

**Kalindi College**  
**DEPARTMENT OF BOTANY**  
**Curriculum/Teaching Plan (2025-26)**  
**(Even Semesters : II, IV, VI)**  
**[2<sup>nd</sup> January 2026 – 30<sup>th</sup> April, 2026]**

**Dr. Pratibha Thakur**

**Course : B. Sc. (H) Botany, 3rd Year, Semester VI [2<sup>nd</sup> January – 30<sup>th</sup> April, 2026]**

**Paper : Plant Biotechnology DSC 16 ALL (THEORY) NEP**

Name of Paper: Plant Biotechnology & Code	Allocation of Lectures	Month wise schedule	Assignment/Presentation	Reading suggestions
<p><b>Unit 1: Introduction to Biotechnology</b>            Historical timeline; sectors of Biotechnology, brief overview of techniques and methods in Biotechnology.</p>	<b>02 Hours</b>	January 2026		1. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. 2. Glick, B.R., Pasternak, J. J. & Patten C. (2010). Molecular Biotechnology Principles and Applications of recombinant DNA.
<p><b>Unit 2: Plant Tissue Culture</b>            Historical perspective (Major contributions of Haberlandt, Laibach, White, Reinert and Steward, Murashige and Skoog, Cocking, Guha and Maheshwari, Bhojwani, Morel and Martin); Types and Composition of media; roles of nutrients (major and minor), vitamins, hormones and others (coconut water, activated charcoal); Plasticity and Totipotency; Organogenesis (direct and indirect); Embryogenesis (somatic and zygotic); Protoplast isolation, culture and fusion; Tissue culture applications (micropropagation, androgenesis, haploids, triploids and cybrids); production of virus-free plants.</p>	<b>08 Hours</b>	January 2026		3. Bhojwani, S.S. and Bhatnagar, S.P. (2011) The Embryology of Angiosperms. 4. Snustad, D.P. and Simmons, M.J.(2010). Principles of Genetics. 5. Stewart, CN Jr (2008). Plant Biotechnology and Genetics: Principles, Techniques and Applications 6. Slater, A., Scott, N. W. & Fowler, M. R. 2010. Plant

Name of Paper: Plant Biotechnology & Code	Allocation of Lectures	Month wise schedule	Assignment/Presentation	Reading suggestions
<p><b>Unit 3: Recombinant DNA technology</b>  Restriction Endonucleases (History, Types I-IV, biological role and application); modifying enzymes and their applications (nucleases, ligases, alkaline phosphatase, polynucleotide kinase) (in brief only); Introduction to prokaryotic and eukaryotic cloning vectors: pBR322, pUC18, pUC19, BACs, Lambda phage, YACs. Gene Cloning: Restriction digestion of DNA, elution of DNA from agarose gels, ligation, bacterial transformation, and selection of recombinant clones (alpha complementation, antibiotic selection, restriction enzyme-based selection)</p>	<b>07 Hours</b>	February 2026		<p>Biotechnology: The Genetic Manipulation of Plants. 2<sup>nd</sup> edn. New York, USA: Oxford University Press Inc.</p> <p>7. Primrose, S. B. &amp; Twyman, R.M. 2006. Principles of Gene Manipulation and Genomics. 7<sup>th</sup> edn. Victoria, Australia: Blackwell Publishing.</p>
<p><b>Unit 4: Genetic transformation of Plants</b>  Methods of gene transfer to plants: Agrobacterium-mediated transformation (Ti plasmids, development of binary vectors), Direct gene transfer by Electroporation, Microinjection, Microprojectile bombardment; selection of transgenic plants: selectable marker genes (Positive selection markers – antibiotic- and herbicide-resistance conferring genes) and reporter genes (Luciferase, GUS, GFP); Introduction to genome editing.</p>	<b>07 Hours</b>	March 2026		<p>8. Brown, T. A. 2020. Gene Cloning &amp; DNA Analysis: An Introduction. 8<sup>th</sup> edn. UK: Wiley Blackwell.</p>
<p><b>Unit 5: Applications</b>  Pest resistant (Bt-cotton) and herbicide resistant plants (RoundUp Ready™ soybean); Transgenic crops with improved quality traits (Flavr Savr™ tomato. Golden™ rice); Improved horticultural varieties (Moondust carnations); Bioremediation (Superbug); Edible vaccines; Biosafety of transgenic plants.</p>	<b>06 Hours</b>	April 2026		
Revision, Assignments and Test		April 2026	Assignment/Presentation/Class test	

Course : B. Sc. (H) Botany, 3rd Year, Semester VI [2<sup>nd</sup> January – 30<sup>th</sup> April, 2026]

Paper : Plant Biotechnology DSC 16 (PRACTICALS) (NEP) Group 2

Name of Paper: Plant Biotechnology & Code	Allocation of Lectures	Month wise schedule	Tutorial/Assignment/ Presentation	Reading suggestions
1. Preparation of Murashige & Skoog's (MS) medium.	2 Practicals	January 2026		1. <b>Bhojwani, S.S. and Razdan, M.K., (1996).</b> Plant Tissue Culture: Theory and Practice.
2. Initiation of axenic cultures- seed sterilisation and inoculation	2 Practicals	January 2026		2. <b>Glick, B.R., Pasternak, J. J. &amp; Patten C. (2010).</b> Molecular Biotechnology Principles and Applications of recombinant DNA.
3. Micropropagation (shoot induction) using leaf and/or nodal explants of tobacco/Datura/ Brassica etc.	2 Practicals	February 2026		3. <b>Bhojwani, S.S. and Bhatnagar, S.P. (2011)</b> The Embryology of Angiosperms.
4. Induction of callus and analysis of effects of growth regulators (Auxin and Cytokinin) on in vitro regeneration using tobacco leaf explant.	2 Practicals	February 2026		4. <b>Snustad, D.P. and Simmons, M.J. (2010).</b> Principles of Genetics.
5. Preparation of chemically competent cells of <i>E. coli</i> .	1 Practical	February 2026		5. <b>Stewart, CN Jr (2008).</b> Plant Biotechnology and Genetics: Principles, Techniques and Applications
6. Transformation of <i>E. coli</i> with plasmid DNA by heat shock method.	1 Practical	March 2026		6. <b>Slater, A., Scott, N. W. &amp; Fowler, M. R. 2010.</b> Plant Biotechnology: The Genetic Manipulation of Plants. 2 <sup>nd</sup> edn. New York, USA: Oxford University Press Inc.
7. Restriction digestion and gel electrophoresis of plasmid DNA.	1 Practical	March 2026		7. <b>Primrose, S. B. &amp; Twyman, R.M. 2006.</b> Principles of Gene Manipulation and Genomics. 7 <sup>th</sup> edn. Victoria, Australia: Blackwell Publishing.
8. Study of methods of gene transfer through photographs: Agrobacterium-mediated, direct gene transfer by electroporation, microinjection, microprojectile bombardment.	2 Practicals	March 2026		8. <b>Brown, T. A. 2020.</b> Gene Cloning & DNA Analysis: An Introduction. 8 <sup>th</sup> edn. UK: Wiley Blackwell.
9. Study of steps of genetic engineering for production of Bt cotton, Golden rice, Flavr Savr tomato through photographs.	2 Practicals	April 2026		
10. Construction of restriction map of circular and linear DNA from the data provided.	2 Practicals	April 2026		
11. Visit to Research laboratory.		April 2026		
Revision, Practical Mock Exam		April 2026		

**B.Sc. (H) Botany 1st Year, Sem II [2<sup>nd</sup> January – 30<sup>th</sup> April, 2026]****Paper : Discipline Specific Core -4 – Microbiology and Plant – Microbe Interactions ALL (THEORY) NEP**

<b>Name of Paper: Microbiology and Plant – Microbe Interactions &amp; Code</b>	<b>Allocation of Lectures</b>	<b>Month wise schedule</b>	<b>Assignment/ Presentation</b>	<b>Reading suggestions</b>
<b>Unit 1: Introduction</b> Microbial world, Growth and nutrition of microbes with reference to nutritional media. (Bacterial Growth curve, Introduction to different types of nutritional media)	04 lectures	January 2026		Suggested Readings: 1. Pelczar, M.J. (2001). Microbiology, 5th edition. New Delhi, Delhi, Tata McGrawHill Co.
<b>Unit 2: Viruses</b> Discovery; Physicochemical and biological characteristics; Classification (Baltimore); General structure with special reference to viroids and prions, DNA and RNA viruses; General account and mechanism of replication, lytic and lysogenic cycle; General account of viral diseases of plants (mosaic and vein clearing disease).	06 lectures	January-February 2026		2. Tortora, G.J., Funke, B.R., Case, C.L. (2016). Microbiology: An Introduction, Indian edition, Pearson India Education Services Pvt. Limited, Noida, India
<b>Unit 3: Bacteria</b> Discovery, General characteristics; Types - Archaeobacteria, Eubacteria, Wall less forms (Mycoplasma, Phytoplasma and Spheroplasts); Cell structure; Nutritional types; Reproduction - vegetative, asexual and recombination (conjugation, transformation and transduction); General account of bacterial diseases of plants (Citrus canker, Angular leaf spots of cotton).	08 lectures	February 2026		3. Prescott, L.M., Harley J.P., Klein D. A. (2005). Microbiology, 6th edition: McGraw Hill, New Delhi.
<b>Unit 4: Applied Microbiology</b> Economic importance of viruses with reference to vaccine production, role in research, medicine, diagnostics and agriculture. Economic importance of bacteria with reference to their role in agriculture and industry (fermentation and medicine).	06 lectures	March 2026		4. Gupta, R., Chugh, G. (2022). Plants, Microbes and Diseases 1st Edition, I.K. International Pvt. Ltd., Delhi.
<b>Unit 5: Plant-Microbe interactions</b> General account of Plant-microbe interactions; Plant growth promoting rhizobacteria (PGPR); Mechanism of nitrogen fixation by Cyanobacteria and Rhizobia; Types of mycorrhizal association with plants; Ectomycorrhiza and Endomycorrhiza and their effects on plant growth.	06 lectures	April 2026		5. Subba Rao, N.S. (2000). Soil Microbiology, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi <b>Additional Resources:</b> 1. Talaro, K.P., Talaro, A. (2006). Foundations in Microbiology. McGraw Hill, New Delhi.
Revision, Assignments and Test		April 2026	Assignment/ Presentation/ Class test	

**B.Sc. (H) Botany 1st Year, Sem II [2<sup>nd</sup> January – 30<sup>th</sup> April, 2026]**

**Paper : Discipline Specific Core -4 – Microbiology and Plant – Microbe Interactions (PRACTICALS) NEP Group 2**

Name of Paper: Microbiology and Plant – Microbe Interactions & Code	Allocation of Lectures	Month wise schedule	Reading suggestions
<b>Practicals :</b>			Suggested Readings:
1. <b>Study of Viruses:</b> Electron micrographs / Models - T-Bacteriophage and TMV; specimens/digital resources/ Line drawings of Lytic and Lysogenic Cycle.	2 weeks	January 2026	1. Pelczar, M.J. (2001). Microbiology, 5th edition. New Delhi, Delhi, Tata McGrawHill Co.
2. <b>Study of Bacteria:</b> Electron micrographs of bacteria; Types of Bacteria from temporary/permanent slides. Endospore, Binary fission, Conjugation, Root nodule through specimens/digital resources.	2 weeks	January 2026	2. Tortora, G.J., Funke, B.R., Case, C.L. (2016). Microbiology: An Introduction, Indian edition, Pearson India Education Services Pvt. Limited, Noida, India
3. <b>Study of Plant Growth Promoting Rhizobacteria (PGPR)</b> through specimens/digital resources (at least three).	1 week	February 2026	3. Prescott, L.M., Harley J.P., Klein D. A. (2005). Microbiology, 6th edition: McGraw Hill, New Delhi.
4. <b>Gram staining</b> to differentiate between Gram-positive and Gram-negative bacteria.	2 weeks	February 2026	4. Gupta, R., Chugh, G. (2022). Plants, Microbes and Diseases 1st Edition, I.K. International Pvt. Ltd., Delhi.
5. <b>Study of Rhizobium</b> from root nodules of a leguminous plant.	2 weeks	March 2026	5. Subba Rao, N.S. (2000). Soil Microbiology, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi
6. <b>Isolation of Anabaena from Azolla</b> leaves.	2 weeks	March 2026	Additional Resources:
7. Histochemical staining to observe <b>Arbuscular Mycorrhizal Fungi (AMF)</b> colonization in roots.	2 weeks	April 2026	1. Talaro, K.P., Talaro, A. (2006). Foundations in Microbiology. McGraw Hill, New Delhi.
8. <b>Study of bacterial diseases</b> (Citrus canker, Angular leaf spots of cotton) and <b>viral diseases</b> of plants (mosaic and vein clearing disease) through specimens/digital resources.	2 weeks	April 2026	
Revision and Practical Mock Exam		April 2026	

**Course : B. Sc. (H) Botany, 2<sup>nd</sup> year, Sem. IV [2<sup>nd</sup> January 2026 – 30<sup>th</sup> April, 2026]**

**Paper : Ecology and Conservation – DSC- 11 – PRACTICALS (NEP) Group 2**

Name of Paper : Ecology and Conservation	Allocation of Lectures	Month wise schedule	References
<p><b>Practicals :</b></p> <p>1. Principle and operation of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge and lux meter.</p> <p>2. Determination of pH and detection of carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency from atleast two soil samples by rapid field tests.</p> <p>3. Determination of pH &amp; dissolved oxygen from polluted and unpolluted water samples.</p> <p>4. Determination of soil organic carbon and organic matter of different soil samples by Walkley &amp; Black rapid titration method.</p> <p>5. Study of ecological adaptations of hydrophytes and xerophytes (four each).</p> <p>6. Study of biotic interactions of the following: Stem parasite (<i>Cuscuta</i>), Root parasite (<i>Orobancha</i>), Epiphytes, Predation (Insectivorous plants).</p> <p>7. Determination of minimal quadrat size and number for the study of herbaceous vegetation in the college campus, by species area curve method (species to be listed).</p> <p>8. Quantitative analysis of herbaceous vegetation in the college campus for frequency and comparison with Raunkiaer's frequency distribution law.</p> <p>9. Quantitative analysis of herbaceous vegetation for density and abundance in the college campus.</p> <p>10. Species distribution pattern based on A/F ratio (regular, random, clumped).</p> <p>11. Field visit to familiarize students with ecology/conservation of different sites.</p>	<p>2 weeks</p> <p>2 weeks</p> <p>1 week</p> <p>2 weeks</p> <p>1 week</p> <p>1 week</p> <p>2 weeks</p> <p>1 week</p> <p>1 week</p> <p>1 week</p> <p>1 week</p>	<p>January 2026</p> <p>January 2026</p> <p>February 2026</p> <p>February 2026</p> <p>February 2026</p> <p>March 2026</p> <p>March 2026</p> <p>March 2026</p> <p>April 2026</p> <p>April 2026</p> <p>April 2026</p>	<p><b>Suggested Readings:</b></p> <ol style="list-style-type: none"> <li>1. Daubenmire, R.F. (1975). Plant and Environment. London: J. Wiley and Sons Inc.</li> <li>2. Kormondy, E.J. (1996). Concepts of Ecology. New Delhi, India: PHI Learning Pvt. Ltd. 4th edition.</li> <li>3. Odum, E.P. (2005). Fundamentals of Ecology. New Delhi, India: Cengage Learning India Pvt. Ltd., 5th edition.</li> <li>4. Sharma, P.D. (2010). Ecology and Environment. Meerut, India: Rastogi Publications. 8th edition.</li> <li>5. Singh, J.S., Singh, S.P., Gupta, S.R. (2014). Ecology, Environmental Science and Conservation. New Delhi, India: S. Chand.</li> </ol> <p><b>Additional Resources:</b></p> <ol style="list-style-type: none"> <li>1. Ambasht, R.S. and Ambasht, N.K. (2008). A text book of Plant Ecology, CBS Publishers &amp; Distributors PVT. LTD.</li> <li>2. Majumdar, R and Kashyap, R (2019). Practical Manual of Ecology and Environmental Science, New Delhi, India: Prestige Publishers</li> <li>3. Singh, J.S., Singh, S.P., Gupta, S. R. (2006). Ecology, Environment and Resource Conservation. New Delhi, India: Anamaya Publications.</li> <li>4. Wilkinson, D.M. (2007). Fundamental Processes in Ecology. USA: An Earth Systems Approach. Oxford University Press.</li> </ol>

Name of Paper : Ecology and Conservation	Allocation of Lectures	Month wise schedule	References
<ul style="list-style-type: none"> <li>• Revision</li> <li>• Mock Practical Test</li> </ul>		<p style="text-align: center;">April 2026</p>	<p>5. Hanski, I.A., &amp; Gilpin, M.E. (1997). Metapopulation biology: Ecology, genetics, and evolution. Academic Press.</p>