# Semester-wise Distribution of Revised Courses of B. Tech. (DT)

## First Year (I Semester)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Contact Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM-111</td>
<td>Fundamentals of Microbiology</td>
<td>3(2+1)</td>
<td>2+2</td>
</tr>
<tr>
<td>DC-111</td>
<td>Physical Chemistry of Milk</td>
<td>3(2+1)</td>
<td>2+2</td>
</tr>
<tr>
<td>DE-111</td>
<td>Workshop Practice</td>
<td>2(1+1)</td>
<td>1+2</td>
</tr>
<tr>
<td>DE-112</td>
<td>Fluid Mechanics</td>
<td>3(2+1)</td>
<td>2+2</td>
</tr>
<tr>
<td>MP-111</td>
<td>Milk Production Management &amp; Dairy Development</td>
<td>3(2+1)</td>
<td>2+2</td>
</tr>
<tr>
<td>DE-113</td>
<td>Engineering Drawing</td>
<td>2(0+2)</td>
<td>0+4</td>
</tr>
<tr>
<td>ES-111</td>
<td>Economic Analysis</td>
<td>2(2+0)</td>
<td>2+0</td>
</tr>
<tr>
<td>CS-111</td>
<td>Computer and Application Software Packages</td>
<td>3(2+1)</td>
<td>2+2</td>
</tr>
<tr>
<td>EN-111</td>
<td>Environmental Studies</td>
<td>3(2+1)</td>
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<td></td>
<td><strong>Total</strong></td>
<td>24(15+9)</td>
<td>29(13+16)</td>
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## Ist Year (II Semester)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Contact Hours</th>
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</thead>
<tbody>
<tr>
<td>DT-121</td>
<td>Market Milk</td>
<td>4 (3+1)</td>
<td>3+2</td>
</tr>
<tr>
<td>DM-122</td>
<td>Introductory Dairy Microbiology</td>
<td>3 (2+1)</td>
<td>2+2</td>
</tr>
<tr>
<td>DE-124</td>
<td>Heat and Mass Transfer</td>
<td>3 (2+1)</td>
<td>3+2</td>
</tr>
<tr>
<td>DC-122</td>
<td>Chemistry of Milk</td>
<td>3 (2+1)</td>
<td>2+2</td>
</tr>
<tr>
<td>DE-125</td>
<td>Thermodynamics</td>
<td>3 (2+1)</td>
<td>2+2</td>
</tr>
<tr>
<td>DE-126</td>
<td>Electrical Engineering</td>
<td>3 (2+1)</td>
<td>2+2</td>
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<tr>
<td>BC-121</td>
<td>Biochemistry &amp; Human Nutrition</td>
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<td><strong>Total</strong></td>
<td>25 (17+8)</td>
<td>34 (18+16)</td>
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### 2nd Year (III Semester)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Lectures</th>
<th>Practical</th>
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<tbody>
<tr>
<td>DT-211</td>
<td>Traditional Dairy Products</td>
<td>4</td>
<td>2+2</td>
<td>2+4</td>
</tr>
<tr>
<td>DT-212</td>
<td>Ice-Cream &amp; Frozen Deserts</td>
<td>4</td>
<td>2+2</td>
<td>2+4</td>
</tr>
<tr>
<td>DT-213</td>
<td>Fat-rich Dairy Products</td>
<td>4</td>
<td>3+1</td>
<td>3+2</td>
</tr>
<tr>
<td>DE-211</td>
<td>Refrigeration and Air Conditioning</td>
<td>3</td>
<td>2+1</td>
<td>2+2</td>
</tr>
<tr>
<td>DT-214</td>
<td>Cheese Technology</td>
<td>5</td>
<td>3+2</td>
<td>3+4</td>
</tr>
<tr>
<td>DE-212</td>
<td>Dairy Engineering</td>
<td>3</td>
<td>2+1</td>
<td>2+2</td>
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<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>23</strong></td>
<td><strong>14+9</strong></td>
<td><strong>14+8</strong></td>
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### 2nd Year (IV Semester)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Lectures</th>
<th>Practical</th>
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</thead>
<tbody>
<tr>
<td>DT-225</td>
<td>Food Technology</td>
<td>4</td>
<td>3+1</td>
<td>3+2</td>
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<tr>
<td>DT-226</td>
<td>Condensed &amp; Dried Milk</td>
<td>5</td>
<td>3+2</td>
<td>3+4</td>
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<tr>
<td>DT-227</td>
<td>By Products Technology</td>
<td>4</td>
<td>3+1</td>
<td>3+2</td>
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<tr>
<td>DE-223</td>
<td>Dairy Process Engineering</td>
<td>3</td>
<td>2+1</td>
<td>2+2</td>
</tr>
<tr>
<td>DT-228</td>
<td>Packaging of Dairy Products</td>
<td>3</td>
<td>2+1</td>
<td>2+2</td>
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<tr>
<td>ES-221</td>
<td>Cost Accounting</td>
<td>2</td>
<td>2+0</td>
<td>2+0</td>
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<tr>
<td>ES-222</td>
<td>Operations Research</td>
<td>2</td>
<td>2+0</td>
<td>2+0</td>
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<tr>
<td>DX-221</td>
<td>Dairy Extension Education</td>
<td>2</td>
<td>1+1</td>
<td>1+2</td>
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<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>25</strong></td>
<td><strong>18+7</strong></td>
<td><strong>18+14</strong></td>
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10 days educational tour during summer vacation after 2nd year.
### Third Year (V Semester)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Contact Hours</th>
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<tbody>
<tr>
<td>CS-311</td>
<td>IT in Dairy Industry</td>
<td>3</td>
<td>(2+1)</td>
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<tr>
<td>DC-311</td>
<td>Chemical Quality Assurance</td>
<td>3</td>
<td>(2+1)</td>
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<tr>
<td>BT-311</td>
<td>Dairy Biotechnology</td>
<td>3</td>
<td>(2+1)</td>
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<tr>
<td>DM-311</td>
<td>Starter Cultures and Fermented Milk Products</td>
<td>3</td>
<td>(2+1)</td>
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<tr>
<td>DE-311</td>
<td>Instrumentation &amp; Process Control</td>
<td>3</td>
<td>(2+1)</td>
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<tr>
<td>DM-312</td>
<td>Quality and Safety monitoring in Dairy Industry</td>
<td>3</td>
<td>(2+1)</td>
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<tr>
<td>ES-311</td>
<td>Financial Management</td>
<td>3</td>
<td>(2+1)</td>
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<tr>
<td>ES-312</td>
<td>Marketing Management &amp; International Trade</td>
<td>2</td>
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<tr>
<td>DX-311</td>
<td>Communication Skills</td>
<td>2</td>
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**Total:** 25 (17+8) 33 (17+16)

### Third Year (VI Semester)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>DE-322</td>
<td>Food Engineering</td>
<td>4</td>
<td>(3+1)</td>
</tr>
<tr>
<td>DE-323</td>
<td>Principles of Dairy Machine Design</td>
<td>3</td>
<td>(2+1)</td>
</tr>
<tr>
<td>DC-322</td>
<td>Food Chemistry</td>
<td>3</td>
<td>(2+1)</td>
</tr>
<tr>
<td>DM-323</td>
<td>Food and Industrial Microbiology</td>
<td>3</td>
<td>(2+1)</td>
</tr>
<tr>
<td>DE-324</td>
<td>Dairy Plant Design and Layout</td>
<td>3</td>
<td>(2+1)</td>
</tr>
<tr>
<td>DT-321</td>
<td>Judging of Dairy Products</td>
<td>3</td>
<td>(2+1)</td>
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<tr>
<td>DT-322</td>
<td>Dairy Plant Management &amp; Pollution Control</td>
<td>2</td>
<td>(1+1)</td>
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<tr>
<td>ES-323</td>
<td>Entrepreneurship Development and Industrial Consultancy</td>
<td>2</td>
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<tr>
<td>ES-324</td>
<td>Financial Management</td>
<td>3</td>
<td>(2+1)</td>
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**Total:** 26 (18+8) 34 (18+16)
### Fourth Year: In-plant Training (VII and VII Semesters)

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course</th>
<th>Hours</th>
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<tbody>
<tr>
<td>VII Semester</td>
<td>IN-PLANT TRAINING</td>
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<tr>
<td>VIII Semester</td>
<td>IN-PLANT TRAINING</td>
<td>25 (0+25)</td>
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<td>Total</td>
<td>25 (0+25)</td>
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</table>
1. DAIRY ENGINEERING

DE-212 Dairy Engineering


DE-223 Dairy Process Engineering


DE-324 Dairy Plant Design and Layout

Practical: Building symbols and convention layouts for small, medium and large size dairies. Isometric presentation of piping. Design and layout of: Milk collection/chilling centre; Fluid milk plant (small, medium and large); Single product dairy (i) Cheese, (ii) ice-cream, (iii) butter and (iv) ghee. Composite dairy plant.

DE-311 Instrumentation and Process Control 3 (2+1)


Practical: Preparation and calibration of thermocouple; study the construction and working of Bourden pressure gauge. Study the mechanism of pH meter and its electrodes. Study a pressure transducer. Study a Proximity sensor. Study of the different parts and working of Rotameter. Study the different parts and working of pressure switch. Study the different parts of an indicating instrument. Study the different parts and their working of single phase induction type watt-hour meter. Visit to a microprocessor controlled dairy plant.

DE-113 Engineering Drawing 2 (0+2)


DE-323 Principles of Dairy Machine Design 3 (2+1)


DE-111 Workshop Practice 2 (1+1)

Introduction to workshop practice, safety, care and precautions in workshop. Wood working tools and their use, Carpentry and pattern making. Mould material and their applications. Heat treatment processes: hardening, tempering, annealing, normalizing etc. Metal cutting. Soldering & Brazing, Electric arc welding, Gas welding. Smithy and forging operations, tools and equipment. The bench : Flat surface filing, Chipping, Scrapping Marking out, Drilling and Serewing. Use of jigs and fixtures in production. Introduction to following machine tools : (a) Lathe (b) Milling machine (c) Shaper and planer (d) Drilling and boring machines (e) Grinder (f) CNC machines
**Practical:** Simple exercises in Filing and Fitting, Chipping and Hack sawing, Chiseling, Tapping and Smithy practice, Simple exercises in Arc, Gas, & Argon welding. Simple exercises in Soldering, Brazing, Basic joints in carpentry

**DE-112 Fluid Mechanics**

3 (2+1)


**Practical:** Study of different tools and fittings. Plotting flow rate versus pressure drop with U-tube manometer. Verification of Bernoulli’s theorem. Determination of discharge co-efficient for venturi, Orifice, V-Notch. Verification of emptying time formula for a tank. Determination of critical Reynold’s number by Reynold’s apparatus. Study of reciprocating, centrifugal and gear pump. Calibration of Rota meter. Study of different types of valves. Problems on following topics: Pressure, capillarity and surface tension. Floating bodies, Liquid flow, venturimeter, orifice, weir, flow through pipes, pumps.

**DE-124 Heat & Mass Transfer**

3 (2+1)


**DE-125 Thermodynamics**

3 (2+1)


**Practical:** Application of thermodynamics in engineering problems. Study of 2-stroke engine and 4-stroke engines. Performance tests on l.c. engines. Determination of dryness fraction of steam. To study the boiler installed in Model Plant. Water softening plant, Lancashire boiler, Locomotive boiler, Babcock & Wilcox boiler, Electrode boiler, Boiler mounting and steam-line layout and steam traps. Visit to sugar mill/rice mill or plant with steam utilization. Study of Solar water heater and biogas plants and appliances

**DE-211 Refrigeration & Air Conditioning**

3 (2+1)


**Practical:** Study of tools used in installation of a refrigeration plant including charging and detection of leaks. To study different parts and learn operation of bulk milk cooler. Study of different parts and learn the operation of a refrigeration plant/ice plant using ammonia refrigerant. Study of different parts and learn the operation of a vapour absorption refrigeration plant. Dismantling and assembled an open compressor and a sealed unit. Study different parts and refrigeration controls of the following (a) Refrigerator (b) Water cooler (c) Deep Freezer (d) Compare their cooling coils and other systems. To find out the rating (cooling rate) at different suction temperatures (temperature differences) and air handling capacity of the air cooling unit. Plotting the practical refrigeration cycle on a pressure enthalpy diagram and to compare it with a theoretical refrigeration cycle. Study different parts and operation of a (a) Air washer, (b) Room cooler, (a) Air conditioner, (d) Chemical dehumidifiers, (e) Cooling. Plotting of psychrometric process: Sensible heating & cooling, Dehumidification & cooling and heating & humidification. Study of different humidity indicating, recording and controlling devices. Problems on cold storage. Visit to cold storage.

**DE-126 Electrical Engineering**

3 (2+1)


**Practical:** Study of voltage resonance in L.C.R. circuits at constant frequency; (a) Star connection-study of voltage and current relation (b) Delta connection-study of voltage and current relation. Measurement of power in 3-phase circuit; (a) For balanced loads (b) For unbalanced loads, by wattmeter and energy meters. Polarity test, no-load test, efficiency and regulation test of single phase. Voltage and current relation in a 3-phase transformer of various kinds of primary and secondary connection systems. Starting of induction motor by the following starters: (i) D.O.L. (ii) Manual star- delta (iii) Automatic star-delta (iv) Manual auto-transformer. Starting of slip-ring induction motor by normal and automatic rotor starters. Test on 3-phase induction motor,
determination of efficiency, line current, speed, slip, power factor at various outputs. Determination relation between the induced armature voltage and speed of separately excited D.C. generator. Magnetization characteristic of D.C. generator. Study the starter connection and starting reversing and adjusting speed of a D.C. motor. Study of various measuring instruments.

DE-322 Food Engineering 4 (3+1)


2. DAIRY MICROBIOLOGY

DM-111 Fundamentals of Microbiology 3 (2+1)

Microbiology: history and scope; contributions of Leeuwenhock, Pasteur and Koch. Principle of microbiology: Light Microscopy (Bright field, dark field, phase contrast, fluorescence); preparation and staining of specimens; electron microscopy. Microbial taxonomy: principles; numerical taxonomy; major characteristics used in taxonomy; classification according to Bergey’s manual of systematic bacteriology. Structure and functions of prokaryotic cells; difference between prokaryotes and eukaryotes. Microbial growth and nutrition: the growth curve; factors affecting growth of microorganisms, estimation of bacterial growth; bacteriostatic and bactericidal agents; the common nutrient requirements and nutritional types of microorganisms. Bacterial genetics; DNA as the genetic material; structure of DNA; bacterial mutations (spontaneous and induced); genetic recombination- (transformation, transduction, conjugation). Micro flora of air, soil and water: methods for controlling microorganisms in air; water as carrier of pathogens.

Practical: General instruction for microbiological laboratory. Microscope- simple and compound; Microbiological equipments; autoclave, hot air oven, incubator, centrifuge, colorimeter, laminar airflow, membrane filter. Simple staining- methylene blue; crystal violate; negative staining. Differential staining (Gram, spore, acid fast). Mortality of microorganisms; hanging drop technique. Measurement of microorganisms by micrometry. Preparation of commonly used growth media liquid and solid: simple and differential media. Isolation technique for microorganisms- Streak & pour plate Enumeration of microorganisms in air and soil. Enumeration of microorganisms in water: total viable count, coliform (MPN).

DM-122 Introductory Dairy Microbiology 3 (2+1)

Hygienic milk production system; microbial quality of milk produced under organized v/s unorganized milk sector in India and comparison with developed countries; microbial and non microbial contaminants, their sources and entry points in milk during various stages of production; Good Hygiene Practices (GHP) during milk production operations Microorganisms associated with raw milk; morphological and biochemical characteristics of important groups and their classification; significance of different groups of bacteria i.e. psychrotrophs, mesophiles, thermodurics, and thermophiles in milk. Microbiological changes in bulk refrigerated raw milk; Impact of various stages like milking, chilling, storage and transportation on microbial quality of milk with special reference to psychrotrophic organisms; Direct and indirect rapid technique for assessment of microbical quality of milk. Role of microorganisms in spoilage of milk; souring, curdling, bitter cream, proteolysis, lipolysis; abnormal flavors and discoloration. Mastitis milk: Processing and public health significance, organisms causing mastitis, somatic cells secreted in milk; detection of somatic cell count (SCC) and organisms causing mastitis in milk. Milk as a vehicle of pathogens; Food infection, intoxication and toxic infection caused by milk borne pathogens like E. coli, Salmonella typhi, Staph aureus, Bacillus cereus etc. Antimicrobial substances in milk: immunoglobulin, lactoferin, lysozymes, LP systems etc.

Practical: Morphological examination of common dairy organism (size and shape, arrangement and sporulation). Enumeration of psychrotrophic, thermophilic, thermoduric and spore forming bacteria in milk. Detection of sources of contamination: air, water, utensils, equipment and personnel line testing. Spoilage
of milk caused by microorganisms souring, sweet curdling, gassiness, lipolysis, ropiness, proteolysis and
discoloration. Detection of mastitis milks, pH, SLST, somatic cell count, chloride content, Hotis test, CAMP test.
Detection and estimation of coliforms; presumptive test, rapid coliform test, IMVIC test. Detection of
important pathogens using selective media; E.coli, Staphylococcus aureus Salmonella and Bacillus cereus.
Estimation of microbial load in milk by SPC and Dye reduction tests-(MBRT, RRT). Detection of antibiotic
residues using qualitative test

DM-323 Food and Industrial Microbiology 3 (2+1)

Food Microbiology: Basic aspects and scope of food microbiology. Intrinsic and extrinsic factors that affect
microbial growth in foods. Microbial spoilage of fruits, fruit juices, vegetables, cereals, meat, poultry, sea foods,
carbonated soft drinks, canned foods; control of spoilage. Food preservation: physical methods; chemical
preservatives and natural antimicrobial compounds, biology based preservation system. Industrial Microbiology:
Fermentation processes: the range, components and types (submerged, surface and solid state fermentation):
criteria for selection of industrially important microorganisms; media for industrial and inoculums development;
down stream processing of fermented products. Fermenters: types, functions, design and control; chemostat
and turbidostat. Microorganism and processes involved in the production of industrial alcohol, organic acids
(citric lactic), enzymes (protease, lipase and rennet), vitamin (B-12), antibiotic (nisin) and microbiology of
effluent treatment in food industry.

Practical: Microbiological examination of: fresh and canned fruits/vegetables/juices; flour and bread, eggs and
meat. Design and control of a tabletop and 10 liter lab fermenter (Demonstration). Isolation of psychrophile, salt
and sugar tolerant microorganisms from foods. Isolation of industrially important microorganisms from
environment. Production and assaying of microbial enzymes (protease/ lipase). Production of lactic acid from
whey. Production of nisin and assaying the antimicrobial activity of the culture. Production of ethyl alcohol
from molasses and whey by yeasts. Production of fermented whey beverages. Educational tour to food
processing/fermentation industries.

DM-311 Starter Cultures and Fermented Milk Products 3 (2+1)

Introduction of starter cultures & their importance in dairy industry, classification of Lactic Acid Bacteria;
Metabolism of Lactic Acid Bacteria and diacetyl production, production of antibacterial substances by lactic
starter cultures. Mixed and define strain starter culture; propagation of starter cultures; factors affecting their
propagation; starter concentrates- direct bulk and direct vat starter cultures; starter distillates. Quality and
activity of starter cultures; defects in starters and their control; starter failures; antibiotic residues, sanitizers and
bacteriophages. Preservation of starter cultures: freezing and freeze-drying; factors affecting the survival of
cultures during preservation. Role of starter cultures in the preparation of various fermented milks; classification
of fermented milks Microbiology of dahi and yoghurt; different types of dahi and yoghurt; preparation; defects
and their control. Microbiology of milk products; their nutritional and therapeutic significance. Kefir and
Kumiss: origin and characteristics: microbiology of Kefir grains. Microbiology of other fermented milks such
as Bugarian milk, cultured buttermilk, Leben and Yakult; their significance. Concept of probiotic starters and
their application in probiotic dairy food.

Practical: Testing for purity of starter cultures; gram’s staining, catalase test; creatine test. Starter activity tests:
die reduction tests, Horrell-Elliker test, Whitehead and Cox test. Preparation of single and mixed starter
cultures: homofermentation and hetrofermentation separately and also in combinations. Maintenance and
preservation of starter cultures- Freeze drying techniques demonstration. Preparation of concentrated starter –
freeze dried and frozen types. Effect of physical factors on dairy starter: temperature, pH, salt, sugar. Testing
milk for the presence of inhibitory substance using B. stearothermophilus and S. thermophilus as indicator
organisms. Effect of antibiotic residues in milk on starter activity. Associative growth of microorganisms in milk
and cream. Detection of bacteriophages in cheese whey by plaque assay. Preparation and evaluation of quality
and grading of Dahi, Yoghurt, cultured butter milks, acidophilus milk and Kumiss. Microbiological analysis of
processed cheese- Total spore count & Anaerobic spore count. Microbiological analysis at different stages of
manufacture of (storage and ripening) hard verities of cheese- such as Cheddar cheese.

BT-311 Dairy Biotechnology 3 (2+1)

Definition, scope and historical development of biotechnology, achievement and future application: structure of
DNA and RNA; DNA replication, protein synthesis, genetic code, mutations: Vectors, cloning strategies in
bacteria and animals, DNA technology. Protoplast fusion & Tissue culture in dairy cultures. Application of
biotechnology in food and dairy industry, dairy effluents. Genetic manipulation of dairy starters for improved
attributes of commercial value. Dairy enzymes and whole cell immobilization. Ethical issues related to use of
genetically modified foods.

Practical: Isolation of plasmid and genomic DNA from bacteria (E. coil, lactic acid bacteria Agarose gel
electroporesis of DNA fragments). Restriction analysis of DNA. Curing of plasmids. Preparation of competent
DM-312 Quality and Safety Monitoring in Dairy Industry 3 (2+1)

Current awareness on quality and safety of dairy foods; consumer awareness and their demands for safe foods; role of food regulatory standards; BIS, PFA, ICMSF, IDF etc., their role in the formulation of standards for controlling the quality and safety of dairy foods. Rapid assessment of dairy food for microbial and non-microbial contaminants; Enumeration Principles in detection of predominant spoilage organisms and pathogens like indicator organisms, E.coli, salmonella, shigella, staph aureus, Bacillus cereus and non-microbial contaminants like antibiotic residues, aflatoxin, pesticides other inhibitors etc from. dairy foods and their control measures. Microbial quality of water and environmental hygiene in dairy plant; chlorination of dairy water supply, quality of air. Personnel hygiene, treatment and disposal of waste water and effluents; setting up of a microbiological/ pathogen lab in a dairy plant and its safety concern.


3. DAIRY TECHNOLOGY

DT-121 Market Milk 4 (3+1)


Practical : Preparation of khoa from cow, buffalo and concentrated milk. Analysis of khoa, chhanna and paneer for total solids, moisture, fat and acidity. Preparation of kheer. Preparation of chhanna from cow and buffalo milk and mixed milk. Preparation of paneer from cow and buffalo milk and mixed milk. Preparation of paneer from cow and buffalo milk and mixed milk. Preparation of misti dahi, chhaka and srikhand. Preparation of khoa and chhanna based sweets. Microbiological examinations of traditional dairy products: Khoa, paneer, spore counts, coliform counts yeast, molds counts etc. Field trip

**DT-213 Fat-Rich Dairy Products**

4 (3+1)


**DT-214 Cheese Technology**

5 (3+2)

changes during preparation ripening in cheese. Role of milk constituents and changes during manufacture and ripening in cheese. Factors affecting yield of cheese. Packing, storage and distribution of cheese. Accelerated ripening of cheese. Microbiological defects in cheese; their cause and prevention. Manufacture of processed cheese, cheese spread and processed cheese foods. Mechanization and automation in cheese processing. Microbiological critical control of cheese cold store.

DT-212 Ice-Cream And Frozen Desserts 4 (2+2)

History, development and status of ice cream industry, History, development and status of ice cream industry, Definition, classification and composition of ice cream and other frozen desserts, Stabilizers and emulsifiers-their classification, properties and role in quality of ice-cream, Technological aspects of ice cream manufacture, Thermodynamics of freezing and calculation of refrigeration loads, Types of freezers, refrigeration control / instrumentation, Types of freezers, refrigeration control / instrumentation, Hygiene, cleaning and sanitation of ice cream plant, Effect of process treatments on the physico-chemical properties of ice-cream mixes and ice cream, Processing and freezing of ice-cream mix and control of over run, Packaging, hardening, storage and shipping of ice-cream, Defects in ice cream, their causes and prevention, Physico-chemical properties of ice-cream and compositional standards., Microenvironment in ice cream, microbiological quality of ingredients, critical process factors & their impact on entry of pathogen in ice cream, their survival during storage, food poisoning out breaks, food safety & legal standards, Recent advances in ice-cream industry and plant management, Technology for preparation of dried ice-cream milk mix. and Nutritive value of ice-cream.


DT-226 Condensed And Dried Milk 5 (3+2)

History, status and scope in India and abroad, Definition and legal standards: Condensed milk, sweetened condensed milk and evaporated milk., Manufacturing techniques;a) Manufacture of evaporated milk including pilot sterilization test b) Manufacture of sweetened condensed milk c) Recombined sweetened condensed milk. Grading and quality of raw milk for condensed and evaporated milk, Physico-chemical changes taking place during manufacture of condensed milk, Heat stability of milk and condensed milk, Physico-chemical properties of condensed milk and role of stabilizers in the stability of condensed milk, Chemical defects in condensed milk, their causes and prevention., Microbiological qualities of condensed milks, preservative used in evaporated, condensed & dried milks, a) Type of microorganisms occurring in condensed milks b) Survival and growth of microorganisms during manufacture and storage.c) Microbiological standards, d) Type of spoilage and their prevention. Recent advances with reference to freeze concentration and membrane concentration, Dried Milks: History and status in India and abroad, Grading and quality of raw milk for dried milks, Manufacture of skim milk powder (SMP), whole milk powders and heat classified powders, Physico-chemical changes taking place during manufacture of dried milks, Physical properties of dried milks, Defects in dried milk during manufacture and storage, their causes and prevention, PFA, BIS and International Standards for dried milk, Manufacture of infant foods, malted milk foods and other formulated dried products, Microbiological quality of various dried milks including infant foods and Management of condensed and dried milk industry.

Practical : Manufacture of plain skim concentrated milk. Chemicals and microbiological examination of concentrated and dried milks for (a) Moisture, T.S., Fat, lactose, sucrose, bulk density, solubility index, and (b) SPC, coliforms, yeasts and molds, toxins etc. Manufacture of SCM.Manufacture of EM. Concentration of milk by membrane processing. Manufacturing of SMP by spray drying/roller drying. Manufacture of instant milk powder.

DT-227 By Products Technology 4 (3+1)


**DT-321 Judging of Dairy Products**

Introduction, definition and importance of sensory evaluation in relation to consumer acceptability and economic aspects; factors affecting food acceptance. Terminology related to sensory evaluation. Design and requirements of sensory evaluation laboratory.


**DT-225 Food Technology**


DT-322 Dairy Plant Management And Pollution Control 2 (1+1)


4. DAIRY CHEMISTRY

DC-111 Physical Chemistry of Milk 3 (2+1)


DC-322 Food Chemistry 

Definition and structure of milk, factors affecting composition of milk, Nomenclature and classification of milk proteins, Casein: Isolation, fractionation and chemical composition, physico-chemical properties of casein, Whey proteins: Preparation of total whey proteins: α-Lactalbumin and β- Lactoglobuline. Properties of α - Lactalbumin and β lactoglobulin, Immunoglobulin and other minor milk proteins and non proteins nitrogen constituents of milk, Hydrolysis and denaturation of milk proteins under different physical and chemical environments, Estimation of milk proteins using different physical and chemical methods, Importance of genetic polymorphism of milk proteins, Milk enzymes with special reference to lipases, Xanthine Oxidase, phosphates, proteases and lactoperoxidase, Milk carbohydrates their status and importance. Physical and chemical properties of lactose, Sugar amine condensation, amadori re arrangement, production of hydroxyl methyl furfural (HMF), Processing related degradation of lactose, Definition, general composition and classification of milk lipids, Nomenclature and general structure of glycerides, factors affecting the fatty acid composition. Milk phospholipids and their role in milk products, Unsaponifiable matter and fat soluble vitamins, Milk Salts: Milk proteins, Casein: Isolation, fractionation and chemical composition, physico-chemical properties of casein, polymorphism of milk proteins, Milk enzymes with special reference to lipases, Xanthine Oxidase, phosphates, proteases and lactoperoxidase, Milk carbohydrates their status and importance, Physical and chemical properties of lactose, Sugar amine condensation, amadori re arrangement, production of hydroxyl methyl furfural (HMF), Processing related degradation of lactose, Definition, general composition and classification of milk lipids. Nomenclature and general structure of glycerides, factors affecting the fatty acid composition. Milk phospholipids and their role in milk products, Unsaponifiable matter and fat soluble vitamins, Milk Salts: Mineral in milk (a) major mineral (b) Trace elements, physical equilibria among the milk salts and Milk contact surfaces and metallic contamination.


DC-311 Chemical Quality Assurance 


Practical : Calibration of dairy glassware such as pipette, burette, volumetric flasks, hydrometer, butyrometers. Preparation and standardization of dairy reagents such as acids, alkalis, sodium thiosulfate, silver nitrate, Fehlings. EDTA solutions etc. Detection of adulterants, preservatives, and neutralizers in milk and milk products. Chemical analysis of permissible additives used in milk and milk products. Chemical analysis of detergents and sanitizers. Preparation and testing of Gerber sulfuric acid used in fat determination. Testing the amyl alcohol used for fat determination. Analysis of market samples of milk and milk products.

DC-322 Food Chemistry


## 5. BIOCHEMISTRY

**BC-121 Biochemistry & Human Nutrition** 3 (2+1)


## 6. DAIRY ECONOMICS STATISTICS AND MANAGEMENT

**ES-111 Economic Analysis** 2 (2+0)

Basic concepts-wants, goods, wealth, utility, consumption, demand and supply, Consumer behaviour-law of diminishing marginal utility and equi-marginal utility, cardinal and ordinal utility approach for consumer’s behaviors. Theory of demand-law of demand, demand schedule, demand function, determinates of demand, individual consumer demand and market demand, demand forecasting, elasticity of demand, price elasticity, income elasticity and cross elasticity, Consumer’s surplus. Theory of production- concepts of firm and industry, basic factors of production and their role, production function for a single product, nature of production function, laws of returns. Concepts of costs-fixed and variable costs, short run and long run costs, average and marginal costs, economics and diseconomies of scale. Concept of market- types of market, pricing and output under different market situations, market price and normal price, price determination under perfect Competition, monopoly, oligopoly and monopolistic competition. National income – GDP, GNP, NNP, disposable personal
Income, per capita income, inflation. Economic features and characteristics of dairy sector in India. Dairy development strategy with special emphasis in post-independence era and Operation Flood Programme

**ES-112 Industrial Statistics**  
3 (2+1)


**Practical:** Measures of central tendency, Measures of dispersion, Moments, Skewness and Kurtosis Fitting of binomial and Poisson distribution. Application of 'Z' test for one and two sample problems. Application of 't' test for one and two sample problems. Application of Chi-square test and F-test. Correlation and regression. Rank correlation coefficient. Control chart for variables & attributes

**ES-221 Cost Accounting**  
2 (2+0)


**ES-222 Operations Research**  
2 (2+0)


**ES-311 Financial Management**  
2 (2 +1)

Introduction: Definition, scope and objective of financial management, common concepts & terms. Book-keeping and Accounts: different systems of accounting; Double entry system of book-keeping; Preparation of accounting records- original records, posting in ledger, cash book, etc., classification and final accounts; adjustments at the end of trading period, preparation of trial balance; banking transactions and bank reconciliation statements. Statements of Financial Information: Accounting system- a source of financial statements, classification of capital and revenue expenditure; balance sheet, profit and loss account, statement of changes in the financial position; funds flow statement, cash flow statement and their use in financial decision making. Depreciation: concepts and methods Capital structure: capital structure and financial structure, capital structure planning, risk return trade off, financial leverage, portfolio analysis and risk diversification. Financial Analysis: Nature and uses of financial analysis, Ratio analysis such as structural ratios, Liquidity ratios, profitability ratios, Activity ratios, turnover ratios, leverage ratios, utility of ratio analysis; CVP analysis and utility of CVP analysis; break even analysis; profit and operating analyses. Capital budgeting/ investment decisions: Capital investment decisions, measurement of cash flow; Time value of money, payback period, average return on investment, accounting rate of return, net present value and internal rate of return, profitability index;
Cost of capital: Management of cost of capital, cost of debt, debentures, preference share capital, equity share capital & retained earnings; overall cost of capital; investment decision making- investment timing and duration, investment during inflation and capital rationing.

Complex investment decisions, investment timing & duration, investment under inflation and Capital rationing.

Working capital management: Concept and determinants of working capital, estimating working capital needs; approaches to working capital management- management of cash, marketable securities and inventory management.

Practicals: Recording and classification of business transactions, Financial statements- balance sheet, profit and loss account, income statement, Depreciation, Cash flow statement, Ratio analysis, Analysis of financial statements, Cost of capital, Capital budgeting and investment decisions, Break-even analysis

ES-323 Entrepreneurship Development and Industrial Consultancy 2 (1+1)


Practicals: Assessment of entrepreneurial skills and characteristics for successful entrepreneur. Consumer opinion surveys. Pricing of milk and milk products. Preparation of feasibility reports for setting of dairy farms, composite milk plants, collection centers, chilling units and processing units.

DX-311 Communication Skills

Communication Skills: Structural and functional grammar; meaning and process of communication, verbal and non-verbal communication; listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, précis writing, summarizing, abstracting; individual and group presentations, impromptu presentation, public speaking; Group discussion. Organizing seminars and conferences. Practical: Listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, précis writing, summarizing, abstracting; individual and group presentations.

**Practical:** Acquiring skill in use of audio-visual & other aids: Overheads Projector, Slide Projector, Use of VCR and PA system, Camera handling. Preparation and use of visual aids and printed material; Poster and chart, Flash card and flannel Graph, Circular letter, leaflet, pamphlet, folder. Group Discussion Technique, Developing Communication and Overall Skills, Brain-storming Technique for developing the Decision making Process, Interview-technique(s), Identification of problems of village farmers through interview method, Writing a radio script.

### 7. COMPUTER SCIENCE

**CS-111 Computer and Application Software Packages**  
3 (2 + 1)

History, features, classification and organization and I/O peripheral devices for computers; Features of modern operating systems; number systems and coding schemes; Basics of networking and communications; Internet, e-mail concepts and application, Word-processing and desktop publishing, Electronic spreadsheet basics and operations, Database management system basics and operations; Fundamental of presentation-graphic packages. Recent strides in computing.

**Practical** : Windows Operating System, Word Processing software operations, Presentation Graphics software operations, Internet Surfing/Email usage, RDBMS software package basic operations, Spreadsheet software package basic operations.
8. INTERDISCIPLINARY COURSES

EN-111 Environmental Studies  
3 (3+0)

Unit 1: The Multidisciplinary nature of environmental studies  
Definition, scope and importance, Need for public awareness (2 lectures)

Unit 2: Natural Resources: Renewable and non-renewable resources: Natural resources and associated problems, Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people, Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems; Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies, Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture fertilizer-pesticide problems, water logging, salinity, case studies, Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies, Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification, Role of an individual in conservation of natural resources, Equitable use of resources for sustainable lifestyles. (8 lectures)

Unit 3: Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids, Introduction, types, characteristic features, structure and function of the following ecosystem:- Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) (6 lectures)

Unit 4: Biodiversity and its conservation: Introduction – Definition: genetic. Species and ecosystem diversity, Biogeographical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, Biodiversity at global, National and local levels, India as a mega-diversity nation, Hot-spots of biodiversity, Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation of biodiversity: In-situ conservation of biodiversity. (8 lectures)


Unit 7: Field work: Visit to a local area to document environmental assets-river/forest/grassland/hill/mountain, Visit to a local polluted site-Urban / Rural / Industrial / Agricultural, Study of common plants, insects, birds, Study of simple ecosystems-pond, river, hill slopes, etc. (Field work Equal to 5 lecture hours)

MP-111 Milk Production Management & Dairy Development  
3 (2+1)

Introduction to Animal Husbandry. Distinguishing characteristics of Indian and exotic breeds of dairy animals and their performance. Systems of breeding and methods of selection of dairy animals. General dairy farm practices- identification, dehorning, castration, exercising, grooming, weighing. Care of animals at calving and management of neonates. Management of lactating and dry cows and buffaloes. Methods of milking and milking procedure and practices for quality milk production. Dairy farm records and their maintenance. Systems of housing dairy animals and maintenance of hygiene and sanitation at dairy farm premises. Common disease problems in dairy animals, their prevention and control. Feed nutrients required by animal body. Feed resources...