M. TECH. (DAIRY TECHNOLOGY)

SEMESTER-I

Course Code Course Title		L-T-P	Credits	
MAS-701	Advanced Engineering Mathematics	3-1-0	4	
MAS-711 COMP-805 DT-810	Statistics- I Computer Programming Dairy Chemistry and Microbiology	2-0-2 2-0-2 2-0-2	3 3 3	

SEMESTER- II

Course Code	Course Title	L-T-P	Credits	
MAS – 715	Statistics –II	2-0-2	3	
DT-811	Dairy Plant Management	3-0-0	3	
DT-812	Advances in Dairy Processing-I	2-0-2	3	
DT- 815	Dairy Equipment Design & Plant Layout	3-0-0	3	
DT-817	Dairy Plant Instrumentation & Process Control (Elective)	3-0-0	3	
APFE- 810	Food Plant Design (Elective)	3-0-0	3	

SEMESTER - III

Course Code Course Title		L-T-P	Credits	
DT-805	Quality Assurance in Dairy Industry (Elective)	2-0-2	3 3	
DT-813	Advances in Dairy Processing – II	2-0-2	3	
DT-814	Steam & Refrigeration Engineering	2-0-2		
APFE- 801	Food Process Equipment Design (Elective) Seminar- I	2-0-4	3	
DT-780		0-0-2	1	

SEMESTER - IV

Course Code	Course Title	L-T-P	Credits
DT-880	Seminar- II	0-0-2	1
DT- 899	Dissertation	0-0-30	15

SYLLABUS OF MASTERS OF TECHNOLOGY IN DAIRY TECHNOLOGY

I SEMESTER

MAS-701 ADVANCED ENGINEERING MATHEMATICS (3-1-2) 4 Credits

Gamma, Beta and Legendre's functions, Euler's equations, Lang-range equations, the Rix method, the Green's functions. Solzane Woirestrass theorem in finite products.

Laplace transforms, Inverse Laplace Transforms, and application to differential equations. Fourier series, Fourier transforms, Solution of non-linear algebraic and transcendental equation by Regula falsi method. Newton Raphson method.

Newton's forward and backward interpolation formula divided differences. Trapezoidal Rule, Simpson's $^1/_3$ rule, Numerical Solution of Ordinary differential equations by Runge Kutta Method, Picard's equations.

MAS 711 STATISTICS I (2-0-2) 3 Credit

Standard Deviation, Coefficient of variation, standard error of mean.

Theory of Probability: equally likely, mutually exclusive events, definition of probability, addition & multiplication theorems of probability & problems on theorems of probability & problems based on them.

Normal & Binomial Distributions.

Simple correlation and regression, Multiple- regression, Multiple & partial –correlation.

Testing of Hypothesis: Concepts of Hypothesis, Degrees of freedom, Level of significance, Type I & Type II errors. X², t, F- tests (definition, applications & problems based on these tests)

COMP 805 COMPUTER PROGRAMMING (2-0-2) 3 Credits

- 1. Algorithms & Flow Charts
- 2. 'C' Programming
 - (i) Preliminaries
 - (ii) Constants & Variables
 - (iii) Arithmetic Expressions
 - (iv) Input Output statements
 - (v) Control Statement
 - (vi) Looping Statements
 - (vii) Subscripted Variables
 - (viii) Elementary Format Specifications
 - (ix) Logical statements & Decision tables
 - (x) Functions & Subroutines
- 3. Computer oriented numerical methods
 - (a) Solution of Non-Linear Equation
 - (i) Bisection Method
 - (ii) Newton Method
 - (b) Numerical integration
 - (i) Trapezoidal Method
 - (ii) Simpson's 1/3 & 3/8 rule
 - (c) Curve Fitting
 - (i) Construction of forward, backward difference table
 - (ii) Interpolation
- 4. Application of statistical packages

Practical List

- 1. To find the largest among three numbers.
- 2. To check whether a given string is a palindrome or not
- 3. To find factorial of a given number by iteration
- 4. To find whether the given integer is a prime number.
- 5. To find sum n terms of series: a.n*2/2!+n*3/3!-n*4/4!+...
- 6. To find the sum and average of n integers using a linear array.
- 7. To read n umbers from the keyboard and display these numbers in the reverse order their entry.
- 8. To search a given number within a linear array.
- 9. To generate the fibbonacci series.

- 10. To find factorial of a given number using a function.
- 11. To deduce error involved in polynomial equation.
- 12. To find out the root of the Algebraic and Transendal equations using Bisection, regula-falsi, Newton Raphson and Ilterative methods. Also give the rate of convergence of roots in tabular form for each these methods.
- 13. To implement Newton's forward and backward Interpolation formula
- 14. To implement gauss forward and backward, bessel's Sterling and Evertt's Interpolation formula
- 15. To implement Newton's Divided difference and Lang ranges Interpolation formula
- 16. To implement numerical differentiations.
- 17. To implement Numerical integration using trapezoidal, simpson 1/3 and simpson 3/8 rule.
- 18. To implement least square method for curve fitting.

DT- 810 DAIRY CHEMISTRY & MICROBIOLOGY 2-0-2 = 3 Credit

Chemistry and Metabolic functions of different milk products, compositions and properties of milk and milk products, Effect of processing on various constituents of milk in relation to physical, chemical and functional properties, chemical spoilage of milk; processing and waste treatments.

Introduction to milk micro-organisms. Effect of processing on milk micro-organisms Vis-a-vis milk preservation. Physical and Chemical factor's affecting microbial growth and decay.

Instrumental measurements of colour, viscosity tenderness, specific gravity, size and size distribution, firmness, texture etc. of various milk products. Analysis of major constituents, such as moisture, fat, protein and carbohydrates of milk and milk products, pH and acidity measurements.

Use of common bacteriological apparatus and equipment and their cases, cleaning of glassware and preparation for sterilization. Preparation of smears and staining. Preparation of nutrients, Broth and nutrient agar; estimation of bacteria by Agar plate. Method and Direct Microscopic count; microbial analysis or drinking water.

II SEMESTER

MAS-715 STATISTICS - II (2-0-2) 3 Cr.

Analysis of variance techniques, Definitions and assumptions, One way classification, two way classification with more than one observation per cell.

Designs of experiment, principles of experimental design, randomized block design (R.B.D)

Latin square design (L.S.D.), missing plot technique in R.B.D. and L.S.D., critical difference (C.D.), split plot design

Factorial experiment 2 x 2 x 3 and 3 x 2, factorial design (Yates method of analysis) 2 x 3 & 2x 4 factorials,

Durcan's multiple range test, Newman's kuel test

Sampling techniques, simple random sampling, stratified random sampling and systematic sampling

DT -811 DAIRY PLANT MANAGEMENT (2-0-2) 3 Credits

Process selection and optimization, process design cost analysis, profitability, alternative investments, replacements, optimization in process design and equipment design, organizational structure, job evaluation and incentives, preventive maintenance and servicing of equipment, safety engineering, plant sanitation, food legislation and safety requirements.

DT-812 ADVANCES IN DAIRY PROCESSING-I (2-0-2) 3 Credits

- 1. Advances in the Heat Treatment of Milk.
- 2. Developments in Cream Separation and Processing.
- 3. Production of Butter and Dairy-based Spreads.
- 4. Drying of Milk and Milk Products.
- 5. Modifications to the Composition of Milk.
- 6. Utilisation of Milk Components: Whey
- 7. Utilisation of Milk Components: Casein
- 8. Automation in the Factory.

DT -815 DAIRY EQUIPMENT DESIGN & PLANT LAYOUT (2-0-2) 3 Credits

Dairy Equipment Design

Codes and regulation, materials of construction, design of pressure vessel, storage tank, milk coolers, pasteurizing plants, flavour treating equipment, evaporation systems - evaporator; milk dryers; spray dryer and roller dryer; ice cream freezers. Design of material handling system and equipment. Design and evaluation of packages and packaging systems; methods and equipment for packaging.

Dairy Plant Layout

Special features of dairy industry; site selection of equipment before designing a plant; estimation of services required, peak and critical loads, stand-by plants; important considerations in planning and layouts of equipment; controls, pipelines, conveyors and services etc. Preparation of sample layouts; selection of building materials, internal construction, grid structure, foundations, drains illumination, ventilation, installation procedures in dairy plants.

DT- 817 2) 3 Credit

DAIRY PLANT INSTRUMENTATION & (2-0-

PROCESS CONTROL

Principles of measurement of temperature, pressure, vacuum, flow rate, liquid level, emissivity, pH, refractive index, viscosity, surface tension, colour, humidity and moisture content. Methods of measurement of textural parameters e.g. Hardness, gumminess, chewiness and cohesiveness. Chromatographic method of analysis of milk constituents.

Principles of feed back theory and process control. Process characteristics and controller characteristics. Automotive control of temperature, pressure, vacuum, flow rate, liquid level refractive index, consistency and humidity, stability analysis. Process control applications in dairy plants.

APFE- 810 3 Credit

FOOD PLANT DESIGN

3-0-0=

Food Plant Location, Food Plant Layout, Process Selection, Forecasting Methods, Facilities & Aggregate Planning, Scheduling Food Plant Operations, Financial Analysis, Process Flow Analysis, PERT/CPM Models, Decision Analysis, Computer Simulation, Feasibility Studies of Food Plant, Design Of A Food Processing Plant.

III SEMESTER

DT-814 STEAM AND REFRIGERATION ENGINEERING (1-1-2) 3 Credits

Properties of Steam

Introduction, Formation of Steam, Total Heat (or Enthalpy) of Water, Latent Heat of Steam, Dryness Fraction, Wetness Fraction, Total Heat (or Enthalpy) of Wet Steam, Total Heat of Superheated Steam, Advantages of Superheating Steam Use of Steam Tables, Specific Volume of Steam, Volume of Superheated Steam, External Work Done during Evaporation, Internal

4

Energy of Steam, Entropy of waters, Entropy of Evaporation's Entropy of Wet Steam \boldsymbol{s}_g , Entropy of Superheated Steam,

Temperature Entropy Diagram for Water and Steam, Isothermal Lines on Temperature Entropy Diagram, Adiabatic Lines on the Temperature Entropy Diagram, Mollier Diagram or Total Heat Energy Chart for Steam, Methods of Heating and Expanding the Steam, Determination of Dryness Fraction of Steam; Type of Steam.

Boilers

Definition, Classification of Boilers, Comparison of Fire Tube and Water, Tube Boilers, Essentials of a Good Boiler, Factors Affecting Boiler Selection, Simple Vertical Boiler, Fraser Culman Boiler, Cochran Boiler, Lancashire Boiler, Cornish Boiler, Locomotive Boiler, Nestler Oil Fired Boiler, Babcock and Wilcox Boiler, Stirling Boiler, High Pressure Boilers, The Benson Boiler, The Loeffler Steam Generator, The Volex Steam Generator, La Mont Boiler, Boiler Mountings, Boiler Accessories, Steam Dryers or Separators, Steam Trap, Pressure Reducing Valve.

Performance of Boilers

Equivalent Evaporation, Factor of Evaporation, Boiler Efficiency, Efficiency of Economiser, Boiler Horse Power, Heat Losses in a Boiler, Heat Balance Sheet of a Boiler, Methods of Minimising the Heat Loss through Different sources, Boiler Draught, Natural Draught, Determination of the Height of Chimney, Determination of the Diameter of Chimney, Condition for Maximum Discharge through a Chimney, Efficiency of the Chimney, Artificial Draught, Steam jet Draught, mechanical Draught, Water treatment for boiler operation, Water Effiueat treatment, Germicidal activity of chlorine, hypochlorites & chloramines. General consideration in cleaning, Detergents for cleaning. Pollution Control, Natural cycles of waste decomposition, concept of BOD-Measurement. Kinetics of biological growth, kinetics of biological decay. Application of kinetics to biological treatment Reactor with recycles. Trickling filter model Design of an aerated tank without recycle Design of trickle filter system.

Introduction.

Brief History of Refrigeration, Unit of Refrigerating Capacity, Thermodynamic State of a Pure Substance, Pressure-Temperature Diagram, Other Phase Diagrams, Thermodynamic Systems and Energy Conservation Equations, The First Law of Thermodynamics, Steady Flow Energy Equation,

Production of Low Temperatures, Expansion of a Liquid with Flashing, Reversible Adiabatic Expansion of a Gas, Irreversible Adiabatic Expansion (Throttling) of a Real Gas, Thermoelectric Cooling, Adiabatic Demagnetization.

Application of Second Law of Thermodynamics

The Second Law of Thermodynamics, A Refrigerating Machine - The Second Law Interpretation, Heat Engine, Heat Pump and refrigerating Machine, Best Refrigeration Cycle.

Vapour Compression System

Vapour Compression Cycle, Pressure Enthalpy Diagram and Calculations, Actual Vapour Compression Cycle.

Refrigerants

Selection of a Refrigerant, Thermodynamic Requirements, Chemical Requirements, Physical Requirements, Refrigerant Piping and Design. Secondary Refrigerants, Using Mixed Refrigerants.

Multi pressure Systems

Cascade Systems

Refrigerant Compressors

Types of Compressors, Thermodynamic Processes during Compression, Rotary Compressors, Screw Compressors, and Centrifugal Compressors.

DT-813 ADVANCES IN DAIRY PROCESSING -II (2-0-2) 3 Credits

- 1. Recent Developments in Yoghurt Manufacture.
- 2. Modern Cheese making: Hard Cheeses
- 3. Modern Cheese making: Soft Cheeses
- 4. Developments in Frozen-products Manufacture
- 5. Physical Properties of Dairy Products.
- 6. Modern Laboratory Practice-1 : Chemical Analyses
- 7. Modern Laboratory Practice 2: Microbiological Analyses
- 8. Technology for the Developing Countries

DT-805 QUALITY ASSURANCE IN DAIRY INDUSTRY (2-0-2) 3 Credits

Importance of chemical quality control in dairy industry, setting up quality control laboratories and testing facilities; mobile testing laboratories.

Sampling procedures; Labelling of samples for analysis; choice of analytical tests for milk and milk products for chemical analysis; instrumental methods of analysis.

Calibration of dairy glassware's including butyrometers, pipettes, burettes, hydrometers, lactometers and freezing point thermometer.

Preparation and standardization of reagents required in the analysis of milk and milk products.

Legislation on production, transport, processing and marketing of milk and milk products; application of PFA, Agmark BIS, IDF, ISO, IPO and international senitory regulations related to dairy products to the quality control of milk and milk products. Dairy effluents and their recycling.

Prediction of shelf-life behaviour and quality assurance in milk and milk products.

APFE- 801 ADVANCED FOOD PROCESS EQUIPMENT DESIGN 3-0-0=

Design considerations of processing agricultural and food products. Food processing equipments, Dryers, design of dryers PHTC, RPEC, LSU and Drum Dryer, Determination of heat and air requirement for drying grains, types of heat exchangers and evaporators. Design of material handling equipments like belt conveyors, screw conveyors, bucket elevator and pneumatic conveyors.

DT-780 Seminar I (0-0-2)=1

IV SEMESTER

DT-880 Seminar II (0-0-2)1 Cr.

DT-899 Dissertation (0-0-30) 15 Cr.