PUNJABI UNIVERSITY,

PATIALA, PUNJAB, INDIA

(Established under Punjab Act No. 35 of 1961)

Outline and Syllabi

for

M.Voc. (Food Processing)
(Choice Based Credit System)

Programme Code: FDPM2PUP

for
Session: 2021-22 & 2022-23

Faculty of Life Sciences,

Punjabi University, Patiala

MASTER OF VOCATION (M.Voc.)

(FOOD PROCESSING)

Outline of syllabi and courses of reading

for

M. Voc. (FOOD PROCESSING) PART I (Semester I)

Programme Code:FDPM2PUP

Session: 2021-22 & 2022-2023

Code	Course	Course Option	Credits (Theory + Practical)	Total Marks (Ext.+ Int.+ Prac.)
FDPM 1101 C	Nutritional Science and Food Chemistry	Core I	4+3=7	150 (74+26+50)
FDPM 1102 C	Advances in Food Processing and Preservation	Core II	4+3=7	150 (74+26+50)
FDPM 1103 C	Advances in Dairy and Meat Technology	Core III	4+3=7	150 (74+26+50)
FDPM 1104 C Option (i)	Food Biotechnology	Elective I	4+3=7	150 (74+26+50)
FDPM1105C Option (ii)	Applied Food Microbiology			
	Industrial Visit		2	Satisfactory/ unsatisfactory
	I		**Total Credits**=30	**Total Marks**= 600

MASTER OF VOCATION (M.Voc.)

(FOOD PROCESSING)

Outline of syllabi and courses of reading

for

M. Voc. (FOOD PROCESSING) PART I (Semester II)

Programme Code:FDPM2PUP

Session: 2021-22 & 2022-2023

Code	Course	Course Option	Credits (Theory + Practical)	Total Marks (Ext.+ Int.+ Prac.)
FDPM 1201 C	Food Quality Control and Quality Assurance	Core IV	4+3=7	150 (74+26+50)
FDPM 1202 C	Bakery, Confectionery and Functional Foods	Core V	4+3=7	150 (74+26+50)
FDPM 1203 C	Food Engineering and Functional Concepts for Food Plant Design	Core VI	4+3=7	150 (74+26+50)
FDPM 1204 C Option (i)	Pseudo-cereals, Millets and Oil Seed Technology	Elective II	4+3=7	150 (74+26+50)
FDPM 1205C Option (ii)	Cereals, Pulses and Spice Processing			
	Industrial Summer Training		2	Satisfactory/ unsatisfactory
			Total Credits=30	**Total Marks**= 600
	NSQF Level 8 (As per National Skill Qualification Framework)			Evaluation will be done by FICSI (Food Processing sector Skill Council of India)

MASTER OF VOCATION (M.Voc.)

(FOOD PROCESSING)

Outline of syllabi and courses of reading

for

M. Voc. (FOOD PROCESSING) PART II (Semester III)

Programme Code:FDPM2PUP

Session: 2021-22 & 2022-2023

Code	Course	Course Option	Credits (Theory + Practical)	Total Marks (Ext.+ Int.+ Prac.)
FDPM 2101 C	Food Product Development, Entrepreneurship and IPRs	Core VII	4+3=7	150 (74+26+50)
FDPM 2102 C	Food Packaging and Marketing	Core VIII	4+3=7	150 (74+26+50)
FDPM 2103 C	Advances in Fruit, Vegetable and Beverage Technology	Core IX	4+3=7	150 (74+26+50)
FDPM 2104C Option (i)	Food Supply Chain and Statistics	Elective III	4+3=7	150 (74+26+50)
FDPM 2105C Option (ii)	Waste Management in Food Industry			
	Industrial Visit		2	Satisfactory/ unsatisfactory
			Total Credits=30	**Total Marks**= 600

MASTER OF VOCATION (M.Voc.)

(FOOD PROCESSING)

Outline of syllabi and courses of reading

for

M. Voc. (FOOD PROCESSING) PART II (Semester IV)

Programme Code:FDPM2PUP

Session: 2021-22 & 2022-2023

Code	Course	Course Option	Credits Practical	Total Marks (External)
FDPM 2201 L	Industrial/Institutional Project	Core X	30	50*
	NSQF Level 9(As per National Skill Qualification Framework)			Evaluation will be done by FICSI (Food Processing sector Skill Council of India)
			Total Credits=30	**Total Marks**= 50

*****Industrial/institutional project will be of 50 marks. It will be evaluated by the external examiner.

M. Voc. (FOOD PROCESSING) PART I (Semester I)

Programme Code: FDPM2PUP

Session: 2021-22, 2022-2023

PAPER CODE: FDPM 1101C	NUTRITIONAL SCIENCE AND FOOD CHEMISTRY	
Theory *Max. Marks: 74* *Credits: 4* *Lectures to be delivered:60 hrs.* *Time allowed: 3 Hours* *Pass Marks: 40%*	***Internal Assessment*** *Max. Marks: 26*	***Practical*** *Max. Marks: 50* *Credits:3* *Pass Marks: 40%*

Instructions for the paper setters: The question paper will consist of three sections A, B and C. Section-A and B will have four questions from the respective sections of the syllabus and carry 11 marks each. Section-C consists of 15 short answer type questions which will cover the entire syllabus uniformly and will carry 30 marks in all.

Instructions for the candidates: Candidates are required to attempt two questions each from sections A and B of the question paper and the entire Section-C.

LEARNING OUTCOMES:

On completing this subject, students will be able to:

1. Understand the composition and nutritive value of different foods.
2. Gain knowledge on the functions, food sources and requirements of essential nutrients
3. Demonstrate skills for determining RDA.
4. Apply the principles of nutrition to ensure good health for the individual and community.

SECTION-A

1. **Introduction to nutritional science:**Relationship between food, nutrition and health, dietary reference intakes (DRI), RDA and daily values (DV),reference dietary guidelines, basis for estimation of nutrient requirements, formulation of RDA
2. **Energy:** Energy value of foods, gross and physiological values, measurement of energy content of food(direct and indirect methods), components of energy expenditure,

basalmetabolic rate (BMR)-definition, factors affecting and determination of BMR; Energy requirements for various age groups.

SECTION-B

3. **Carbohydrates, proteins and lipids:** Carbohydrates-forms, functional properties, effect of processing and applications, modification of starches for industrial applications; Proteins-functional properties and effect of processing, industrial application; Lipids-functional properties, effect of processing (oils,rancidity, lipolysis, flavor reversion), applications;Auto-oxidation and its prevention.
4. **Flavors, minerals, pigments&enzymes:** Description of some common foodadditives: colorants, flavors, aroma/ flavor enhancers, sweetners,Major and minor minerals, toxic minerals in food,types of food pigments-chlorophyll, carotenoids, anthocyanins and flavonoids, caramel;Enzymes as aid in food processing industry.

REFERENCES

1. *Handbook of Food Chemistry*byCheung, Peter C. K., Mehta, Bhavbhuti M, Springer (2015).
2. *Principles of Food Chemistry*by John M. deMan, Springer (2018).
3. *Food chemistry* by Owen R. Fennema, CRC Publications (2017).
4. *Food Science* by Potter NN &Hotchleiss JH, CBS Publications (2007).
5. *Food Chemistry* by Meyer LH, CBS (2004).
6. Essentials of food and nutrition by Swaminathan, M Ganesh and Co., Chennai(2010).
7. *Fundamentals of food and nutrition* by Sumati R Mudambi and Rajagopal MV, New Age International Pvt. Ltd. Publishers, New Delhi, India (2007).

PRACTICALS:

1. Qualitative tests for carbohydrates.
2. Blood glucose level test.
3. Separation of amino acids by paper chromatography.
4. Determination of protein content by using burett method
5. Determination of the iodine numbers of lipids using Hanus method.
6. Determination of the saponification number of fats.
7. Estimation of ascorbic acid.
8. Estimation of calcium.
9. Estimating energy requirements using factorial method.
10. Calculating nutritive value of foods from food composition tables.
11. Planning and preparing a balanced diet.

12. Categorization of foods as rich, moderate and poor sources of energy and nutrients.
13. Planning and preparation of recipes rich in energy, protein, fibre, calcium, iron, zinc, pro-vitamin A, vitamin C, folic acid, thiamine, riboflavin and niacin.

PAPER CODE: FDPM 1102 C	**ADVANCES IN FOOD PROCESSING &PRESERVATION**	
Theory *Max. Marks: 74* *Credits: 4* *Lectures to be delivered:60 hrs.* *Time allowed: 3 Hours* *Pass Marks: 40%*	***Internal Assessment*** *Max. Marks: 26*	***Practical*** *Max. Marks: 50* *Credits:3* *Pass Marks: 40%*

Instructions for the paper setters: The question paper will consist of three sections A, B and C. Section-A and B will have four questions from the respective sections of the syllabus and carry11 marks each. Section-C consists of 15 short answer type questions which will cover the entire syllabus uniformly and will carry 30 marks in all.

Instructions for the candidates: Candidates are required to attempt two questions each from sections A and B of the question paper and the entire Section-C.

LEARNING OUTCOMES:

On completing this subject, students will be able to:

1. Explain cold preservation, food irradiation, microwave processing & thermal and non-thermalfood processing methods.
2. Understand novel methods of processing, viz. HTT, oscillating magnetic field, pulsed electric field and ultrasonic processing.
3. Demonstrate recent trends of processing in food industry.
4. Discusses a variety of modern technologies that aim to reduce the spoilage of food products.

SECTION-A

1.Cold preservation: Freezing-requirements of refrigerated storage, controlled low temperature, air circulation and humidity; Changes in food during refrigerated storage, progressive freezing, changes during freezing viz., concentration effect and ice crystal damage; Freeze burn, refrigeration load, factors determining freezing rate-food composition and non-compositional influences.

2.**Food irradiation and microwave processing:**Ionizing radiation and sources, direct and indirect radiation effects, safety and wholesomeness of irradiated food,microwave heating and applications;advantages, mechanism of heat generation, applications in food processing and limitations.

SECTION-B

3.Thermal processing: Introduction,principles of thermal processing, thermal resistance of microorganisms, thermal death time-D, F, Z value; Lethality concept, characterization of heat penetration data, thermal process calculations.

4. Non thermal food processing methods: Oscillating magnetic field-introduction, mode of action;Pulsed electric field-description/ mechanism and factors affecting microbial inactivation effects on food components;Hydrostaticpressure processing (pascalization)-principle of microbial inactivation, barotolerance of microorganisms, effect on food constituents & equipment;Ultrasonic processing-properties of ultrasonics, application of ultrasonic as processing techniques; Recent trends in food processing.

REFERENCES:

1. *Food Processing Principles and Applications*by Ramaswamy H and Marcott M, CRC Press (2006).
2. *Fundamentals of Food Engineering* by Rao PG, PHI Learning Pvt Ltd (2010)
3. *Food science* by B. Srilakshmi, New Age Publishers (2002).
4. *Food Chemistry* by Meyer, New Age (2004).
5. *Food Science* by Bawa. A.S, O.P Chauhan etal, New India Publishing agency (2013).
6. *Food Microbiology* by Frazier WC and Westhoff DC, TMH Publication(2004).
7. *New Methods of Food Preservation* by Blackie, NDRI (2001).

PRACTICALS:

1. Comparison of conventional and microwave processing of food.
2. Preservation of food by the process of freezing.
3. Study of a microwave oven.
4. Determination of power output of a microwave oven.
5. Temperature profile in a microwave oven cavity.
6. Microwave absorption by various food packaging materials.
7. Heating behavior of water, milk, cream and other milk products – effect of composition.
8. Shelf-life extension of pasteurized milk employing microwave heating.

9. Effect of shape and size of water/milk container on microwave heating.
10. Cooking of 'instant' products in a microwave oven.
11. Drying of casein, 'instant' wheat, 'instant' rice, etc. in a microwave oven.
12. Miscellaneous food processing/heating applications of microwaves.
13. Visit to a commercial food irradiation facility.

PAPER CODE: FDPM1103 C	**ADVANCES IN DAIRY AND MEAT TECHNOLOGY**	
Theory *Max. Marks: 74* *Credits: 4* *Lectures to be delivered:60 hrs.* *Time allowed: 3 Hours* *Pass Marks: 40%*	***Internal Assessment*** *Max. Marks: 26*	***Practical*** *Max. Marks: 50* *Credits:3* *Pass Marks: 40%*

Instructions for the paper setters: The question paper will consist of three sections A, B and C. Section-A and B will have four questions from the respective sections of the syllabus and carry 11 marks each. Section-C consists of 15 short answer type questions which will cover the entire syllabus uniformly and will carry 30 marks in all.

Instructions for the candidates: Candidates are required to attempt two questions each from sections A and B of the question paper and the entire Section-C.

LEARNING OUTCOMES:

On completing this subject, students will be able to:

- Explicate the physical and functional properties of milk.
- Describe thermal processing of milk and milk products.
- Demonstrate processing of meat.
- Explainprocessing of fish and egg.

SECTION-A

1.Physical & functional properties of milk: Composition, nutritive value, functional propertiesof milk proteins, fats, vitamins, enzymes and hormones, milk adulteration, role of stabilizers and emulsifiers and bio-surfactants in milk processing.

2.**Thermal processing of fluid milk&milk products**: Pasteurization (LTLT and HTST), sterilization and UHT techniques, packaging of fluid milk, fermentedand non-fermented milk products-cheese, yogurt, probiotic dairy products, cream, butter, ghee, ice-cream; Processing of evaporated and dried milk products-milk powder, SCM, infant formulae.

SECTION-B

3. Meat: Nutritive value, meat tenderization, microscopic structure;Slaughtering stages-pre-slaughter, slaughter and post slaughter stages in meat production;meat processing-curing, canning, smoking; Gelatin production.

4. Fish: Varieties, nutritive value, processing-canning, salting, smoking, freezing; Fishery by products; Egg-structure, nutritive value, external and internal quality parameters; Processing of egg.

REFERENCES

1. *Outlines of Dairy Technology* by De Sukumar, Oxford University Press (2007).
2. *Advances in Fish Processing Technology* by Sen DP, Allied Publishers (2005).
3. *Chemical, Microbiological Analysis of Milk and Milk Products* by R. Sharma, International Book Distr. Co. (2006).
4. *Milk and Dairy Products Technology* by E. Spreer, M. Dekker(2005).
5. *Milk and Milk Products* by A.H. Varnam and J.P. Sutherland, Springer(2010).
6. *The Technology of Dairy Products*by R. Early, Springer(2010).
7. *Chemical, Microbiological Analysis of Milk and Milk Products* by R. Sharma, International Book Distributing Co. Lucknow (2006).
8. *Dairy science and technology*, 2nd edt, P. Walstra, Taylar& Francis (2006).
9. *Fundamentals of dairy technology- Theory and practicals*byRathoreNS, HimanshuPubls (2008).
10. *Handbook of Meat and Meat Processing*, 2nd Edition by Hui YH, CRC press (2018).
11. *Meat and Meat Products Technology* bySharma BD, Medical Publs, New Delhi. (1999).
12. *Milk and Dairy Products Technology* by Spreer E and Dekker M, New York (2005).
13. *Milk and Milk Products* byVarnamAH and Sutherland JP, Springer, London (2010).
14. *Technology of Indian milk products* by Aneja RP, Mathur BN, Chandan RC &Banerjee AK, Dairy India publ, (2002).

15. *Technological Interventions in Dairy Science: Innovative Approaches in Processing, Preservation, and Analysis of Milk Products* byChavan RS,Goyal MR, CRC press (2018).

PRACTICALS:

1. To perform platform tests in milk (acidity, COB, MBRT and TSS)
2. Nutrient analysis of milk – fat, lactose, SNF.
3. Development of a high-protein, low-fat dairy product.
4. To extract casein and calculate its yield.
5. Detection of various adulterants in milk.
6. Preparation of fermented milk products-cheese, yogurt.
7. To perform curing of meat.
8. Inspection and grading of eggs.
9. Estimation of meat:bone ratios.
10. Shelf-life studies on processed meat products.
11. Perform processing of fish.

PAPER CODE: FDPM 1104 C	**FOOD BIOTECHNOLOGY**	
Theory *Max. Marks: 74* *Credits: 4* *Lectures to be delivered:60 hrs.* *Time allowed: 3 Hours* *Pass Marks: 40%*	***Internal Assessment*** *Max. Marks: 26*	***Practical*** *Max. Marks: 50* *Credits:3* *Pass Marks: 40%*

Instructions for the paper setters: The question paper will consist of three sections A, B and C. Section-A and B will have four questions from the respective sections of the syllabus and carry 11 marks each. Section-C consists of 15 short answer type questions which will cover the entire syllabus uniformly and will carry 30 marks in all.

Instructions for the candidates: Candidates are required to attempt two questions each from sections A and B of the question paper and the entire Section-C.

LEARNING OUTCOMES:

On completion of this subject, students will be able to:

1. Understandthe application of biotechnology in food production.
2. Demonstrate production of vinegar & organic acids.
3. Understand SCP and its importance.
4. Prepare Indian fermented foods.

5. To understand ethical issues of GM foods and its safety analysis.
6. Appreciate applications of immobilized whole cell technology in food industry.

SECTION A

1. **SCP:**Single cell proteins as food, feed and supplements, single cell oils, bio preservatives-a brief account.
2. **Production of vinegar:** Raw materials, culture, fermentation and post fermentation processing, recovery and applications. Organic acids-fermentative production, down streaming process and applications of citric &lactic acid.

SECTION B

3. **Indian fermented foods:** Brief account of fermented foods of Eastern, Northern and Southern India;fermented dairy products, cultured dairy milk, cultured cream, yoghurt;Bio-sweeteners-high fructose syrup, maltose syrup;Invert syrup, glucose syrup.
4. **GM foods:** Introduction, safety assessment, environmental, social and ethical issues, labelling and regulations; Applications of immobilized whole cell technology in food industry.

REFERENCES:

1. *Fundamentals of Applied Microbiology*by A.N. Glazer and, H. Nikaido, Cambridge University Press (2012).
2. *Industrial Microbiology*by G. Reed, CBS Publishers & Distributors(2004).
3. *Principles of Fermentation Technology*by P.F. Stanbury, A. Whitaker and J. Hall, Butterworth-Heinemann (2016).
4. *Food Biotechnology* by Stahl, Ulf, Donalies**,** Ute E.B., Nevoigt, Elke, Springer (2008).
5. *Food Science and Biotechnology* by Gustavo F. Gutierrez-Lopez, CRC Press (2003).
6. *Genetically modified foods: Debating Biotechnology* by Ruse M and Castle D, Prometheus Books, Amherst NY (2002).

PRACTICALS:

1. Preparation of high fructose syrup, maltose syrup. Invert syrup, glucose syrup.
2. Preparation of Indian fermented foods.
3. Production of lactic acid.
4. Preparation of fermented dairy products.
5. Demonstrate production of SCP.

6. To study techniques of producing GM foods.
7. To study environmental and regulatory aspects of using genetically modified plants.
8. To do survey of current status of genetically modifiedfoods and enlist various foods used in locality.
9. Data retrieval from IGMORIS site pertaining to genetically modified crops.

PAPER CODE: FDPM 1105 C	**APPLIED FOOD MICROBIOLOGY**	
Theory *Max. Marks: 74* *Credits: 4* *Lectures to be delivered:60 hrs.* *Time allowed: 3 Hours* *Pass Marks: 40%*	***Internal Assessment*** *Max. Marks: 26*	***Practical*** *Max. Marks: 50* *Credits:3* *Pass Marks: 40%*

Instructions for the paper setters: The question paper will consist of three sections A, B and C. Section-A and B will have four questions from the respective sections of the syllabus and carry 11 marks each. Section-C consists of 15 short answer type questions which will cover the entire syllabus uniformly and will carry 30 marks in all.

Instructions for the candidates: Candidates are required to attempt two questions each from sections A and B of the question paper and the entire Section-C.

LEARNING OUTCOMES:

On completing this subject, students will be able to:

1. Demonstrate the spoilage caused by microorganism.
2. Understand microbiology of various food stuffs.
3. Describe role of lactic acid bacteria in food processing industry.
4. To analyze impact of food spoilage by microorganisms.
5. Describe role of biosensors in food.

SECTION A

1.**Microbiology of raw and processed foods:**Microorganisms inraw and processed foods, Microbiology of various food stuffs-cereals, legumes, oilseeds, fruits & vegetables, milk and meat; their processed products.

2. Food poisoning and public health: Food borne infections and intoxications, bacterial, fungal and viral agents of food borne illness.

SECTION B

3. **Lactic acid bacteria:**Properties, uses and role in food processing and preservation;microorganisms in food and feed industry, beneficial uses of microorganisms in food.

4. Biosensors: Biosensors in food testing and safety, control of microorganisms in food manufacturing.

REFERENCES:

1. *Food Microbiology* by Frazier William C and Westhoff, Dennis C,McGraw Hill(2004).
2. *Introduction to Microbiology*, M.H. Gajbhiye& S.J. Sathe et al, Career Publications (2015).
3. *Food microbiology: An introduction* by Thomas J. Montville, Karl R. Matthews, ASM Press (2008).
4. *Food Microbiology: Principles into practices* by T. FarukBozoglu, Osman ErkmenJohn Wiley & Sons, Wiley publications (2016).
5. *The Microbiological Quality of Food:* Foodborne Spoilers,Antonio Bevilacqua, Maria Rosaria Corbo, Milena Sinigaglia,Woodheadpublishing (2016).

PRACTICALS:

1. Familiarization with instruments used in microbiological lab, their principles and working: microscope, autoclave, laminar flow bench, hot air over, incubator, BOD incubator, centrifuge, pH meter and spectrophotometer.
2. Preparation of culture media-liquid and solid; preparation of slant, deep tubes, concept of nutrition.
3. Isolation of pure culture by serial dilution-pour plate, spread plate, streak plate method.
4. To study the microflora of raw and traditional food materials
5. Investigation of microflora from packaged food.
6. Identification of *Salmonella, E. coli, Listeria, Proteus, Shigella and Vibrio*from permanent slides.
7. To study the antibiotic sensitivity pattern and MIC for different food pathogen.
8. Microbiological analysis of market samples- milk & milk products, fresh & processed fruits and vegetables, cereal & bakery products.
9. Isolation and identification of lactic acid bacteria from raw milk.
10. To study applications of biosensors in food industry.

M. Voc. (FOOD PROCESSING) PART I (Semester II)

Programme Code: FDPM2PUP

Session: 2021-22, 2022-2023

PAPER CODE:FDPM 1201 C	FOOD QUALITY CONTROL AND QUALITY ASSURANCE	
Theory *Max. Marks: 74* *Credits: 4* *Lectures to be delivered:60 hrs.* *Time allowed: 3 Hours* *Pass Marks: 40%*	***Internal Assessment*** *Max. Marks: 26*	***Practical*** *Max. Marks: 50* *Credits:3* *Pass Marks: 40%*

Instructions for the paper setters: The question paper will consist of three sections A, B and C. Section-A and B will have four questions from the respective sections of the syllabus and carry 11 marks each. Section-C consists of 15 short answer type questions which will cover the entire syllabus uniformly and will carry 30 marks in all.

Instructions for the candidates: Candidates are required to attempt two questions each from sections A and B of the question paper and the entire Section-C.

LEARNING OUTCOMES:

On completing this subject, students will be able to:

1. Demonstrate the concept of quality in food processing industry.
2. Acquaintance with food quality regulations.
3. Apply good practices in food quality management.
4. Understand food safety management systems.

SECTION A

1.**Concept of quality:** Quality attributes-physical, chemical, nutritional and microbial evaluation.Physiochemical and microscopic methods of food analysis; hazards-biological, physical and chemical; food additives-definition, classification and functions of food additives; adulterants-types of adulteration in food and methods of detection of food adulterants; statistical procedures in quality control.

2.Food quality regulations:FSSAI-Its structure &functions,Food Safety and Standards Act, 2006 (FSSA, 2006),Essential Commodities Act, 1955 (in relation to food),Agmark, Codex Alimentarius, BIS.

SECTION B

3. Good practices in food quality management: Introduction of good laboratory practices (GLPs) and its applications, Elements of GLPs, OECD guidelines for GLPs, GMPs, National Accreditation Board for Testing and Calibration Laboratories (NABLs).

4. Quality assurance (QA): Concept of QA, in-process monitoring, types of audit-external and internal,documentation, SOPs (manufacturing, quality and sanitation), concept of total quality management, Food Safety Management System (ISO 22000), Environment Management System (ISO 14000), HACCP, hurdle technology.

REFERENCES:

1. *Food Quality Assurance: Principles and Practices* by InteazAlli, CRC Press (2003).
2. *Food Additives* by Branen AL, Davidson PM and Salminen S., Marcel Dekker McGraw Hill (2001).
3. *Guide to Quality Management Systems for the Food Industry*,Early R, Blackie, Academic and professional, London (1995).
4. *Total Quality Assurance for the Food Industries* by Gould WA and Gould RW, CTI Publications Inc. Baltimore (1998).
5. *Food Analysis: Theory and Practice* by Pomeraz Y, and MeLoari CE, CBS publishers and Distributor, New Delhi (1996)
6. *Hazard Analysis Critical Control Point Evaluations A Guide to Identifying Hazards and Assessing Risks Associated with Food Preparation and Storage*byBryan FL., World Health Organization, Geneva (1992)
7. *Pearson s Composition and Analysis of Foods*by Kirk RS and SawyerR., Longman Scientific and Technical. 9th Edition, England (1991)
8. *Manuals of Food Quality Control &Additives Contaminants Techniques* byFood and Agricultural Organization, Rome (1980).
9. *Quality Control for the Food Industry 3rd Edn.*ByKrammer A and Twigg BA., AVI, Westport. (1970)
10. *Statistical Quality Control for the Food Industry, 3rd Edition by* Hubbard, Merton R., Springer (2003)

PRACTICALS

1. To identify different types of hazards.
2. Description of common practices for food safety in Hazard analysis, criteria control points(HACCP) during industrial visit.
3. To make HACCP plan of any food industry.
4. Overview of ISO`s official website.
5. Study of implementation of ISO standards in a concern.
6. An overview of ISO 14000 family of environment management standards.
7. A brief about ISO 14000 certified Indian food companies.
8. A brief about ISO 22000 certified Indian food companies.
9. Internet Survey of Food Processing Industries of Punjab.
10. Internet Survey of Food Processing Industries of India.
11. Internet Survey of Global Food Processing Industries of India.
12. Internet Survey of FAO site regarding foodprocessing Industry Promotion.
13. Protocols for food and feed industry biosafety clearance.
14. Detection of Metanilyellow in a given food sample.
15. Check the Presence of Rhodamine B in the given food sample.
16. Detection of $NaHCO_3$ (Chalk) in flour.
17. Check for the presence of vanaspati and rancidity in the ghee.
18. Check the milk for presence of proteins, urea, sugar and starch.
19. To perform various tests for detection of adulterants in milk, spices, fats &oils, food grains and their products &sweeting agents.
20. Numerical problems related to statistical procedures in quality control.
21. Quality control documentation.
22. Finished product release, quality review, Quality audit. Batch release documents.
23. Validation of Analytical Procedures as per ICH Guidelines Implications of cGMP and Food plant sanitation

PAPER CODE: FDPM 1202 C	BAKERY, CONFECTIONERY AND FUNCTIONAL FOODS	
Theory *Max. Marks: 74* *Credits: 4* *Lectures to be delivered:60 hrs.* *Time allowed: 3 Hours* *Pass Marks: 40%*	***Internal Assessment*** *Max. Marks: 26*	***Practical*** *Max. Marks: 50* *Credits:3* *Pass Marks: 40%*

Instructions for the paper setters: The question paper will consist of three sections A, B and C. Section-A and B will have four questions from the respective sections of the syllabus and carry 11 marks each. Section-C consists of 15 short answer type questions which will cover the entire syllabus uniformly and will carry 30 marks in all.

Instructions for the candidates: Candidates are required to attempt two questions each from sections A and B of the question paper and the entire Section-C.

LEARNING OUTCOMES:

On completion of this course the students will be able to

1. Gain knowledge on the ingredients and processes involved in bakery and confectionery and functional foods.
2. To prepare various bakery and confectionary products.
3. To understand the functional aspects of food components and to study their role in food processing.
4. Apply the knowledge of functional foods in health and disease management.

SECTION A

1.Bakery: Principles of baking, raw material and their role, flour, leavening agents, sugars, fats, additives, spice, types of bakery products and technology for their manufacture, cakes, pies, pastries, bread, biscuits**.**

2. Icings and fillings quality parameters of bakery products: Chemistry of dough and batters, rheological testing and interpretation of data, sensory evaluation, staling and nutrient losses in bakery products sanitation and hygiene in a bakery unit equipment used in the bakery industry.

SECTION B

3. Confectionary: Principles of confectionery manufacture raw material and their role, interfering agents, inversion of sugars, types of confectionery products and technology for their manufacture, quality parameters of confectionery products, nutrient and other losses in confectionery products, sanitation and hygiene in a confectionery unit, equipment used in the confectionery industry and manufacturer of Indian confectioneries.

4. Functional foods: Role of functional foods in management of health and disease-cardiovascular diseases, hypertension, cancer, diabetes, cholesterol management; Concept of antioxidants; Properties of various functional foods-lycopene, isoflavonoids, prebiotics and probiotics, glucosamine, phytosterols and mushroom extracts.

REFERENCES:

1. *Basic Baking* by Dubey SC, The Society of Indian Bakers(2002).
2. *Food Science & Technology* by Francis FJ., Wiley Encyclopedia (2000).
3. *Technology of Biscuits, Crackers & Cookies* by Manley D., CRC Press (2000).
4. *Bakery Science & Technology* by Pyler EJ., Sosland Publishing (2009).
5. *Functional foods Concept to product* Edited by Glenn R. Gibson and Christine M. Williams, CRC Press (2000).

PRACTICALS:

1. Tests for the rheological properties of dough.
2. Preparation of advanced bakery products – sourdoughs, pastries, croissants, doughnuts.
3. Preparation of filled and iced cakes.
4. Preparation of chocolate.
5. Preparation of coated confectionery.
6. Quality evaluation of the bakery products, filled and iced cakes, chocolate, and coated confectionery.
7. Determination of nutritional value of bakery and confectionery products.
8. Identification of various nutraceuticals and functional foods available in the market.
9. Determination of lycopene in fruit/vegetable.
10. Preparation and evaluation of probiotic/prebiotic foods.

PAPER CODE: FDPM 1203 C	FOOD ENGINEERING AND FUNCTIONAL CONCEPTS FOR FOOD PLANT DESIGN	
Theory *Max. Marks: 74* *Credits: 4* *Lectures to be delivered:60 hrs.* *Time allowed: 3 Hours* *Pass Marks: 40%*	***Internal Assessment*** *Max. Marks: 26*	***Practical*** *Max. Marks: 50* *Credits:3* *Pass Marks: 40%*

Instructions for the paper setters: The question paper will consist of three sections A, B and C. Section-A and B will have four questions from the respective sections of the syllabus and carry 11 marks each. Section-C consists of 15 short answer type questions which will cover the entire syllabus uniformly and will carry 30 marks in all.

Instructions for the candidates: Candidates are required to attempt two questions each from sections A and B of the question paper and the entire Section-C.

LEARNING OUTCOMES:

On completion of this course the students will be able to

1. Learn various concepts of various process parameters, unit operations that are essential in a food industry.
2. Understand the various factors affecting design of food plant layout.
3. Evaluate design concepts w.r.t. building construction.
4. Perform calculations for setting up a food industry

SECTION A

1.Introduction: Concept of unit operation, units and dimensions, unit conversions, dimensionanalysis,mass and energy balance, grinding and mixing,principle and equipment used in food industry, fluid flow in food processing, liquid transport systems, properties of liquids, Newton's law of viscosity, principle of capillary tube and rotational viscometer, properties of non-Newtonian fluids, flow characteristics, Reynolds number, Bernoulli's equation.

2. Heat and mass transfer: Systems for heating and cooling food products, thermal properties of food, modes of heat transfer, application of steady state heat transfer, estimation of conductive heat transfer coefficient and convective heat transfer coefficient, design of tubular heat exchanger, steam generation, boiler and bits fittings, refrigeration and freezing-compression system, insulation, cold room construction and management.

SECTION B

3. Food plant design: Location and site selection of food plants, food plant size,utilities and services, food plant layout-introduction, planning and experimentation, symbols used for food plant design and layouts, process scheduling and operation,software's for plant layout design, plant lay out for material handling, safety (workplace) systems.Techno-economic analysis.

4.Building-construction materials: Floors, general requirement of floor finishes, floors for different section. Foundations, walls, doors and windows, other design aspects, drains and drain layout for small and large industries, ventilation, fly control, mold prevention, illumination in plants.

REFERENCES:

1. *Food Plant Design* by Lopez Gomez, A. and Barbosa Canovas, G.V. Taylor & Francis, CRC Press (2005).
2. *Introduction to Food Process Engineering* by Smith, P.G., Springer (2005).
3. *Engineering Properties of Food* by Rao, M.A. Rizvi, S.S.H. and Datta, A.K., CRC Press (2005).
4. *Fundamentals of food engineering* by Rao DG., PHI learning private ltd (2010).
5. *Introduction to food engineering* by Singh RP and Heldman DR., Academic press (2009).
6. *Essentials of food process engineering* by Rao C G., B. S. publications (2006).

PRACTICALS:

1. To determine the evaporation capacity of an evaporator by material balance.
2. To calculate the specific heat of the given sample by Siebel's equation.
3. To determine the thermal conductivity of the given sample.
4. To study the effect of moisture content on thermal conductivity.
5. To calculate the heat energy required to raise the temperature of 1 kg mass to 40° Celsius.
6. Generation of steam for heat transfer in a steam kettle at pilot scale.
7. To determine the flow rate of a fluid using Reynold's number.
8. To evaluate the elevation in boiling point of a given liquid and construct Duhring's lines for given solution.
9. To determine the viscosity of the given sample using Ostwald's viscometer.
10. To calculate the rate of heat transfer through a pipe.
11. To calculate LMTD of a tubular heat exchanger.
12. Using McCabe and Thiele Method calculate the number of ideal plates for distillation.

13. To calculate LMTD of the tubular heat exchanger.
14. Application of psychrometric charts in food engineering.
15. Determination of viscosity of Newtonian and non-Newtonian fluids.
16. Study of effect of temperature on viscosity.
17. To draw layout of cheese plant.
18. To draw layout of ice-cream plant.
19. To draw layout of meat plant.

PAPER CODE:FDPM 1204C	**PSEUDOCEREALS, MILLETS AND OIL SEED TECHNOLOGY**	
Theory *Max. Marks: 74* *Credits: 4* *Lectures to be delivered:60 hrs.* *Time allowed: 3 Hours* *Pass Marks: 40%*	***Internal Assessment*** *Max. Marks: 26*	***Practical*** *Max. Marks: 50* *Credits:3* *Pass Marks: 40%*

Instructions for the paper setters: The question paper will consist of three sections A, B and C. Section-A and B will have four questions from the respective sections of the syllabus and carry 11 marks each. Section-C consists of 15 short answer type questions which will cover the entire syllabus uniformly and will carry 30 marks in all.

Instructions for the candidates: Candidates are required to attempt two questions each from sections A and B of the question paper and the entire Section-C.

LEARNING OUTCOMES:

On completion of this subject student will be able to

1. Gain knowledge about pseudocereals.
2. Explain nutritional value and processes to remove antinutritional factors in different millets.
3. Develop products using different millets
4. Gain knowledge about extraction, refining, bleaching, and hydrogenation of oils.

SECTION A

1. Introduction to pseudo cereal: Geographical distribution, nutritionaland health benefits, protein efficiency ratio, anti-nutrients, comparison to staple cereal of Indian concern,

commercially available pseudo cereal, processing of pseudo cereals-germination, fermentation, cooking.Current applications of gluten free foods.

2. Buckwheat,amaranth&quinoa: Seed morphology, nutritional value and bio-chemical composition,functional properties, fortified foods,latest trends in preparation of multigrain flour, bread, biscuits and breakfast cereal,soups, stews and desserts.

SECTION B

3.Millets: Nutritional and nutraceutical properties, millets technology-major and minor millets, types, pre- processing, processing& methods to remove toxic factors, nutritional losses during processing, storage.Importance of millet products, flaked, puffed, expanded, extruded and shredded products.

4.Oil seed technology: Types, pre-processing, processing, preservation, extraction of oils, meal concentrates and value addition, post-harvesttechnology of oil seeds, nutritional losses during processing, storage.

REFERENCES:

1. *Pseudocereals and Less Common Cereals: Grain Properties and Utilization Potential* by Peter S. Belton, John R.N. Taylor, CRC Press (2002).
2. *Pseudocereals: Chemistry and Technology* by Cludia Monika Haros, ReginеSchoenlechner Wiley encyclopedia (2017).
3. *Millets and Millet Technology* by Anil Kumar, Manoj Kumar Tripathi, Dinesh Joshi, Vishnu Kumar, Springer (2021).
4. Principles of Seed Technology by Phundan Singh, Kalyani Publishers(2013).
5. *Seed Science and Technology*by Subir Sen &Nabinananda Ghosh, Kalyani Publishers(2014).

PRACTICALS:

1. Study seed structure of Buckwheat, Amaranth and Quinoa.
2. Preparation of gluten free biscuits from pseudo cereals.
3. Tabulate Nutrient contents of quinoa and selected foods, per 100 grams dry weight.
4. Equipment used in milling of pseudocereals.
5. Recent utilization trends in pseudocereals.
6. Machinery and equipment's used in the crude oil extraction and its refining.
7. Determination of amylose content of buckwheat starches by iodine binding method.

8. Preparation of pseudo cereal bread, soup, stews and desserts.
9. Preparation of products of millets.
10. Sensory changes and anti-nutrient minimization in millets using minimal pre-processing treatments.
11. Vigor test of oil seeds.
12. Industrial visit to oil seed processing plant.

PAPER CODE: FDPM 1205 C	**CEREALS, PULSES AND SPICE PROCESSING**	
Theory *Max. Marks: 74* *Credits: 4* *Lectures to be delivered:60 hrs.* *Time allowed: 3 Hours* *Pass Marks: 40%*	***Internal Assessment*** *Max. Marks: 26*	***Practical*** *Max. Marks: 50* *Credits:3* *Pass Marks: 40%*

Instructions for the paper setters: The question paper will consist of three sections A, B and C. Section-A and B will have four questions from the respective sections of the syllabus and carry 11 marks each. Section-C consists of 15 short answer type questions which will cover the entire syllabus uniformly and will carry 30 marks in all.

Instructions for the candidates: Candidates are required to attempt two questions each from sections A and B of the question paper and the entire Section-C.

LEARNING OUTCOMES:

On completion of the subject students will be able to

1. Understand the structure and composition of cereals, pulses and spices.
2. Know the techniques involved in milling of cereals, pulses and spices.
3. Know various techniques and equipment used to process cereals, pulses and spices.
4. Gain knowledge about value added products developed from cereals and pulses.

SECTION A

1.Wheat & rice technology: Wheat milling-general principles and operation, cleaning, conditioning and roller milling systems; Flour extraction rates and various flour grades, criteria of flour quality; Enzymes of wheat and their technological significance, dough rheology and its

measurement; Milling of rice-types of rice mill, huller mill, sheller-cum-cone polisher mill, modern rice milling unit;Operation-dehusking, paddy separation, polishing and grading; Factors affecting rice yield during milling, by-products of rice milling, rice parboiling technology.

2.Corn, malt and coarse cereal grains: Wet and dry milling of corn, products of wet and dry milling of corn, malting of barley-steeping, germination and drying. Different types of malts and their food applications, technological and milling aspects of sorghum, oats and millets.

SECTION B

3.Pulses: Structure and composition of pulses, anti-nutritional factors and methods of inactivation, pre-treatments, traditional and modern milling methods and equipment involved, byproducts of pulse milling and their utilization.

4. Spice processing: Classification and functions, major international quality specifications of spices, spice processing, spice reconditioning, spice grinding, post- processing treatments; Major spices-pepper, cardamom, ginger, clove, nutmeg, vanilla, cinnamon, chilli and turmeric; Method of manufacture, chemistry of the volatiles, enzymatic synthesis of flavour identical, value added spice products.

REFERENCES:

1. *Principles of Cereal Science and Technology* by Jan A. Delcour and R. curl Hoseney, Elsevier (2010)
2. *Hand book of herbs and spices* by Peter, K.V. Wood head publishing Ltd (2004).
3. *Handbook of post-harvest technology – cereals, fruits, vegetables, tea and spices* by Chakraverty, A., Mujumdar, A.S., Raghavan, G.S.V., Ramaswamy, CRC Press (2010).
4. *Principles of Food Chemistry* by deMan, J.M., Finley, J., Hurst, W.J., Lee, Springer (2018).
5. *Cereals and Cereal Products: Technology and Chemistry*by David A.V. Dendy , Bogdan J. Dobraszczyk, Springer (2000).

PRACTICALS:

1. Milling of wheat and rice and calculate % bran and flour recovery.
2. Physical characterization of wheat and rice kernel.

3. Determination of quality characteristics of flours.
4. Parboiling and evaluation of quality of parboiled rice.
5. Milling of rice and assessment of per cent of head, broken, immature kernels degree of polish.
6. Determination and conditioning of moisture in given sample of kernels/flours
7. Baking practice for the preparation of bread, cookies and cakes.
8. Determination of physical properties of different cereal grains.
9. To determine the water absorption capacity of the wheat flour / maida.
10. Estimation of Protein content of different cereals and legumes.
11. Assessment of market samples of wheat, rice, and pulses for conforming to some PFA specifications.
12. Storage studies of cereal and legume grains having different moisture levels.
13. Visit to working rice mill, collection of samples at various steps of milling and analysis for efficiency of cleaning, shelling, paddy separation, and degree of polish.
14. Preparation of expanded & puffed rice from raw and parboiled materials and assessment of quality of products including expansion in volume.
15. Traditional and improved pretreatments and its effect on dehusking of some legumes.
16. Determination of dry and wet gluten of a given flour sample.
