

M.Sc (Sugarcane Technology)

i. Preamble

Directorate of Open and Distance Learning (DODL), Tamil Nadu Agricultural University has designed, developed and implemented the post graduate education programme through its expertise and infrastructural facilities.

Sugarcane Breeding Institute (SBI), Coimbatore is engaged in advance research in sugarcane viz., breeding of superior sugarcane varieties/ genotypes having high sugar productivity as well as sustainability; conducting basic and strategic researches on crop improvement, production and protection aspects of sugarcane cultivation; collection, maintenance, evaluation, documentation and conservation of sugarcane; effecting technology transfer and human resource development in the areas of sugarcane agricultural research, etc.

PG education in M.Sc Sugarcane Technology course in Open and Distance Education mode for the benefit of Sugarcane Research & Development personnel working in sugarcane research stations, sugar factories, state department of agriculture, public & private undertakings of the country and graduates in life sciences etc. with a view to enrich the knowledge of graduates and enhance their employment potential to have a career in the field of sugarcane research and development.

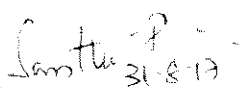
- ii. Duration** : Two years - Four semesters
150 working days per semester, duration inclusive of Saturday
- iii. Eligibility** : B.Sc (Ag.) / any degree with minimum of three years work experience in the relevant field
- iv. Medium of Instruction** : English
- v. Personal Contact Programme (PCP)** : PCP: 10 classes
Second week Saturday and Sunday of Every month
6th month – Final Examinations
A minimum attendance of 60% is compulsory

vi. Financial resources for conducting the PG programme

- Bench fee @ Rs.11,000/- per semester per student will be collected by Directorate of Open and Distance Learning of Tamil Nadu Agricultural University for meeting expenditure towards conducting the programme viz., preparation of course material, honorarium to resource persons, expenditure towards TA/DA to resource persons, incidental charges, etc.

vii. Courses to be offered

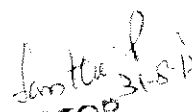
- a) Sugarcane breeding & genetics
- b) Crop production technology of sugarcane


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- c) Sugarcane soils and their management
 - d) Sugarcane chemistry, sugar and gur technology
 - e) Sugarcane physiology
 - f) Sugarcane diseases, epidemiology and control
 - g) Sugarcane pests and their control
 - h) Statistical techniques and computer applications for data management and analysis
 - i) Strategies for transfer of sugarcane technology
 - j) Sugarcane development and management
 - k) Principles and practices of cropping and farming systems
 - l) Plant cell tissue culture
 - m) Plant water relations
 - n) Farm machinery for sugarcane cultivation
- Candidates have to undergo all the fourteen courses besides one project work in the area of interest.
 - A contact programme of ten working days duration per semester will be organized by Sugarcane Breeding Institute, Coimbatore and Directorate of Open and Distance Learning, Tamil Nadu Agricultural University main campus, Coimbatore.
 - Candidates should possess a minimum of 60% attendance in the contact programme classes.
 - The resource material for the course will be compiled on Self-Instructional Materials (SIM) mode by a team of experts in the respective discipline.
 - At the end of each semester, theory examinations will be conducted by TNAU at Coimbatore and practical examination will be conducted by course leaders from TNAU and SBI.

viii . Course content

I SEMESTER	: ODL-SCT-601 - Sugarcane Breeding, Genetics and seed production ODL-SCT-602 - Crop Production Technology of Sugarcane ODL-SCT-603 - Sugarcane soils and their Management ODL-SCT-604 - Principles and Practices of cropping and Farming systems
II SEMESTER	ODL-SCT-605 - Sugarcane chemistry, Sugar and gur technology ODL-SCT-606 - Sugarcane physiology ODL-SCT-607 - Plant cell tissue culture ODL-SCT-608 - Plant water relation


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III SEMESTER	ODL-SCT-609 - Sugarcane Diseases. Epidemiology and Control
	ODL-SCT-610 - Sugarcane Pest and their Management
	ODL-SCT-611 - Statistical Techniques and Computer Applications for Data Management and Analysis
	ODL-SCT-612 - Farm Machinery for Sugarcane cultivation
IV SEMESTER	ODL-SCT-613 - Strategies for Transfer of Sugarcane Technology
	ODL-SCT-614 - Sugarcane development and management

ix. Course wise Syllabus

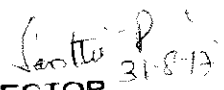
ODLS-SCT-601 - SUGARCANE TECHNOLOGY, GENETICS AND SEED PRODUCTION

BREEDING PRINCIPLES AND PROCEDURES FOR VEGETATIVELY PROPAGATED CROPS

Breeding Principles and Procedures for Vegetatively Propagated Crops -Modes of Vegetative Propagation in Crop Plants-Genetic constitution of Vegetatively Propagated Crops-Breeding Procedures for Vegetatively Propagated Crops -Some constraints in Breeding for Vegetatively Propagated Crops-The size of the Breeding Population -Mutation breeding-Use of Biotechnological Methods -The History of Sugarcane Improvement-Story of cane improvement -Java -India -Improvement in Other Countries-Base Broadening Programme-The Present Glory of Sugarcane -Future ahead-Sugarcane : Botany, Taxonomy and Origin -General Morphology - Taxonomy - Origin of Saccharum Species -Origin and Distribution-Main Characters of the Genera -Flowering behaviour and hybridization techniques in sugarcane -Flower induction and emergence -Hybridization procedure -Hybridization techniques -Lantern method of crossing - Solution crossing -Tile pot technique or marcotting technique

FLOWERING IN SUGARCANE & HYBRIDIZATION PROCEDURES

Breeding Methods in Sugarcane - Breeding Objectives -Breeding Methods -Breeding Procedures and Selection Scheme -Breeding for Special Characters -Need for Special Varieties -Short Duration Varieties -Breeding for High Biomass Production -Breeding for Biotic Stress in Sugarcane -Breeding for Pest Resistance -Considerations in Resistant Breeding -Essential Requirements for Resistant Breeding -Mechanism of Resistance Screening Methods -General Scheme for Breeding Resistance to Pests -Breeding for Disease Resistance -Breeding for Red Rot Resistance -Genetic Mechanism of Resistance - Screening Techniques -Breeding for Abiotic Stress tolerance in Sugarcane -Abiotic stresses and breeding work -Drought - Salinity -Cold / Frost -Waterlogging -Genetic of abiotic stress tolerance - Nobilisation in Sugarcane -


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Nobilisation -Gene transfer in nobilisation -Autosyndetic pairing- Mechanizm of $2n$ transmission through egg cells -Gene pool of *Saccharum* Characteristics of *S. officinarum* and *S. spontaneum* -Nobilization since 1960's Nobilization of *Erianthus arundinaceus* -Future for nobilization

GENETICS OF AGRONOMICALLY IMPORTANT TRAITS IN SUGARCANE

Genetics of Agronomically Important Traits in Sugarcane -Genetic Structure of Polyploids - Biometrical Approaches in Sugarcane -Assumptions underlying quantitative genetic analysis - Designs for estimating genetic parameters -Quantitative genetics in sugarcane - Selection of superior parents -Breeding method -Multistage selection-Genetic control and selection for yield and quality -Genetic control and selection for disease resistance -Sugarcane Cytogenetics - Chromosome number and meiotic behaviour of chromosomes -Basic Chromosome number - Interspecific Hybrids - $2n + n$ transmission and the commercial sugarcane hybrids - Intergeneric Hybrids -Molecular Cytogenetics - Chloroplast Genome -All India Co-ordinated Project on Sugarcane and National Hybridization Garden -Varietal Improvement Programme of All India Coordinated Research-Project on Sugarcane - AICRP(S) Trials -Sugarcane Varieties - Varietal Identification and Botanical Description - Botanical Description- Morphology - Morphological standards for description of a variety

SEED PRODUCTION IN SUGARCANE

Factors determining quality of seed Age of crop - Growing condition -Diseases and pests Hot water treatment -Aerated steam treatment - Moist hot air treatment -Hot air treatment -Seed nursery programme -Breeder seed -Foundation seed -Certified seed -Micropropagation in sugarcane -Protocol -Stage I : Establishment of shoot cultures - Sterilization of the material - Inoculation - Stage II: Multiplication of shoots - Stage III: Rooting and hardening -Stage IV: Field planting -Advantages of micropropagation -Production of virus free plants -Molecular markers for testing the genetic fidelity or genetic variation -Seed certification for sugarcane tissue culture plant -Recent approaches in sugarcane micropropagation - Direct regeneration - Photoautotrophic micropropagation - Use of Bioreactor in micropropagation -In vitro storage of encapsulated micropagules Future prospects - Tissue Culture Technique in Sugarcane -Somaclonal variation -Factors causing variability in *in vitro* cultures -Somaclonal variation at the chromosomal level -Transposable elements -Molecular variation -DNA methylation -Potentiality of somaclonal variation -Somaclonal variation in Sugarcane -Future prospects -Molecular techniques in sugarcane -Genome structure of the commercial cultivars -Introgression of exotic germplasm -Molecular markers and backcross breeding - Genome mapping -Tagging genes of interest -QTL mapping -Candidate gene markers in breeding - Genetic Transformation in Sugarcane -Introduction - Why Genetic Transformation in Sugarcane? -Status of sugarcane transgenics -Transformation methodology -Target tissue -Plasmid construct Microprojectile bombardment conditions - Selection and regeneration transgenics -Transient expression of the reporter gene -Molecular analysis of the putative transgenics -Bio-assay of the transgene - Environmental and IPR issues -Conclusion

PROCESSING, TESTING AND STORAGE OF SUGARCANE TRUE SEED

Sugarcane Inflorescence And True Seed -Seed Processing -Seed Drying - Defuzzing or Dehairing - Seed Grading Seed Testing for Germination and Seedling Raising - Seed Germination -True Seed Germination Test Seed Invigouration - Seedling Raising - Seed Sowing In Mist Chamber -Seed Storage -Intellectual Property Rights on Plant Varieties -Sugarcane Genetic Resources: Collection, Conservation and Utilization *Saccharum* Germplasm Collection -Collection from Indonesia-New Guinea Region - *Saccharum* germplasm Collection in India Conservation of germplasm -*In Vitro* Conservation -Wild species as sources for important characters -Utilization of *Saccharum* germplasm -Intraspecific Improvement -Utilization of related species and genera.

ODL-SCT-602 - CROP PRODUCTION TECHNOLOGY OF SUGARCANE

SUGARCANE BASED CROPPING SYSTEMS

Effect of Intercrops on sugarcane - Tillering -Number of millable canes -Single cane weight - Cane yield -Minimizing the adverse effect of intercrops on sugarcane -Selection of genotypes- Fertilizer Management - Plant density and geometry -Biological basis for intercropping advantages -Biological basis for intercropping advantages -Soil fertility improvement - Evaluation of intercropping systems -Management Practices to Maximize Sugarcane Ratoon Productivity-Ratoon yield decline-Methods of weed management in sugarcane-Definition of weed-Nature of weed problem in sugarcane-Weed flora -Losses caused by weeds -Critical stage of weed competition - Methods of weed management -Biological control -Weed dynamics in new sugarcane areas - Weed management through cropping systems -Control of problem weeds - Integrated weed management

INTEGRATED NUTRIENT MANAGEMENT IN SUGARCANE

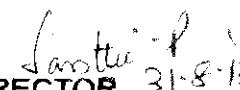
Nutrient requirements of sugarcane -Fertilizer recommendations -Organics FYM and compost - Legumes - Crop residues and recyclable wastes - Sugarcane trash -Pressmud - Biofertilizers - Integration of organics, chemical fertilizers and biofertilizers -Biofertilizers

WATER REQUIREMENT, METHODS AND SCHEDULING OF IRRIGATION AND FERTIGATION IN SUGARCANE

Water requirement of sugarcane -Conventional methods of irrigation -Sub-surface irrigation - Overhead/Sprinkler irrigation -Micro-irrigation -Recommendations -Management under excess moisture/ water logging -Management of Sugarcane in Salt Affected Soils -Fertilizer management- Management of Sugarcane under Acid Soils

HARVEST MANAGEMENT

Ensuring adequate cane availability -Optimum cane quality -Age of harvest -Pre-harvest maturity survey -Issue of cutting orders -Varietal mix -Flowered cane harvest -Weather conditions -Pre-harvest irrigation - Chemical ripeners - Harvest labour -Feasibility of mechanized harvesting -Method of harvest -Low topping - Avoiding extraneous matter - Transport of cane -Optimum economic distance -Post harvest deterioration -Nature and


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magnitude of post harvest deterioration -Methods to minimize stale cane losses -Cane yard - Contingency plan -Effective communication -Good rapport with the farmers

ECONOMICS OF SUGARCANE GROWING

Cost of cultivation -Economic aspects worked out -Costs and returns analysis of plant crop - Costs and returns analysis in the factory areas -Cost of cultivation of sugarcane of jaggery farmers -Cost of cultivation in the sub tropics

ODL-SCT-603 - SUGARCANE SOIL AND THEIR MANAGEMENT

SOIL AND THEIR PROPERTIES

Definition of Soil - Components of soil - Volume composition of soil -Mineral matter in soils Organic matter in soils - Soil water - Soil air - Soil types - Soils of major sugarcane growing tracts - Problem soils - Saline, alkali and acid soils and their reclamation - Saline/Sodic soils Effect of salinity/sodicity on sugarcane - Acid soils -Soil organic matter and its role

ORGANIC FARMING OF SUGARCANE

Introduction - Why organic farming? - Concepts in organic farming - Scope for organic farming of sugarcane - Cane trash - Nutrient content of sugarcane trash compost - Intercropping with legumes - Biomass incorporation through intercropping (t/ha) - Pressmud - Biofertilizers - Productivity of sugarcane under organic farming - Limitations of organic farming - Opportunities

SOIL FERTILITY

Soil productivity - Soil fertility evaluation - Hidden hunger - Biological tests - Assessing macro and micro nutrient requirement for sugarcane - Soil Testing and Plant analysis - Available Nutrients - Soil Testing

MACRO NUTRIENTS

Major nutrients -Nitrogen - Phosphorus - Potassium - Secondary Nutrients -Micronutrients - Diagnosis and Recommendations Integrated Systems (DRIS) - Plant Analysis versus Sugarcane Yields - Essential nutrients - Macro Nutrients -Nitrogen and its deficiency symptoms - Phosphorus and its deficiency symptoms -Potassium and its deficiency symptoms -Secondary nutrients – Micronutrients -Slow release fertilizers - Nitrogen inhibitor - Chemically modified fertilizers - Coated fertilizers - Precision farming -Fertigation -Fertilizer control order – 1957 - Tolerance or permissible limits -Micronutrient mixture -Calcareous soils, chlorosis and amelioration

SOIL WATER

Importance of soil water - Forms of Soil Water - Soil water characteristics - Quality of irrigation waters - Management of poor quality waters - Effluents as irrigation water - Use of distillery effluents in agriculture - Use of spent wash for reclamation of sodic soils -Sugar factory effluent

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Diluted distillery effluent irrigation for sugarcane - Effect on soil properties -One time application of treated effluent.

PRACTICAL

Estimation of available nutrients
Estimation of available nitrogen
Estimation of available phosphorus - Bray's method (for acid soils)
Estimation of available potassium (neutral normal ammonium acetate method using flame photometer)
Estimation of organic carbon
Estimation of available micronutrients bulk density, particle density and pore space - cylinder method
Bulk density - wax coating method
Determination of bulk density of soil - core sampler method
Determination of hydraulic conductivity determination of soil moisture - oven dry moisture
Determination of wilting point - laboratory method
Determination of field capacity
Determination of soil ph
Determination of electrical conductivity
Estimation of calcium carbonate
Gypsum requirement of sodic soil
Determination of lime requirement of acid soil estimation of CO_3 , HCO_3 , Cl and SO_4 in soil
Identification of nutrient deficiency symptoms – iron chlorosis
Estimation of metabolically active iron
Collection and assesment of quality of irrigation water
Determination of total soluble salts determination of calcium and magnesium in Irrigation water
Determination of sodium and potassium in irrigation water sulphates in irrigation water
Determination of carbonates and bicarbonates in irrigation water
Determination of chlorides in irrigation water quality of irrigation waters

ODLS-SCT-604 - PRINCIPLES AND PRACTICES OF CROPPING AND FARMING SYSTEM

CROPPING SYSTEM, PRINCIPLES AND BASIC CONCEPTS

System Approach –Need -Cropping system - Definition and classification

CROPPING SYSTEM - PLANT INTERACTIONS, COMPLIMENTARY AND COMPETITIVE INTERACTION

Plant interactions -Interactions in mixed crop communities -Competitive Interaction - Competition for solar radiation -Competition for Carbon dioxide-Competition for soil factors- Allelopathy -Complementary interaction- Annidation -Other complementary effects

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CROPPING SYSTEM MANAGEMENT

Selection of Crops and Varieties -Tillage and Land Shaping -Plant Population and Crop Geometry -Method and time of sowing -Water management -Soil fertilizer management and fertilizer use-Plant protection measures-Labour management-Cost reduction in crop production Non Monetary inputs in crop production -Low cost technology

EVALUATION INDICES OF CROPPING SYSTEM

Indices based on land use efficiency -Indices based on biological potential-Indices based on economic viability-Indices based on energetic approach

FARMING SYSTEM

Definition-Need-Principle-Farming system components-Important component details-Interaction between different Components

ODL-SCT-605 - SUGARCANE CHEMISTRY, SUGAR AND GUR TECHNOLOGY

UNIT: 1 THE COMPOSITION OF SUGARCANE AND JUICE

Composition of the Cane - Composition of the Juice - Occurrence of Sucrose, Glucose and Fructose in Cane Juice and their Chemistry - The Quality of Sugarcane and Juice - Factors Affecting the Cane Quality - Juice Constituents of Sugarcane on Sugar Recovery

UNIT II - QUALITY BASED HARVEST MANAGEMENT OF SUGARCANE: NEED OF PRE-HARVEST MATURITY SURVEY

Need of Pre-harvest Maturity Survey Factories - Methods of Judging Maturity / Ripeness in Sugarcane - Procedure for Maturity Survey - Points to be taken care of

UNIT - III - POST HARVEST DETERIORATION OF SUGARCANE AND METHODS OF MINIMIZING STALE CANE LOSSES

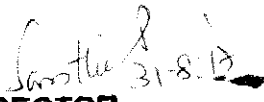
Reasons for stale cane crush - Nature and Magnitude of post harvest losses - Biochemical basis of post harvest sugar losses - Role of Microorganisms in stale cane

UNIT - IV - ROLE OF NON-SUGARS IN JAGGERY AND SUGAR PRODUCTION

Role of Non-Sugar Constituents - Organic Non-Sugars - Coloured Non-Sugars - Nutrient Diagnosis of Sugarcane Crop

UNIT - V - JAGGERY MANUFACTURE AND ALLIED PRODUCTS

Steps involved in the jaggery Making - Manufacturing of Sugar from Sugarcane - Sugarcane By-products and scope for diversification of sugar industry


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ODL-SCT-606 - SUGARCANE PHYSIOLOGY

UNIT 1: SETT GERMINATION IN SUGAR CANE

Physiology of Tillering in sugarcane - Photosynthesis and sucrose accumulation in sugarcane

UNITE2: GROWTH ANALYSIS OF SUGARCANE

Growth analysis - Role of Nutrients In Sugarcane Growth, Yield and Quality - Flowering in Sugarcane

UNIT 3 : PHYSIOLOGY OF RATOONING IN SUGARCANE

Causes for ratoon decline - General growth and development of ratoon crop - Management of poor sprouting and gaps - Leaf initiation and development - Drought Tolerance in Sugarcane - Biochemical factors

UNIT 4. PHYSIOLOGY OF SUGARCANE UNDER SALINITY

Salinity - Relative salt tolerance of sugarcane at various growth stages and that of plant organs - Juice and jaggery quality characters as affected by salinity - Physiological and metabolic behaviour under salinity - Journey of ions responsible for salinization through the sugarcane plant - Strategies adopted by plants to become salt tolerant - Physiological basis of water logging resistance in Sugarcane

UNIT 5 : HIGH TEMPERATURE STRESS IN CROP PLANTS -

Nature of heat injury - Heat resistance - Heat Stress Acclimation and Adaptation

Practical

Expt.1: Measurement of Nitrate Reductase activity in sugarcane leaf samples

Expt2: Estimation of Protein

Expt3: Estimation of plant pigments like chlorophyll and carotenoids

Expt. 4: Estimation of free Proline content

Expt 5: Lipid Peroxidation

Estimation of Dry matter production (DMP)

Leaf area index (LAI)

Determination of Relative Water Content (RWC)

Estimation of Cellular membrane thermostability in sugarcane leaves

ODL-SCT-607 - PLANT TISSUE CULTURE

UNIT I

History and Origin - Techniques of Tissue Culture Totipotency - Benefits of Tissue culture - Disadvantages - Laboratory Organization and Sterilization Techniques Laboratory space - Washing and sterilization -Sterilization techniques -Need for Sterile (Aseptic) Technique - Contaminants - Bacteria, fungi, and insects - Yeast Viruses Insects Initial Contaminants Latent Contamination Introduced Contamination Detection of Contaminants Sterilization methods - Dry

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heat sterilization The Transfer Hood - Autoclaving - Sterilizing tools, media, vessels Autoclaving and Filter-sterilizing Media and Other Liquids Ethylene Oxide Gas - UV Radiation – Microwave – Personnel - Dry sterilization - Surface-sterilization - Preparation of Stock Plants - Ethanol (or Isopropyl Alcohol) - Sodium Hypochlorite Calcium Hypochlorite Mercuric Chloride - Hydrogen Peroxide - Enhancing Effectiveness of Sterilization Procedure Rinsing - Use of Antibiotics and Fungicides in Vitro - Plant Preservative Mixture - Tissue culture media and their constituents Culture medium - Media constituents - Inorganic nutrients -Major or macroelements Growth hormones/Regulators - Gelling agents - Medium preparation - Callus Culture Totipotency - Establishment of calli - Callus induction, subculture and maintenance - Texture of the calli - Colour of the calli - Callus maintenance – Cell Suspension Culture - Nature and Advantages of suspension cultures - Initiation of S.C from callus – Types - Subculture and Measurement of Growth –Applications

UNIT II

Anther and Microspore Culture Haploid Production –Androgenesis - Induction of androgenesis - Anther culture technique - Doubling chromosomes- Factors influencing anther culture - Donor plants - Medium constituents - Growth regulators -Stages of pollen development -Culture Environment Temperature Pretreatment Other factors Pollen culture - Pollen/microspore cultures -Hybrid sorting in haploid breeding Hybrid sorting using anther culture technique Ovary Culture -Embryo Culture and Embryo Rescue Culture Importance of Embryo rescue and culture- Types of embryo culture -Factors affecting the success of embryo culture - Practical applications- Elimination of (absolute) inhibition of seed germination - Dry storage - Immaturity of embryo - Germination of seeds of obligatory parasites - Shortening breeding cycle - Overcoming - self sterility of seeds - Seed Testing Prevention of embryo abortion in early ripe fruits - Prevention of embryo abortion as a result of incompatibility - Production of Haploids - Vegetative propagation Other applications - Meristem and Shoot Tip Culture Meristem Culture -Attributed Reasons Factors affecting virus elimination - Vegetative propagation Other applications Meristem and Shoot Tip Culture Meristem Culture - Attributed Reasons Factors affecting virus elimination

UNIT III

Introduction - Major causes of somaclonal variation - Causes for variation - Changes of mother plant origin - Explant derived variation - Genetic changes arising in culture - Point mutations Structural changes in the DNA sequence - Effect of the genotype - Somaclonal Breeding Procedures - **Isolation of Variation** - Selection of somaclonal variants on subjecting the cells to selection pressure -Somaclonal Breeding -Successes of Somaclonal Breeding -Herbicide Resistance and Tolerance -**Applications of Somaclonal Variations** -**Somatic Embryogenesis**-Morphogenesis - Zygotic embryogenesis - Somatic embryogenesis -Embryo Structure of somatic embryos - The stages of embryogenesis - Stages of embryogenesis -Factors affecting somatic embryogenesis -Growth regulators

UNIT IV

Protoplasts- Isolation, Culture and Regeneration - Uses for protoplasts- Enzymes for the preparation of protoplasts - Protoplast Isolation - Mechanical - Enzymatic method - Direct (one step) method - Protoplast isolation - Enzyme Mixture - Two step method - Sequential (two step)

method - Commercial enzyme preparations - Purification of isolated protoplasts - Sedimentation and Washing - Flootation - Viability and plating Density of protoplasts FDA treatment - Phenosafranin (0.1%) - Calcofluor white (0.1%) - Protoplast culture and Regeneration of plants - Factors affecting protoplast regeneration Advantages - Sub protoplasts
Cytoplasts - Protoplast fusion and somatic hybridization - Advantages of Protoplast Fusion - Techniques of protoplast fusion - Spontaneous Mechanical - Induced fusion - Electrofusion Properties - Methods for selection -Using visual markers – Selection of hybrids - Culturing the protoplast fusion - Benefits of protoplast fusion - Somatic hybrids - Symmetric hybrids or near – symmetric hybrids - Somatic back hybridization - Application - Asymmetric hybrids Chromosome status of somatic hybrids - Cybrids or cytoplasmic hybrids - Production - Objective of cybrid - production - Applications / advantages of cybrids – Achievements

UNIT V

Secondary Metabolites From Plant Cell Cultures – Introduction- Need for breakthroughs for the production of secondary compounds - Secondary metabolites and plant cell culture – Organ cultures - Prospecting genetic Variability -Establishment of in vitro cell lines -Cell suspension cultures -Bioreactor cultures -Methods for screening hyper producing lines -Methods to improve secondary metabolite yield - Anti diabetic –Dyes -Essential oils -Flavours and fragrances - Pharmaceutical compounds -Plant metabolic engineering -Flower colors -Lignin synthesis Germplasm Conservation – Types -In vitro methods -Cryopreservation and Germplasm Storage Cryopreservation steps – Cryoprotectants - Permeating: Non-permeating Freezing Methods - Applications

ODL-SCT-608 - PLANT WATER RELATIONS

THEORY

UNIT I - CELL AND WATER

Cell wall – cell membranes – water and cells

UNIT II - WATER POTENTIAL AND ITS COMPONENTS

Water Potential, Components and Relation - Diffusion and Osmosis - Imbibition and Plasmolysis- Process and its Impacts - Osmotic Potential - Pressure Potential - Bound Water Content and its Role

UNIT III - WATER ABSORPTION, STOMATAL MOVEMENTS AND TRANSPIRATION

Absorption of Water - Theories and Mechanism of Water Absorption - Water Potential in Cells and their Inter-Relationship - Water Movement - Water Relations in Stomata - Stomatal Movement - Theories of Stomatal Movement - Transpiration & Factors Controlling Transpiration - Water Economy and Water use Efficiency (WUE) of Crops - Leaf Structure in Relation to Transpiration - Leaf Water Content - Water Movement between Cells

UNIT IV - WATER STRESS – DROUGHT

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ODL-SCT-612 - FARM MACHINERY FOR SUGARCANE CULTIVATION

UNIT I - MACHINERY FOR TILLAGE

Tillage - Methods of ploughing - Methods of tractor ploughing - Field capacity - Classification and types of Tillage - Secondary tillage

UNIT II - MACHINERY FOR SEEDBED PREPARATION AND PLANTING

Sugarcane planting - Preparation of sugarcane sets - Preparation of furrow/trench - Sugarcane sett cutter planter

UNIT III - MACHINERY FOR WEEDING AND INTERCULTURE

Mechanical Method of Weed Control - Implements/machinery for weed control

UNIT IV - MACHINERY FOR PLANT PROTECTION

Sprayers - Basic components of sprayer - Types of spray - Types of sprayers - TYPES OF NOZZLE - Care of power sprayer - Dusters - Purpose of plant protection equipments

UNIT V - MACHINERY FOR HARVESTING, LOADING, TRASH AND RATOON MANAGEMENT

Equipment for cane harvesting/cleaning - Sugarcane harvester - Loading and transport - Post harvest operation in sugarcane - Harvesting, Ratoon & Irrigation management - Selection, economic use and maintenance of sugarcane machine - Future thrust areas of mechanization

ODL-SCT-613 - STRATEGIES FOR TRANSFER OF SUGARCANE TECHNOLOGY

UNIT I - ASSESSING THE EXTENT OF ADOPTION, YIELD GAP AND TECHNOLOGICAL GAP OF SUGARCANE PRODUCTION TECHNOLOGIES

Attributes of Innovation - Adopter Categories - Yield Gap Analysis in Sugarcane Production - Technological Gap

UNIT II - DISSEMINATION OF SUGARCANE TECHNOLOGIES

The Innovation – Decision Process - The Change Agent - Diffusion of Innovations and assessing the threshold on Sugarcane Varieties - Effective Utilization of Communication Channels for Transferring Technologies - Communication Models - Communication Channels

UNIT III - UTILIZING OPINION LEADERS IN DIFFUSION OF SUGARCANE TECHNOLOGIES

Models of Mass Communication Flows - Measuring Opinion Leadership - Characteristics of Opinion Leaders - Analysis of Constraints in Technology Adoption

UNIT IV - DEVELOPING EFFECTIVE STRATEGIES FOR TECHNOLOGY TRANSFER

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Reasons for non- adoption - A systems perspective - Role of extension agents - Extension role of sugar factories - Participatory Approach to Sugarcane Development - The Experience of SBI

UNIT V - DEVELOPING COMPUTER BASED EXTENSION MODULES TO TRANSFER SUGARCANE TECHNOLOGIES

What is Cyber Extension? - Multimedia - Expert Systems - E-Learning - Virtual Reality - Technology Assessment and Refinement (TAR) in Sugarcane Production - Participatory Rural Appraisal

ODL-SCT-614 - SUGARCANE DEVELOPMENT AND MANAGEMENT

UNIT I - AREA, PRODUCTION AND PRODUCTIVITY OF SUGARCANE IN DIFFERENT STATES AND DIFFERENT COUNTRIES

World Sugarcane Cultivation - The Indian Sugar Industry – Target 2020 - Organization, Roles, Duties and Responsibilities

UNIT II - VARIETAL SCHEDULING FOR SUGAR FACTORY AREAS

Details of Sugarcane Varieties Released in Tamil Nadu - Varietal Improvement to Enhance Sugar Industry Productivity - Integrated Technology Transfer package for Sugarcane Cultivation

UNIT III - SUGARCANE DEVELOPMENT FUND

Sugarcane Development Fund - Sugarcane Cess Fund (Tamil Nadu) - Department Of Sugar (Tamil Nadu Model) - Sugarcane Control Order, Acts and Rules

UNIT IV - PERSONNEL MANAGEMENT AND INDUSTRIAL RELATIONS IN SUGAR INDUSTRIES

Conflict Management - Inter Personal Relations & Industrial Relations Strategy - Industrial Relations Strategy - Human Resource Development

UNIT V - SUGARCANE FUTURE PERSPECTIVE

Sugarcane Research Priorities to Meet Growing Demands of Sugar Industry - The Indian Sugar Industry – Challenges & Prospects

PRACTICAL

Preparing varietal schedule for sugar factories

ODL-SCT-615 - DISSERTATION

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RULES AND REGULATIONS

III. PG Degree Programmes

1. Regulations

PG Degree Programme : Rules and Regulations for the ODL P.G. Degree programme (Under Semester System) at DODL, TNAU.

The Regulations provided herein shall apply to all ODL P.G. Degree Programmes offered by Directorate of ODL, TNAU, Coimbatore, for a duration of 2 years (4 Semesters) in English to candidates of Tamil Nadu, other parts of the India as well as other countries with minimum education qualifications of an under graduate degree as prescribed for the course **under semester system, in an academic year.**

2. Courses offered at DODL and eligibility for admission

10+2+3 system (10th, Plus two and bachelor's Diploma from recognized Universities).

Master Degree Programme	Eligibility Criteria
MBA	Any degree
MBA	Any degree
M.Sc (Sugarcane Technology)	B.Sc. (Ag.) / Any degree with minimum of three years work experience in the relevant field.
M.Sc (Environmental Management)	B.Sc. (Ag.) / Any degree in Life sciences/ Any professional degree with minimum of three years work experience in the relevant field.

3. Definitions

3.1. Academic Year means a period consisting of two consecutive semesters including the inter-semester break as announced by the Director (ODL).

3.2. The study year shall be the first and second semesters following a student's admission.

3.3. Curriculum is a group of courses and other specified requirements for the fulfillment of the specific programme of ODL.

3.4. Curricula and syllabi Are a list of approved courses of P.G. Degree programme under ODL. Each course will be identified with ODL and three-Letter subject code indicating the respective department which is offering the course, along with an ODL code. Three letter subject code

Model for PG Degree programme

Course ID	:	ODL-MBA-601 onwards
		ODL-ENS-601 onwards
		ODL-SCT-601 onwards
Candidate ID	:	ODL-MBA-05-001 onwards
		ODL-SCT-05-001 onwards

3.5. Course 'Course' is a teaching unit of a discipline to be covered within a semester as detailed in the curricula and syllabi issued by the University.

3.6. Personal Contact Programme: Personal contact programmes will be offered for the respective courses as **proposed by the DODL**, which offer the courses as part of the requirement to fulfill the course completion, based on its need as the case may be.

3.7. Duration of Semester: Duration of each semester is 150 days, including the day of practical examination but excluding the period of final theory examinations.

3.8. The Directorate will organize contact programme of ten days / semester (2 days / month @ 6 hours / day). Candidates has to attend a minimum of 6 days / semester. A minimum of 4 semesters is to be completed for the award of P.G. Degree programme under ODL.

4. System of Education

4.1. The duration of PG Degree programme is normally two academic year.

4.2. Course requirement: Each student has to complete required number of courses for PG Degree programme as per the details given below.

Master Degree Programme	Course requirement
MBA	16 courses + One Project work
MBA (RB&FM)	16 courses + One Project work
M.Sc (Sugarcane Technology)	14 courses + One Project work
M.Sc (Environmental Management)	14 courses + One Project work

5. Registration of Courses

5.1. All eligible candidates including the entrants shall register the requisite courses in the beginning of each semester. Registration will be done only through online.

A candidate permitted to register only one semester at a time.

5.2. Registration without fine: The courses prescribed for a semester shall be registered on the date fixed by the University. The registration shall be permitted by the DODL **upto 10 days inclusive of the date of registration without fine.**

5.3. Registration with fine: The late registration shall be permitted by the DODL upto 30 days inclusive of the date of registration with a late fine of **Rs.300 (Rupees Three Hundred only)** and **60 days inclusive of the date of registration with a late fee of Rs.500/- (Rupees Five hundred) only.**

The student concerned shall apply with proper reason to the DODL through the concerned Coordinator and get permission for the late registration of the course. Beyond the prescribed time limit, no student shall be permitted to register the course for the particular semester.

6. Tuition fee and other fees

6.1. In case of new admissions, the fees for the first semester are payable in advance failing which they will not be admitted.

6.2. In other cases, the fees are payable within seven working days including the date of registration from the commencement of the semester. If the seventh day happens to be a holiday, the next working day shall be the last due date for payment of fees without fine.

6.3. Semester fees once paid will not be refunded on any circumstances.

6.4. In default of full payment within seven working days, a fine of Rs.50/- for each day of default in respect of tuition fees alone will be collected. The students who fail to pay tuition fees "within 30 working days" of commencement of the semester will not be allowed to continue the programme.

6.5. Re-registration fee: Respective course semester fee (Mentioned in 7.3)

Late registration and Default in tuition fees (Mentioned in 5.3)

Revaluation / Re-totaling - Rs.400 per subject

Reappearance - Rs.400 per subject

(either theory / practical/both theory and practical)

7. Discontinuance and Readmission

7.1. The student who discontinues the first semester for genuine reasons with the permission of the Director, ODL, will be re-admitted in the first semester of the next year or in the second semester of the same year, with the approval of the Director, ODL.

7.2. A candidate may discontinue the studies temporarily on valid and genuine grounds with prior permission of the Director, ODL of the Institute. Grade 'E' will be awarded for all the courses registered. The student has to rejoin on payment of respective course semester fee with the permission of the DODL.

7.3. In case of revision of curricula and syllabi the candidate has to complete all the course work in the original syllabus in which the candidate has joined, by registering equivalent / special semester courses (or) the candidate has to forgo all the courses registered so far in the original curricula and syllabi and register all the courses from first semester in the new syllabus.

7.4. On no account a student who discontinued without written permission of the Director, ODL of the institute will not be readmitted for further studies.

8. Attendance Requirements: Each candidate is expected to maintain 60% per cent attendance in each course. A candidate who has not maintained a minimum of 60 % attendance of each course shall not be permitted to appear for both the practical and theory in the course concerned and 'E' "incomplete" will be awarded. The candidate must re-register for the course with the permission of the DODL when offered again.

9. Examinations

9.1. An examination schedule approved by the Director, DODL shall be final. The duration of final theory examinations will be for three hours.

9.2. A candidate must take up all the examinations prescribed for a course to become eligible for a pass in that course.

9.3. Late comer in Examinations: The candidates who are late by 30 minutes shall not be allowed to enter the examination hall. Similarly no candidate will be allowed to leave the examination hall within 30 minutes after the commencement of the examination.

9.4. The practical examination will be conducted in the last practical contact class of the respective courses by the Course Teachers and the statement of marks should be sent to the Director, ODL.

9.5. **Postponement of Final Examination:** Whenever Government declares holidays on the dates of final examinations due to unforeseen circumstances, the examinations that fall on the dates will be postponed to the dates after the last examination as per the original examination schedule.

9.6. A failing candidate in a subject shall reappear either for final theory or practical, as and when conducted.

9.7. The minimum mark to be secured for a pass for the successful completion of individual course is 50.0. A candidate should secure a minimum of 50% of the marks in theory and 50% in practical and aggregate of 50%.

10. Question paper setting and Evaluation

10.1. The Semester final theory question papers for all the courses will be set by the External Examiners.

10.2 Final Examinations:

A. **Theory:** The examinations will be conducted as per the schedule communicated by the Director, ODL. The valuation of the final theory papers will be done by the External Examiner nominated by the Controller of Examinations.

B. The practical examination will be conducted in the last practical contact class of the respective courses and the statement of marks should be sent to the Director, ODL within 10 days by the concerned **course teachers** through the Director (ODL).

11. Evaluation of course work

11.1. The results of the course shall be indicated by the percentage of marks obtained in all the courses.

11.2. The following symbols may be used

P	-	Pass
E	-	Incomplete (Lack of 60% Attendance)
F	-	Fail
A	-	Absent for theory and/or practical/ assignment

11.3. Each course shall carry a maximum. of 100 marks which may be distributed as follows:

A. Courses with theory and practical

Examination	Marks
Final Practical Examination	40
Final Theory Examination	60

I. Question pattern for 60 marks

1. Part A- (out of 12 / 10) - 1 mark (1x10=10 marks)
2. Part B - Short notes (out of 12 / 10) - 2 marks (2x10=20 marks)
3. Part C - Essay type (out of 8 / 6) - 5 marks (5x6= 30 marks)

II. Evaluation pattern for practical examinations for 40 marks

- a. Procedure /Identification - 10 marks
- b. Viva-Voce - 5 marks
- c. Short notes - 5 marks
- d. Practical work - 20 marks

B. Courses with only practical (100 marks)

- a. Written part - 40 marks
- b. Procedure /Identification - 10 marks
- c. Experiments Demonstration - 20 marks
- d. Assignment - 10 marks
- e. Record - 10 marks
- f. Viva-voce - 10marks

C. Course with only theory – 100 marks

Question pattern for 100 marks

1. Part A- (out of 8 / 6) - 2 marks (2x6=12 marks)
2. Part B - Short notes (out of 12/10) - 4 marks (4x10=40 marks)
3. Part C - Essay type (out of 8 / 6) - 8 marks (8x6=48 marks)

12. Re-Examinations

PG Degree Programme: The student is permitted to appear for the theory and practical exam **only three times excluding the regular examinations** within n+3 years (which includes the period of Degree programme).

Incase the student failed to secure pass in the three reexaminations permitted he/she has to re-register the course along with the juniors by paying the semester fee, attend the personal contact programmes and permitted to appear for re-appearance examinations as per the regular registration.

12.1. Re-Evaluation/Re-Total

A student can submit a request for revaluation or re-total in the prescribed format along with the fee to the Controller of Examinations through the Director, ODL within 30 days from the issue of class grade chart to the students from DODL. Submissions thereafter will not be considered.

13. Project Work

- Students are to submit the project work within the stipulated time mentioned by Director, ODL

- The student submitting the project work beyond closure of the semester has to pay the fine amount now and than fixed by the Director, ODL.
- The project work for MBA, M.Sc. (ENS), M.Sc. (SCT) will be evaluated.

14. Result Notification

14.1. After the completion of each semester, the student will be given the statement of marks by the Controller of Examinations through the Director, ODL.

14.2. The transcript will be prepared by the Controller of Examinations.

14.3. The result declaration proposal will be sent by the Director, ODL to the Registrar and the Controller of Examinations.

15. Malpractices in examination and conduct of students

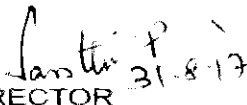
15.1. **The Director (ODL)** shall be responsible for dealing all cases of unfair means in assignments and examinations.

15.2. **The invigilator or the course teacher** concerned shall report to the DODL on the day of the occurrence of each case of unfair means with full details of the evidence and written explanation of the student concerned.

15.3. **Amending or Canceling the Result:** If it is established that the result of a candidate has been vitiated by malpractice, fraud or any other improper conduct and that the candidate has been a party to or connived at malpractice or improper conduct of another candidate, the Vice Chancellor shall have the powers at any time to amend the results of such a candidate and to make such declaration as the Vice Chancellor 'may deem necessary and to cancel the results of the candidate in such a manner as the Vice Chancellor may decide.

15.4. **Removal of Difficulties:** If any difficulty arises in giving effect to the provisions of these regulations, the Vice Chancellor may issue necessary orders which appear to him to be necessary or expedient for removing the difficulty.

Every order issued by the Vice Chancellor under this provision shall be laid before the Academic Council of the University immediately after the issuance. Notwithstanding anything contained in the rules and regulations, the Academic Council shall make changes whenever necessary.


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