Course offered by Agribusiness Incubator
Dept. of Agricultural Engineering,
College of Agriculture, Vellanikkara

Post-graduate Diploma in Food Industry Management and Quality Control

1. **Semester I (18 Credits)**

Sl. No.	*Course No.*	*Course Title*	*Credits*
1.	FDT 501	Food Industry Management	3 (2+1)
2.	FDT 502	Food Quality Control	3 (2+1)
3.	FDT 503	Unit Operations in Food Process Engineering	3 (2+1)
4.	FDT 504	Entrepreneurship Development in Food Processing	3 (2+1)
5.	FDT 505	Entrepreneurship Development Skills	3 (2+1)
6.	FDT 506	Food Packaging and Storage Technology	3 (2+1)

2. Semester II (22 Credits)

Sl. No.	*Course No.*	*Course Title*	*Credits*
1.	FDT 510	Special Problems/case study	2 (0+2)
2.	FDT 520	Seminar	1 (0+1)
3.	FDT 530	Industrial Attachment	4 (0+4)
4.	FDT 540	Project	15 (0+15)

FDT 501 FOOD INDUSTRY MANAGEMENT (2+1)

Unit I
Definition and classification of food industries - characteristics - labor wages and incentives - decision making and production management - production planning - production control - job production - batch, mass production - production and process charts - time and motion study.
Unit II
Materials management - inventory control and types - ABC analysis - VED analysis - economic order quantity (EOQ), plant location - factors - plant layout - types – advantages- Waste management.
Unit III
Production planning and control- optimization technique - network analysis - PERT and CPM
Unit IV
Financial management - determination of capital needs - break even analysis - manpower management - industrial relations and labor welfare - marketing management -advertising, market research.
Unit V
Management control and information systems in agro-food processing units- design of management information systems, social responsibility of business.

Practical
Agro-food processing industry visit, analyzing production management systems, financial management, inventory control, marketing management, plant layout, project planning,

preparation of organization structure for a food industry.

Lecture schedule

1. Introduction to food industries and management - Classification of food industries-Production management- Principles and techniques
2. Wages-Fixing of wages-Time wage system-Piece wage system
3. Balance and debt system- Incentive wage plan- Halsey plan-Rowan premium plan
4. Organization Structure-Span of management-authority responsibility-line and staff relationship-group dynamics
5. Production planning and control-techniques of production control-PERT/CPM techniques
6. Manufacturing systems-job production-Batch and mass production-production chart-process chart-routing and scheduling
7. Work study-time study-motion study-fatigue study
8. Material management and inventory control-types of inventory-ABC analysis-VED analysis-economic order quantity record lever
9. Plant location-factors affecting location-plant layout-product layout-process layout-combined layout
10. Effluent treatment plant - Factors
11. Financial management-kinds of capital-mixed and working capital-source of capital funds
12. Budgetary control-breakeven analysis
13. Personnel management-manpower planning-recruitment-selection and placement promotion-job evaluation
14. Workers' participation in management
15. Mid-term examination
16. Marketing management-consumer behavior and market segmentation
17. Channels of distribution-sales promotion and advertising-advertising media
18. Personal selling-marketing research
19. Management information systems in agro-food processing units
20. Social responsibility of management and business-to the owners-to the employees-to the consumer-to the community
21. Prospects of agro-food processing industries in the emerging economic scenario

Practical Schedule

1. Prepare organization structure for an agro-based industrial concern
2. Analyse, with the help of suitable examples, the various advertising media.
3. Prepare a project report on an agro-based industrial concern
4. Recommend a system of wage payment that may stimulate productivity and improve labor-management relations
5. What steps you should follow when you are appointed as a sales manager of anagro-based food processing company?
6. Give an account of the production planning process of an agro-based food processing industry taking into consideration the different systems of production
7. Describe the different methods that you can take for ensuring workers' participation in management.
8. "Non-financial incentives are as strong motivators as financial ones." – Critically examine this statement and bring out the role of financial and non-financial motivators
9. Visit to an agro-food processing industry, prepare and analyze the plant layout.
10. Prepare production and process flow charts for an agro-processing industry
11. Practical examination.

Suggested Reading

1. Joseph. G. Monkas(1981). Operations management- Theory and problems, Mc Graw Hill Book Company, New Delhi
2. Khanna, O.P.(1995). Industrial Engineering and Management. Dhanpath Rai & Sons, New Delhi
3. Richard A. Jhonson, T. William, Newel &Rager C. Vergin, (1975). Operations Management-A system concept, Houghton Miffon Company, Boston.

FDT 502 Food Quality Control (2+1)

Unit I

Food quality, quality assurance and quality management; objectives, importance and functions of quality control, Current challenges to food safety. Principles of food quality assurance, total quality management (TQM) – good manufacturing/management practices, good hygienic practices, good lab practices.

Unit II

Proximate analysis – carbohydrates, fats, proteins, minerals, physicochemical properties; Instrumental methods of analysis; Spectrophotometric: UV/VIS.

Unit III

Principal aspects of sampling of food: Importance of sample collection, sampling tools and containers, sample collection techniques, sampling for microbiological analysis of food, routine versus investigational sampling, dispatch of sample, documentation and commodity-specific sampling procedure.

Unit IV

Development of hazard analysis procedures. Food specifications, grades, and standards. Food safety management systems (FSMS), HACCP-Principles &applications of HACCP in food safety,the concept of food traceability for food safety.

Practical

Sampling Quantity, packaging and sealing of sample, dispatch of sample, documentation, and commodity-specific sampling procedure for microbiological analysis of food &chemical analysis of foods. Hazard Analysis and Critical Control Points (HACCP) of different categories of food products. Good lab practices and safety measures. Assessment of hygiene levels of food industries-finding solutions and presentation.

Lecture Schedule

1. Food quality, food quality assurance and food quality management; objectives, importance, and functions of quality control
2. Current challenges on food safety
3. Principles of food quality assurance, total quality management (TQM)
4. Good manufacturing/management practices
5. Good hygienic practices
6. Good lab practices
7. General awareness and role of management practices in quality control
8. Proximate analysis
9. Ultraviolet-Visible Spectrophotometry
10. Importance of sample collection, Sampling tools and containers, sample collection techniques
11. Sampling techniques for microbiological analysis of food
12. Routine versus investigational sampling and quantity of samples to be collected
13. Packaging, sealing and dispatch of sample
14. Documentation and commodity-specific sampling procedure

15. Mid-Semester Examination
16. Principles & applications of HACCP in food safety
17. Concept of food traceability for food safety
18. Food Safety and Food Standards Authority of India (FSSAI)
19. Codex Alimentarius Commission,
20. International organization for standardization (ISO)

Practical schedule

1. Commodity-specific food sampling
2. Microbiological analysis of foods
3. Chemical analysis of foods
4. Industrial visit of food industry and analyze the lacunae in the processing line
5. Hazard Analysis and Critical Control Points (HACCP) of different categories of food products.
6. Preparation and presentation of HACCP spreadsheet for food industry
7. Modification /suggestion of HACCP plan for the industry
8. The procedure of FSSAI licensing and registration
9. Good lab practices and safety measures
10. Assessment of concepts in food safety and quality assurance

Suggested reading:

1. Inteaz Alli, (2003). Food Quality Assurance: Principles and Practices. CRC Press
2. VindikaLokunarangodage (2018). ISO 22000:2018 Generic Model
3. Early. R. (1995): Guide to Quality Management Systems for the Food Industry, Blackie, Academicand professional, London.
4. Gould, W.A and Gould, R.W. (1998). Total Quality Assurance for the Food Industries, CTIPublications Inc. Baltimore.
5. Bryan, F.L. (1992): Hazard Analysis Critical Control Point Evaluations A Guide to IdentifyingHazards and Assessing Risks Associated with Food Preparation and Storage. World HealthOrganization, Geneva
6. Food and Agricultural Organization (1980): Manuals of Food Quality Control. 2 AdditivesContaminants Techniques, Rome.
7. Krammer, A. and Twigg, B.A. (1970). Quality Control for the Food Industry.3rd Edn. AVI,Westport.

FDT 503Unit Operations in Food Process Engineering(2+1)

Unit I

Basic engineering mathematics - units and dimension -conservation of mass and energy - principles of fluid flow – properties of liquids, fluid dynamics - mass and energy balance-Newtonian, and non - Newtonian fluids-stream line and turbulent flow - flow measurement and measurement of viscosity.

Unit II

Blanching, pasteurization-LTLT, HTST and UHT process- evaporation – definition -single and Multiple-effect evaporator– liquid characteristics – single and multiple effect evaporation-performance of evaporators and boiling point elevation – capacity – economy and heat balance-types of evaporators- distillation - methods – flash distillation and differential distillation – steam distillation -steam requirements in food processing industries.

Unit III

Sedimentation – gravitational sedimentation - Stoke's law - sedimentation of particles in fluids - cyclones -centrifugal separations – rate of separations – liquid–liquid separation – centrifuge

equipment - filtration –filter media – types and requirements - filtration equipment – rotary vacuum filter – filter press - membrane technology- classification - types of membrane – Reverse osmosis membrane process –ultrafiltration membrane process-extraction equipment-– crystallization - rate of crystal growth- crystallization equipment..

Unit IV

Material handling equipment- screw conveyor, bucket elevator, belt conveyor, chain conveyor, pneumatic conveyor-size reduction process- energy and power requirements in comminuting- Rittinger's, Bond's and Kick's laws of crushing - principles of milling equipment - hammer mill, attrition mill- pin mill, ball mill - homogenization principles - mixing – types of mixers –kneaders and blenders.

Practical

Fluid flow properties- cyclone, blanching – pasteurization - centrifuge, membrane process, crystallization – extraction - handling and conveying equipment, size reduction equipment, mixing equipment.

Lecture Schedule

1. Basic engineering mathematics - units and dimension-conservation of mass and energy
2. Principles of fluid flow- properties of liquids- fluid dynamics- mass and energy balance
3. Newtonian and non-Newtonian fluids-stream line and turbulent flow - viscosity
4. Blanching - methods of blanching- pasteurization – methods - LTLT, HTST and UHT processes.
5. Evaporation – definition - single effect evaporator& multiple effect
6. Types of evaporators
7. Distillation method – flash distillation – differential distillation – steam distillation.
8. Fractional distillation
9. Sedimentation - gravitational sedimentation of particles in a fluid - stokes law
10. Cyclones - settling under sedimentation and gravitational sedimentation
11. Centrifugal separations – rate of separations – liquid-liquid separation – centrifuge equipment
12. Filtration – filter media – types and requirements
13. Filtration equipment – rotary vacuum filter – filter press
14. Membrane technology- classification – dialysis - gas permeation membrane process – types of membrane – equipment
15. Mid Semester Examination
16. Reverse osmosis membrane process – flux equation – ultra filtration membrane process
17. Extraction - equipment
18. Crystallization – equilibrium – rate of crystal growth – equilibrium crystallization- Crystallization equipment
19. Material handling equipment- screw conveyor, bucket elevator, belt conveyor, pneumatic conveyor, chain conveyor
20. Size reduction process- energy and power requirements in comminuting - Rittinger's, Bond's and Kick's laws for crushing
21. Principles of milling - equipment - hammer mill and attrition mill
22. Principles of milling - equipment - pin mill and ball mill
23. Homogenization - principles- mixing – types of mixers – kneaders and blenders.

Practical schedule

1. Mass and energy balances
2. Single &multiple-effect evaporators

3.Experiment on centrifugal separation
4.Experiment on vacuum filtration
5.Experiment on reverse osmosis
6. Experiment on extraction
7.Experiments on conveying equipment
8.Experiments on hammer mill
13. Energy requirements in size reduction
14.Experiment on mixing
15. Blanching experiments
16. Pasteurization experiments
17.Industrial visit and analysis of Unit operations
18. Final Practical Examination

Suggested readings

1.Bird R. Byron, Warren E. Stewart and Edwin N. Lightfoot. 2006. Transport Phenomena.Wiley India Pvt. Ltd., New Delhi.
2.Earle, R.L. 1985. Unit Operations in Food Processing. Pergamon Press. London.
3.Geankoplis J. Christie. 1999. Transport Process and Unit Operations. Third Edition, Prentice Hall of India, New Delhi.
4.McCabe L. Warren, Smith C. Jullian and Peter Harriott.1993. Unit Operations of Chemical Engineering. McGraw Hill Inc. New York.
5.Paul Singh, R. and Dennis R. Heldman. 2004. Introduction to Food Engineering. Elsevier India Pvt. Ltd., New Delhi.
6.Sinnott, R.K.2000. Coulson and Richardson's Chemical Engineering. Volume VI. Butterworth Heinemann, New Delhi.

FDT 504Entrepreneurship Development in Food Processing (2+1)

Unit I

Entrepreneurship development – concept and importance, function of entrepreneur, goal determination – problems challenges and solutions.

Unit II

Project proposal: need and objects; nature of organization, production management; financial management; marketing management; consumer management. Project planning and DPR preparation.

Unit III

Role of regulatory institutions; role of development organizations; self-employment-oriented schemes; various grant schemes.

Unit IV

Food industry basics, unit operations and food process, processing lines; processing and equipment of fruits and vegetables, grains, millets, spices and coconut

Unit V

Financial management for project: financial institution and their role, capital estimation and arrangement, cost and price determination, accounting management. Marketing strategies.

Unit VI

Problem of entrepreneur: problem relating capital, problem relating registration, administration problem and how to overcome from above problems.

Practical

Hands-on training on post-harvest technology; Identification of various tools, equipment and

accessories in food processing; Demonstration on cold chain, post-harvest techniques fruits and vegetable and package techniques; Exposure visit to research stations, laboratories, processing units, export market, etc.; Market Survey and cost analysis; Project Formulation: Preparation of Preliminary Project Report, Detailed Project Report.

Lecture Schedule

1. Entrepreneurship development – concept and importance
2. Function of entrepreneur, goal determination – problems challenges and solutions.
3. Project proposal: need and objects; nature of organization
4. Production management
5. Marketing management
6. Consumer management
7. Project planning and DPR preparation.
8. Role of regulatory institutions; role of development organizations
9. Self-employment-oriented schemes; various grant schemes
10. Food industry basics, unit operations and food process, processing lines
11. Processing and equipment of fruits and vegetables
12. Processing and equipment of grains
13. Processing and equipment of millets
14. Processing and equipment of spices
15. Processing and equipment of coconut
16. Financial management for the project: financial institution and their role, capital estimation and arrangement
17. Cost and price determination, accounting management
18. Marketing strategies
19. Problem of entrepreneur: problem relating to capital
20. Problem relating to registration, administration problem

Practicalschedule

1. Hands-on training on post-harvest technology
2. Identification of various tools, equipment and accessories in food processing
3. Demonstration on cold chain
4. Industrial visit to fruits and vegetable industry and process flow chart preparation
5. Industrial visit to grain processing industryand process flow chart preparation
6. Industrial visit to coconut processing industry and process flow chart preparation
7. Identification of problems in the processing line and suggestion for improvement
8. Project Formulation: Preparation of Preliminary Project Report
9. Detailed Project Report for any food industry
10. Interaction with successful entrepreneur.
11. Report preparation, presentation and submission.

Suggested readings

1. DebdattaSaha. 2020. Economics of the Food Processing Industry. Springer Nature Singapore.
2. Sudheer K. P. and IndiraV. 2021. Entrepreneurship Development in Food Processing. CRC Press LLC.
3. Sudheer K. P. and IndiraV. 2021. Entrepreneurship Development in Horticultural Processing. CRC Press LLC.

FDT 505 Entrepreneurship Development Skills(2+1)

Unit – I

Entrepreneur: Definition, the emergence of Entrepreneurial class: Theories of Entrepreneurship, Socio-economic Environment and Entrepreneur.

Unit – II

Promotion of a venture: Opportunity analysis, external environmental forces, economic, social, technological and competitive factors, and establishment of a new unit.

Unit – III

Entrepreneurial behavior: innovation and entrepreneurship, entrepreneurial behavior, social responsibility; the meaning of entrepreneurship skill, types of entrepreneurship skills: business management skills, teamwork and leadership skills, communication and listening, customer service skills, financial skills, analytical and problem-solving skills, critical thinking skills, strategic thinking and planning skills, technical skills, time management and organizational skills, branding, marketing, and networking skills, how to improve entrepreneurial skills, entrepreneurial skills in the workplace, entrepreneurial imagination and creativity

Unit – IV

Entrepreneurial development programme: Entrepreneurial development programme relevance and achievements, role of government in organizing such programmes. Entrepreneurship and industrial development: Planning and growth of industrial central and state level promotional services.

Practical

Development of entrepreneurial skill- communication- creativity- marketing aspects- presentation skills- leadership qualities- team spirit- group discussions-interviews.

Lecture schedule

1. Entrepreneur: Definition, the emergence of Entrepreneurial class: Theories of Entrepreneurship
2. Socio-economic Environment and Entrepreneur.
3. Promotion of a venture: Opportunity analysis, external environmental forces, economic, social, technological and competitive factors
4. Establishment of a new unit.
5. Entrepreneurial behavior: innovation and entrepreneurship, social responsibility
6. Meaning of entrepreneurship skill, types of entrepreneurship skills: business management skills, teamwork and leadership skills
7. Communication and listening, customer service skills
8. Financial skills, analytical and problem-solving skills, critical thinking skills
9. Strategic thinking and planning skills, technical skills
10. Time management and organizational skills
11. Branding, marketing, and networking skills
12. How to improve entrepreneurial skills, entrepreneurial skills in the workplace
13. Entrepreneurial imagination and creativity
14. Entrepreneurial development programme: Entrepreneurial development programme relevance and achievements
15. Role of government in organizing programmes
16. Entrepreneurship and industrial development
17. Planning and growth of industrial central and state-level promotional services.

Practical schedule

1. Assessing entrepreneur potential
2. Assessment of problem-solving ability

3. Exercises in creativity- communication skills
4. Conducting market survey to know the demands for different products
5. Preparing advertisements for popularization of products and news writing
6. Preparing project proposals
7. Individual and group presentations and evaluation of presentation
8. Telephonic conversation: Rate of speech, clarity of voice, speaking and listening politeness, telephonic etiquettes
9. Conducting meeting – Purpose, procedure, participation, physical arrangements,recording and writing of minutes of meeting
10. Seminar and conferences: Use of body language
11. Conducting mock interviews – testing initiative, team spirit and leadership
12. Group discussion and debates on current topics
13. Visit to entrepreneurship institute/ case study of successful entrepreneurs

Suggested readings

1. Chole R.R., Kapse P.S and Deshmukh P.R. 2012. Entrepreneurship Development and Communication Skills. Scientific Publishers.
2. Kumar S.A., Poornima S.C., Abraham M.K. and Jayshree K. 2021. Entrepreneurship Development. New Age International Publishers.
3. Rameshwari Pandya. 2016. Skill Development and Entrepreneurship in India. New Century Publications
4. Sudheer, K.P. and Indira, V. (2022). Entrepreneurship and Skill Development inHorticultural Processing. Joint publication of CRC Press and NIPA, New Delhi

FDT 506 Food Packaging and Storage Technology (2+1)

Unit 1

Fundamentals of Packaging-Packaging types-Active and intelligent packaging systems, Advances in Active packaging techniques and Intelligent packaging techniques; Current use of novel packaging techniques in different food products, consumers' acceptance of novel food packaging.

Unit II

Time-temperature indicators (TTIs), Definition and classification of TTIs, Requirement, development and current TTI systems -Application of TTIs- to monitor shelf-life.

Unit III

Role of the food matrix and different packaging materials. Aseptic packaging technology-advances, systems and its food applications

Unit IV

Storage of grains, biochemical changes during storage - temperature and moisture - moisture migration in stored grains - storage factors affecting losses, storage requirements - bag and bulk storage, rat-proof godowns and rodent control, method of stacking, preventive method, bio-engineering properties of stored products.

Unit V

Traditional and Modern storage structure – hermetic storage - vertical silo, flat bottom silo, squat silo, deep and shallow bin - aeration system - requirements

Unit VI

Controlled and modified atmosphere of durables and perishables - preservation of fruits and vegetables - factors affecting storage life – respiration - modified atmosphere storage - gases used, facilities, construction, operation and maintenance - effect of nitrogen, oxygen and carbon dioxide on storage of perishable crops - controlled atmospheric storage - equipment - scrubber - gas

generation devices - cold storage of fruits and vegetables - design of cold storages - concept of cold chain.

Practical

Assessment of properties of packaging materials- shelf-life studies- vacuum packaging- retort packaging- MAP- Cold storage- selection of packaging materials for specific products.

Lecture schedule

1. Fundamentals of Packaging-Packaging types
2. Active and intelligent packaging systems, Advances in Active packaging techniques and Intelligent packaging techniques
3. Current use of novel packaging techniques in different food products, Consumers' acceptance of novel food packaging.
4. Time-temperature indicators (TTIs), Definition and classification of TTIs, requirement.
5. Development and current TTI systems -Application of TTIs- to monitor shelf-life.
6. Role of the food matrix and different packaging materials.
7. Aseptic packaging technology-advances, systems and its food applications
8. Storage of grains, biochemical changes during storage - temperature and moisture
9. Moisture migration in stored grains
10. Storage factors affecting losses, storage requirements
11. Bag and bulk storage, rat-proof godowns and rodent control, method of stacking, preventive method
12. Bio-engineering properties of stored products
13. Traditional and Modern storage structure
14. Hermetic storage - vertical silo, flat bottom silo, squat silo, deep and shallow bin
15. Aeration system - requirements
16. Controlled and modified atmosphere of durables and perishables
17. Preservation of fruits and vegetables - factors affecting storage life – respiration
18. Modified atmosphere storage - gases used, facilities, construction, operation and maintenance
19. Effect of nitrogen, oxygen and carbon dioxide on storage of perishable crops
20. Controlled atmospheric storage - equipment - scrubber - gas generation devices
21. Cold storage of fruits and vegetables
22. Design of cold storages - concept of cold chain.

List of Practicals

1. Selection of different packaging materials for food products
2. Determination of packaging material characteristics (Thickness, strength)
3. Application of MAP packaging in selected foods
4. Shelf-life extension studies
5. Experiment on vacuum packaging
6. Experiment on retort packaging
7. Accelerated shelf-life studies
8. Packaging of dairy products
9. Gas analysis of packed food
10. To study textural characteristics of selected fruit/ vegetable under MAP storage
11. Design of cold storage
12. Visit to food packaging material manufacturing industry

Suggested Readings

1. Ahvenainen R. 2001. *Novel Food Packaging Techniques*. CRC.
2. Mahadeviah M &Gowramma RV. 1996. *Food Packaging Materials*. Tata McGraw Hill.

3. Painy FA. 1992. *A Handbook of Food Packaging*. Blackie.
4. Palling SJ. 1980. *Developments in Food Packaging*. App. Sci. Publ.
5. Rooney ML. 1988. *Active Food Packaging.* Chapman & Hall.
6. Sacharow S & Griffin RC.1980. *Principles of Food Packaging*. AVI Publ.
7. Bala,B.K. 1998. Drying and Storage of Cereal Grains. Oxford and IBH Publishing Co., New Delhi.
8. FAO. 1984. Design and Operation of Cold Stores in Developing Countries. FAO, Rome.
9. Hall, C.W. 1970. Handling and Storage of Food Grains in Tropical and Sub-tropical Areas. FAO Publ. Oxford and IBH. New Delhi
10. Henderson, S. and Perry, S.M. 1976. Agricultural Process Engineering. 5 Ed. AVI Publ.

****