



Rayat Shikshan Sanstha's

YASHAVANTRAO CHAVAN INSTITUTE OF SCIENCE, SATARA

(AUTONOMOUS)

Lead college

of

Karmaveer Bhaurao Patil University, Satara

Syllabus For

Master of Science

Part - II

Food Technology

Syllabus

To be Implemented from June, 2024 onwards

(As Per NEP-2020 Guidelines)

Rayat Shikshan Sanstha's

Yashwantrao Chavan Institute of Science, Satara (Autonomous)

Syllabus for Master of Science Part II

1. **Title:**M.Sc.Food Technology
2. **Year of Implementation:**2024-25
3. **Preamble:**

M.Sc. Food Technology course under autonomy has been prepared keeping in view the unique requirements of M. Sc. Food Technology students. The emphasis of the contents is to provide students the latest information along with due weightage to the concepts of classical trends in Processing and Packaging in food.

The course content also lists new practical exercises so the students get hands on experience of the latest techniques that are currently used in Food industries. Project curriculum spanning over the one year of the course is designed in a way to give the students first hand research experience as it consists of writing of synopsis, literature review along with actual table work. Along with students are also provided with an opportunity to peruse internship in industry or research centers. The course will also inspire students to pursue higher studies and research in Food Technology, for becoming an entrepreneur a deniable students to get employed in Food, Nutraceutical and Agriculture Industries.

- **Credit Framework for M.Sc. II**

- **Structure of Course: M.Sc. – II**

Semester – III

Level	Semester	Course Code	Course Title	No. of Lectures Per Week	Credits		
		Discipline Specific Courses (Mandatory)					
6.5	III	MFTT 531	Snack Food and Extrusion Technology	4	4		
		MFTT 532	Technology of Milk, Meat, Fish and Poultry	4	4		
		MFTT 533	Technology of Bakery and Confectionary	4	4		
		Discipline Specific Elective (Choose Any one among two)					
		MFTT 534 E-I MFTT 534 E-II	E-I) Cold Storage and Refrigeration E-II) Climate Change and Food Security	2	2		
		MFTP 535	Research Project	12	6		
		MFTP 536	Practical III (based on MFTT 531, 532 and 533)	4	2		
Total					22		

- **Structure of Course: M.Sc. – II**

- **Semester –IV**

Level	Semester	Course Code	Course Title	No. of Lectures Per Week	Credits		
		Discipline Specific Courses (Mandatory)					
6.5	IV	MFTT 541	Quality Evaluation of Processed Food	4	4		
		MFTT 542	Waste Management and Renewable Energy in Food Processing	4	4		
		MFTT 543	Advance in Food Processing Engineering	4	4		
		Discipline Specific Elective (Choose Any one among two)					
		MFTT 544 E-I MFTT 544 E-II	E-I) Advanced Food Packaging E-II) Marketing Management in Food Sector	4	4		
		MFTP 545	On Job Training (OJT)	8	4		
		MFTP 546	Practical IV (based on MFTT 541, 542 and 543)	4	2		
Total					22		

SEMESTER III

SEMESTER III

MFTT 531:- SNACK FOOD AND EXTRUSION TECHNOLOGY

Course Objectives: Students should be able to...

1. learn about the importance and scope of snack food.
2. study and formulate the ingredients and current practices for preparation of snacks.
3. understand extrusion & processing of snacks through extruders.
4. know packaging material required for snack foods & their quality control.

Credits= 04	MFTT 531 SNACK FOOD AND EXTRUSION TECHNOLOGY	No. of hours 60
UNIT-I	Introduction & Snack Food Ingredients	15
	<ul style="list-style-type: none">• Introduction to snacks, Domestic and Global status of Snack food Industry,• Ingredients & additives commonly used in snack food, the attributes and functions.• Starches for snack foods, Technology for grain-based snacks: wholegrains roasted, toasted, puffed, popped and flakes, coated grains-salted, spiced and sweetened; flour based – batter and dough based products papads.	
UNIT-II	Products and Processing	15
	<ul style="list-style-type: none">• Potato Chips, Meat based snacks, Snacks based on popcorn, baked snacks, Nut based snacks (salted, spiced and sweetened), Savory and Farsans.• Processing of Papad, Chips and Wafers, Corn Chips and Simulated Potato Chips, Application of seasonings, Indian Savory Sweets.	
UNIT-III	Extrusion & Extrusion Methods of Snack Foods	15
	<ul style="list-style-type: none">• Extrusion: definition, introduction to extruders, principles and types, Extruded products, Extruding Equipment, Uses of extruders in the snack food industry.	

	<ul style="list-style-type: none"> Specialized Equipment for Popcorn Processing; Potato chip processing, Equipment for Frying, Baking, and Drying, Snack foods from cooking extruders 	
UNIT-IV	Packaging & Quality Control of Snack Foods	15
	<ul style="list-style-type: none"> Product protection & packaging materials; Quality properties of snack foods, Properties of snack food packaging materials, Packaging Materials required for snack foods. Quality assurance and quality control of snack foods; Evaluation methods- process control and product attributes and safety, Oil Content and Shelflife Stability. 	

Course Outcomes: After completion of syllabus, student will be able to:

- analyze application of seasonings and Indian savory snacks.
- describe the type of packaging material required for snack foods.
- standardize quality control & quality assessment for snack foods & shelflife study.
- formulate the ingredients and current practices for preparation of snacks.

References:

- S. M. Kamran, S. Z. Makkia, H. R. Sharif, and R. S. Hafiz*, "Enrichment and fortification of traditional foods with plant protein isolates." In Plant protein foods, Cham: Springer International Publishing, pp. 131-169 2022.
- N. R. Mian*, Extruders in food applications. CRC press, 2000.
- A. M. Samuel*, Snack food technology. Springer Science & Business Media, 2012.
- M. Medeni and A. Altan*, eds. Advances in food extrusion technology. Florida, USA: CRC press, 2012.
- L. W. Edmund and L. W. Rooney*, Snack foods processing. CRC Press, 2001.

MFTT 532:- TECHNOLOGY OF MILK, MEAT, POULTRY AND FISH

Course Objectives: Students should be able to...

1. learn the various milk products and technology in milk products.
2. study the meat processing technology.
3. understand the techniques used in poultry processing.
4. know about fish processing technology.

Credits= 04	MFTT 532 TECHNOLOGY OF MILK, MEAT, POULTRY AND FISH	No. of hours 60
UNIT-I	Technology of Milk and Milk Products	15
	<ul style="list-style-type: none"> • Introduction–Status and scope of dairy industry in India, Definition, composition, Physical and chemical properties, Physio – chemical properties of milk. • Quality control tests: Platform tests–smell, appearance, temperature, lactometer reading. Chemical/ Laboratory test. Fluid milk processing: Pasteurization: LTLT, HTST, UHT methods. • Classification of dairy products and manufacturing process of cheese, Butter/Ghee, Channa, paneer, Condensed milk. Dry milk products methods of drying milk(Drum and Spraydrying), factors affecting the quality of dry milk, • Frozen products: Manufacturing of ice – cream factors affecting the quality offrozen products,Cleaning and sanitation of dairy plant and equipment 	
UNIT-II	Technology of Meat	15
	<ul style="list-style-type: none"> • Sources and development of meat industries in India. Muscle structure and composition of meat. Abattoir design and layout. • Pre slaughtering practices and slaughtering methods.Anti and 	

	<p>post mortem examination.</p> <ul style="list-style-type: none"> • Tenderization of meat. Factors affecting quality of meat. Preservation methods and processing methods of meat. Meat products and its quality evaluation. 	
UNIT-III	Technology of Poultry and Egg	15
	<ul style="list-style-type: none"> • Sources and development of poultry industries in India, Types and classes of poultry- Chicken, turkeys, ducks, geese, guineas and pigeons. Classification of chicken, poultry parts, pre-mortem handling, Transportation and slaughtering, poultry carcass evaluation. • Preservation methods and processing methods of poultry. Processed products and its quality evaluation. • Egg structure: composition, quality characteristics, processing and preservation of egg, Processing of egg products. 	
UNIT-IV	Technology of Fish	15
	<ul style="list-style-type: none"> • Sources and development of fish industries in India. Classification of fish (fresh water and marine) • composition of fish, characteristics of fresh fish, Handling, storage and transportation of fresh fish. • Fish freshness and quality evaluation, post mortem changes in fish. • Fish products: fish protein concentrate (FPC), fish protein extract (FPE), fish protein hydrolysate (FPH) 	

Course Outcomes: After completion of syllabus, student will be able to:

1. create various quality control measures in milk processing.
2. characterize various meat products.
3. illustrate the technology used for preparation on various poultry products.
4. analyze handling, storage and transportation of fish.

References:

1. *E. D. Aberle*, Principles of meat science. Kendall Hunt, 2001.
2. *V. P. Singhand*, Principles of meat technology. New India Publishing, 2011.
3. *Y. H. Hui*, ed. Handbook of meat and meat processing. CRC press, 2012.
4. *D. Sukumar* "Outlines of dairy technology." 1980
5. *S. R. Bhole, S. Shukla, K. Kishor, H. Singh, and S. Dey*, "Sensory acceptability of value added multigrain biscuit with different level's of wheat flour, maize flour and sesame seed." The Pharma Innovation 6, no. 7, 1015.

MFTT 533:- TECHNOLOGY OF BAKERY AND CONFECTIONARY

Course Objectives: Students should be able to...

1. understand the importance and principles involved in baking.
2. learn the processing technology of various bakery products.
3. aware about the basics of confectionary technology.
4. know the chocolate manufacturing process.

Credits = 04	MFTT 533 TECHNOLOGY OF BAKERY AND CONFECTIONARY	No. of hours 60
UNIT-I	Introduction to Bakery Technology	15
	<ul style="list-style-type: none">• Introduction and development of bakery industries in India. Principles involved in baking,• Functions of bakery ingredients. Raw material specifications. Mixing, Moulding, Baking and Cooling of Bakery products.• Physico-chemical changes during baking and cooling. Oven profile.	
UNIT-II	Technology of Bakery Products and Quality control.	15
	<ul style="list-style-type: none">• Manufacturing of bakery products:-Bread, biscuits, cookies, cracker, cake, specialized baked products. Process parameters.• Defects and preventive measure in bakery products. Freezing of baked products, canned bakery products.• Quality assurance and quality control of bakery products. Maintenance, safety and hygiene of bakery industries.	
UNIT-III	Introduction To Confectionary Technology	15
	<ul style="list-style-type: none">• Introduction and development of confectionary industries in India. Principle involved in confectionery products,• Types of confectionary products, ingredients in confectionary.	
UNIT-IV	Technology of Confectionary Products and Quality Control	15
	<ul style="list-style-type: none">• Boiled Sweets - Hard and soft boiled sugar confectionary: fondant, fudge, caramel, toffee, nut Brittles,• Gelatin Sweets – Fruit chews, jellies, gums, Defects in confectionary: sugar bloom, Fat bloom	

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|--|--|--|
| | <ul style="list-style-type: none"> • Harvesting of Cocoa bean, Cocoa Processing. Chocolate Processing- Ingredients used in chocolate, Cocoa butter substitutes. • Chocolate refining, conching, tempering, molding, enrobing, panning. Defects in chocolates | |
|--|--|--|

Course Outcomes: After completion of syllabus, student will be able to:

1. evaluate the ingredients and their function, types and quality of flour.
2. demonstrate the fermentation and proofing.
3. explain the chocolate processing.
4. illustrate the cocoa butter substitutes.

References:

1. *N. H. Khetarpaul*, Bakery science and cereal technology. Daya Books, 2005.
2. *I. Davidson*, Biscuit, cookie and cracker production: process, production and packaging equipment. Academic Press, 2018.
3. *S. K. Sharma, T. K. Mandal, R. Banoo, A. Rai and M. Rani*, "Long-term variation in carbonaceous components." Bulletin of Environmental Contamination and Toxicology 109, no. 3:502-510. 2022
4. *S. J. Sonja, D. R. Pajin, and M. I. Borislav*, The influence of extruded sugar beet pulp on cookies' nutritional, physical and sensory characteristics. Sustainability 13, 2021
5. *R. S. Krajangsang, and W. Lorliam*, "Effects of jasmine rice flour, glutinous rice flour, and potato flour on gluten-free coffee biscuit quality." Journal of Culinary Science & Technology 1-19. 2022

MFTT 534 E-I:- COLD STORAGE AND REFRIGERATION

Course Objectives: Students should be able to...

1. understand the refrigeration cycle and refrigeration system.
2. study best practices in cold Storage and freeze Storages.

Credits=02	MFTT 534 E-I COLD STORAGE AND REFRIGERATION	No. of hours 30
UNIT-I	Principles of Refrigeration	15
	<ul style="list-style-type: none">• Principles of Refrigeration, Refrigeration cycles, Vapour compression and vapour absorption cycles, refrigerants, characteristics of different refrigeration's, ozone-depletion potentials, green house potential refrigerants, use of non-polluting refrigerants, net refrigerating effect, ton of refrigeration.• Component of Refrigeration system: compressor, condenser, Evaporator, Expansion valves piping and different controls. Atmospheric air and its properties, Psychometrics.	
UNIT-II	Cold Storage Design and Construction	15
	<ul style="list-style-type: none">• Cold Storage Design and Construction, Small and large commercial storages, Cold Room temperatures, Insulation, Properties of insulating materials, Air diffusion equipment, Doors and other openings.• Cold load estimation; prefabricated systems, walk-in coolers and refrigerated container truck: Freezer Storages, Freezer room temperatures, insulation of freezer rooms: Pre-cooling and prefreezing.• Cold storage practice, Stacking and handling of material in and around cold rooms, Optimum temperatures of storage for different food materials.	

Course Outcomes: After completion of syllabus, student will be able to:

1. remember the refrigeration system.
2. evaluate the cold storage and its construction.

References:

1. *D. M. Clive*, ed. Cold and chilled storage technology. Springer Science & Business Media, 1997.
2. *M. P. Chris*, ed. Frozen food technology. Springer Science & Business Media, 1993.
3. *R. M. shukla and M. D. singh*, The Climate Solution: India's Climate-Change Crisis and What We Can Do about It. Hachette UK, 2018.
4. *I. Davidson*, Biscuit, cookie and cracker production: process, production and packaging equipment. Academic Press, 2018.

MFTT 534 E-II:- CLIMATE CHANGE AND FOOD SECURITY

Course Objectives: Students should be able to...

1. know the stability of food production in different climate.
2. study about the food mitigation and adaptations of agriculture.

Credits=02	MFTT 534 E-II CLIMATE CHANGE AND FOOD SECURITY	No. of hours 30
UNIT-I	Climate Change and Agriculture	15
	<ul style="list-style-type: none">• Climate change and agriculture, impact of temperature and changed climate on crop productivity, climate change and food availability.• Climate change and stability of food production, climate change and access to food, climate change and food utilization, government of India policies and programs for food Security	
UNIT-II	Mitigation and Adaptations.	15
	<ul style="list-style-type: none">• Smart agriculture, Conservation agriculture, Sustainable intensification, urban agriculture.• Food supply management, Demand changes-diet changes, Food waste.• Food supply chain management in climate change, flow process of SCM	

Course Outcomes: After completion of syllabus, student will be able to:

1. analyze the impact of climate change on food.
2. remember the policies and programs for food Security and food waste

References:

1. Z. Y. Zhou, Global food security: What matters?. Routledge, 2019.
2. S. M. Swaminathan, Combating hunger and achieving food security. Cambridge University Press, 2016.

3. *C. Chinnala and B. Ramulu*, *Marginalized Communities and Decentralized Institutions in India: An Exclusion and Inclusion Perspective*. Rutledge India, 2020.
4. *W. Lioba*, "The concept of food and nutrition security." *Achieving food and nutrition security* 3: 21-52. 2009

MFTP 535:- RESEARCH PROJECT

Credits = 06	MFTP 535 RESEARCH PROJECT
	<ul style="list-style-type: none">• Self study and reference work of relevant topics and concepts by the student.• The Project Work must involve practical work (wetlab.) related to selected discipline.• Students are expected to work on “Project Work” for about 10 periods per week.• The project work must be allotted individually.• The student invests his energy, time and resources in a project. The project therefore should, if possible, have important bearing on some practical aspect. This will help student to justify his efforts on project.• It is the joint responsibility of student and project supervisor to maintain daily register book of his/her project work and has to be produced at the time of examination if asked.• Submission Process: Student should prepare 2 copies of the Project Report. At the beginning, the respective Project Supervisor must approve both copies positively before final examination. Then respective Head or Coordinator approves both copies of the Project Report.• The student has to submit one of these approved copies of project report, duly signed by the project Supervisor and Principal, before practical examination.

MFTP 536:- Practical III

Course Objectives: Students should be able to...

1. know snack food, extrusion technology and technology of meat, fish and milk
2. study shelf life studies and quality evaluation for each snack
3. understand various quality parameters in meat and poultry products
4. learn about methods used to prepare milk products and learn quality parameters.

Credits=02	MFTP 536 Practical III
	1. Preparation of potato chips and its quality evaluation.
	2. Preparation of extruded snack food and its quality evaluation.
	3. Preparation of mathri and its quality evaluation.
	4. Preparation of Expanded snack and its quality evaluation.
	5. Preparation of Coated grains or nuts and its quality evaluation.
	6. Preparation of noodles/vermicelli and its quality evaluation.
	7. Preparation of popcorn and its quality evaluation.
	8. Slaughtering and dressing of poultry bird.
	9. Determination of meat PH.
	10. Preparation of meat products.
	11. Determination of egg quality.
	12. Determination of terrible acidity of milk.
	13. Determination of fat content in milk and milk powder.
	14. Preparation of ice-cream.
	15. Preparation of bread and assessment of its quality.
	16. Preparation of pizza base and assessment of its quality
	17. Preparation of Choco chip cookies and assessment of its quality.
	18. Preparation of sponge cake, assessment of its quality.
	19. Preparation of fondant, assessment of its quality.
	20. Preparation of brittles and assessment of its quality

Course Outcomes: After completion of syllabus, student will be able to:

1. remember about the preparation methods of different snacks like potato chips, popcorn, expanded snacks.
2. formulate the shelf life studies and quality evaluation for each snack.
3. characterize different methods used for the preparation of milk products.
4. evaluate various bakery products

References:

1. *S. M. Kamran, S. Z. Makkia, H. R. Sharif, and R. S. Hafiz*, "Enrichment and fortification of traditional foods with plant protein isolates." In *Plant protein foods*,. Cham: Springer International Publishing, pp. 131-169 2022.
2. *D. Sukumar*, "Outlines of dairy technology." 1980
3. *S. R. Bhole, S. Shukla, K. Kishor, H. Singh, and S. Dey*, "Sensory acceptability of value added multigrain biscuit with different level's of wheat flour, maize flour and sesame seed." *The Pharma Innovation* 6, no. 7, 1015.
4. *S. J. Sonja, D. R. Pajin, and M. I. Borislav*, The influence of extruded sugar beet pulp on cookies' nutritional, physical and sensory characteristics. *Sustainability* 13, 2021
5. *S. K. Sharma, T. K. Mandal, R. Banoo, A. Rai and M. Rani*, "Long-term variation in carbonaceous components." *Bulletin of Environmental Contamination and Toxicology* 109, no. 3:502-510. 2022

SEMESTER IV

SEMESTER IV

MFTT 541:- QUALITY EVALUATION OF PROCESSED FOOD

Course Objectives: Students should be able to...

1. understand and the quality evaluation in dairy industries
2. know about quality evaluation in bakery and confectionary industries
3. study quality evaluation in Meat, Poultry and Sea food industries
4. learn sensory analysis of food and its methods

Credits = 04	MFTT 541 QUALITY EVALUATION OF PROCESSED FOOD	No. of hours 60
UNIT-I	Quality Evaluation in Dairy Industries	15
	<ul style="list-style-type: none">• Milk Composition, Major and minor milk constituents, Nutritional Importance - Milk reception operations - Unloading-Conveying-Examined at or of raw milk-weighing sampling of Milk - Quality control lists for milk and their significance.• Introduction- Preservatives – Neutralizer - Adulterants – Detection methods – Standard specification of Milk and Milk Products- Dairy product certification and licensing.	
UNIT-II	Quality Evaluation in Bakery and Confectionary Industries	15
	<ul style="list-style-type: none">• Quality of raw materials, quality check of flours, building inspection and routine cleaning programs, process control- microbial and fungal contaminants.• Ingredients, equipments, bakery quality assurance, ingredient inspection, process control, assessing Products for quality.	
UNIT-III	Quality Evaluation in Meat, Poultry and Sea Food Industries	15
	<ul style="list-style-type: none">• Poultry processing, Nutritive value of egg, Microorganisms associated with egg, Measurement of egg shell, albumin and yolk quality - Determination of interior quality, defects – grading of egg-quality assurance – Test methods. Egg powder and products. MPL of contaminants for egg products.• Sea foods - nutritional composition- microbial, non –microbial and metal contaminants in sea foods – transportation of fish - grading - sea food products and processing - preservation methods - freezing – IQF – canning – salting – surimi	

	process. Maximum Permissible Limit for sea foods.	
UNIT-IV	Sensory Analysis of Food	15
	<ul style="list-style-type: none"> • Definition of Sensory Analysis, Sensory characteristic of food, Requirements of conducting Sensory Analysis Sensory panel – types. • Training of sensory panel, Reason for testing food quality, Methods of Sensory Evaluation and sensory card. 	

Course Outcomes: After completion of syllabus, student will be able to:

1. evaluate the quality of dairy products.
2. characterize the quality evaluation of confectionary products.
3. analyze the quality evaluation of meat and poultry.
4. formulate the sensory analysis of food.

References:

1. *P. A. Marchant, and T. R. Dutson*, HACCP in meat, poultry, and fish processing. Vol. 10. Springer Science & Business Media, 2012.
2. *B. A. Shai*, Poultry products processing: an industry guide. CRC press, 2016.
3. *J. N. Robert and S. P Patton*, "Principles of dairy chemistry." Principles of dairy chemistry. 1999
4. *M. C. Josefina, E. S. Vargas and R. G. Zepeda*, "Sensory evaluation of dairy supplements enriched with reduced iron, ferrous sulfate or ferrous fumarate." salud pública de méxico 57:14-21 2015.
5. *K. R. Vijayakumar, A. Martin, L. R. Gowda, and V. Prakash*, "Detection of genetically modified soya and maize: Impact of heat processing." Food Chemistry 117, no. 3 (2009): 514-521.

MFTT 542:- WASTE MANAGEMENT AND RENEWABLE ENERGY IN FOOD PROCESSING

Course Objectives: Students should be able to...

1. understand various sources of energy and pretreatment of wastes.
2. know the utilization of wastes produced by various food industries
3. learn energy and application of solar energy in food processing.
4. study the biofuel production and utilization modern applications of biomass.

Credits = 04	MFTT 542 WASTE MANAGEMENT AND RENEWABLE ENERGY IN FOOD PROCESSING	No. of hours 60
UNIT-I	Sources and Pretreatment of Wastes	15
	<ul style="list-style-type: none"> • Sources of waste and pollutants, Classification, and characterization of Solid, Liquid and Gaseous wastes from food industry. (Dairy industry, agro processing industry, meat industry, bakery industry) • Pretreatment of waste, secondary treatments, and Tertiary treatments, Measurement of levels of pollution. 	
UNIT-II	Utilization of Waste and Effluent Treatment	15
	<ul style="list-style-type: none"> • Utilization of waste from: Fruit and Vegetable processing, Fish, Meat and Poultry industry, oil milling, and pulses milling, and utilization of by-products of dairy industry. • Microbiology of effluent and treated water. Identification of insecticide, pesticides, and fungicides in effluent water. 	
UNIT-III	Solar Energy and its Applications	15
	<ul style="list-style-type: none"> • Solar Energy - Biomass Energy - Wind Energy and other Renewable Sources of Energy - Economics of Waste-Heat Recovery and Cogeneration-Energy Conservation Economics. Solar Thermal Energy: Solar radiation, flat plate collector and their materials. • Solar furnaces, Solar operated refrigeration systems, Solar Thermal Energy Storage, Solar still; Solar cooker: Solar pond 	

UNIT-IV	Biofuels and Biomass Applications	15
	<ul style="list-style-type: none"> • Bio ethanol – production from conventional as well as unconventional sources. Biodiesel – Technology for production of biodiesel. Rural applications of biomass – Combustion-Chulas-improved Chulas-Biomass–Physical-Chemical composition–properties of biomass, • Recovery from the in industrial waste water–Case Studies in sugar,distillery,dairy,pulp and papermill,etc. 	

Course Outcomes: After completion of syllabus, student will be able to:

1. remember the pretreatment of wastes, secondary and tertiary treatments.
2. determine utilization of waste products produced by food industries.
3. formulate the various aspect of solar energy.
4. evaluate the production of various biofuels.

References:

1. *H. P. Garg*, Solar energy: fundamentals and applications. Tata McGraw-Hill Education, 2000.
2. *F. M. Lewis and L. D. Partain*, Solar cells and their applications. John Wiley & Sons, 2010.
3. *M. A. Datta*, "Waste disposal in engineered landfills." Narosa, New Delhi 1997.
4. *D. S. Chauhan*, Non-Conventional Energy Resources. New Age International, 2006.
5. *K. L. Shah*, "Basics of solid and hazardous waste management technology." 2000.
6. *A. D. Bhide*, Solid waste management in developing countries. Vol. 2. Indian National Scientific Documentation Centre, 1983.

MFTT 543:- ADVANCES IN FOOD PROCESSING ENGINEERING

Course Objectives: Students should be able to...

1. understand the thermal techniques used in food processing.
2. know the recent trends in non-thermal techniques.
3. learn the novel drying techniques and extraction techniques.
4. study the different types of equipment used in material handling.

Credits= 04	MFTT 543 ADVANCES IN FOOD PROCESSING ENGINEERING	No. of hours 60
UNIT-I	Thermal Operations	15
	<ul style="list-style-type: none">• Emerging Technologies like infrared, microwave heating, ohmic heating, radio frequency, dielectric, instant and high heat infusion and their current status. Recent trends in retort technology & continuous heat processing.• Advances in evaporation – multi effect evaporation (DSE, MVR & TVR), recent trends and design calculations, centrifugal evaporation, freeze concentration.	
UNIT-II	Non Thermal Operations	15
	<ul style="list-style-type: none">• Recent trends in High pressure processing, high voltage pulsed electric field, high intensity pulsed light technology, oscillating magnetic field, cold plasma, ozone and ultrasonic technology, Osmotic dehydration.• Membrane concentration – mechanisms of membrane transport, transport models, equipment – fluid & membrane movement modules.	
UNIT-III	Mass Transfer Operations	15
	<ul style="list-style-type: none">• Novel drying technologies like microwave drying, radio frequency drying, infrared drying, airless drying, heat pump assisted drying and pulse combustion drying.• Extraction – Different types of commercial extraction systems used in processing (solvent extraction) – Super critical fluid extractions and its application. Recent trends in distillation, absorption and crystallization	

UNIT-IV	Material, handling, storage and distribution	15
	<ul style="list-style-type: none"> • Material handling, handling equipment for raw materials and ingredients. • handling equipment for processing, waste management and disposal, storage, distribution 	

Course Outcomes: After completion of syllabus, student will be able to:

1. remember the thermal technology
2. illustrate the non-thermal technology
3. apply the knowledge about mass transfer in industries.
4. analyze concept of material handling.

References:

1. *S. B. Rodrigues and F. N. Fernandes*, "Advances in fruit processing technologies." 2012.
2. *M. A. Richardson and V. L. Philip*, ed. Thermal technologies in food processing. Elsevier, 2001.
3. *S. R. Paul and D. R. Heldman*, Introduction to food engineering. Gulf Professional Publishing, 2001.
4. *H. Q. Zhang, V. B. Canovas, V. M. Balasubramaniam, and D. F. Farkas*, eds. "Nonthermal processing technologies for food." 2011.
5. *A. S. Mujumdar*, Advanced drying technologies. CRC press, 2009.
6. *D. R. Heldman, and C. Sabliov*, eds. Handbook of food engineering. CRC press, 2018.

MFTT 544-EI:- ADVANCED FOOD PACKAGING

Course Objectives: Students should be able to...

1. know the various designing & labeling parameters for food packaging.
2. learn about the packaging molds and operations cost.
3. understand the novel techniques in food Packaging.
4. aware about packaging technologies in food Packaging.

Credits=04	MFTT 544-EI ADVANCED FOOD PACKAGING	No. of hours 60
UNIT-I	Package Labelling and Packaging Design Concepts	15
	<ul style="list-style-type: none"> • Label, types of label, Importance of nutritional labelling package design consideration, cushioning materials and their properties. • Introduction to design, Principles of Typography, Introduction to visual ergonomics, Understanding the relationship between consumer & communication Design. 	
UNIT-II	Design of packaging molds for packaging	15
	<ul style="list-style-type: none"> • Injection Molds, Blow Molds and its principle of working Hazards in distribution & design of packages for various foods. • Product Design, Designing for Packaging Application, can manufacturing process, Flexible packaging, Application of various molds 	
UNIT-III	Novel Techniques in Packaging I	15
	<ul style="list-style-type: none"> • Smart Packaging, Active Packaging-Oxygen absorbers, Carbondioxide absorbers, Ethylene absorbers, Humidity absorbers, Lactose remover, UV light absorbers and Cholesterol remover. • Antimicrobial Food Packaging- application, objective and 	

	composition of antimicrobial food packaging. Edible packaging- Edible coating and Edible films.	
UNIT-IV	Novel Techniques in Packaging II	15
	<ul style="list-style-type: none"> • Active packaging systems- Self-heating cans and Self-cooling cans, Green Plastics for Food Packaging-Polylactic acid (PLA), Native starch, Thermo plastic starch, Chitin and chitosan, Cellulose and Shellacresins. • Intelligent Packaging- Thermochromic inks, , Radio Frequency Identification (RFID). Bioactive packing- Non-Migratory Bioactive Polymers (NMBP) In Food Packaging, Types and Applications • Nano technologyin food packaging-Nano composite, Innovative packaging technologies-Functional barrier and High chemical barrier material innovations. 	

Course Outcomes: After completion of syllabus, student will be able to:

1. remember the Concept of nutritional labelling package.
2. determine the test of packaging material.
3. formulate the biodegradable packaging technologies.
4. evaluate various novel methods of packaging.

References:

1. *S. P. Athavale*, Hand Book of Printing, Packaging and Lamination: Packaging Technology. Notion Press, 2018.
2. *M. R. Klimchuk and S. A. Krasovec*, Packaging design: Successful product branding from concept to shelf. John Wiley & Sons, 2013.
3. *M. Mahadeviah and R. V. Gowramma*, Food packaging materials.Tata Mc Graw-Hill, 1996.
4. *G. A. Nayik, S. M. Dar, and V. Nanda*, "Novel food packaging technologies: Innovations and future prospective." Journal of the Saudi Society of Agricultural Sciences 17, no. 4:454-462. 2018.

5. *E. Candace and S. Roncarelli*, Packaging essentials: 100 design principles for creating packages. Rockport Publishers, 2010.
6. *M. Behzad*, "The art of packaging: An investigation into the role of color in packaging, marketing, and branding." *International Journal of Organizational Leadership* 3:92-102, 2014.

MFTT 544 E-II:-MARKETING MANAGEMENT IN FOOD SECTOR

Course Objectives: Students should be able to...

1. understand the concepts of marketing management
2. know about marketing theories, principles, strategies and process of marketing planning
3. study about marketing process for different types of products and services
4. learn Branding and packaging, Benefits of advertising.

Credits=04	MFTT 544 E-II MARKETING MANAGEMENT IN FOOD SECTOR	No. of hours 60
UNIT-I	Concept of Marketing Management	15
	<ul style="list-style-type: none"> • Concept of Marketing Management; Marketing Environment; Marketing Mix, Strategic Marketing, Market Segmentation, Targeting, and Positioning. • Buyer Behavior, Marketing Information System, Marketing Organization and Control. 	
UNIT-II	Marketing Strategy, Planning and Control	15
	<ul style="list-style-type: none"> • Introductory strategy, policy and planning, Strategic business units, the need for marketing planning, the process of marketing planning, Contents of the marketing plan, Monitoring, evaluating and controlling the marketing planning. • Marketing controls, Marketing plan control, Efficiency control. Digital and Non-digital, marketing. 	
UNIT III	Marketing channel decisions	15
	<ul style="list-style-type: none"> • Retailing, wholesaling and distribution; Pricing decisions, Pricing objectives, The laws of supply and demand, Elasticity of demand, Cross-price elasticity of demand, Practical problems of price theory, 	

	<ul style="list-style-type: none"> • Cost - revenue - supply relationships, The meaning of price to consumers, Price as an indicator of quality, Pricing strategies. 	
UNIT IV	Product Policy and Advertising	15
	<ul style="list-style-type: none"> • Product and product line, Product classification, product mix strategy, Product life cycle, New product development, Branding and packaging, Benefits of advertising, • Developing and advertising program, Sales promotion, public relation, personal selling, Pricing, significance of pricing, Price adjustments, Effect of price change 	

Course Outcomes: After completion of syllabus, student will be able to:

1. remember the marketing organization and management
2. formulate the need for marketing planning.
3. evaluate the marketing organization and control
4. analyze the marketing strategy for an existing product policy.

References:

1. *D. Dire*, "A Curriculum for Master of Business Administration (MBA) MAY, 2015
2. *K. A. Philip, K. L. Keller, K. Abraham and M. Jha*, Marketing management: South Asian perspectives. Pearson, 2013.
3. *R. Gupta and S. C. Sharma*, "A Study on the Factor Determinant and Their Effect on Consumer Behavior (In Reference to Two Wheeler Automobile Industry)." 2017.
4. *D. B. Shah*, "A Study on Marketing, Usage Trend and Status of Fanta & Mirinda in Kalaiya." PhD diss., Thakur Ram Multiple Campus, Birgunj, 2009.
5. *K. Philip and G. Armstrong*, "Principles of Marketing 12th Edition: Pearson Prentice Hall." Upper Saddle River New Jersey (2007).

MFTP 545:- ON JOB TRAINING (INDUSTRIAL TRAINING)

Course Objectives: Students should be able to...

1. explore themselves to become an entrepreneur.
2. identify strengths and weaknesses of industry.
3. know the practical knowledge about food processing and machine handling.
4. understand industrial principles of various food safety and processing techniques

Credits=04	MFTP 545 ON JOB TRAINING (INDUSTRIAL TRAINING)	3 months
	<ul style="list-style-type: none">• Industrial training is a crucial aspect of a student's educational journey, as it bridges the gap between theoretical knowledge and practical application. It provides students with real-world exposure and the opportunity to develop hands-on skills, enhancing their employability.• During a 3-month industrial training program at Food industries students can gain several benefits:• Practical Experience: On job training students to the latest technologies and tools used in the industry. This practical experience is essential for students to understand how concepts learned in the classroom are implemented in real projects.• Skill Enhancement: The training program focuses on skill development. Students can learn the process and product develop,R and D, Production process, man power handling, etc.• Exposure to Real Projects: Students get the opportunity to work on live projects, allowing them to apply their knowledge in a real-world setting. This experience helps in building confidence and competence.• Industry Insights: Interacting with professionals in industries provides students with insights into the food industry's working environment, culture, and best practices. They can learn from experienced mentors.• Networking: Building professional networks is essential for career growth. During the training, students can connect with professionals and peers, potentially opening doors to future job opportunities.	

Course Outcomes: After completion of syllabus, student will be able to:

1. get exposure to the industrial environment becoming competent professionals for the industry.
2. apply to the current technological developments relevant to the subject area of training.
3. determine the real time technical / managerial skills required at the job.
4. analyze various practical skill

MFTP 546:- Practical IV

Course Objectives: Students should be able to...

1. know the preparation technology of milk products
2. study about processing of different food sector
3. understand biogas technology used in food processing
4. learn about various equipment in food industry

Credits=02	MFTP 546 Practical IV
	1. Characterize and study shelf of meat
	2. Preparation of milk/flour/sugar/chocolate based based confectionary
	3. Determine fat content by gerber method and SNF content in milk.
	4. Determination of homogenization efficiency of milk.
	5. Carryout Sensory evaluation by hedonic scale
	6. Quality evaluation of egg with reference to yolk.
	7. Detection of adulterants from milk
	8. Biogas Technology potential and status
	9. Assessment of overall energy consumption, production and its cost in 2 selected agro-industries
	10. Characterization of biomass
	11. Solar Photovoltaic cell characteristics, analysis of SPV systems
	12. Waste utilization (value added product) of fruit / vegetable industry
	13. Waste utilization (value added product) of milk industry
	14. Design of tray and fluidized bed dryer.
	15. Design of bucket elevator.
	16. Design of vertical retort.
	17. Design of sterilizers (Batch type).
	18. Design of climbing and falling film evaporator.
	19. Design of shell and tube heat exchanger.
	20. Design of screw and roller conveyor.

Course Outcomes: After completion of syllabus, student will be able to:

1. remember the practical knowledge of dairy processing
2. formulate the research technology in food industry
3. characterize different aspect of waste management
4. develop machinery which is useful to the food processing

References:

1. *P. A. Marchant, and T. R. Dutson*, HACCP in meat, poultry, and fish processing. Vol. 10. Springer Science & Business Media, 2012.
2. *B. A. Shai*, Poultry products processing: an industry guide. CRC press, 2016.
3. *K. L. Shah*, "Basics of solid and hazardous waste management technology." 2000.
4. *A. D. Bhide*, Solid waste management in developing countries. Vol. 2. Indian National Scientific Documentation Centre, 1983.
5. *S. R. Paul and D. R. Heldman*, Introduction to food engineering. Gulf Professional Publishing, 2001.
6. *H. Q. Zhang, V. B. Canovas, V. M. Balasubramaniam, and D. F. Farkas*, eds. "Nonthermal processing technologies for food." 2011.
7. *A. S. Mujumdar*, Advanced drying technologies. CRC press, 2009.