| BTY 5208 | **PLANT BIOTECHNOLOGY AND PLANT GENETICENGINEERING**<br>(Credits4;Theory4hrs;Practical3 hrs) |
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| **Aim** | To study recombinant DNA (rDNA) technology and plant geneticengineeringand,theirapplicationinplantbiotechnology |
| **Objectives** | • To Study about various vectors and DNA modifying enzymesusedin rDNA technology<br>• To understand the methodsand applications of plantbiotechnology<br>• To study the biosafety methods, laws, ethical issues of rDNAtechnologyand IPR |
| **Learning outcome** | Afterthecompletionofthiscourse,thelearnerwillknow<br>➢ Howtoutilizeplantsforbiotechnologyapplication<br>➢ Understand the principles of rDNA technology and how it can beusedin plants to generatebettertraits<br>➢ Understand biosafety, legal and ethical issues of genetic engineeringinplants. |
| **S.No.** | **Theory** |
| **1.** | **Vectorsinmolecularcloning:**<br>Plasmids, phages, phagemids, hybrid vectors, cosmids, eukaryotic virus-basedvectors,shuttlevectors,expressionvectors(especiallyplant expressionvectors),fosmids,PACs, BACsandYACs. |
| **2.** | **Molecularcloning:**<br>Steps - amplification, restriction digestion, ligation, transformation,screening.<br>Special molecules and enzymes for DNA modifications – restriction enzymes, ligases, klenow, phosphatases, recombinases, modification ofDNAfragmentsusinglinkers,adaptorsandhomopolymer tailing.<br>Recombinationbasedcloning. |
| **3.** | **Introducinggenesintoprokaryotes:**<br>Transformation,transduction,conjugation,electroporation. |
| **4.** | **Identifyingtherightclone:**<br>Screeningandselection-reportergenes,selectablemarkers,insertional |
| | inactivationofmarkergenes.<br>Molecular screening - PCR, colony and dot-blot hybridization, nucleicacidhybridization andimmunological techniques. |
| **5.** | **ApplicationsofrDNAtechnologyinbiotechnology:**<br>GenomicandcDNAlibraries,isolationofimportantgenes,Construction of gene cassette, protein engineering, bioprocessing, phytoremediation,agriculture. |

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| **6.** | **Genetransfertoplants:**<br>Tissueculturein plantgeneticengineering<br>IntegrativeDNAtransfer-directtransformationmethods,<br>*Agrobacterium*-basedmethods,Organelleengineering.<br>Non-integrative DNA transfer - Plant viruses and Protoplast fusion.Molecularandfunctional analysisof transgenicplants. |
| **7.** | **Biotechnologicalapplicationsofplantgeneticengineering:**<br>Functional genomics, resistance to abiotic and biotic stresses, crop qualityimprovement, nutrient enhancement, nitrogen fixation, nutrition up-<br>take,productionofmalesterilelines,plantibodies,vaccines,commercialoils, plantsecondaryproducts,biofuel,bioplasticsandplantsasbioreactors. |
| **8.** | **Hazardsandimpactof GMOs:**<br>Biosafetyconsiderations,BiosafetyregulationsinIndia.<br>Ethical issues, biological risks, impact on biodiversity, controlled trials.Economicissues,legalissues,intellectualpropertyrights(IPR)inrelation toplantbiotechnology. |
| **S. No.** | **Laboratory/Practical** |
| **1.** | Plasmid restriction digestion and gel electrophoresis to study DNAmobility, stoichiometry, deciding factors for percentage ofagarose/polyacrylamide,importanceofDNAmarker,bandsize calculation,etc. |
| **2.** | Isolation of vector plasmid and, plasmid with insert/ or PCR product, forcloning |
| **3.** | Preparation of vector and insert by restriction digestion and elution, forcloning |
| **4.** | Ligationforcloning |
| **5.** | Preparationofcompetentcellsandtransformation |
| **6.** | Workingoutproblemsonhowtocalculaterestriction-digestedbandsize andconstructionofto-the-scaleplasmidmap |
| **7.** | *Agrobacterium*-mediatedplanttransformation–preincubation |
| **8.** | *Agrobacterium*-mediatedplanttransformation–infection |
| **9.** | *Agrobacterium*-mediatedplanttransformation–selection |
| **10.** | GUSorGFPdetection |
| **11.** | Gene amplification using PCR and its confirmation using gelelectrophoresis |
| **12.** | Southernblottingandtransfer |

**TextBooks:**


1. Primrose SB, Twyman R. 2016. PrinciplesofGeneManipulationandGenomics,8th edition.Wiley-Blackwell.
2. BrownTA.2016.GeneCloningandDNAAnalysis:AnIntroduction,7th edition.Wiley-Blackwell.
3. CooperG.2018.TheCell:AMolecularApproach,8th edition.SinauerAssociates.
4. Glick BR, Patten CL. 2017. Molecular Biotechnology: Principles and

Applications of RecombinantDNA,5th edition. ASM Press.
5. BourgaizeD,JewellTR,BuiserRG.1999.Biotechnology:DemystifyingtheConcepts ,1stedition.BenjaminCummings.
6. NichollDST.2008.AnIntroductiontoGeneticEngineering,3rdedition.CambridgeUn iversityPress.
7. GelvinSB,SchilperoortRA.(Eds.).2000.PlantMolecularBiologyManual.Springer.
8. Clark,MelodyS.(Eds.).1997.PlantMolecularBiology—ALaboratoryManual.Springer.
9. DaleJW,SchantzMV,PlantN.2011.FromGenestoGenomes:ConceptsandApplicati onsofDNATechnology, 3rd edition. Wiley.
10. ShahJM.2012.Strategiestoovercomefungaldiseasesinplants:Anenchiridion.Lamb ertAcademicPublishing AG & Co.
11. KshitijKumarSingh.2015.BiotechnologyandIntellectualPropertyRights:Legaland SocialImplications.Springer.
12. ErbischFH,MarediaK(Eds.).2003.IntellectualPropertyRightsinAgriculturalBiote chnology,2ndedition. CABI Publishing.
13. ParasharS,GoelD.2013.IPR,BiosafetyandBioethics.PearsonIndia.