Botany VOC Syllabus

Part A - Introduction			
Semester	4th		
Name of the Course	Natural Farming		
Course Code	B25-VOC-209(BOT)		
Course Type (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	VOC-1		
Level of the Course (as per Annexure 1)	100-199		
Prerequisite for the Course (if any)			
Course Learning Outcomes	After completing this course: 1: Students will be able to understand the need and concept of natural and integrated farming system. 2: Students will develop a conceptual understanding of utilization of biofertilizers. 3: Students will gain knowledge about the disease and pest management 4: Students will learn about the use of plant products in natural farming. quality control and certification procedures of organic products. 5. Students will gain the knowledge of practical aspects of natural and integrated farming system, role of nutrient in plant growth, utilization of plant and animal waste in organic farming, and also learn about standardization procedures.		
Credits	Theory	Practical	Total
	2	2	4
Contact Hours	2	4	6

Theory

Max. Marks: 50
Time: 3 Hours
Internal Assessment Marks: 15
End Term Exam Marks: 35

PRACTICAL

Max. Marks: 50
Time: 4 Hours
Internal Assessment Marks: 15
End Term Exam Marks: 35

Part B – Content of the Course

Instructions for Paper- Setter

1. Nine questions will be set in all. All questions will carry equal marks.

2. Question No.1 will contain seven short answer type questions covering the entire syllabus and will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each unit. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.

UNIT	Topics	Contact Hours
I	**Natural Farming:** Definition, history, and scope of natural farming; principles of organic and chemical-free agriculture; soil fertility management using compost, vermicompost, green manure, and biofertilizers;	7
II	**Crop Rotation:** Introduction to crop rotation; Principle, types and Importance of crop rotation;intercropping, and mulching; Crop rotation vs mixed cropping vs intercropping; Crop rotation and soil health	7
III	**Pest and Disease management:** Natural pest and disease management using botanical extracts, traps, and biocontrol agents; role of beneficial microorganisms in maintaining soil health	8
IV	**Sustainable Crop Production:** Use of locally available resources for farm inputs; sustainable crop production practices; benefits to environment, human health, and economy; challenges and future prospects of natural farming.	8
V	**Practicum:** 1. To prepare compost using plant residues, vegetable waste, and cow dung for improving soil fertility. 2. To prepare vermicompost using earthworms and learn worm handling, feeding, and harvesting techniques. 3. To grow and in corporate green manure crops into soil for enhancing organic matter and soil fertility. 4. To test soil samples for pH, texture, moisture,and nutrient content using simple laboratory methods. 5. To prepare plant based pest repellents using neem, garlic, chili, and marigold and study their effectiveness. 6. To demonstrate mulching using dry leaves, straw, or husk for moisture retention, temperature control, and weed suppression. 7. To perform intercropping or companion planting in pots 8. To treat and germinate seed using natural method such as soaking in cow urine, neem extract, or water. 9. To demonstrate small-scale water conservation techniques including drip irrigation and rainwater	60

	harvesting in pots. 10. To maintain proper documentation and records of composting, vermi-composting, soil testing, plant growth, and pest management experiments **Note: Student will perform at least eight experiments**	

Suggested Evaluation Methods

Internal Assessment: ➢ Theory (15 Marks) • Class Participation: 05 Marks • Seminar/presentation/assignment/quiz/class test etc.:05 Marks • Mid-Term Exam: 5 Marks ➢ Practicum (15 Marks) • Class Participation: Nil • Seminar/Demonstration/Viva-voce/Lab records etc.:15 Marks • Mid-Term Exam: Nil	End Term Examination 35 Marks 35 Marks

Part C – Learning Resources

Recommended Books/e-resources/LMS:

1. Elasas, J.D.V, Jansson J.K. and Trevors (2006). Modern Soil Microbiology. Second Edition. CRC Press. Boca Raton.
2. Das, D.K. (2015) Introductory Soil Science. 4th Edition, Kalyani Publishers, ISBN-13. 978-9327257540
3. Agarwal, A and Udipi, S. (2014). Text Book of Human Nutrition. Jaypee Medical Publication, Delhi.
4. Akshay Krishi Parivar (2022). Bhumi Suposhan-Commemorative Publication of the Nationwide Bhumi
5. Suposhan and Samrakshan Abhiyan. AKP Publication No.11. pp 212.
6. AOAC International (2016) AOAC Official Methods of Analysis. 20th Edition, Association of Official Analytical Chemists. Washington DC.
7. Behera, UK. 2013. A Text Book of Farming Systems. Agrotech Publishing House, Udaipur, Rajasthan.
8. Bhattacharyya, P., & Chakraborty, G. (2019). Organic Farming in India: Problems and Prospects. New India Publishing Agency.
9. Chander, M and Subrahmanyeswari, B. 2017. Organic Livestock Farming. Indian Council of Agricultural Research, New Delhi
10. Choudhary, S.L., G.S. Sharma and Y.L. Nene (2000) Ancient and Medieval History of Indian Agriculture and its

Part A - Introduction			
Semester	4th		
Name of the Course	Plant Propagation and Nursery Techniques		
Course Code	B25-VOC-210(BOT)		
Course Type (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	VOC-2		
Level of the Course (as per Annexure 1)	100-199		
Prerequisite for the Course (if any)			
Course Learning Outcomes	After completing this course: 1: Students will be able to understand to use various tools and implements used in nursery. 2: Students will develop a conceptual understanding of the infrastructure of nursery propagation structures 3: Students will gain knowledge about the various types of common diseases and their management.. 4: Students will learn about the vegetative propagation methods. 5*: Students will gain the knowledge of practical aspects of plant propagation and nursery techniques common diseases and their management and vegetative propagation methods.		
Credits	Theory	Practical	Total
	2	2	4
Contact Hours	2	4	6
Theory Max. Marks: 50 Time: 3 Hours Internal Assessment Marks: 15 End Term Exam Marks: 35			
PRACTICAL			

Max. Marks: 50
Time: 4 Hours
Internal Assessment Marks: 15
End Term Exam Marks: 35

Part B – Content of the Course

Instructions for Paper- Setter

1. Nine questions will be set in all. All questions will carry equal marks.

2. Question No.1 will contain seven short answer type questions covering the entire syllabus and will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each unit. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.

UNIT	Topics	Contact Hours
I	**Nursery Layout:** Objectives and scope; infrastructure for development of nursery; Propagation structures like Mist chambers, humidifiers, greenhouses, glasshouses, cold frames, hotbeds, poly-houses; nursery tools and implements; planning and seasonal activities.	7
II	**Raising of Seedlings: Seed** Structure and types; Seed dormancy: causes and methods of breaking dormancy; Seed storage: Seed banks, factors affecting seed viability. Land preparation, manuring, watering, sowing/ raising of seeds and seedlings; transplantation of seedlings.	8
III	**Nutrient and Disease Management:** Media for propagation and growing nursery plants-soil, sand, peat, sphagnum moss, vermiculite, perlite. Vermicompost production preparation, use of vermicompost in the nursery. Common diseases and their management: Anthracnose, blights, dieback, leaf spots, powdery mildew; insect/pest/disease control in the nursery.	8
IV	**Plant Propagation:** Need and potentialities for plant multiplication, vegetative propagation: cutting, layering, grafting and budding and propagation through specialized organs; rhizome, corm, runners and suckers. Use of growth regulators in vegetative propagation. Factors influencing rooting of cuttings and layering, graft incompatibility. Maintenance of mother trees, collection of scion wood sticks, scion-stock relationship and their influences.	7
V	**Practicum:** 1. Study of different tools and implements used in nursery. 2. Study of seed dormancy breakage by scarification and stratification. 3. Investigating the effect of different environmental conditions on seed germination. 4. Preparation and application of growth regulators 5. Bed preparation for growth of seedlings. 6. Raising of seed lings and transplantation.	60

	7. Study of different methods of vegetative propagation. 8. Study of common diseases (as given in the theory syllabus) 9. Effect of different cutting types on rooting 10. Study of different grafting technique like air layering **Note: Student will perform at least eight experiments**.	

Suggested Evaluation Method

Internal Assessment: ➢ Theory (15 Marks) • Class Participation: 05 Marks • Seminar/presentation/assignment/quiz/class test etc.:05 Marks • Mid-Term Exam: 5 Marks ➢ Practicum (15 Marks) • Class Participation: Nil • Seminar/Demonstration/Viva-voce/Lab records etc.:15 Marks • Mid-Term Exam: Nil	End Term Examination 35 Marks 35 Marks

Part C – Learning Resources

Recommended Books/e-resources/LMS:

1. Singh, A.K. & Kumar A.(2023). Plant Propagation and Nursery management. S.K.Kataria and sons.
2. Ray,P.K.(2021).Essentials of Plant nursery management. Scientific publishers, India. 2nd edition.
3. Taiz, L., Zeiger, E., Moller, I.M. and Murphy, A. (2015). Plant Physiology and Development. Sinauer Associates Inc. USA.6th edition.
4. Ray,P.K.(2012). Plant nursery management: how to start and operate a plant nursery. Scientific publishers, India.
5. Sinha,N.K.,Hui,Y.H.(2011).Hand book of vegetables & vegetable processing.Wiley-Blac, A John Wiley & SOns, Ltd.
6. Jain,S.M.&Ochatt,S.J.(2009).Protocols for *invitro* propagation of ornamental plants: 598 (Methods in Molecular Biology). Humana Press.
7. Hopkins,W.G.andHuner,A.(2008).Introduction to Plant Physiology.John Wiley and Sons.U.S.A. 4th edition.
8. Mason,J.(2004).Nursery management. Landlinks Press.

Part A - Introduction			
Semester	5th		
Name of the Course	Basics of Plant Breeding		
Course Code	B25-VOC-309(BOT)		
Course Type (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	VOC-3		
Level of the Course (as per Annexure 1)	100-199		
Prerequisite for the Course (if any)			
Course Learning Outcomes	After completing this course: 1: Students will be able to understand basic principles and objectives of plant breeding. 2: Students will develop a conceptual understanding the of plant breeding 3: Students will gain knowledge about methods used for crop improvement 4: Students will learn about basic plant breeding practices such as selection and hybridization 5*. Students will gain the knowledge of practical aspects of plant breeding, methods used for crop improvement and basic plant breeding practices such as selection and hybridization		
Credits	Theory	Practical	Total
	2	2	4
Contact Hours	2	4	6

Theory

Max. Marks: 50
Time: 3 Hours
Internal Assessment Marks: 15
End Term Exam Marks:35

PRACTICAL

Max. Marks: 50
Time: 4 Hours
Internal Assessment Marks: 15
End Term Exam Marks: 35

Part B – Content of the Course

Instructions for Paper- Setter

1. Nine questions will be set in all. All questions will carry equal marks.

2. Question No.1 will contain seven short answer type questions covering the entire syllabus and will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each unit. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.

UNIT	Topics	Contact Hours
I	**Plant Breeding:** definition, scope and importance History and development of plant breeding Role of Gregor Mendel in plant breeding .Role of Norman Borlaug in crop improvement and Green Revolution. Objectives of plant breeding:Yield improvement Quality improvement, Biotic stress resistance (disease, insects) Abiotic stress resistance (drought, salinity, temperature)	7
II	**Floral Biology:** structure and function, Modes of reproduction in crop plants:Self pollination, Cross pollination, Mechanisms promoting self and cross pollination: Dichogamy,Self incompatibility, Male sterility	7
III	**Selection Methods in Plant Breeding**: definition and importance Types of selection: Natural selection,Artificial selection Methods of selection: Mass selection,Pure line selection Clonal selection Advantages and limitations of each method, Application of selection in crop improvement	8
IV	**Hybridization**: definition and objectives Types of hybridization:Intervarietal hybridization Inter specific hybridization (basic concept) Steps in hybridization:Selection of parents Emasculation,Pollination Bagging and tagging, Heterosis (hybrid vigor): concept and importance	8
V*	**Practicum:** 1. Study of Floral Biology of self and cross pollinated crops. 2. Study of Emasculation and Bagging Techniques in crops like wheat or pea. 3. Study of Artificial Hybridization Techniques in selected crops. 4. Estimation of Pollen Viability using acetocarmine or iodine staining. 5. Study of Pollen Germination using hanging drop method. 6. Observation of Male Sterility Systems (Genetic male sterility / Cytoplasmic male sterility) using charts or	60

	specimens. 7. Study of Different Mating Systems (selfing, sib mating, test cross, back cross) 8. Study of Germplasm Conservation Methods (in situ and ex situ) with examples. 9. Artificial Pollination Demonstration in pea or okra. 10. Pollen Viability Test using Tetrazolium (TZ) staining. **Note: Student will perform at least eight experiments**	

Suggested Evaluation Method

Internal Assessment: ➢ Theory (15 Marks) • Class Participation: 05 Marks • Seminar/presentation/assignment/quiz/class test etc.:05 Marks • Mid-Term Exam: 5 Marks ➢ Practicum (15 Marks) • Class Participation: Nil • Seminar/Demonstration/Viva-voce/Lab records etc.:15 Marks • Mid-Term Exam: Nil	End Term Examination 35 Marks 35 Marks

Part C – Learning Resources

Recommended Books/LMS:

1. Allard, R. W. (1999). Principles of plant breeding (2nd ed.). John Wiley & Sons, New York.
2. Poehlman, J. M., & Sleper, D. A. (2006). Breeding field crops (5th ed.). Blackwell Publishing, Ames, Iowa.
3. Singh, B. D. (2015). Plant breeding: Principles and methods (10th ed.). Kalyani Publishers, New Delhi.
4. Acquaah, G. (2012). Principles of plant genetics and breeding (2nd ed.). John Wiley & Sons, Hoboken, New Jersey.
5. Sharma, J. R. (2017). Principles and practice of plant breeding (2nd ed.). McGraw Hill Education, New Delhi.
6. Chahal, G. S., & Gosal, S. S. (2002). Principles and procedures of plant breeding: Biotechnological and conventional approaches. Narosa Publishing House, New Delhi.
7. Singh, P. (2016). Essentials of plant breeding. Kalyani Publishers, Ludhiana.

Part A - Introduction			
Semester	6TH		
Name of the Course	Plant Tissue Culture and Micropropagation		
Course Code	B25-VOC-409(BOT)		
Course Type (CC/MCC/MDC/CC-M/DSEC/VOC/DSE/PC/AEC/VAC)	VOC-4		
Level of the Course (as per Annexure 1)	100-199		
Prerequisite for the Course (if any)			
Course Learning Outcomes	After completing this course: 1: Students will be able to understand the principle and techniques of plant tissue culture and micropropagation 2: Students will develop a conceptual understanding of various procedure and techniques used for plant tissue culture 3: Students will gain knowledge about the basic steps of micropropagation including initiation, multiplication, rooting and hardening. 4: Students will learn about different types of employment opportunities in plant biotechnology laboratory. 5*. Students will gain the knowledge of practical aspects of plant tissue culture and micropropagation		
Credits	Theory	Practical	Total
	2	2	4
Contact Hours	2	4	6

Theory

Max. Marks: 50
Time: 3 Hours
Internal Assessment Marks: 15
End Term Exam Marks: 35

PRACTICAL

Max. Marks: 50
Time: 4 Hours
Internal Assessment Marks: 15
End Term Exam Marks: 35

Part B – Content of the Course

Instructions for Paper- Setter

1. Nine questions will be set in all. All questions will carry equal marks.

2. Question No.1 will contain seven short answer type questions covering the entire syllabus and will be compulsory. The remaining eight questions will be set unit wise selecting two questions from each unit. The candidate will be required to attempt question No. 1 and four more questions selecting one question from each unit.

UNIT	Topics	Contact Hours
I	**Introduction to plant tissue culture:** definition, history and scope; concept of totipotency; cellular differentiation and dedifferentiation; types of plant tissue culture (callus, cell suspension, organ, meristem, embryo)	7
II	**Micropropagation**: Concept and stages of micropropagation (initiation, multiplication, rooting, hardening); nutrientmedia composition (macro/micronutrients, vitamins, carbon sources, gelling agents)	7
III	**Plant regeneration and somatic hybridization**: Callus formation, organogenesis and embryogenesis, Protoplast isolation, somatic hybridisation, cybrids and their application	8
IV	**Cryopreservation and somaclonal Variation**: Cryopreservation of plant cell and tissue culture and establishment of gene banks. Somaclonal variations and isolation or useful mutant. Production of synthetic seed, importance, limitation and utilization	8
V*	**Practicum:** 1. To familiarize students with the plant tissue culture laboratory, basic equipment, safety measures and Standard laboratory practices. 2. To learn the cleaning, washing, drying,and sterilization of glassware used in plant tissue culture experiments. 3. To prepare nutrient media (Murashige and Skoog medium) for in-vitro culture of plant tissues. 4. To sterilize culture media, glassware and instruments using autoclave: and other sterilization methods. 5. To study the preparation of explants and perform surface sterilization 6. To learn the operation and working principles of the	60

	laminar airflow cabinet for aseptic inoculation. 7. To perform aseptic inoculation of explants onto nutrient media under sterile conditions. 8. To initiate callus culture from suitable plant explants using appropriate growth regulators. 9. To study shoot multiplication in in-vitro cultures using cytokinins. 10. To induce rooting in regenerated shoots using auxins **Note: Student will perform at least eight experiments**	

Suggested Evaluation Method

Internal Assessment: ➢ Theory (15 Marks) • Class Participation: 05 Marks • Seminar/presentation/assignment/quiz/class test etc.:05 Marks • Mid-Term Exam: 5 Marks ➢ Practicum (15 Marks) • Class Participation: Nil • Seminar/Demonstration/Viva-voce/Lab records etc.:15 Marks • Mid-Term Exam: Nil	End Term Examination 35 Marks 35 Marks

Part C – Learning Resources

Recommended Books/e-resources/LMS:

1. Bhojwani, S. S., and Razdan, M. K. (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Publishers, Amsterdam.
2. George, E. F., Hall, M. A., and De Klerk, G. J. (2008). Plant Propagation by Tissue Culture.Springer, Dordrecht, The Netherlands.
3. Gamborg, O. L., and Phillips, G. C. (1995).Plant Cell, Tissue and Organ Culture.Springer-Verlag, Berlin.
4. Razdan, M. K. (2003). Introduction to Plant Tissue Culture.Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.Plant Tissue Culture: An Introductory Text
5. Bhojwani, S. S. and Dantu, P. K. (2013). Springer India.
6. Plant Tissue Culture: Methods and Applications in Agriculture,Thorpe, T. A. (1981). Academic Press.