green and K. Jayaraman. 2004.
2. Biotechnology. Universities Press (India) Private Limited, Hyderabad.
3. Channarayappa. 2007. Molecular Biotechnology – Principles and Practices. Universities Press (India) Private Limited, Hyderabad.
4. Chawala, H. S. 2002. Introduction to Plant Biotechnology. Oxford & IBH Publishing Company, New Delhi.
5. Dubey, R. C. 2001. A Textbook of Biotechnology. S. Chand & Company Ltd., New Delhi
6. Edmond, J. B., T. L. Senn, F. S. Adrews and R. J. Halfacre. 1977..
7. Jha, T.B. and B. Ghosh. 2005. Plant Tissue Culture – Basic and Applied. Universities Press (India). Private Limited, Hyderabad..
8. Ramawat, K. G. 2008. Plant Biotechnology. S. Chand & Company Ltd., New Delhi.
9. Salisbury, F. B. and C. W. Ross. 1992. Plant Physiology. 4th edn. (India Edition),
Wordsworth, Thomson Learning Inc., USA.
10. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
12. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.
13. Bhojwani, S.S. and Bhatnagar, S.P. (2011). The Embryology of Angiosperms. Vikas Publication House Pvt. Ltd., New Delhi. 5th edition.
14. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley and Sons, U.K. 5th edition.
15. Stewart, C.N. Jr. (2008). Plant Biotechnology & Genetics: Principles, Techniques and Applications. John Wiley & Sons Inc. U.S.A.

name Shreya B. Calitka

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SEMESTER – VI

PAPER-2B: TISSUE CULTURE AND BIOTECHNOLOGY PRACTICAL
(DSE-2: ELECTIVE)

Major Experiments

1. Isolation of plant DNA (Tomato)
2. Production of synthetic seeds /Encapsulation of embryo
3. Preparation of plant tissue culture medium - MS medium
4. Isolation of protoplasts.

Minor Experiments

1. Callus induction
2. Demonstration of Micropropagation/multiple shoots
3. Anther culture
4. PCR – Demonstration
5. Study of biotechnology products: Samples of antibiotics and vaccines
6. Photographs of Gene transfer methods.
7. Instruments used in Biotechnology lab- Autoclave, Laminar air flow, Hot air oven and Incubator.
8. Demonstration of *in vitro* sterilization and inoculation methods using leaf and nodal explants of tobacco, *Datura*, *Brassica* etc.

Spotting

1. Study of anther, embryo and endosperm culture, micropropagation, somatic embryogenesis & artificial seeds through photographs.
2. Study of methods of gene transfer through photographs: *Agrobacterium*-mediated, direct gene transfer by electroporation, microinjection, microprojectile bombardment.
3. Study of steps of genetic engineering for production of Bt cotton, Golden rice, Flavr Savr tomato through photographs.
4. Restriction digestion and gel electrophoresis of plasmid DNA.

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B.S.C. BOTANY III YEAR
SEMESTER – VI

PAPER-2C: ANALYTICAL TECHNIQUES IN PLANT SCIENCES
(DSE-2: ELECTIVE)

Theory: 4 Hours/Week; Credits: 4 Marks: 100 (Internal: 20; External: 80)
Practical: 3 Hours/Week Credits: 1 Marks: 25

Unit -I

1. Imaging and related techniques: Principles of microscopy; Light microscopy; Fluorescence microscopy; Confocal microscopy.
2. Use of fluorochromes: Fluorescence-activated cell sorting (FACS); Applications of fluorescence microscopy: Chromosome banding, FISH, chromosome painting.
3. Transmission and Scanning electron microscopy - sample preparation for electron microscopy, cryofixation, negative staining, shadow casting, freeze fracture, freeze etching.

Unit II:

4. Cell fractionation: Centrifugation: Differential and density gradient centrifugation, sucrose density gradient, analytical centrifugation, ultracentrifugation, marker enzymes.
5. Radioisotopes: Use in biological research, auto-radiography, pulse chase experiment.
6. Spectrophotometry: Principle and its application in biological research.

Unit –III

7. Chromatography: Principle; Paper chromatography; Column chromatography, TLC, GLC, HPLC, Ion exchange chromatography; Molecular sieve chromatography; Affinity chromatography.
8. Characterization of proteins and nucleic acids: Mass spectrometry; X-ray diffraction; X-ray crystallography; Characterization of proteins and nucleic acids;
9. Electrophoresis: PAGE, SDS-PAGE

Unit IV:

10. Biostatistics: Statistics, population, samples, parameters;
11. Representation of Data: Tabular, Graphical; Measures of central tendency:
12. Arithmetic mean, mode, median; Measures of dispersion: Range, mean deviation, variation, standard deviation; Chi-square test for goodness of fit.

Suggested Readings

1. Plummer, D.T. (1996). An Introduction to Practical Biochemistry. Tata McGrawHill Publishing Co. Ltd. New Delhi. 3rd edition.
2. Ruzin, S.E. (1999). Plant Microtechnique and Microscopy, Oxford University Press, New York. U.S.A.
3. Ausubel, F., Brent, R., Kingston, R. E., Moore, D.D., Seidman, J.G., Smith, J.A., Struhl, K. (1995). Short Protocols in Molecular Biology. John Wiley & Sons. 3rd edition.
4. Zar, J.H. (2012). Biostatistical Analysis. Pearson Publication. U.S.A. 4th edition.

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SEMESTER – VI

PAPER-2C: ANALYTICAL TECHNIQUES IN PLANT SCIENCES
PRACTICALS
(DSE-2: ELECTIVE)

1. Study of Blotting techniques: Southern, Northern and Western, DNA fingerprinting, DNA sequencing, PCR through photographs.
2. Demonstration of ELISA.
3. To separate nitrogenous bases by paper chromatography.
4. To separate sugars by thin layer chromatography.
5. Isolation of chloroplasts by differential centrifugation.
6. To separate chloroplast pigments by column chromatography.
7. To estimate protein concentration through Lowry's methods.
8. To separate proteins using PAGE.
9. To separate DNA (marker) using AGE.
10. Study of different microscopic techniques using photographs/micrographs (freeze fracture, freeze etching, negative staining, positive staining, fluorescence and FISH).
11. Preparation of permanent slides (double staining).

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