Resolution No.: AC/I(19-20).2.RPS4

S.P. Mandali's

RAMNARAIN RUIA AUTONOMOUS COLLEGE

RUIA COLLEGE
Explore • Experience • Excel

Syllabus for: Semester III and IV

Program: M. Sc.

Course Code: Botany (RPSBOT)

Ramnarain Ruia Autonomous College

(Credit Based Semester and Grading System with effect from the academic year 2019 – 2020)

SEMESTER III

Course Code	UNIT	TOPICS	Credits	Lectures/ Week
RPSBOT 301	**TECHNIQUES AND INSTRUMENTATION I**			
	I	Biostatistics	**4**	**1**
	II	Bioinformatics		**1**
	III	pH and buffers and Electrophoresis		**1**
	IV	Centrifugation		**1**
RPSBOT 302	**MOLECULAR BIOLOGY I**			
	I	DNA Replication	**4**	**1**
	II	Transcription		**1**
	III	RNA Processing		**1**
	IV	Translation		**1**
RPSBOT 303	**PLANT BIOTECHNOLOGY I**			
	I	Plant Tissue Culture I	**4**	**1**
	II	Plant Tissue Culture II		**1**
	III	Plant Tissue Culture III		**1**
	IV	Commercial Aspects		**1**
RPSBOT 304	**MOLECULAR BIOLOGY AND CYTOGENETICS I**			
	I	Cytology	**4**	**1**
	II	Cancer Biology		**1**
	III	Immune Systems		**1**
	IV	Genetic Disorders		**1**
RPSBOTP 301		Techniques and Instrumentation I	**02**	**04**
RPSBOTP 302		Molecular Biology I	**02**	**04**
RPSBOTP 303		Plant Biotechnology I	**02**	**04**
RPSBOTP 304		PROJECT	**02**	**04**
			24	

Ramnarain Ruia Autonomous College

SEMESTER IV

Course Code	UNIT	TOPICS	Credits	Lectures/ Week
RPSBOT 401	**TECHNIQUES AND INSTRUMENTATION II**			
	I	Microscopy & Spectroscopy	**4**	**1**
	II	Chromatography		**1**
	III	Tracer Techniques and PCR		**1**
	IV	Membrane biophysics and plant growth in microgravity		**1**
RPSBOT 402	**MOLECULAR BIOLOGY II**			
	I	Gene regulation I	**4**	**1**
	II	Gene regulation II		**1**
	III	Gene regulation III		**1**
	IV	Cell signalling		**1**
RPSBOT 403	**PLANT BIOTECHNOLOGY II**			
	I	Environmental Biotechnology	**4**	**1**
	II	Traditional knowledge and IPR		**1**
	III	Nanotechnology		**1**
	IV	Food Biotechnology		**1**
RPSBOT 404	**MOLECULAR BIOLOGY AND CYTOGENETICS II**			
	I	Plant Breeding I	**4**	**1**
	II	Plant Breeding II		**1**
	III	Molecular Plant Breeding		**1**
	IV	Plant Genetic Engineering		**1**
RPSBOTP 401		Techniques and Instrumentation II	**02**	**04**
RPSBOTP 402		Molecular Biology II	**02**	**04**
RPSBOTP 403		Plant Biotechnology II	**02**	**04**
RPSBOTP 404		PROJECT	**02**	**04**
			24	

Ramnarain Ruia Autonomous College

SEMESTER III

Course Code: RPSBOT 301
Course Title:Techniques and Instrumentation I
Academic year 2019 - 20

Learning Objectives:

- Study various tools of Statistical analysis.
- Learn about the concepts of bioinformatics,
- Science and applications of buffers
- Centrifugation techniques

Learning Outcome: The students will be able to: understand the importanceand applications of Biostatistics in Plant breeding, use bioinformatics softwares and work with different databases for recent and novelapplications in upcoming fields of biology,understand the science behind the preparation of various buffers and also the techniques and application of centrifugation

Detailed Syllabus

RPSBOT 301	Techniques and Instrumentation I	Credits – 4
UNIT I	**Biostatistics**	**15 Lectures**
	Hypothesis testing: Theory of errors – Type I and Type II errors, Null Hypothesis,	
	z-test	
	Test of significance.	
	Introduction to ANOVA, One-way & two way ANOVA,	
	Dunett's test.	
	Randomized Block Design and Latin Square. (5 problems to be solved in each category)	
UNIT II	**Bioinformatics**	**15 Lectures**
	Databases of bioinformatics: Primary, Secondary and tertiary • Nucleic acid sequence databases: GenBank, EMBL, DDBJ • Protein sequence databases: SWISS-PROT, TrEMBL, PIR, PDB • Genome Databases at NCBI, EBI, TIGR, SANGER	
	Markov Chains & Hidden Markov Models:	
	Introduction to Markov Chains and Hidden Markov models, HMM for protein structure prediction	
	Plant Reactome	
	Bioinformatics as a tool in Taxonomy studies	
UNIT III	**pH and Buffers; Electrophoresis**	**15 Lectures**
	pH and buffer solutions, acids and bases, strong acids and bases, hydrogen ion concentration, dissociation of acids and bases, measurement of pH, titration curves.	
	Physiological Buffers.	
	Electrophoresis: Theory and application	
	PAGE (Native & SDS) and AGE , 2D Electrophoresis	
UNIT IV	**Centrifugation**	**15 Lectures**
	Basics principle of Sedimentation	

Ramnarain Ruia Autonomous College

	Types of rotors	
	Differential & density gradient centrifugation	
	Preparative centrifugation & Applications; Analytical centrifugation & applications.	
PRACTICALS		
RPSBOTP 301	**Techniques and Instrumentation I**	**Credits - 2**
1	Hypothesis testing, Normal deviate test.	
2	ANOVA- one way & two way	
3	Randomized block Design and Latin square	
4	HMM for protein structure prediction	
5	Plant Reactome	
6	Bioinformatics as a tool in Taxonomy studies	
7	Preparation of buffers (phosphate and acetate)	
8	Determination of pKa	
9	Density gradient centrifugation	

References:

1. Bryan Bergeron M.D. 2008, Bioinformatics Computing.PHI Publications New Delhi.
2. Cantor, C.R. and P.R. Schimel 2010. Biophysical chemistry by, W.H. Freeman & Co.,
3. Freeman Dyson 1999, Origin of life , Cambridge University Press
4. Glasel A. and M.P.Duetscher.1995. Introduction to Biophysical Methods for protein and nucleic acid Research. Academic Press.
5. Goon,A.M., Gupta,M.K. and Dasgupta,B.(1986) Fundamentals of Statistics (Vol.2). The world press Private limited, Calcutta.
6. Gupta,S.C. and Kapoor,V.K.(1993) Fundamentals of applied statistics. Sulthan Chand and Sons, New Delhi
7. Gupta,S.P(2001) Statistical methods. Sulthan Chand and Sons, New Delhi.
8. Khan I and Khanum (2008) Fundamentals of Biostatistics, Ukaaz Publications, Hyderabad
9. 16) Vanholdem K.E. and W.C.Johnson, 1998. Principles of Physical Biochemistry
10. Wilson & Walker 1986. Practical biochemistry: Principles & Techniques. Cambridge Univ.Press.
11. Alfonso Valencia &Blascheke. L. 2005. Developing Bioinformatics Skills. Orille's Publication.

Ramnarain Ruia Autonomous College

Course Code: RPSBOT 302
Course Title:Molecular Biology I
Academic year 2019 - 20

Learning objectives:

- Understanding the concept of Central dogma and the similarity and variation in prokaryotes and Eukaryotes
- Life processes at sub-cellular and molecular levels, to create awareness regarding the recent advances in molecular biology

Learning Outcomes: The students will be able to: build a career in genetic engineering, genomics and proteomics, understand molecular mechanisms and develop basic understanding of cellular and molecular biology.

Detailed Syllabus

RPSBOT 302	**Molecular Biology I**	**Credits – 4**
UNIT I	**DNA Replication**	**15 Lectures**
	Molecular details of DNA replication in prokaryotes and eukaryotes.	
	Assembly of raw DNA into nucleosomes.	
	DNA recombination, Holliday model for recombination.	
UNIT II	**Transcription**	**15 Lectures**
	Transcription, RNA synthesis, classes of RNA and the genes that code for them.	
	Transcription of protein coding genes, prokaryotes and eukaryotes, mRNA molecule.	
	Transcription of other genes, ribosomal RNA, tRNA.	
UNIT III	**RNA processing**	**15 Lectures**
	Capping, polyadenylation, splicing, introns and exons.	
	snRNA, Types and significance of snRNA, snRNA in spliceosome,	
	Non coding RNAs, ribozyme, riboswitches, RNA localization.	
UNIT IV	**Translation**	**15 Lectures**
	Protein structure, nature of genetic code, translation of genetic message.	
	Post translational modifications, localization, chaperons.	
PRACTICALS		
RPSBOTP 302	**Molecular Biology I**	**Credits - 2**
1	Aseptic techniques, safe handling of microorganisms.	
2	Establishing pure cultures, streak plate method (T-streak and pentagon method), Pour plate, spread plate.	
3	Maintenance of cultures - Paraffin embedding, Lyophilisation.	
4	Preparation of culture medium, stock solutions	
5	Determination of cell number, viable count method (using pour plate and serial dilution technique).	
6	Separation of seed proteins using PAGE.	
7	Analysis of proteins by one and two dimensional gel electrophoresis.	
8	Genomic DNA isolation and quantification.	

Ramnarain Ruia Autonomous College

References:

1. Lewin B. 2000. Genes VII. Oxford University Press, New York.
2. Alberts, B., Bray, D Lewis, J., Raff, M., Roberts, K and Walter 1999. Molecular Biology of the Cell. Garland Publishing, Inc., New York.
3. Wolfe S.L 1993 Molecular and Cellular Biology, Wadsworth Publishing Co., California, USA.
4. Gupta. P.K. 1995. Cytogenetics. Rastogi& Co., Meerut.
5. Glick. B.R. & Thompson. J.E. 1993. Methods in Plant Molecular Biology and Biotechnology. CRC Press, Boc Raton, Florida.
6. Sybenga. J. 1973. General Cytogenetics. American Elsevier Pub. Co., New York.
7. Swanson, Merz& Young. 1967. Cytogenetics. Prentice Hall India.
8. Lewis. K.R. & John. B. 1963. Chromosome Marker. J & A Churchill Co., London
9. Wilson. J.,& Hunt. T. 2007. Molecular Biology of the Cell. 5th Edition. The Problems Book. 2nd Edition. Garland Publisher, New York.
10. Celis. J.E. (Ed.). 2006. Cell Biology: A Laboratory Hand Book. 3rd Edition. Elsevier, USA.
11. Lodish. H., Berk. A., Kaiser. C.A., Kreiger. M., Scott. P.M., Bretcher. A., Ploegh. H.,&Matsudaira. P. 2004. Molecular Cell Biology. 5th Edition. W.H. Freeman and Co., New York.
12. Kleinsmith. L.J. & Kish. V.M. 1995. Principles of Cell and Molecular Biology. 2nd Edition. Harper Collins College Publishes., New York, USA.
13. William. K., Cummings. S., Spencer. M.R.,& Charlotte. A. 2013. Essentials of Genetics. Pearson Books, Delhi.
14. Hartwell L. 2011. Genetics: From Genes to Genomes, Study Guide and Solution Manual. 4th Edition. Nero.
15. Bass. H. &Birchler. J. 2011. Plant Cytogenetics: Genome Structure and Chrmosome Function. Springer, New York.
16. Russel. P.J. 2009. Genetics – A Molecular Approach. 3rd Edition. Pearson Benjamin Cummings, San Francisco, USA.
17. Roy. D. 2009. Cytogenetics. Alfa Science International Ltd., UK.
18. Gupta. P.K. 1995. Cytogenetics. Rastogi& Co., Meerut.
19. Sybenga. J. 1992. Cytogenetics in Plant Breeding. Springer London Ltd.
20. Swanon. M. & Young. 1982. Cytogenetics. Prentice Hall, India

Ramnarain Ruia Autonomous College

Course Code: RPSBOT 303
Course Title:PlantBiotechnologyI
Academic year 2019 - 20

Learning objectives:

- The benefits of somaclonal variations in crop improvement, to know the basic experimental designs required for a successful transfer of plantlets from labs to farms.
- Familiarization with the advanced methods of biotransformation and bioprocesses, appreciation of the use of bioreactors and to understand details of bioreactors designfor large scale production of useful products.
- Comprehension of the requirement of processing and recovery of pure products and to understand different industrial applications of bioreactors.

Learning Outcomes: The students will be able to: Develop a skill base for working in industries like pharmaceuticals, food industries, fermentation units etc. Understand the baseline requirements to set upan enterprise based on fermentation technology, developing efficient methods for product recovery. Develop the ability to understand, exploreand address problems associated with current tissue culture techniques.

Detailed Syllabus

RPSBOT 303	**Plant Biotechnology I**	**Credits – 4**
UNIT I	**Plant Tissue Culture I**	**15 Lectures**
	Plant improvement through somaclonal variations.	
	Plant cell culture systems: a potential renewable source of flavours, fragrances, and colorants	
	Metabolic engineering: Production of useful secondary metabolites through regulation of biosynthetic pathway in cell and tissue suspension culture	
UNIT II	**Plant Tissue Culture II**	**15 Lectures**
	Plant cell cultures as chemical factories: Cell suspension, enhancement of product formation using biotic and abiotic elicitors, immobilization, permeabilization and product recovery.	
	Biotransformation using: Freely suspended plant cells and Immobilized plant cells	
	Biotransformation for Vanillin production from *Capsicum* cell cultures.	
UNIT III	**Plant Tissue Culture III**	**15 Lectures**
	In vitro storage of Germplasm, Cryopreservation	
	Studies on *Agrobacterium* mediated transformed root cultures.	
	Transgenic plants in phytoremediation	
	Scale –up of secondary metabolites from hairy roots	
	Risk assessment and the regulatory frame work	
UNIT IV	**Commercial aspects**	**15 Lectures**
	The quest for commercial production from plant cell: scaling up of cell cultures,	
	Bioreactors: factors for bioreactor design, pneumatically agitated bioreactors, comparison of bioreactors, operating mode, batch, fed-batch, semi continuous, two stage operation, continuous	

Ramnarain Ruia Autonomous College

	cultivation.	
	Factors for growth in Bioreactors.	
	Shikonin production by *Lithospemum erythrorhizon* cell cultures.	
PRACTICALS		
RPSBOTP 303	**Plant Biotechnology I**	**Credits - 2**
1	Preparation of stock solutions	
2	Preparation of MS basal medium & Defined medium	
3	Callus induction	
4	Regeneration of the callus	
5	Micropropagation	
6	Isolation of bioactive compounds from callus and plant source using TLC.	
7	Enhancement of product formation using biotic or abiotic elicitor (Total phenolics/ flavonoids).	
8	Types of Bioreactors.	
9	*Agrobacterium* mediated transformed root cultures	
10	Study of mitotic index.	
11	Blood group testing.	
12	Identification of genetic diseases by chemical tests.	
13	Karyotypes of genetic disorders.	

References:

1) Bhojwani. S.S. &Razdan. M.K. 1996. Plant Tissue Culture: Theory and Practice (Rev.Ed.). Elsevier Science Publishers, New York.
2) Chawla. H.S 1999. Introduction to Plant Biotechnology. Oxford & IBH.
3) Collin. H.A & Edwards. S. 1998. Plant Cell Culture. Bioscientific Publishers, Oxford, UK.
4) Gamborg& Phillips. Plant Cell, Tissue and Organ Culture. Narosa Publications.
5) Jain. S.M., Sopory. S.K. &Valleux. R.E. 1996. In Vitro Haploid Production in Higher Plants. Volumes 1 to 5. Fundamental Aspects and Methods. Kluwer Academic Publishers, Dordrecth, Netherlands.
6) Kalyan Kumar De. 1997. Plant Tissue Culture. NCB Agency, Kolkata.
7) Ramawat. K.G. &Merillon. J.M. 2007. Biotechnology: Secondary Metabolites. 2nd Ed. Science Pub., Netherlands.
8) Razdan. M.K. 2003. An Introduction to Plant Tissue Culture. Oxford & IBH, New Delhi
9) ShuklaYM,PatelNJ,JithendraJD,BhatnagarR,Talati JG ,Kathiria KB 2009, Plant Secondary Metabolites, New India Publishing Agency, Gujarat.
10) Vasil. I.K. & Thorpe. T.A. 1994. Plant Cell and Tissue Culture. Kluwer Academic Publishers, Dordrecth, Netherlands.

Ramnarain Ruia Autonomous College

Course Code: RPSBOT 304
Course Title:Molecular Biology and Cytogenetics I
Academic year 2019 - 20

Learning Objectives: To familiarize the students about the intricacies of cellular processes with respect to permeability, cell cycle and non-nuclear genomes. To study principles and finer aspects of cancer biology, immune system and genetic disorders

Learning Outcomes: The students will be able to : Understand the structure of the cell membrane to its function, regulatory aspects of cell division and PCD, along with non-nuclear genomes, the nature, development and causes of cancer. They will also be able to acquire knowledge about the components of the immune system and applications in health care, application of the study of genetic disorders for genetic counseling and therapy.

Detailed Syllabus

RPSBOT 304	**Molecular Biology and Cytogenetics I**	**Credits – 4**
UNIT I	**Cytology**	**15 Lectures**
	Cell membrane and permeability: Molecular models of cell membrane, cell permeability. Differentiation of cell membrane, intercellular communications and gap junctions. Cell coat and cell recognition, cell surface.	
	Cell Cycle and Apoptosis: Check points during cell cycle-G1 to S, progression of S phase, G2 to M phase, Anaphase check points and components involved as regulators of check points, role of cyclins and CDKs, synthesis and degradation of cyclins, structural features of CDKs and cyclins, activation and inactivation of cyclin dependent kinases; role of RBs, E2Fs, and DP proteins, P53, different types of Cyclin dependent CDKs, CDC25, CAKs, Wee1 proteins, nim-proteins, SCFs, Anaphase Promoting Complexes APC (cyclosomes), Centrosome activation- structure, duplication of centrosomes, Role of nucleophosmins, organization of mitotic apparatus, binding of tractile fibers to kinetochore complexes, molecular motors involved in movement of chromosomes to equatorial plate and in anaphase movement; cytokinesis by cleavage and phragmoplast formation- different gene products and structures involved and the mechanisms of cytokinesis. Cell Plate formation, PCD.	
	Organization and function of mitochondrial and chloroplast genomes.	
UNIT II	**Cancer Biology**	**15 Lectures**
	Cancer cells: Characteristics, division, spread, treatment. Course of cancer cell formation, Carcinogens: radiations, chemicals, oncogenic virus	
	Cancer and mutations, reproductive properties of transformed animal cell in culture, oncogenes, protoncogenes and their conversion. Oncogenes and growth factors.	
	Stem cells, Regenerative medicine	
UNIT III	**Immune System**	**15 Lectures**

Ramnarain Ruia Autonomous College

	Phylogeny of immune system, innate and acquired immunity, nature and biology of antigens, major histocompatibility complex cells of immune system, regulation of immune responses.	
	Immunity in Health and Disease: Immunodeficiency and AIDS	
UNIT IV	**Genetic Diseases**	**15 Lectures**
	Genetic disorders, genetic counselling and gene therapy	
	Biochemical disorders, sex linked disorders	
	Cardiovascular disorders.	
PRACTICALS		
RPSBOTP 304	**Molecular Biology and Cytogenetics I**	**Credits - 2**
1	Projects will be allotted in third semester and students will submit project work having introduction, review of literature, well defined material and methods, expected results and references	

References:

1) Glick. B.R. & Thompson. J.E. 1993. Methods in Plant Molecular Biology and Biotechnology. CRC Press, Boc Raton, Florida.
2) Sybenga. J. 1973. General Cytogenetics. American Elsevier Pub. Co., New York.
3) Swanson, Merz& Young. 1967. Cytogenetics. Prentice Hall India.
4) Lewis. K.R. & John. B. 1963. Chromosome Marker. J & A Churchill Co., London.
5) Alberts. B., Breyer. D., Hopkin. K., Johnson. A.D., Lewis. J., Raff M., Roberts. K. &Watter. P. 2014. Essential Cell Biology. 4th Edition. Garland Publishers, New York.
6) Karp. G. 2013. Cell and Molecular Biology – Concepts and Experiments. 7th Edition. Wiley Global Education, USA.
7) De Robertis and De Robertis 2005 (Eight edition) (Indian) Cell and Molecular Biology, Lippincott Williams, Philadelphia. [B.I Publications Pvt. Ltd. New Delhi].
8) Sadova David – 2004 (First Indian Edition). Cell Biology, New Delhi.
9) Albert Etal 2002 (Fourth Edition). Molecular Biology of the cell, Garland Science (Iaylar and Francis) New York Group (wt)
10) LodishEtal 2004 (Fifth Edition). Molecular Cell Biology, W H Freeman and company, New York.
11) Powar C.B 2005 (Third Edition). Cell Biology, Himalaya Publishing, Mumbai.
12) Roy S.C and KKDe 2005 (Second Edition). Cell Biology, New central Book Agency Private Ltd., Kolkata.
13) Verma P.S and Agarwal V.K 2006 Cell Biology, Genetics, Molecular Biology, Evolution, Ecology. S.Chand and Company, New Delhi.
14) Gerald Karp 1999 Cell and Molecular Biology- Concept and Expts. John Wiley and ScneIne., USA.
15) Swanon. M. & Young. 1982. Cytogenetics. Prentice Hall, India
16) Snustad. P & Simmons. M.J. 2003. Principles of Genetics. 3rd Ed. John Wiley & Sons Inc., USA

Ramnarain Ruia Autonomous College

Semester IV

Course Code: RPSBOT 401
Course Title:Techniques and Instrumentation II
Academic year 2019 - 20

Learning Objectives:

- The basics principles of microscopy, spectroscopy and chromatography, tracer techniques and PCR.
- The basic concepts of membrane biophysics and plant growth in microgravity.

Learning Outcomes: The students will be able to: understand the techniques and application ofmicroscopy, spectroscopy and chromatography, and PCR. They will be able to understand role of membrane biophysicsin human disease research and they will also gather knowledge about plant research in microgravity.

Detailed Syllabus

RPSBOT 401	**Techniques and Instrumentation II**	**Credits – 4**
UNIT I	**Microscopy and Spectroscopy**	**15 Lectures**
	Principles, instrumentation, working and applications of Fluorescence microscope, TEM, SEM.	
	Biological sample preparation for electron microscopy.	
	IR, GC MS, AAS , Plasma Emission spectroscopy, NMR, MS	
UNIT II	**Chromatography**	**15 Lectures**
	General Principle of chromatography.	
	Techniques and applications of Ion exchange, Affinity Chromatography&HPLC	
	Application / validation of herbal drugs using HPTLC.	
UNIT III	**Tracer techniques & PCR**	**15 Lectures**
	Radioactive isotopes and autoradiography	
	Principle, instrumentation &technique: Geiger-Muller counter, Liquid scintillation counters	
	Applications of isotopes in biology: Tracer techniques	
UNIT IV	**Membrane biophysics and plant growth in Microgravity**	**15 Lectures**
	Conformational properties of membranes.	
	Modification of cell membrane and Biophysical importance.	
	Isolation and characterization of plant membranes.	
	Effect of microgravity on plant growth.	
PRACTICALS		
RPSBOTP 401	**Techniques and Instrumentation**	**Credits - 2**
1	Separation of proteins by Ion exchange chromatography	
2	Separation of phytochemicals using column chromatography.	
3	Separation of amino acids/ Plant pigments by two dimensional chromatography.	
4	DNA Amplification using PCR (Demonstration)	
5	Viscosity studies of proteins: standard BSA and varying concentrations of urea	
6	Isolation of plasma membrane	
7	Industrial visit and report submission.	

Ramnarain Ruia Autonomous College

References:

1) Berlyn GP and Miksche JP. 1976. Botanical micro-techniques and cytochemisty
2) Chang R (1971). Basic principles of spectroscopy. McGraw Hill.
3) Garry D Christian, James E O'reilvy (1986). Instrumentation analysis. Alien and Bacon, Inc.
4) Gordon MH and Macrae M. 1987. Instrumental analysis in the biological sciences.
5) Henry B Bull (1971). An Introduction to physical biochemistry. F A Devis Co.
6) Stanford J R (1975). Foundation of Biophysics. Academic press.
7) Wilson K and Walker JM.1994. Principles and techniques of practical biochemistry.
8) Allan peacock, H. 1966. Elementary Microtechnique. Edward Arnold Publ.
9) Duddington, C.L, 1960. Practical microscopy. Pitman publ.
10) Perkampus H (1992). UV-VIS Spectroscopy and its applications. Springer-Verlag.
11) Pesce A J, Rosen C G, Pasty T L. Fluorescence Spectroscopy: An introduction for Biology

Course Code: RPSBOT 402
Course Title:Molecular Biology II
Academic year 2019 - 20

Learning Objectives:
To study gene location and structure.To understand the expression of gene regulation and to understand the various techniques used to study gene expression and regulation

Learning Outcomes: Awareness regarding various processes of cell signaling and mechanism ofsignaling and development of knowledge of gene regulation mechanism and gene expression

Detailed Syllabus

RPSBOT 402	Molecular Biology II	Credits – 4
UNIT I	**Gene Regulation I**	**15 Lectures**
	Regulations of gene expression in bacteria – trp operon, ara operon, histidine operon.	
	Regulation of gene expression in bacteriophage λ.	
UNIT II	**Gene Regulation II**	**15 Lectures**
	Control of gene expression in eukaryotes, Transcriptional control, RNA processing control, mRNA translocation control, mRNA degradation control, protein degradation control	
	Gene editing-(CRISPR-cas technologies - Biotechnology application)	
UNIT III	**Gene Regulation III**	**15 Lectures**
	Genomics, proteomics and metabolomics	
	Genetic regulation of development in *Drosophila* Developmental stages in *Drosophila* – embryonic development, imaginal discs, homeotic genes	
UNIT IV	**Cell signaling**	**15 Lectures**
	Hormones and their receptors, cell surface receptor, , intracellular receptor, signaling through G-protein coupled receptors, signal relay pathways-signal transduction pathways, second messengers, regulation of signaling pathways, bacterial and plant two-	

Ramnarain Ruia Autonomous College

	component systems, light signaling in plants, bacterial chemotaxis and quorum sensing.	
	Forms of signalling (paracrine, synaptic, autocrine, endocrine, cell to cell contact)	
PRACTICALS		
RPSBOTP 402	**Molecular Biology II**	**Credits - 2**
1	Isolation of plasmid DNA	
2	Quantification of plasmid DNA	
3	Agarose gel electrophoresis separation of plasmid DNA	
4	Restriction enzyme digestion and separation of fragments	
5	Southern blot transfer technique	
6	Transformation of *E. coli* cell by plasmid DNA	
7	β-galactosidase expression and assay	
9	Culturing of Drosophila and study of genetic traits.	

References:

1) De Robertis& De Robertis, 2004. Cell and Molecular Biology. Lippincott. Williams and Wilkins. USA.
2) Freifelder, 1990. Molecular Biology, Narosa Publishing House, New Delhi.
3) Jain, H.K. 2000. Genetics, Oxford & IBH, New Delhi 13. Jocelyn E Krebs, Elliott S Goldstein, Stephen T Kilpatrick (2011). Lewin's Genes X. Jones and Bartlett Publishers
4) Mary A. Schuler Raymond and E.Zrelinski, 2005. Methods in Plant Molecular Biology, Academic Press an imprint of Elsevier
5) Peter Porella, 1998. Introduction to Molecular Biology, McGraw – Hill, New York
6) Rastogi, S.C. 2004. Cell Biology. New age International Pub. New Delhi.
7) Robert J Brooker (2009). Genetics: analysis and principles (III Edn). McGraw Hill.
8) Schuler MA and Selinski, R. 1989. Methods in molecular Biology
9) David A Micklos, Greg A Freyer with David A Crotty (2003). DNA Science: A first course (II Edn).
10) Swanson, C.P. 1972. Cytology and Cytogenetics. Mac Millan. New York.
11) Goodenough U, 1990. Genetics. Armugam N, 1992. Organic evolution.
12) Basu.S.B. and M.Hossain.2004. Principles of Genetics. Books and Allied (P). Ltd, Kolkatta.
13) Benjamin, Levin. 2004. Genes VIII. Oxford university press. Blackwell Science Ltd.
14) Benjamin Lewin (2000). Genes VII. Oxford university press. Blackwell Science Ltd.
15) Daniel L Hartl, Elizabeth W Jones (2009). Genetics: Analysis of genes and genomes (VII Edn). Jones and Bartlett publishers.
16) Gardner, E.J. 1972. Principles of genetics. Willey Eastern Pvt.Ltd.
17) George Ledyard Stebbins (1971). Process of Organic evolution.
18) Gupta, P.K, 2000. Gentics.Rasatogi publications, Meerut.
19) Gurbachan and S. Miglani, 2000. Basic Genetics, Narosa Publishing House, New Delhi.
20) Strickberger (2005). Genetics (III Edn). Prentice Hall of India Pvt. Ltd.

Ramnarain Ruia Autonomous College

Course Code: RPSBOT 403
Course Title:Plant Biotechnology II
Academic year 2019 - 20

Learning Objectives:

- Study bio-absorption using various biological sources,
- Understand the importance and requirement of alternate fuels such as biomass and to study the production of biogas.
- Understand the placement of GMOs in global scenario,
- Study the importance of security in case of intellectual properties and to understand the Indian patent law and standards of patent protection.
- The need and importance of protection of traditional knowledge,
- The concept of nanotechnology, synthesis of nanoparticles and its applications and to understand the various fields of application for Nano sciences
- The techniques and application in the field of quality control in food technology.

Learning Outcomes: The students will be able to:Create awareness regarding the need of alternate source of energy, develop ideas and technologies to increase production and use of biofuels and biological sources of energy, develop interest among students in patent filing, patent law and related fields, understand the rapidly developing field of nanotechnology and developing skill base for advanced research endeavors in nanotechnology, understand the pros and cons of nanotechnology and applicability of the same in various industries, and understand the requirement and technologies involved in food biotechnology and implementation of quality control parameters.

Detailed Syllabus

RPSBOT 403	**Plant Biotechnology II**	**Credits – 4**
UNIT I	**Environmental Biotechnology**	**15 Lectures**
	Biosorption: use of fungi, algae and biological components	
	Biomass for energy: Sources of biomass, advantages &disadvantages, uses of biomass	
	Biogas production from food processing waste: vegetable canning waste,flour, molasses etc.	
	Biocomposting	
	Ethanol from biomass and Ligno-cellulosic residue	
	GMO's	
UNIT II	**Traditional Knowledge & IPR**	**15 Lectures**
	Different property rights & IPR in India	
	IPR: Objectives, process & scope	
	TRIPS & Patent laws: Introduction & standards for patent protection	
	WTO& Indian Patent Laws	
	Protection of traditional knowledge– objective, concept of traditional knowledge, holders, issue concerning, bio-prospecting and biopiracy; Advantages of IPR , some case studies	
	International Depository authority ,Gene patenting, plant variety protection, trade secrets & plant breeders right	
UNIT III	**Nanotechnology**	**15 Lectures**
	Introduction, properties of nano-materials.	
	Green synthesis of nano-materials, biological methods, use of	

Ramnarain Ruia Autonomous College

	microbial system & plant extracts, use of proteins & templates like DNA	
	Characterization of nanoparticles (FTIR, SEM, TEM, STEM, Scanning Tunneling Microscope, Atomic Force Microscope, UV-Vis,)	
	Application of nano-materials in food, cosmetics, agriculture, environment management and medicine	
	Risk of Nanomaterial to human health and Environment	
UNIT IV	**Food Biotechnology**	**15 Lectures**
	History and development of biotechnology , Application of genetics to food production.	
	Methods of molecular cloning, immobilization of microbial and cultured plant cells.	
	Genetically modified foods (GMF), Food Fermentation technology-bioreactors and bioprocessing, Production of food flavour, colour. polysaccharides, amino acids, vitamins, baker's yeast, brewer's yeast, Single Cell Protein and Single Cell Oil.	
	Factors affecting spoilage	
	Quality control of food	
PRACTICALS		
RPSBOTP 403	**Plant Biotechnology II**	**Credits - 2**
1	Biogas production from food processing waste	
2	Patent search and patent filing	
3	Biocomposting (pH, conductivity and organic matter content)	
4	Synthesis of nanoparticles	
5	Characterization of nanoparticles by UV spectroscopy.	
6	Market survey on the availability of Genetically modified foods (GMF).	
7	Production of yoghurt using Direct into Vat cultures	
8	Development of a fermented food/drink utilizing plant products /animal products or byproducts as substrate	

References:

1) Botkin, D.B. and E.A. Keller. 2004. Environmental Science. 5th ed. John Wiley and Sons.
2) Bernhardsen, T. 1999. Geographic Information System: An Introduction. 02nd Edition, John Wiley and Sons.
3) Canter, L.W. 1996. Environmental Impact Assessment. McGraw Hill, New York.
4) Alan Scragg, 2005. Environemntal Biotechnology. II Edition. Oxford University Press. New York.
5) Bernard R. Glick and Jack J. Pasternak, 2001. Molecular Biotechnology – 2nd edition, ASM press Washington DC.
6) Brown, C.W, I.Campbell and F.G. Priest, 1987. Introduction to Biotechnology. Blackwell scientific publications, Oxford
7) Chawla, H.S, 2000. Introduction to Biotechnology. Oxford & IBH Publishing Co Pvt. Ltd, New Delhi.
8) Hamilton, C.(2006) Biodiversity, Biopiracy and Benefits: What allegations of Biopiracy tell us about intellectual property. Blackwell publishing Ltd., Oxford.
9) Heink, U and Kowarik,I. (2010) What criteria should be used to select biodiversity indicators . Biodiversity Conservation 19:3769-3797.
10) Ram Reddy,S. Surekha ,M. and Krishna Reddy,V (2016). Biodiversity Traditional Knowledge Intellectual Property Rights .Scientific Publishers.

Ramnarain Ruia Autonomous College

11) Unnikrishna,P and Suneetha,M. (2012). Biodiversity ,traditional knowledge and community health : strengthening linkages .Institute for Advanced Studies, United Nations University ,Tokyo
12) Wood ,A., Pamela, S.E.and Johanna, M.(2000). The root causes of biodiversity loss. United Kingdom: Early –Scan Publications.
13) Bagchi, D., Lau, F.C. and Ghosh, D.K. (Eds.). 2010. Biotechnology in functional foods and nutraceuticals. CRC Press, Boca Raton, Florida, USA.
14) Duggan, C., Watkins, J.B. and Walker, W.A. (Eds.). 2008. Nutrition in pediatrics: basic science and clinical applications. People's Medical Publishing House, Hamilton, USA.
15) Government of Canada, 2013. Nutraceuticals / Functional Foods and Health Claims on Foods. Policy Paper. Hasler, C.M. (Ed.) 2005. Regulation of functional foods and nutraceuticals: A global perspective. IFT Press and Wiley-Blackwell, Ames, Iowa, USA.
16) Katsilambros, K. 2011. Clinical nutrition in practice. John Wiley & Sons, New York. USA.
17) Nestle, M. 2002. Food politics. University of California Press, Berkeley, USA.
18) Pathak, Y.V. (Ed.) 2010.Handbook of nutraceuticals. vol. 1: Ingredients, formulations, and applications. CRC Press, Boca Raton, Florida, USA.
19) Shahidi, F. and Naczk, M. (EDs.) 2003. Phenolics in food and nutraceuticals. 2nd edition. CRC Press, Boca Raton, Florida, USA.
20) J. Draper 1988. Plant Genetic Transformation and Gene Expression Blackwell Scientific Publications, Oxford.
21) R.W. Old, S.B. Primrose. 2004. Principles of Gene Manipulation. An Introduction to Genetic Engineering. Fifth Edition, Blackwell Science Publications.

Course Code: RPSBOT 404
Course Title:Molecular Biology and Cytogenetics II
Academic year 2019 - 20

Learning Objectives:

- Basic principles and techniques of plant breeding
- The techniques of transgenic plant production
- The use of molecular markers in plant improvement.

Learning Outcomes: The students will be able to:apply principles of plant breeding and hybridization along with latest molecular techniques for the production of high yielding, abiotic and biotic stress resistant plants in agriculture and horticulture**.**

Detailed Syllabus

RPSBOT 404	**Molecular Biology and Cytogenetics II**	**Credits – 4**
UNIT I	**Plant Breeding I**	**15 Lectures**
	Aims and objectives, plant introductions and acclimatization.	
	Selection – mass, pure line and clonal.	
	Hybridization techniques, hybridization in self-pollinated and cross pollinated plants.	
	Genetic control and manipulation of breeding systems including male sterility and apomixes	
UNIT II	**Plant Breeding II**	**15 Lectures**
	Distant hybridization: In nature (plant breeding) – Barriers to the production of distant hybrids; Unreduced gametes in distant hybridization; Sterility in distant hybrids; Consequences of segregation in distant hybrids;	

Ramnarain Ruia Autonomous College

	Applications and Achievements of distant hybridization in crop improvement; Limitations of distant hybrids.	
UNIT III	**Molecular plant Breeding (Transgenic Crops)**	**15 Lectures**
	Natural method of gene transfer (*Agrobacterium* and virus), selectable markers	
	Artificial methods of gene transfer: Direct DNA uptake by protoplast, electroporation, liposome mediated and particle gun transformation	
	Production of Transgenic plants :virus resistant & Herbicide – resistant, plants, Bt Cotton, Golden rice	
UNIT IV	**Plant Genetic Engineering**	**15 Lectures**
	Production of bio pharmaceuticals in transgenic plants.	
	Edible vaccines &Plantibodies	
	DNA-based molecular marker aided breeding: RAPD, RFLP, AFLP, STS, ISSR, Microsatellites	
	Contribution of plant breeding institutes in India	
PRACTICALS		
RPSBOTP 404	**Molecular Biology and Cytogenetics II**	**Credits - 2**
1	Research methodology will be discussed andwell defined material and methods, discussion, results and conclusions, references and itspresentation based on some advancedtechniques in Botany	

Ramnagar Rural Autonomous College

References:

1) Al Chaudhari, H.K. (1984). Elementary principles of plant breeding Oxford IBH..New Delhi lards R W (1995). Principles of Plant Breeding. John Wiley and Sons, Inc.
2) Allard, R.W, 1960. Principles of plant breeding. John Willeg, New York.
3) Chaudhary, H. K. (2001) Plant Breeding Theory and Practice, Oxford IBH Ltd, New Delhi, India
4) David Allen Sleper, John Milton. (2006). Breeding Field Crops. Blackwell Publishing
5) Dwivedi and Singh (1980) Essentials of Plant Techniques, 2nd Ed., Scientific Publishers. Moan Bhavan Udaipur, India.
6) Gardner, E.J. (1972). Principles of genetics. Willey Eastern Pvt.Ltd.
7) Ghahal G S and Gosal S S (2002). Principles and procedures of Plant Breeding. Narosa Publishing House.
8) Hays, K.K. Immer, F.R. and Smith, D.C. (1985). Methods in plant breeding .Tata McGraw Hill.Newyork.
9) Neal.C.Stopskopf. (1999). Plant Breeding Theory & Practices. Scientific Publ, Jodhpur.
10) Sharma J R (1994). Principles and practices of Plant Breeding. Tata McGraw-Hill Publishers
11) Singh,B.D. 2001. Plant Breeding, Principles and Methods.Kalyani Publications,
12) Swaminathan, M.S, P.K.Gupta and V.Singa. (1983). Cytogenetics of crop plants. Macmillan India Ltd, New Delhi.
13) Sharma J R (1994). Principles and practices of Plant Breeding. Tata McGraw-Hill Publishers
14) Potrykus and G.Spangenberg, 1995 Gene Transfer to plants Springer, Berlin. Heidelberg
15) J. Sambrook, E.F.Fritsch and T.Maniatis 1989. Molecular Cloning - A Laboratory Manual
16) Adrian Slater, Nigel Scott and Mark Flower, 2000 Plant Biotechnology -The Genetic Manipulation of Plants,Oxford University Press,).

MODALITY OF ASSESSMENT

Theory Examination Pattern:

A) Internal Assessment - 40%: 40 marks.

Sr No	Evaluation type	Marks
1	Seminar presentation/ Short Project presentation / Photo documentation report of field visit/ Industry Visit Report /Presentation based on Research papers and references/Class Tests	30
2	Continuous assessment on the basis of participation in departmental activities	10

B) External examination - 60 %

Semester End Theory Assessment - 60 marks

i. Duration - These examinations shall be of **2½ hours** duration.
ii. Paper Pattern:
   1. There shall be **05** questions each of **12** marks and **01** question of **12** marks. On each unit there will be one question & last question will be based on all the **04** units.
   2. All questions shall be compulsory with internal choice within the questions.

Questions	Options	Marks	Questions on
Q.1)A)	Any 1 out of 2	06	Unit I
Q.1)B)	Any 1 out of 2	06	
Q.2)A)	Any 1 out of 2	06	Unit II
Q.2)B)	Any 1 out of 2	06	
Q.3)A)	Any 1 out of 2	06	Unit III
Q.3)B)	Any 1 out of 2	06	
Q.4)A)	Any 1 out of 2	06	Unit IV
Q.4)B)	Any 1 out of 2	06	
Q.5)	Any 3 out of 6	12	All Units

Practical Examination Pattern:

(A) External (Semester end practical examination):

Particulars	Practical 1
Laboratory work	45
Viva	5
Total	**50**

Ramnarain Ruia Autonomous College

PRACTICAL BOOK/JOURNAL

The students are required to present a duly certified journal for appearing at the practical examination, failing which they will not be allowed to appear for the examination.

In case of loss of Journal and/ or Report, a Lost Certificate should be obtained from Head/ Co-ordinator / Incharge of the department; failing which the student will not be allowed to appear for the practical examination.

Overall Examination and Marks Distribution Pattern

Semester- III and IV

Course	301/401		302/402		303/403		304/404		Total per Course	Grand Total
	Internal	External	Internal	External	Internal	External	Internal	External		
Theory	40	60	40	60	40	60	40	60	100	400
Practicals	50		50		50		50		50	200

---- x ---- 0 ---- x ----

Ramnarain Ruia Autonomous College