**Scheme & Syllabus of**

**M. Tech in Food Technology**

**Batch 2018 onwards**

**Kurukshetra University, Kurukshetra**

**(‘A+’ Grade, NAAC Accredited)**

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| **Subject code** | **SUBJECT** | **L** | **T** | **P** | **Total** | **Minor\* Test** | **Major Test** | **Practical** | **Cr.** | **Duration of Exam (Hrs.)** |
| MFT-101A | Advance in Food Technology | 3 | - | - | 3 | 40 | 60 |  | 3 | 3 |
| MFT-103 A | Flavor Technology | 3 | - | - | 3 | 40 | 60 |  | 3 | 3 |
| PE-I | Elective –I\* | 3 | - | - | 3 | 40 | 60 |  | 3 | 3 |
| PE-II | Elective-II\* | 3 | - | - | 3 | 40 | 60 |  | 3 | 3 |
| MFT-117 A | Lab –I (Advance in Food Technology) | - | - | 4 | 4 | 40 |  | 60 | 2 | 3 |
| MFT-119 A | Lab –II( flavor Technology) | - | - | 4 | 4 | 40 |  | 60 | 2 | 3 |
| MTRM 111 A | Research Methodology and IPR | 2 | - | - | 2 | 40 | 60 |  | 2 | 3 |
| AC-I | Audit Course\* | 2 |  |  | 2 | 100 |  |  | 0 | 3 |
| Total 16 8 24 | | | | | | 380 | 300 | 120 | 18 |  |
|  | | | | | | 800 | | |  | |

**Semester- I**

**List of Program Elective (PE) papers for First Semester**

|  |  |  |  |
| --- | --- | --- | --- |
| **Program Elective (PE-I)** | | | **Program Elective (PE-II)** |
| **Course No.** | **Subject** | **Course No.** | **Subject** |
| MFT-105 A | Food Additives & Contaminant | MFT-111 A | Bioprocess Engg. |
| MFT-107 A | Advances in cereal science & Technology | MFT-113 A | Neuraceutical&Functional Foods |
| MFT-109 A | Enzymes In Food Processing | MFT-115 A | Advances In Dairy Engg. |

**List of Audit Course-I (AC-I) for First Semester**

|  |  |
| --- | --- |
| **Course No.** | **Subject** |
| MTAD-101A | English for Research Paper Writing |
| MTAD-103A | Disaster Management |
| MTAD-105A | Sanskrit for Technical Knowledge |
| MTAD-107A | Value Education |

**Note:** 1.The course of program elective will be offered at 1/3rd or 6 numbers of students (whichever is smaller) strength of the class.

2. \*\*\* Along with the credit course, a student may normally be permitted to take audit course, however for auditing a course; prior consent of the course coordinator of the course is required. These courses shall not be mentioned for any award/calculation of SGPA/CGPA in the DMC. A certificate of successful completion of the audit course will be issued by the Director/Head of institution.

**Semester – II**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject code** | **Subject** | **L** | **T** | **P** | **Total** | **Minor\***  **Test** | **Major Test** | **Practical** | **Cr.** | **Duration of Exam (Hrs.)** |
| MFT-102 A | Novel Food packaging Techniques | 3 | - | - | 3 | 40 | 60 |  | 3 | 3 |
| MFT-104 A | Advances In FoodAnalysis. | 3 | - | - | 3 | 40 | 60 |  | 3 | 3 |
| PE-III | Elective-III\* | 3 | - | - | 3 | 40 | 60 |  | 3 | 3 |
| PE-IV | Elective-IV\* | 3 | - | - | 3 | 40 | 60 |  | 3 | 3 |
| MFT-118 A | Lab-III (Novel Food packaging Techniques) |  | - | 4 | 4 | 40 |  | 60 | 2 | 3 |
| MFT-120 A | .Lab-IV(Advances In Food Analysis) | - | - | 4 | 4 | 40 |  | 60 | 2 | 3 |
| MFT-122 A | Mini Project | - | - | 4 | 2 | 40 | 60 |  | 2 | 3 |
| AC-II | Audit Course\* 2 | 2 |  |  | 2 | 100 |  |  | 0 | 3 |
| Total |  | 14 |  | 12 | 24 | 380 | 300 |  | 18 | 3 |
| Total | | | | | | 380 | 300 | 120 |  | |
| 800 | | |  | |

**List of Program Elective (PE) papers for Second Semester**

|  |  |  |  |
| --- | --- | --- | --- |
| **Program Elective (PE-III)** | | **Program Elective (PE-IV)** | |
| **Course No.** | **Subject** | **Course No.** | **Subject** |
| MFT-106 A | Advance In FoodEngg | MFT-112 A | Biotechnological Tools in Food Analysis |
| MFT-108 A | Advances in Meat, Fish, Poultry Technology | MFT-114 A | Food Safety and Quality Assurance |
| MFT-110 A | Technology of frozen Foods | MFT-116 A | Beverage & Snacks Food Technology |

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| **List of Audit Course-II (AC-II) for Second Semester** | |
| **Course No.** | **Subject** |
| MTAD-102A | Constitution of India |
| MTAD-104A | Pedagogy Studies |
| MTAD-106A | Stress Management by Yoga |
| MTAD-108A | Personality Development through Life Enlightenment Skills. |

**Note:** 1.The course of program elective will be offered at 1/3rd or 6 numbers of students (whichever is smaller) strength of the class.

2. \*\*\* Along with the credit course, a student may normally be permitted to take audit course, however for auditing a course; prior consent of the course coordinator of the course is required. These courses shall not be mentioned for any award/calculation of SGPA/CGPA in the DMC. A certificate of successful completion of the audit course will be issued by the Director/Head of institution.

3. Students be encouraged to go to Industrial Training/Internship for at least 6-8 weeks during the summer break with a specific objective for Dissertation Part–I (MFT-203 A). The industrial Training/Internship would be evaluated as the part of the Dissertation–I (with the marks distribution as 40 marks for Industrial Training/Internship and 60 marks for Dissertation Part–I).

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| #4**. Mini project:** During this course the student will be able to understand the contemporary/emerging technologies for various processes and systems. During the semester, the students are required to search/gather the material/information on a specific topic, comprehend it and present/discuss the same in the class. He/she will be acquainted to share knowledge effectively in oral (seminar) and written form (formulate documents) in the form of report. The student will be evaluated on the basis of viva/ seminar (40 marks) and report (60 marks). |

**Semester – III**

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| **Subject code** | **Subject** | **L** | **T** | **P** | **Total** | | **Minor\***  **Test** | **Major Test** | **Cr.** | **Duration of Exam (Hrs.)** |
| MFT-201 A | Food Rheology and Microstruture | 3 | - | - | 3 | | 40 | 60 | 3 | 3 |
| OE-I | Open Elective-VI\* | 3 | - | - | 3 | | 40 | 60 | 3 | 3 |
| MFT-203 A | Dissertation-I | - | - | 20 | - | | 100 | - | 10 | - |
|  |  | 6 |  | 20 | 6 | | 180 | 120 | 16 | - |
| Total | | | | | | 180 | | 120 |  | |
| 300 | | |  | |

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| **List of Open Elective (OE)-I papers for Third Semester** | |
| **Course No.** | **Subject** |
| MTOE-203A | Industrial Safety |
| MTOE-205A | Operations Research |
| MTOE-207A | Cost Management of Engineering Projects |
| MTOE-213A | Industerial Statistic |
| MTOE-215A | Non Conventional Sources of energy |
| MTOE-217A | Instrumentation & Process Control |

**Semester – IV**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject code** |  | **L** | **T** | **P** | **Total** | **Minor\***  **Test** | **Major Test** | **Cr.** | **Duration of Exam (Hrs.)** |
| MFT-202 A | Dissertation-II | - | - | 32 | - | 100 | 200 | 16 | - |
| Total |  |  |  | 32 |  | 100 | 200 | 16 | - |
| Total | | | | | | 300 | | 16 |  |

**Total credit - 68**

**SEMESTER - I**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **MFT-101A** | **Advance in Food Technology** | | | | | | |  |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Practical** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **60** | **40** | **-** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | To enlighten the knowledge of the Students on newer technology in Food processing. | | | | | | | |
| **Course Outcomes (CO)** | | | | | | | | |
| **CO1** | Students will be able to know about use of microwave energy in foods. | | | | | | | |
| **CO2** | Students will be able to gain knowledge about ultrasonic in food processing. | | | | | | | |
| **CO3** | Students will be able to know about techniques of Nanotechnology. | | | | | | | |
| **CO4** | Students will be able to study about Modeling of Microbial food spoilage. | | | | | | | |

**Unit – I**

**Modeling of Microbial Food Spoilages:** Microbial growth dynamics models, partial differentiation equation models, application of models in thermal preservation, Concept, mechanism of microbial destructions, equipments etc.

**Membrane Technology:** Introduction to pressure activated membrane processes, performance of RO/UF and NF and industrial application.

**Unit – II**

**Supercritical Fluid Extraction:** Property of near critical fluids (NCF), solubility and efficiency of NCF extraction, equipment and experimental techniques used in NCF extraction and industrial application

**Use of Microwave Energy in Foods:** Theory of microwave heating, dielectric properties of food materials, working principle of magnetron, microwave blanching, sterilization and finish drying.

**Unit – III**

**Hurdle Technology:** Types of preservation techniques and their principles, concept of hurdle technology and its application.

**High Pressure Processing of Foods:** Concept of high pressure processing, quality changes, effects of pressure on microorganisms and its application in food processing.

**Unit – IV**

**Ultrasonic in Food Processing:** Properties and generation of ultrasonic, ultrasonic imaging, application of ultrasonics as an analytical tool and processing techniques.

**Newer Techniques in Food Processing:** Application of technologies of high intensity light, pulse electric field, micronization in food processing and preservation.

**Nanotechnology:** Principles, mechanism and applications in food

**References**

1. New Methods of Food Preservation (Non Thermal Processing of Foods), G. W. Gould, Springer Science & Business Media, 1995

2. Introduction to Food Engineering, [R Paul Singh](http://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22R+Paul+Singh%22), [R. Paul Singh](http://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22R.+Paul+Singh%22), [Dennis R. Heldman](http://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Dennis+R.+Heldman%22) Academic Press, 2008

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| **MFT-103A** | | **Flavour Technology** | | | | | | |  |
| **Lecture** | | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor**  **Test** | **Practical** | **Total** | **Time** |
| **3** | | **0** | **0** | **3** | **60** | **40** | **-** | **100** | **3 Hrs.** |
| **Program Objective (PO** | | To enlighten the knowledge to Students on Methods of Flavor extraction, isolation, separation. | | | | | | | |
| **Course Outcomes** | | | | | | | | | | **Course Outcomes (CO)** |
| **CO1** | Students will be able to know about flavor Precursors. | | | | | | | | |
| **CO2** | Students will be gain knowledge of Flavor encapsulation and stabilization. | | | | | | | | |
| **CO3** | Students will be able to Know about Flavor Precursors, intensifiers, Biogenesis. | | | | | | | | |
| **CO4** | Students will be able to Know about enzyme and fermentation flavors. | | | | | | | | |

**Unit – I**

**Introduction:** Fundamentals of flavour, Classification of food flavour, flavour profile, factors affecting flavours, bioflavour and reconstituted flavour, flavour release from foods, interaction of flavor compounds with foods

**Flavour Extraction:** Methods of flavour extraction, isolation, separation and equipment

**Unit – II**

**Flavour Precursors:** Flavour Compounds from Carbohydrates and Proteins, Lipid oxidation

**Flavour intensifiers:** Flavour intensifiers and their effects, Chemistry and technology of various flavour intensifiers

**Flavour Biogenesis:** Fruit aroma, vegetable aroma, Methyl ketones, diacetyl, acetaldehyde, lactones, terpenes, esters, pyrazines, vanillaflavour, enzyme and fermentation flavors.

**Unit – III**

**Process Flavours:** Effect of processing on flavor compounds, Non enzymatic browning, heat reaction flavors

**Food Flavours:** Flavour constituents: Onion, garlic, cheese, milk, meat, wine, coffee, tea, chocolate, citrus flavour

**Unit – IV**

**Flavor encapsulation and stabilization:** Principles and techniques of flavor encapsulation, types of encapsulation, factors affecting stabilization of encapsulated flavor and their applications in food industry, Packaging and flavor compounds interaction, Effect of storage, processing, transportation and environmental conditions on flavor components or constituents.

**Reference Book**

1. Source Book of Flavors, Gary Reineccius, Springer Science & Business Media, 1998
2. Flavour chemistry and technology, Heath, H. B., Avi publication company,1978
3. Understanding Natural Flavors, Piggott, J. R., Paterson, A., Blackie Academic & professional,1994
4. Food Flavor, Morton, I. D., Macleod A., Elsevier,1990
5. Food Flavourings, Ashurst P.R.,Blackie,Glasgow&London,1991

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| **MFT- 117A** | **LAB –I (ADVANCE IN FOOD TECHNOLOGY)** | | | | | | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major**  **Test (Practical)** | **Minor**  **Test** | **Total** | **Time** |
| **-** | **-** | **4** | **2** | **60** | **40** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | To familiarize the students with various advance techniques in food technology | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | Learner will know about concept of Filtration. | | | | | | |
| **CO2** | Students will be able to learn about concept of Ultrasonication preservation of food | | | | | | |
| **CO3** | Students will understand the concept of different methods Microwave treatment | | | | | | |
| **CO4** | Students will be able to learn about Microwave treatment. | | | | | | |

**Practical Exercises :-**

* Filtration of juices for preservation.
* Microbial load estimation in preserved food.
* Ultrasonication preservation of food.
* Microwave treatment of food.
* Estimation of loss of nutrients due to microwave and thermal treatment.
* High temperature processing of the given food material.
* To study the effect of processing on the keeping quality of food.

**References**

1. New Methods of Food Preservation (Non Thermal Processing of Foods), G. W. Gould, Springer Science & Business Media, 1995

2. Introduction to Food Engineering, [R Paul Singh](http://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22R+Paul+Singh%22), [R. Paul Singh](http://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22R.+Paul+Singh%22), [Dennis R. Heldman](http://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Dennis+R.+Heldman%22) Academic Press, 2008

3. Food processing technology, Fellows P. J., Elsevier, 2009

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| **MFT- 119A** | **LAB –II (Flavour technology)** | | | | | | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test (Practical)** | **Minor Test** | **Total** | **Time** |
| **-** | **-** | **4** | **2** | **60** | **40** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | **To familiarize the students with various techniques of food flavour.** | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | Learner will know about the extraction of essential food flavor. | | | | | | |
| **CO2** | Students will be able to learn about the effect of storage conditioning on flavouring compounds. | | | | | | |
| **CO3** | Students will understand the effect of cooking on flavouringcompunds. | | | | | | |
| **CO4** | Students will be able to learn about development of flvouring foods. | | | | | | |

**Practical Exercises :-**

* Qualitative identification of different flavouringcompunds.
* Extraction of essential oil / flavouring compound of basil leaves by hydrodistilation.
* To check the effect of cooking on flavor of food samples.
* To check effect of fermentation on food flavor.
* Encapsulation of flavouringcompunds.
* To study the flavor development on roasting / baking.

**References ;-**

1. Source Book of Flavors, Gary Reineccius, Springer Science & Business Media, 1998
2. Flavour chemistry and technology, Heath, H. B., Avi publication company,1978
3. Understanding Natural Flavors, Piggott, J. R., Paterson, A., Blackie Academic & professional,1994
4. Food Flavor, Morton, I. D., Macleod A., Elsevier,1990
5. Food Flavourings, Ashurst P.R.,Blackie,Glasgow&London,1991

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| **MTRM- 111A** | **Research Methodology and IPR** | | | | | | | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Theory** | **Sessional** | **Practical** | **Total** | **Time** |
| **4** | **0** | **0** | **4** | **60** | **40** | **-** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | **To enable students to Research Methodology and IPR for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.** | | | | | | | |
| **Course Outcomes (CO)** | | | | | | | | |
| CO1 | Understand research problem formulation. | | | | | | | |
| CO2 | Analyze research related information | | | | | | | |
| CO3 | Understand that today’s world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity. | | | | | | | |
| CO4 | Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular. | | | | | | | |

**Unit 1:**

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.

Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

**Unit 2:**

Effective literature studies approaches, analysis, Plagiarism, Research ethics, Effective technical writing, how to write report, Paper.

Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

**Unit 3:**

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

**Unit 4:**

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

**References**:

1. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students’”

2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”

3. Ranjit Kumar, 2 ndEdition , “Research Methodology: A Step by Step Guide for beginners”

4. Halbert, “Resisting Intellectual Property”, Taylor& Francis Ltd ,2007.

5. Mayall , “Industrial Design”, McGraw Hill, 1992.

6. Niebel , “Product Design”, McGraw Hill, 1974.

7. Asimov , “Introduction to Design”, Prentice Hall, 1962.

8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “ Intellectual Property in New Technological Age”, 2016.

**PROGRAM ELECTIVE (PE-I)**

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| **MFT-105A** | **FOOD ADDITIVES & CONTAMINANTS** | | | | | | |  |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Practical** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **60** | **40** | **-** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | To enlighten the knowledge of the Students on Food additives**.** | | | | | | | |
| **Course Outcomes (CO)** | | | | | | | | |
| **CO1** | Students will be able to know about the role of food additives in manufacturing of food products. | | | | | | | |
| **CO2** | Students will be able to gain knowledge regarding permissible additives and their limits in the processed food | | | | | | | |
| **CO3** | Students will be able to know about Perceive the contaminants from various sources. | | | | | | | |
| **CO4** | Students will be able to study about Comprehend the effects of contaminants on human health. . | | | | | | | |

# UNIT-I

Additives in food processing and preservation: Classification, need, properties, functions and safety, quality evaluation of additives, Food labeling, Laws and regulations for food additives

# UNIT-II

Chemistry, uses and functions: Chemical preservative, bio-preservatives, fortification, antioxidants, emulsifiers, humectants, stabilizers, chelating agents, pH control agents and acidulants, texturizing agents, plasticizers, flavor enhancers, enzymes, coloring agents, sweeteners, flavoring agents

# UNIT-III

Food contaminants: biological, chemical, physical and environmental contaminants, Inorganic and organometallic food contaminants, Sources and their impact on human health.

**UNIT – IV**

Food contaminants from industrial wastes: Heavy metals, polychlorinated polyphenyls, dioxins, Toxicants formed during food processing polycyclic aromatic hydrocarbons, nitrosamines, veterinary drug residues and melamine contaminations, Pesticide residues in food

***Recommended Readings:***

1. Branen, A. L., Davidson, P. M. and Salminen, S. (2002). *Food Additives*: Marcel Dekker, New York.
2. Wood, R., Foster, L., Damant, A. and Pauline, K. (2004). *Analytical Methods for Food Additives*:

Boca Raton, New York.

1. Watson, D. H. (2014). *Food Chemical Safety*: Additives: WP, New Delhi.

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| **MFT-107A** | **Advances in cereal science Technology** | | | | | | | |  |
| **Lecture** | **Tutorial** | | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Practical** | **Total** | **Time** |
| **3** | **0** | | **0** | **3** | **60** | **40** | **-** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | To enlighten the knowledge of the Students on recent developments in the cereals science and technology | | | | | | | | |
| **Course Outcomes (CO)** | | | | | | | | | |
| **CO1** | | Students will be able to know about advancement in the major cereal grains quality and processing aspects. | | | | | | | |
| **CO2** | | Students will be able to gain knowledge about basic and advanced milling methods for wheat, rice, maize ultrasonic in food processing. | | | | | | | |
| **CO3** | | Students will be able to know about by-product utilization of various grains.. | | | | | | | |
| **CO4** | | Students will be able to Understand the mechanism underlying the interaction of various flour components and their role in end use quality. | | | | | | | |

# UNIT-I

Present status and future prospects of cereal grains in India, food grain production and consumption trends. Coarse grain processing.Wheat kernel structure, wheat grading, roller flour milling, influence of wheat type and grain quality on flour yield, grain hardness and its relevance to end product quality, advances in wheat cleaning, conditioning and milling, wheat flour component interactions (protein-starch, protein-lipid and starch-lipid) and their influence on end product quality, advances in isolation, biochemical characterization, micro-structural and functionality of wheat gluten proteins.

# UNIT-II

Advances in role of wheat proteins in dough and gluten visco-elasticity, micro-structure of dough, conversion of dough foam structure to bread sponge structure during bread baking, concept of gas retention in wheat dough during fermentation and baking, advances in bread making processes, effect of wheat components and ingredients on the growth of yeast during fermentation operation, bread staling and its prevention, production of variety biscuits, breads and pasta products.

# UNIT-III

Paddy varieties, their composition and quality characteristics, advances in methods of paddy parboiling, advantages and limitation of parboiling, paddy dehusking processes, Rice ageing, accelerated ageing, modern rice milling, factors affecting head rice yields and losses at different stages of milling, rice mill machinery, Rice based products and their quality. Methods of rice bran oil extraction and refining.

# UNIT-IV

Dry and wet milling of maize, modern methods of maize processing, gluten and starch separation, maize starch conversion into value added products, acid hydrolysis, enzyme hydrolysis, processing for dextrose, malto-dextrin and other products, Barley varieties, composition and quality characteristics, malting process and industrial applications of barley malt and malt products.

***Recommended Readings:***

1. Kulp K. & Ponte J. G. (2014).*Handbook of Cereal Science & Technology,2nd edition*: CRC press.
2. Wrigley C.W. &Batey I. L. (2010).*Cereal grains, assessing and managing quality,* CRC press.
3. Dendy D. A. V. &Dobsasoczyk B. J. (2001).*Cereal and Cereal Products, Chemistry and Technology*: An ASPEN publication.
4. Owens G. (2000).*Cereal Processing Technology*: CRC Press.
5. Faridi H. &Faubin J. M. (1997).*Dough Rheology & Baked product Texture*: CBS Publishers.

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| **MFT-109A** | **Enzymes in food processing** | | | | | | | |  |
| **Lecture** | **Tutorial** | | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Practical** | **Total** | **Time** |
| **3** | **0** | | **0** | **3** | **60** | **40** | **-** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | To enlighten the knowledge of the Students on details of enzymes in food processing. | | | | | | | | |
| **Course Outcomes (CO)** | | | | | | | | | |
| **CO1** | | Students will be able to know about the basics of enzymes. | | | | | | | |
| **CO2** | | Students will be able to gain knowledge different types of enzymes and their use in milk production. | | | | | | | |
| **CO3** | | Students will be able to know about enzymes in beverage. | | | | | | | |
| **CO4** | | Students will be able to Understand the use of enzymes in baking industry | | | | | | | |

**Unit – I**

Enzymes: Introduction, classification, properties, characterization. Enzyme kinetics- enzyme concentration, substrate concentration, environment conditions & enzyme immobilization. Enzymesin food industry: commercialization of enzyme processes, alternative method to use the enzymes, types of reaction. Sources of enzymes, legal &implication.

**Unit – II**

Enzymes in milk production: enzymes in milk preservation, lactose hydrolyses, use of enzymes for determining milk quality, enzymes in cheese manufacturing. Endogenous microbial enzymes, exogenous enzymes. Coagulant technology, enzymes in cheese preservation.

**Unit – III**

Enzymes in beverage: application of enzymes in tea and coca processing. Application og enzymes in alcoholic beverages as beer, whisky, wine, ciders. Role of the enzymes in fruit juice production. Factors affecting the enzymatic activity.

**Unit – IV**

Enzymes in baking industry: Introduction, use of proteinases, lipases and pentose in baking industry. Starch degrading enzymes: source, analysis & application of starch degrading enzymes.

**Suggested Readings**

FlickingerMC & Drew SW. 1999. *Encyclopedia of Bioprocess Technology*. A Wiley- Inter Science Publ. Kruger JE. *et al*. 1987. *Enzymes and their Role in Cereal Technology*. American Association of Cereal Chemists Inc.

Nagodawithana T & Reed G. 1993. *Enzymes in Food Processing*. Academic Press. Tucker GA & Woods LFJ. 1991. *Enzymes in Food Processing*.

Whitehurst R & Law B. 2002. *Enzymes in Food Technology*. Blackwell Publ.

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| **MFT-111A** | | | **BIOPROCESS ENGG.** | | | | | | |  |
| **Lecture** | | **Tutorial** | | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Practical** | **Total** | **Time** |
| **3** | | | **0** | **0** | **3** | **60** | **40** | **-** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | | | **To enlighten the knowledge of the Students on recent concepts of Bioprocess.** | | | | | | | |
| **Course Outcomes (CO)** | | | | | | | | | | |
| **CO1** | Students will be able to know about the aware of the status of bio-processing in food industry. | | | | | | | | | |
| **CO2** | Students will be able to gain knowledge regarding instrumentation involved in production of bio-processed products. | | | | | | | | | |
| **CO3** | Students will be able to know apprehend about the recovery of bio-processed products. | | | | | | | | | |
| **CO4** | Comprehend the fermentation technology involving design and processing. | | | | | | | | | |

## **UNIT-I**

## Introduction to bioprocessing, historical developments, bioenergetics, enzyme kinetics- Micaelismenton model, effect of temperature on reaction rate, microbial growth kinetics- batch culture, continuous culture, fed batch culture and application of fed batch culture, Sterilization and sanitation: thermal death kinetics, medium sterilization (batch and continuous design), sterilization of fermenter, feed and wastes; filter sterilization of media, air and exhaust air; theory of depth filters, isolation, preservation (storage on reduced temp, storage under liquid nitrogen, storage on agar slopes, storage in dehydrated form) and improvement of industrially important micro-organisms.

## **UNIT-II**

Fermenter design- basic functions of fermenters, types of fermenter, construction material, pipes and tubes, valves and steam traps, agitator and impeller, stirrer and bearing (seals and drives), sparger, baffles, achievement and maintenance of aseptic conditions (sterilization of air, exhaust gas and fermenter), sampling port, controlling devices.

**UNIT-III**

Product recovery- foam separation, precipitation, filtration (batch, continuous, cross flow filtration), filter aids, filteration equipment, filteration theory, centrifugation, centrifuge equipment, centrifugation theory, liquid- liquid extraction– solvent recovery, two phase aqueous extraction, supercritical fluid extraction, chromatography, (adsorption chromatography, gel permeation, ion exchange chromatography, HPLC, RPC, continuous chromatography), membrane processes

(ultrafilteraiton, reverse osmosis, liquid membranes), drying, crystallization, whole broth processing.

**UNIT-IV**

Bioprocess instrumentation- Offline analytical methods, physical, chemical and biosensors, online sensors.

**References**

1. Doran, P. M. (1995). *Bioprocess Engineering Principles*: Academic press, New Delhi.
2. Shuler, M. L. (2002). *Bioprocess Engineering Basic Concepts* (2 ed.): PHI, New Delhi.
3. Sablani, S. S., Rahman, M. S., Datta, A. K. and Mujumdar, A. S. (2007). *Handbook of Food and Bioprocess Modeling Techniques*: CRC Publications, New York.

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| **MFT-113 A** | | **NEUTACEUTICAL & FUNCTIONAL FOODS** | | | | | | |  |
| **Lecture** | | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Practical** | **Total** | **Time** |
| **3** | | **0** | **0** | **3** | **60** | **40** | **-** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | | **To enlighten the knowledge of the Students on nature, type and scope of nutraceutical and functional foods .** | | | | | | | |
| **Course Outcomes (CO)** | | | | | | | | | |
| **CO1** | Students will be able to know about the aware of the status of bio-processing in food industry | | | | | | | | |
| **CO2** | Students will be able to gain knowledge regarding dietary fibers and complex carbohydrates as functional food ingredients. | | | | | | | | |
| **CO3** | Students will be able to know about protein as a functional food ingredient | | | | | | | | |
| **CO4** | Marketing and regulatory issues for functional foods and nutraceuticals. | | | | | | | | |

**Unit – I**

Defining nutraceuticals and functional foods, Nature, type and scope of nutraceutical and functional foods Nutraceutical and functional food applications and their health benefits, Nutraceutical compounds and their classification based on chemical and biochemical nature with suitable and relevant descriptions

**Unit – II**

Nutraceuticals for specific situations such as cancer, heart disease, stress, osteoarthritis, hypertension etc. Antioxidants and other phytochemicals, (isoflavones, lycopenes), their role as nutraceuticals and functional foods, Dietary fibers and complex carbohydrates as functional food ingredients

**Unit – III**

Protein as a functional food ingredient, Probiotic foods and their functional role, Herbs as functional foods, health promoting activity of common herbs. Cereal products as functional foods – oats, wheat bran, rice bran etc. Functional vegetable products, oil seeds, spices and sea foods.Coffee, tea and other beverages as functional foods/drinks and their protective effects

**Unit – IV**

Effects of processing, storage and interactions of various environmental factors on thepotentials of such foods. Marketing and regulatory issues for functional foods and nutraceuticals .Recent development and advances in the areas of nutraceutical and functional foods.

**References**

1. Functional Foods, R. Chadwick,S. Henson,B. Moseley,G, Springer Science & Business Media, 2003
2. Methods of Analysis for Functional Foods and Nutraceuticals ,W. Jeffrey Hurst CRC Press, 2008
3. Handbook of Functional Dairy Products Functional Foods, Colette Shortt, John O'Brien, CRC Press, 2003
4. Handbook of Nutraceuticals and Functional Foods, Robert E.C. Wildman, Robert Wildman, Taylor C. Wallace, CRC Press, 2006

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| **MFT-115A** | | **Advances in Dairy Technology** | | | | | | |  |
| **Lecture** | | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Practical** | **Total** | **Time** |
| **3** | | **0** | **0** | **3** | **60** | **40** | **-** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | | To enlighten the knowledge of the Students on different techniques of milk**.** | | | | | | | |
| **Course Outcomes (CO)** | | | | | | | | | |
| **CO1** | Students will be able to know about the aware of the status of preservation of raw milk. | | | | | | | | |
| **CO2** | Students will be able to gain knowledge regarding UHT processed milk products. | | | | | | | | |
| **CO3** | Students will be able to know about homogenization and their applications in dairy industry. | | | | | | | | |
| **CO4** | Students will be able to know about different types of dehydration. | | | | | | | | |

**Unit - I**

Useof bio-protective factors for preservation of raw milk: effects onphysicochemical, microbial and nutritional properties of milk and milk products.Present status of preservation of raw milk by chemical preservatives; thermal processing for preservation.

**Unit - II**

Methods of determining lethality of thermal processing, UHT processed milk products, their properties and prospects, types of UHT plants, aseptic fillers, heat stability and deposit formation aspects, effect on milk quality; techno- economic considerations; retort processing.

**Unit - III**

Principles and equipment for bactofugation and Bactotherm processes, Microfluidization of milk: Principle, equipment, effects and applications, Homogenization and their applications in dairy industry.

**Unit - IV**

Dehydration: advances in drying of milk and milk products; freeze concentration, freeze dehydration: physicochemical changes during freeze drying and industrial developments.

**Suggested Readings**

Burton H. 1998. *Ultra-high Temperature Processing of Milk and Milk Products*. Elsevier. Fellow P. 1988. *Food Processing Technology*. EllissHorwood Ltd.

Gould GW. 1995. *New Methods of Food Preservation*. Blackie.

IDF Bulletin 1981. *New Monograph on UHT Milk*. Document No. 133, Intern. Dairy Fed., Brussels. Smit G. 2003. *Dairy Processing–Improving Quality*. CRC-Woodhead Publ.

Troller JA & Christian HB. 1978. *Water Activity and Food, Food Science and Technology*. A Series of Monograph Academic Press, London.

Walstra P, Geurts TJ, Noomen A, Jellema A & Van Boekel MAJS. 1999. *Dairy Technology–Principles ofMilk Properties and Processes*. Marcel Dekker.

**AUDIT COURSE –I (AC-1)**

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| **MTAD-101A** | **English For Research Paper Writing** | | | | | | | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Practical** | **Total** | **Time** |
| **2** | **0** | **0** | **0** | **60** | **40** | **-** | **100** | **3 Hrs.** |
| **Program Objective (PO)** |  | | | | | | | |
| **Course Outcomes (CO)** | | | | | | | | |
| **CO1** | Understand that how to improve your writing skills and level of readability | | | | | | | |
| **CO2** | Learn about what to write in each section | | | | | | | |
| **CO3** | Understand the skills needed when writing a Title | | | | | | | |
| **CO4** | Ensure the good quality of paper at very first-time submission | | | | | | | |

**Units** 1

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

**Units** 2

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

**Units** 3

Review of the Literature, Methods, Results, Discussion, Conclusions, the Final Check.

key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

**Units** 4

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

**Suggested Studies:**

* Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
* Day R (2006) How to Write and Publish a Scientific Paper, CambridgeUniversity Press
* Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman’sbook.
* Adrian Wallwork, English for Writing Research Papers, Springer New YorkDordrecht

HeidelbergLondon, 2011

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| **MDAD-103A** | **Disaster Management** | | | | | | |  | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Practical** | **Total** | | **Time** |
| **2** | **0** | **0** | **0** | **60** | **40** | **-** | **100** | | **3 Hrs.** |
| **Program Objective (PO)** |  | | | | | | | | |
| **Course Outcomes (CO)** | | | | | | | | | |
| **CO1** | Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response. | | | | | | | | |
| **CO2** | Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives. | | | | | | | | |
| **CO3** | Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations. | | | | | | | | |
| **CO4** | critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in | | | | | | | | |

**Units 1**

Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

**Units 2**

Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem.

Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

**Units 3**

Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics

Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

**Units 4**

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People’s Participation in Risk Assessment. Strategies for Survival.

Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs Of Disaster Mitigation in India.

**SUGGESTED READINGS:**

* R. Nishith, SinghAK, “Disaster Management in India: Perspectives, issues and strategies “’New Royal book Company.
* Sahni, PardeepEt.Al. (Eds.),” Disaster Mitigation Experiences And Reflections”, Prentice Hall Of India, New Delhi.
* Goel S. L., Disaster Administration And Management Text And Case Studies”,Deep&Deep Publication Pvt. Ltd., New Delhi.

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| **MTAD-105A** | **Sanskrit for Technical Knowledge** | | | | | | |  | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Practical** | **Total** | | **Time** |
| **2** | **0** | **0** | **0** | **60** | **40** | **-** | **100** | | **3 Hrs.** |
| **Program Objective (PO)** | Students will be able to Understanding basic Sanskrit language and Ancient Sanskrit literature about science & technology can be understood and Being a logical language will help to develop logic in students | | | | | | | | |
| **Course Outcomes (CO)** | | | | | | | | | |
| **CO1** | To get a working knowledge in illustrious Sanskrit, the scientific language in the world | | | | | | | | |
| **CO2** | Learning of Sanskrit to improve brain functioning | | | | | | | | |
| **CO3** | Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power | | | | | | | | |
| **CO4** | The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature | | | | | | | | |

**Unit 1**

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences

**Unit 2**

Order, Introduction of roots, Technical information about Sanskrit Literature

**Unit 3**

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

***Suggested reading***

* “Abhyaspustakam” – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
* “Teach Yourself Sanskrit” PrathamaDeeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
* “India’s Glorious Scientific Tradition” Suresh Soni, Ocean books (P) Ltd., New Delhi.

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| **MTAD-107A** | **Value Education** | | | | | | | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Practical** | **Total** | **Time** |
| **2** | **0** | **0** | **0** | **60** | **40** | **-** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | Understand value of education and self- development, Imbibe good values in students and  Let the should know about the importance of character | | | | | | | |
| **Course Outcomes (CO)** | | | | | | | | |
| **CO1** | Knowledge of self-development | | | | | | | |
| **CO2** | Learn the importance of Human values | | | | | | | |
| **CO3** | Developing the overall personality | | | | | | | |
| **CO4** | Know about the importance of character | | | | | | | |

**Unit 1**

Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgments.

**Unit 2**

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline

**Unit 3**

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labor. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature

**Unit 4**

Character and Competence –Holy books vs Blind faith. Self-management and Good health.

Science of reincarnation. Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively

***Suggested reading***

1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi

**SEMESTER –II**

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| **MFT-102A** | **Novel Food Packaging Techniques** | | | | | | |  |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major**  **Test** | **Minor**  **Test** | **Practical** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **60** | **40** | **-** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | **To enlighten the knowledge of the Students about the recycling of packaging materials, biodegradable packaging materials and safety and legislative aspects.** | | | | | | | |
| **Course Outcomes (CO)** | | | | | | | | |
| **CO1** | Students will be able to know about the various types of scavengers and emitters for improving the food shelf life. | | | | | | | |
| **CO2** | Students will be able to gain knowledge on the properties and production of various packaging materials and effect of various indicators used in supply chain management to indicate the food quality. | | | | | | | |
| **CO3** | Students will be able to know about consumer response about new packaging systems and safety and legislative requirements. | | | | | | | |
| **CO4** | Learn about Acquaint about food-package interaction between package-flavour, gas storage systems for food storage, recycling | | | | | | | |

**Unit – I**

**Active and intelligent packaging:** Active Packaging Techniques and intelligent Packaging Techniques, current use of novel Packaging Techniques, consumers and novel Packaging

**Oxygen, ethylene and other scavengers:** Oxygen scavenging technology, selecting right types of oxygen scavenger, ethylene scavenging technology, corbon dioxide and other scavengers

**Antimicrobial food packaging:** Antimicrobial agents, constructing antimicrobial packaging systems, factors affecting the effectiveness of antimicrobial packaging

**Unit – II**

**Non-migratory bioactive polymers (NMBP) in food packaging:** Advantages of NMBP, Inherently bioactive synthetic polymers: types and application, Polymers with immobilized bioactive compounds and their applications

**Time Temperature indicators (TTIs):** Defining and classifying TTIs, Requierments for TTIs, development of TTIs, Maximizing the effectiveness of TTIs, Using TTIs to monitor shelf life during distribution

**The use of freshness indicator in packaging:** Compounds indicating the quality of packaged food products, freshness indicators, pathogen indicators, other methods for spoilage detection

**Unit – III**

**Packaging-flavour interaction:** Factors affecting flavourabsorpstion, role of food matrix, role of differing packaging materials,flavour modification and sensory quality

**Moisture regulation:** Silica gel, clay, molecular sieve, humectants, salts, irreversible adsorption

**Developments in modified atmosphere packaging (MAP):** Novel MAP gas, testing novel MAP applications, applying high oxygen MAP

**Recyling packaging materials:** Recyclability of packaging plastics, improving the recyclability of plastics packaging, testing safety and quality of recycled materials, using recycled plastics inPackaging.

**Unit – IV**

**Green plastics for food packaging:** Problems of plastic packaging wastes, range of biopolymers, developing novel biodegradable materials

**Integrating Intelligent packaging, storage and distribution:** Supply chain for perishable foods, role of packaging in the supply chain, creating integrated packaging, storage and distribution: alarm systems and TTIs

**Testing consumer responses to new packaging concepts:** New packaging techniques and the consumers, methods for testing consumer responses, consumer attitudes towards active and intelligent packaging

**Safety and legislative aspects of packaging:** Regulatory considerations, plastic, metal, paper and glass package.

**References**

1. Novel Food Packaging Techniques, Ahvenainen,Elsevier, 2003

2. Food Packaging, Robertson, CRC Press, 2012.

3. Handbook of Package Engineering, [Joseph F. Hanlon](http://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Joseph+F.+Hanlon%22), [Robert J. Kelsey](http://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Robert+J.+Kelsey%22), [Hallie Forcinio](http://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Hallie+Forcinio%22) CRC Press, 1998

4. A Handbook of Food Packaging, Frank A. Paine, H.Y. Paine published by Springer Science & Business Media, 1992

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| **MFT-104A** | **Advances in food Analyses** | | | | | | |  |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major**  **Test** | **Minor**  **Test** | **Practical** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **60** | **40** | **-** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | To enlighten the knowledge of the Students about the advanced analytical and instrumental techniques | | | | | | | |
| **Course Outcomes (CO)** | | | | | | | | |
| **CO1** | Students will be able to know about the bio-chemical analysis of food components. | | | | | | | |
| **CO2** | Students will be able to gain knowledge about the applications various analytical and instrumental techniques. | | | | | | | |
| **CO3** | Students will be able to know about technical exposure in chromatographic techniques. | | | | | | | |
| **CO4** | Students will be able to know about the spectroscopic and microscopic techniques. | | | | | | | |

# UNIT-I

Spectroscopy: UV-Visible spectroscopy, Atomic absorption spectroscopy, Flame photometry, Fluorescence spectroscopy, Emission spectroscopy, Mass-spectroscopy, Fourier Transform Infra-Red.

# UNIT-II

Methods of separation and analysis of biochemical compounds and macromolecules:Principles and applications of Gas Chromatography, High Performance Liquid Chromatography, Thin layer chromatography.

# UNIT-III

Microscopic techniques: Light microscopy, Scanning electron microscopy, Transmission electron microscopy, particle size analysis, Thermal techniques in food analysis: Differential scanning calorimetry and Thermo gravimetric analysis.

# UNIT-IV

Electrophoresis: Different kinds of electrophoresis, western blotting, gel documentation, DNA analysis: DNA purification, PCR-based analysis, DNA fingerprinting.

***Recommended Readings:***

1. Pare, J. R. J. and Bélanger, J. M. R. (2015). *Instrumental Methods of Food Analysis*: Elsevier
2. Pomeranz, Y. and Meloan, C. E. (1996). *Food Analysis: Theory and Practice* (3 ed.): CBS Publications, New Delhi.
3. Winton, A. L. (2001). *Techniques of Food Analysis:* Agrobios, Jodhpur.
4. Sharma, B. K. (1994). *Instrumental Methods of Chemical Analysis*: Krishna, Meerut.
5. Skoog, D. A., Holler, F. J. and Nieman, T. A. (1998). *Principles of Instrumental Analysis* (5 ed.): Harcourt, Singapore.
6. Gopalan, R., Subramanian, P. S. and Rangarajan, K. (2008). *Elements of Analytical Chemistry*: Sultan Chand & Sons

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| **MFT- 118A** | **LAB –III (NOVEL FOOD PACKAGING)** | | | | | | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test (Practical)** | **Minor Test** | **Total** | **Time** |
| **-** | **-** | **4** | **2** | **60** | **40** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | **To familiarize the students with various recent techniques of food packaging used in industries.** | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | Learner will aware about symbols used in food industries. | | | | | | |
| **CO2** | Students will be able to learn about the role and effectiveness of various packaging systems. | | | | | | |
| **CO3** | Students will understand the different types of food packaging. | | | | | | |
| **CO4** | Students will be able to learn about shelf life evaluation of packaged foods | | | | | | |

**Practical Exercises :-**

* Testing of properties of different packaging materials (paper, plastic, glass and metal).
* To study of symbols and labels used on food packages.
* To study the different types of packaging (vacuum packaging, form-fill- seal packaging).
* Estimation of shelf life of food under different packaging materials.
* Determination of changes in packaged foods.
* To study the packaging of foods under different conditions.
* **References**

1. Novel Food Packaging Techniques, Ahvenainen,Elsevier, 2003

2. Food Packaging, Robertson, CRC Press, 2012.

3. Handbook of Package Engineering, [Joseph F. Hanlon](http://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Joseph+F.+Hanlon%22), [Robert J. Kelsey](http://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Robert+J.+Kelsey%22), [Hallie Forcinio](http://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Hallie+Forcinio%22) CRC Press, 1998

4. A Handbook of Food Packaging, Frank A. Paine, H.Y. Paine published by Springer Science &Business Media, 1992

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| **MFT- 120A** | **LAB –IV (Advances in food Analysis)** | | | | | | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test (Practical)** | **Minor Test** | **Total** | **Time** |
| **-** | **-** | **4** | **2** | **60** | **40** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | To familiarize the students with various applications of current analytical and instrumental techniques**.** | | | | | | |
| **Course Outcomes** | | | | | | | |
| **CO1** | Learner will aware about basic preparation of solutions and buffers. | | | | | | |
| **CO2** | Students will be able to understand the functioning and principle of various analytical instruments. | | | | | | |
| **CO3** | Students will understand the advanced analytical methods. | | | | | | |
| **CO4** | Students will be able to learn about spectrophotometric and chromatographic techniques. | | | | | | |

**Practical Exercises :-**

* Preparation of solutions and buffers.
* Determination of titratable acidity in foods using a potentiometric titration.
* Atomic absorption spectroscopic analysis of heavy metals in foods.
* Secondary structure analysis of starch and proteins using Fourier Transform Infra-Red (FTIR).
* Separation and identification of food constituents using HPLC.
* Extraction of different types of proteins and identification using electrophoresis.
* DNA isolation and fingerprinting of plant tissues.

**References**

1. Fundamentals of Engineering Heat and mass transfer, R.C. Sachdeva, New Age Science, 2009
2. Fundamentals of Food Process Engineering, R.T. Toledo, Springer Science & Business Media, 2007

3. Food Engineering Operations, Brennan, J.G. and J.R.Cowell published by **Elsevier,1990**

4. Food Process Engineering, Heldman,D.R. and R.P.Singh , Avi Pub. Cop., 1981

5. Elements of Food Engineering, Harper J.C., Van Nostrand Reinhold, 1988

6. Fundamentals of Food Engineering, [Stanley E. Charm](http://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Stanley+E.+Charm%22) , Avi Pub. Cop., 1971

**PROGRAM ELECTIVE (PE-III)**

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| **MFT-106 A** | **Advance in Food Engg.** | | | | | | | |  |
| **Lecture** | **Tutorial** | | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Practical** | **Total** | **Time** |
| **3** | **0** | | **0** | **3** | **60** | **40** | **-** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | To enlighten the knowledge of the Students on various aspects of food engineering**.** | | | | | | | | |
| **Course Outcomes (CO)** | | | | | | | | | |
| **CO1** | | Students will be able to able to calculate through different dimensions. | | | | | | | |
| **CO2** | | Students will be able to able to calculate freezing time. | | | | | | | |
| **CO3** | | Students will be able to know of food engineering to design new process. | | | | | | | |
| **CO4** | | Students will be able to understand pump selection and velocity of flowing fluids. | | | | | | | |

**Unit – I**

**Fluid Foods:** Material and energy balance, Flow of fluids foods. Hygienic design concepts, sanitary pipe fittings, pumps and fans, bulk milk coolers, milk collecting and chilling centers, milk tanks, stirrers and mixers, milk reception equipment, pasteurizers, sterilizers and treatment by irradiations, CIP system, corrosion process and their controls.

**Unit – II**

**Separators:** Centrifugation, separation, cyclone separators, homogenizers, ultra-filtration, reverse osmosis and electrodialysis, Equipment for cheese, ice cream, butter manufacture, and other special milk products.

**Unit – III**

**Thermal Processing:** Thermal processing, sterilization classification U.H.T. systems and recent advances, factors affecting spoilage of different types of food products and design of thermal processes. Survival curves, thermal death curves, analysis of thermal resistance data, process time evaluation, Design of batch and continuous sterilization cycles in vat, inter-relationship between batch and continuous reactors, design calculations.

**Unit – IV**

**Refrigeration:** Refrigeration cycles, performance of refrigeration compressors, refrigeration system balance and multiple evaporation systems. Flash cooling, design of condensors, evaporators, cooling towers, thermo-electric cooling, cryogenics, different refrigeration systems for ultra low refrigeration.

**Thermodynamics of Food Freezing:** Properties o frozen foods, freezing point depression, Ice crystal formation, Enthalpy change during freezing, experimental related numerical

problems, Predicting rates of product freezing and design of food freezing equipments.

**Energy Management:** Energy audit and management strategies in food process industries

**References**

1. Fundamentals of Engineering Heat and mass transfer, R.C. Sachdeva, New Age Science, 2009
2. Fundamentals of Food Process Engineering, R.T. Toledo, Springer Science & Business Media, 2007

3. Food Engineering Operations, Brennan, J.G. and J.R.Cowell published by **Elsevier,1990**

4. Food Process Engineering, Heldman,D.R. and R.P.Singh , Avi Pub. Cop., 1981

5. Elements of Food Engineering, Harper J.C., Van Nostrand Reinhold, 1988

6. Fundamentals of Food Engineering, [Stanley E. Charm](http://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Stanley+E.+Charm%22) , Avi Pub. Cop., 1971

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| **MFT-108A** | **Advances in Meat, Fish & Poultry Technology** | | | | | | | |  |
| **Lecture** | **Tutorial** | | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Practical** | **Total** | **Time** |
| **3** | **0** | | **0** | **3** | **60** | **40** | **-** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | **To enlighten the knowledge of the Students on processing technology of meat, poultry, fish and eggs.** | | | | | | | | |
| **Course Outcomes (CO)** | | | | | | | | | |
| **CO1** | | Students will be able to able to understand the technology for raw material characteristics, handling, processing, and preservation. | | | | | | | |
| **CO2** | | Students will be Perceive the knowledge regarding transportation and storage practices. | | | | | | | |
| **CO3** | | Students will be able to know comprehend the food standards in relation to these food commodities. | | | | | | | |
| **CO4** | | Students will be able to know Grasp by-product utilization of meat, poultry, fish and egg products. | | | | | | | |

# UNIT-I

Production, Processing and consumption trends, Prospects of meat industry, Meat spoilage, Endogenous and exogenous infections, Hygiene and sanitation, Meat composition from different sources, Post-mortem muscle chemistry and composition, Intramuscular fat, Rigor mortis, The conversion of muscle into meat.

Animals’ stunning methods, ante-mortem and post-mortem examination, Design of handling facilities: Slaughtering and dressing, Consequences of circulatory failure, Proteolytic and other chemical changes, Operational factors affecting meat quality, Effects of processing on meat tenderization, Chilling, freezing and preservation, prepared meat products, intermediate moisture and dried meat products, The eating quality of meat: color, flavors and retention, water holding capacity, juiciness, texture and taste, meat eating and health, Inedible by-products

**UNIT-II**

Quality characteristics of poultry products, Lay-out and design of poultry processing plants, Plant sanitation, Poultry meat processing operations and equipment for de-feathering, bleeding, scalding etc., Poultry meat products, Refrigerated storage of poultry meat, by-products

**UNIT-III**

Egg structure, structural abnormalities, functions of egg in food system, egg products, whole egg powder, egg yolk products, by-products, their packaging and storage, eating quality of eggs, Inspection and grading, preservation and safe handling

# UNIT-IV

Commercially important marine products from India, Product export and its sustenance, Processing operations, Basic biochemistry, Preservation of postharvest fish freshness, Transportation in refrigerated vehicles, Deodorization of transport systems, Design of refrigerated and insulated trucks, Grading and preservation of shell fish, pickling and preparation of fish protein concentrate, fish oil and other byproducts

***Refrences books:***

1. Lawrie, R. A. (1998). *Lawrie’s Meat Science* (6 ed.): Woodhead Publications, Cambridge.
2. Alan, H. V. and Jane, P. S. (1995). *Meat and Meat Products: Technology, Chemistry and Microbiology*: Champan& Hill, London.
3. Carmen, R. O. and George, J. M. (1997). *Poultry Meat and Egg Production*: CBS Publications, New Delhi.
4. Winton, A. L. and Barberwinton, K. (1999). *Fish and Fish Products*: Agrobios, Bikaner.

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| **MFT-110 A** | | **Technology of Frozen Foods** | | | | | | |  |
| **Lecture** | | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Practical** | **Total** | **Time** |
| **3** | | **0** | **0** | **3** | **60** | **40** | **-** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | | **To enlighten the knowledge to understand suitability of different packaging materials for packing of frozen foods.** | | | | | | | |
| **Course Outcomes (CO)** | | | | | | | | | |
| **CO1** | Students will be able to able to understand the technology for raw material characteristics, handling, processing, and preservation. | | | | | | | | |
| **CO2** | Students will be gain knowledge on different properties and microbiology of frozen foods. | | | | | | | | |
| **CO3** | Students will be able to Know about different freezing methods, equipment and transportation of frozen foods. | | | | | | | | |
| **CO4** | Students will be able to Gain knowledge on quality and safety of different frozen foods. | | | | | | | | |

**Unit – I**

**Fundamentals of Freezing:** Glass transitions in frozen foods and biomaterials,

Microbiology of frozen foods, Thermo -physical properties of frozen foods, Freezing loads and Freezing time calculation, Freezing methods and equipment. Innovations in freezing process.

**Unit – II**

**Facilities for the Cold Chain:**, Cold store design and maintenance, Transportation of frozen foods, Retail display equipment and management, Household refrigerators and freezers, Monitoring and control of the cold chain.

**Unit – III**

**Quality and Safety of Frozen Foods:** Quality and safety of frozen meat and meat product, Quality and safety of frozen poultry and poultry products, Safety and quality of frozen fish, Shellfish, and related products, Quality and safety of frozen vegetables, Quality and safety of frozen fruits, Quality and safety of frozen dairy products, Quality and safety of frozen ready meats, Quality and safety of frozen bakery products, Quality and safety of frozen eggs and egg products

**Unit – IV**

**Monitoring and Measuring Techniques for Quality and Safety:** Chemical Measurements, Sensory analysis of frozen foods, Foodborne illnesses and detection of pathogenic microorganisms, Shelf-life prediction of frozen foods.

**Packaging of Frozen Foods:** Introduction to frozen food packaging, Plastic packaging of frozen foods, Paper and card packaging of frozen foods, Packaging of frozen foods with other materials, Packaging machinery

**References**

1. Quality in Frozen Foods, Marilyn C. Erickson,Yen-Con Hung , Springer Science & Business Media, 1997.
2. Handbook of Frozen Foods, Y. H. Hui, Isabel Guerrero Legarretta, MiangHoong Lim, K.D. Murrell, Wai-Kit Nip, CRC Press, 2004.
3. Managing Frozen Foods, Kennedy Chris J, Elsevier
4. Frozen Food Technology, C.P Mallete, Springer Science & Business Media, 1993

**PROGRAM ELECTIVE (PE-IV)**

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| **MFT-112 A** | **BIOTECHNOLOGICAL TOOLS IN FOOD ANALYSIS** | | | | | | |  |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Practical** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **60** | **40** | **-** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | **To enlighten the knowledge to Students on Biotechnology & Genetic Engg.** | | | | | | | |
| **Course Outcomes (CO)** | | | | | | | | |
| **CO1** | Students will be able to know PCR | | | | | | | |
| **CO2** | Students will be gain knowledge of serology. | | | | | | | |
| **CO3** | Students will be able to Know about Biosensor | | | | | | | |

**Unit – I**

**Introduction:** Concept of Biotechnology, history, old vs new Biotechnology, Different food borne pathogens

**Genetic Engineering:** Concept, different vector systems used in gene cloning, gene cloning procedures: isolation of DNA fragment, joining to vector, expression & selector of recombinant with suitable example, DNA fingerprinting, Method of DNA fingerprinting, Identification techniques, Practical applications

**Unit – II**

**Polymerase Chain Reaction:** Introduction and principle, process of PCR, Development of a PCR assay, PCR optimization, Practical modifications to the PCR technique, Advantages and disadvantages, Applications, Application of PCR in the detection of different pathogen species, MPCR analysis

**Unit – III**

**ELISA**: Concept of Antigen & Antibody, ELISA, Types of ELISA, Methods, ELISA kits, Applications in food and agriculture

**Immunoassay kits:** Types of Immunoassays, Principle of detection of kits, Monoclonal Antibodies-antigen, antibody, Nomenclature, Production of monoclonal antibodies-in vitro and in -vivo, merits and demerits, application in food industries

**Unit – IV**

**Biosensor:** Types of biosensor- Calorimetric, Potentiometric, Amperometric, Optical, Piezoelectric, Immunosensors, Principle of detection, Application, Biosensors in food analysis

**References**

1. Biotechnology :Food Fermentation, V.K.Joshi& Pandey, Educational Publishers & Distributors, 1999

2. Biotechnology in Food Industry, M.P.Tombs, Open University Press, 1990

3. Modern Concepts of Biotechnology, H. D. Kumar, Vikas Publishing House

(P) Ltd.

4. Elements of Biotechnology, P. K. Gupta, Rastogi Publications

5. Modern Food Micro-Biology, ed. J.M. Jay, 1986, Van Nostrand Reinhold Company, New York

6. Recombinant DNA, ed. James D Watson and Michael Gilman, 2001, W. H Freeman and Company NY.

7. Molecular Biotechnology: Principles and Application of Recombinant DNA,ed.Bernard R Glick and Jack J.Pasternak, ASM press Washington DC

8. Essentials of Diagnostic Microbiology, ed. Lissa Anne Shimeld.

9. Methodology of immunochemical and immuno-logical research, ed.

Kwapinski- Willey inter science

10. Commercial Biosensors, ed. Graham Ramsay, John Wiley Publishers

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| **MFT-114 A** | **FOOD SAFETY AND QUALITY ASSURANCE** | | | | | | |  |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Practical** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **60** | **40** | **-** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | To enlighten the knowledge to Students on food safety, food quality, food laws and regulations in Food industry. | | | | | | | |
| **Course Outcomes (CO)** | | | | | | | | |
| **CO1** | Students will be able to know nationals and international food laws and regulations. | | | | | | | |
| **CO2** | Students will be gain knowledge offood quality managements systems. | | | | | | | |
| **CO3** | Students will be able to Know about exemplify different food adulterants. | | | | | | | |

**UNIT-I**

Sampling, specification, labeling,safety and quality assessment of fruits and vegetable, cereals, dairy products, meat, fish, poultry and processed food products, Sensory evaluation: Introduction, panel screening, selection methods, interaction and thresholds.

**UNIT-II**

Developments, objective and functions of food safety and quality assurance, Quality enhancement models, Statistical Quality Control for food industry, Food Quality Management Systems, implementation of quality control programmes, Quality control tools, Quality control charts for food plant sanitation, Food Safety Management Systems, Causes of failure of Food Safety Programs.

# UNIT-III

Indian food laws and regulations, Food safety acts, Regulations for waste disposals, Codex alimentarious, ISO series, World Trade Organization, Food and Agricultural Organization, World Health Organization, Food safety and legislation in USA and Europe, Technical Barriers in Trade, Enforcers of food laws approval process for food additives, additives food labeling, Intellectual Property Right, HACCP and its application.

# UNIT-IV

Food adulteration: Types of adulterants, Common adulterants for foods like milk and milk products, honey, wheat flours, edible oils, cereals, condiments (whole and ground) pulses, coffee, tea, confectionery, baking powder, non-alcoholic beverages, vinegar, besan and curry powder

***Recommended Readings:***

1. Lawless, H. T. and Heymann, H. (2013). *Sensory Evaluation of Food: Principles and Practices*: Springer, New Delhi.
2. Shapton, D. A. and Shapton, N. F. (1993). *Principles and Practice for the Safe Processing of Foods*: Heinemann, Oxford.
3. Schmidt, R. H. and Rodrick, G. E. (2003). *Food Safety Handbook*: John Wiley, New Jersey.
4. Rees, N. and Watson, D. (2000). *International Standards for Food Safety*: Aspen, Americ

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| **MFT-116 A** | **BEVERAGES & SNACKS FOOD TECHNOLOGY** | | | | | | |  |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Practical** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **60** | **40** | **-** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | **To enlighten the knowledge to types of beverages , snacks and their importance,** | | | | | | | |
| **Course Outcomes (CO)** | | | | | | | | |
| **CO1** | Students will be able to able to understand Alcoholic beverages | | | | | | | |
| **CO2** | Students will be gain knowledge on Technology for grain based snacks, whole grains. | | | | | | | |
| **CO3** | Students will be able to Know about Packaged and drinking water | | | | | | | |
| **CO4** | Students will be able to Gain knowledge Formulation and processing technology for fruit and vegetable based snacks. | | | | | | | |

**Unit I**

**Types of beverages and their importance**- Status of beverage industry in india, manufacturing technology for juice-based beverages, synthethic beverages, still, carbonated, low calorie and dry beverages, isotonic and sports drinks.

Role of various ingredients of soft drinks, carbonated soft drinks, Speciality beverages based on tea, coffee, cocoa, spices, plant extracts, herbs, nuts, dairy and imitation dairy based beverages.

**Unit II**

**Alcoholic beverages**- type, manufacture and quality evaluation, the role of yeast in beer and other alchoholic beverages, ale type beer, lager type beer technology of brewing process, equipment used for brewing and distillation, wine and related beverages, distilled beverages, distilled spirits

**Packaged and drinking water**- definition, types, manufacture and quality evaluation and raw and processed water, methods of water treatment, BIS quality standards of bottled water, mineral water, natural spring water, flavoured water, carbonated water.

**Unit- III**

**Technology for grain based snacks, whole grains**- roasted, toasted, puffed, popped and flakes, coated grains- Salted, spiced and sweetened. Flour based – batter and dough products, savoury, spiced and sweetened, formulated chips and wafers, papads, instant premixes of traditional Indian snack foods.

**Unit- VI**

**Formulation and processing technology for fruit and vegetable based snacks**:- Chips, wafers, coated nuts- salted, spiced and sweetened ,chikkis, extruded snack foods. Colouring, flavouring and packaging techniques, Equipment for frying, baking & drying, toasting, roasting and flaking, popping, blending, coating, chipping.

**References**

1. Extrusion of food Vol 2, Harper JM, CRC Press,1981.
2. Bakery technology & engineering, Matz SA, AVI Pub,1960
3. Beverages: Technology, Chemistry and Microbiology ; [A. Varnam](https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22A.+Varnam%22), [J.M. Sutherland](https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22J.M.+Sutherland%22); Chapman & Hall
4. Snack Food Technology, Samuel AM.1976 AVI Publ
5. Beverages: Carbonated and Non Carbonated. Woodroof JG & Phillips GF, AVI Publ.1974

**AUDIT COURSE –II (AC-II)**

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| **MTAD-102 A** | **Constitution of India** | | | | | | |  | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Practical** | **Total** | | **Time** |
| **2** | **0** | **0** | **0** | **60** | **40** | **-** | **100** | | **3 Hrs.** |
| **Program Objective (PO)** | * Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective and to address the growth of Indian opinion regarding modern Indian intellectuals’ constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism. | | | | | | | | |
| **Course Outcomes (CO)** | | | | | | | | | |
| **CO1** | Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics. | | | | | | | | |
| **CO2** | Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India. | | | | | | | | |
| **CO3** | Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution. | | | | | | | | |
| **CO4** | Discuss the passage of the Hindu Code Bill of 1956. | | | | | | | | |

**Unit I**

History of Making of the Indian Constitution: History , Drafting Committee, ( Composition & Working)

Philosophy of the Indian Constitution: Preamble , Salient Features

**Unit 2**

Contours of Constitutional Rights & Duties: Fundamental Rights , Right to Equality , Right to Freedom , Right against Exploitation , Right to Freedom of Religion, Cultural and Educational Rights , Right to Constitutional Remedies , Directive Principles of State Policy , Fundamental Duties.

Organs of Governance: Parliament , Composition, Qualifications and Disqualifications , Powers and Functions , Executive , President, Governor , Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications. Powers and Functions

**Unit 3**

Local Administration: District’s Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: ZilaPachayat, Elected officials and their roles, CEO ZilaPachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

**Unit 4**

Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

**Suggested reading**

* The Constitution of India, 1950 (Bare Act), Government Publication.
* Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
* M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
* D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

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| **MTAD-104A** | **Pedagogy Studies** | | | | | | |  | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Practical** | **Total** | | **Time** |
| **2** | **0** | **0** | **0** | **60** | **40** | **-** | **100** | | **3 Hrs.** |
| **Program Objective (PO)** | Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers and Identify critical evidence gaps to guide the development. | | | | | | | | |
| **Course Outcomes (CO)** | | | | | | | | | |
| **CO1** | What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries? | | | | | | | | |
| **CO2** | * What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners? | | | | | | | | |
| **CO3** | * How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? | | | | | | | | |

**Units 1**

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology , Theories of learning, Curriculum, Teacher education., Conceptual framework, Research questions. Overview of methodology and Searching.

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. , Curriculum, Teacher education.

**Units II**

Evidence on the effectiveness of pedagogical practices , Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers’ attitudes and beliefs and Pedagogic strategies.

**Units III**

Professional development: alignment with classroom practices and follow-up support, Peer support Support from the head teacher and the community. Curriculum and assessment , Barriers to learning: limited resources and large class sizes,

**Units IV**

Research gaps and future directions :Research design, Contexts , Pedagogy, Teacher education Curriculum and assessment, Dissemination and research impact.

**Suggested reading**

* Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
* Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
* Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
* Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
* Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell. Chavan M (2003) Read India: A mass scale, rapid, ‘learning to read’ campaign.

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| **MTAD-106A** | **Stress Management by Yoga** | | | | | | |  | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Practical** | **Total** | | **Time** |
| **2** | **0** | **0** | **0** | **60** | **40** | **-** | **100** | | **3 Hrs.** |
| **Program Objective (PO)** | To achieve overall health of body and mind and to overcome stress | | | | | | | | |
| **Course Outcomes (CO)** | | | | | | | | | |
| **CO1** | Develop healthy mind in a healthy body thus improving social health. | | | | | | | | |
| **CO2** | Improve efficiency | | | | | | | | |
| **CO3** | learn the Yogasan | | | | | | | | |
| **CO4** | Learn the pranayama | | | | | | | | |

**Unit I**

Definitions of Eight parts of yog. ( Ashtanga )

**Unit II**

Yam and Niyam. Do`s and Don’t’s in life.

1. Ahinsa, satya, astheya, bramhacharya and aparigraha
2. Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

**Unit III**

Asan and Pranayam

1. Various yog poses and their benefits for mind & body
2. Regularization of breathing techniques and its effects-Types of pranayam

***Suggested reading***

* ‘Yogic Asanas for Group Tarining-Part-I” :Janardan Swami YogabhyasiMandal, Nagpur
* “Rajayoga or conquering the Internal Nature” by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

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| **MTAD-108A** | **Personality Development through Life Enlightenment Skills** | | | | | |  | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Practical** | **Total** | **Time** |
| **2** | **0** | **0** | **0** | **60** | **40** | **-** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | To learn to achieve the highest goal happily  To become a person with stable mind, pleasing personality and determination  To awaken wisdom in students | | | | | | | |
| **Course Outcomes (CO)** | | | | | | | | |
| **CO1** | Students become aware about leadership. | | | | | | | |
| **CO2** | Students will learn how to improve communication skills | | | | | | | |
| **CO3** | Understand the team building and conflict | | | | | | | |
| **CO4** | Student will learn how to manage the time. | | | | | | | |

**Unit 1**

Leadership Introduction to Leadership, Leadership Power, Leadership Styles, Leadership in Administration. Interpersonal: Introduction to Interpersonal Relations, Analysis Relations of different ego states, Analysis of Transactions, Analysis of Strokes, Analysis of Life position

**Unit II**

Communication: Introduction to Communication, Flow of Communication, Listening, Barriers of Communication, How to overcome barriers of communication.

Stress Introduction to Stress, Causes of Stress, Impact Management Stress, Managing Stress

**Unit III**

Group Dynamics and team Building: Importance of groups in organization, Interactions in group, Group Decision Taking, Team Building, Interaction with the Team, How to build a good team?

Conflict: Introduction to Conflict, Causes of Conflict, Management Managing Conflict

**Unit IV**

Time Management: Time as a Resource, Identify Important Time Wasters, Individual Time Management Styles, Techniques for better Time Management.

Motivation: Introduction to Motivation, Relevance and types of Motivation, Motivating the subordinates, Analysis of Motivation

**Suggested reading**

* E.Berne, Games People Play, Grove Press Inc., 1964; Penguin, 1968.
* Hargreaves, G. Stress Management, Marshall Publishing, London 1998
* Barker D, TA and Training, Gower Publishing Company Ltd., 1982.
* JONGEWARDM D & SEYER P C CHOOSING SUCCESS John Wiley & Sons Inc.1978
* Arnold, JHC Feldman, D.C. Organizational Behaviour IRWIN/McGRAW-HILL 1986
* Chandan, J.S., Organizational Behaviour. Vikas Publishing House PVT LTD 1994
* Statt, D.A. Using Psychology in Management Training, Taylor and Francis Inc.2000
* Luthans F., OrganisationalBehaviour, IRWIN/McGRAW-HILL 1998

**SEMESTER –III**

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| **MFT-201 A** | | **Food Rheology & Microstructure** | | | | | | |  |
| **Lecture** | | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Practical** | **Total** | **Time** |
| **3** | | **0** | **0** | **3** | **60** | **40** | **-** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | | To enlighten the knowledge to Student onFood Rheology & Microstructure**.** | | | | | | | | . |
|  | | | | | | | | | | **Course Outcomes (CO)** | |
| **CO1** | Students will be able to know about food Structuring. | | | | | | | | |
| **CO2** | Students will be able to gain knowledge about heat & Mass transfer. | | | | | | | | |
| **CO3** | Students will be able to know about Examining food Microstructure. | | | | | | | | |
| **CO4** | Students will be able to study about Microstructure Approach. | | | | | | | | |

**Unit – I**

**Examining Food Microstructures:** History of Food Microstructure Studies, Light Microscopy, Transmission Electron Microscopy, Scanning Electron Microscopy, Other Instrumentation and Techniques

**Basic rheological concepts** : stress, strain, stiffness and hooke’s law, yield, ductility and necking, strain rate , poisson’s ratio, strength, shear deformation, uni-axial compression and extention, relation between various rheological parameters. Rheological classification of food: Mechanical characterization of food, equilibrium behavior, time dependent flow, time scale effects.

**Unit – II**

**Image Analysis:** Image Acquisition, Image Processing, Measurement Analysis

**Food Structuring:** Introduction, factor affecting texture, effect of enzyme on texture, Approaches to Food Structuring, Extrusion and Spinning, Structuring Fat Products, Structure and Stability, Gels, Gelation Mechanisms, Mixed Gels, The Microstructure of Gels, Structure-Property Relations in Gels

**Unit – III**

**Microstructural Components and Food Assemblies:** Water and Ice, Proteins, Lipids, Carbohydrates, Cells and Cell Membranes, Structural Aspects of Animal Tissue, Structural Aspects of Plant Tissue.

**Food Microstructure and Quality:** Measurement of Texture, Structural Aspects of Food Texture,Quality and Structure.

**Unit – IV**

**Microstructure and Mass Transfer: Solid-Liquid Extraction:** Fundamental Aspects of Extraction,the Extraction process, Extraction of Food Materials, Modifying Microstructure, Modeling the Extraction Process.

**Simultaneous Heat and Mass Transfer: Dehydration:** Basic Concepts, The Drying Process, Osmotic Dehydration, Influence of Drying on Structural Properties, Frying of Foods.

**The Micro-structural Approach:** Structure-Property Relationships. The Micro-structural Approach

**References Books ;**

1. Microstructural Principles of Food Processing & Engineering, [José Miguel Aguilera](http://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Jos%C3%A9+Miguel+Aguilera%22), [David W. Stanley](http://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22David+W.+Stanley%22),Springer Science & Business Media, 1999
2. Food Texture by Moskowitz , CRC Press,1987
3. Principles of Food Processing [Dennis R. Heldman](http://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Dennis+R.+Heldman%22), [Richard W Hartel](http://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Richard+W+Hartel%22), Springer Science & Business Media,1997
4. Phase Transitions in Foods, Yrjö H. Roos , Academic Press,1995

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| **MTOE-203A** | **Industrial Safety** | | | | | | |  | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Theory** | **Sessional** | **Practical** | **Total** | | **Time** |
| **4** | **0** | **0** | **4** | **60** | **40** | **-** | **100** | | **3 Hrs.** |
| **Program Objective (PO)** | To enable students to aware about the industrial safety. | | | | | | | | |
| **Course Outcomes (CO)** | | | | | | | | |  |
| **CO1** | Understand the industrial safety. | | | | | | | | |
| **CO2** | Analyze fundamental of maintance engineering. | | | | | | | | |
| **CO3** | Understand the wear and corrosion and fault tracing. | | | | | | | | |
| **CO4** | Understanding that when to do periodic inceptions and apply the preventing maintance. | | | | | | |  | |

**Unit-I:**

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, washrooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

**Unit-II:**

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

**Unit-III:**

Fault tracing: Fault tracing-concept and importance, decision treeconcept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic,automotive, thermal and electrical equipment’s like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

**Unit-IV:**

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

**Reference:**

* Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
* Maintenance Engineering, H. P. Garg, S. Chand and Company.
* Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
* Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

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| **MTOE-205A** | **Operations Research** | | | | | | |  | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Theory** | **Sessional** | **Practical** | **Total** | | **Time** |
| **4** | **0** | **0** | **4** | **60** | **40** | **-** | **100** | | **3 Hrs.** |
| **Program Objective (PO)** | To enable students to aware about the dynamic programming to solve problems of discreet and continuous variables and model the real world problem and simulate it. | | | | | | | | |
| **Course Outcomes (CO)** | | | | | | | | |  |
| **CO1** | Students should able to apply the dynamic programming to solve problems of discreet and continuous variables. | | | | | | | | |
| **CO2** | Students should able to apply the concept of non-linear programming | | | | | | | | |
| **CO3** | Students should able to carry out sensitivity analysis | | | | | | | | |
| **CO4** | Student should able to model the real world problem and simulate it. | | | | | | |  | |

**Unit 1:**

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

**Unit 2**

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

**Unit 3**

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

**Unit 4**

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

**References:**

* H.A. Taha, Operations Research, An Introduction, PHI, 2008
* H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
* J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
* Hitler Libermann Operations Research: McGraw Hill Pub. 2009
* Pannerselvam, Operations Research: Prentice Hall of India 2010
* Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

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| **MTOE-207A** | **Cost Management of Engineering Projects** | | | | | | |  | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Theory** | **Sessional** | **Practical** | **Total** | | **Time** |
| **4** | **0** | **0** | **4** | **60** | **40** | **-** | **100** | | **3 Hrs.** |
| **Program Objective (PO)** | To enable students to make aware about the cost management for the engineering project and apply cost models the real world projects. | | | | | | | | |
| **Course Outcomes (CO)** | | | | | | | | |  |
| **CO1** | Students should able to learn the strategic cost management process. | | | | | | | | |
| **CO2** | Students should able to types of project and project team types | | | | | | | | |
| **CO3** | Students should able to carry out Cost Behavior and Profit Planning analysis. | | | | | | | | |
| **CO4** | Student should able to learn the quantitative techniques for cost management. | | | | | | | | |

**Unit-I**

Introduction and Overview of the Strategic Cost Management Process

Cost concepts in decision-making; relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

**Unit-II**

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

**Unit-III**

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

**Unit-IV**

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

**References:**

* Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
* Charles T. Horngren and George Foster, Advanced Management Accounting
* Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
* Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
* N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

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| **MTOE-209 A** | **Industerial statistics** | | | | | | | |  |
| **Lecture** | **Tutorial** | | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Practical** | **Total** | **Time** |
| **3** | **0** | | **0** | **3** | **60** | **40** | **-** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | To enlighten the knowledge to Student on BasicIndusterial statistics. | | | | | | | | |
| **Course Outcomes (CO)** | | | | | | | | | |
| **CO1** | | Students will be able to able to measures of Central | | | | | | | |
| **CO2** | | Students will be gain knowledge about classification of Data. | | | | | | | |
| **CO3** | | Students will be able to Know test of Significance. | | | | | | | |
| **CO4** | | Students will be able to Gain knowledGraphical Representation of Biometric Data | | | | | | | |

**UNIT- I**

**Classification of Data:**

1. Introduction purpose and scope
2. Statistics terms & notations
3. Presentation of frequency distribution table
4. Some basic rules in preparation frequency
5. Distribution table
6. Exercise

**Graphical Representation of Biometric Data:**

1. Introduction and unit of representation
2. Quantitative and continuous data
3. Histogram
4. Frequency polygon
5. Frequency curve
6. Cumulative Frequency curve or ogive
7. Scatter or dot diagram
8. Quantitative and discontinuous data
9. Bar diagram
10. Pie chart and sector diagram
11. Exercise

**UNIT-II**

**Measures of Central Tendency:**

1. Introduction
2. Mathematical average
3. Arithmetic mean
4. Geometric mean
5. Harmonic mean
6. Averages of position
7. Median
8. Mode
9. Exercise

**Measures of Dispersion**:

1. Introduction
2. Range
3. Quartile Deviation
4. Mean Deviation
5. Standard Deviation
6. Variance
7. Exercise

## **UNIT-III**

**Test of Significance:**

1 Introduction definition and uses of standard error of mean

2 Standard error of mean (SEM) in ungrouped data.

1. Standard error of mean (SEM) in grouped data.
2. Standard error of Standard deviation in ungrouped data.
3. Standard error of Standard deviation in grouped data.

**Student’s Test:**

1. Introduction
2. Unpaired or uncorrected T- Test.
3. Paired or corrected T- Test.

4 T- Test from Paired grouped data.

**The CHI- SQUARE Test:**

1. Introduction, definition and common application of Chi- Square.
2. Pre – requisites of Chi- Square test and method to draw inference.
3. Calculation of Chi Square Test
4. Exercise.

**UNIT – IV**

**Probability:**

1. Introduction
2. Terminology related to probability.
3. Definition of probability.
4. Calculation of probability of simple events.
5. Rules probability of simple events.
6. Rules of probability
7. Conditional probability distribution.
8. Theoretical probability distribution. 9Types of probability distribution.
9. TheBinomial distribution.
10. The poission distribution.
11. The normal distribution.
12. Deviation from the normal Distribution - Skew ness.
13. Kurtosis 15 Exercise.

**Correlation:**

1. Introduction
2. Positive, negative and linear correlation
3. Correlation coefficient
4. Method of studying correlation
5. Types of correlation
6. Pearson’s products moment method
7. Spearman’s rank difference method
8. Standard error of correlation coefficient and verification. 9Signification of correlation coefficient.

**Regression :**

1. Introduction and difference between correlation and Regression
2. Objective of Regression analysis
3. Liner Regression
4. Regression Equation
5. Regression coefficient
6. Calculation of Regression equation from values of deviation mean of two

variables

1. Standard deviation for the Regression line.

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| **MTOE-211A** | **Non Conventional Sources of energy** | | | | | | |  | |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Practical** | **Total** | | **Time** |
| **4** | **0** | **0** | **4** | **60** | **40** | **-** | **100** | | **3 Hrs.** |
| **Program Objective (PO)** | To enable students to aware about the sources of energy. | | | | | | | | |
| **Course Outcomes (CO)** | | | | | | | | | |
| **CO1** | Students should able to learn the Classification of energy sources. | | | | | | | | |
| **CO2** | Students should able to learn the Solar radiation. | | | | | | | | |
| **CO3** | Students should able to uses of gasifiers | | | | | | | | |
| **CO4** | Student should able to learn the Characterization of biomass. | | | | | | | | |

**Unit-1**

Classification of energy sources; Introduction to renewable energy sources and technologies, theirimportance for sustainable development and environmental protection, production and potentia

**Unit 2**

Solar radiation, measurement of solar radiation, types of solar collectors and their uses, solar thermal energy conversion and storage.

**Unit 3**

Solar PV cells, modules, arrays, conversion process of solar energy into electricity, applications Wind energy, potential & process of conversion, types of wind energy conversion systems

**Unit 4**

Characterization of biomass; briquetting of biomass, biomass combustion, pyrolysis, gasification,types and uses of gasifiers,.

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| **MTOE-213 A** | **INSTRUMENTATION & PROCESS CONTROL** | | | | | | | |  |
| **Lecture** | **Tutorial** | | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Practical** | **Total** | **Time** |
| **3** | **0** | | **0** | **3** | **60** | **40** | **-** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | To enlighten the knowledge to Student on Basic Building Blocks of any Instrumentation System. | | | | | | | | |
| **Course Outcomes (CO)** | | | | | | | | | |
| **CO1** | | Students will be able to able to Definitional and Classification of transducers | | | | | | | |
| **CO2** | | Students will be gain knowledge about Basic Control Loops and Characteristics. | | | | | | | |
| **CO3** | | Students will be able to KnowControl System Components . | | | | | | | |
| **CO4** | | Students will be able to Gain know led Temperature Measurement | | | | | | | |

## **UNIT – I**

**Basic Building Blocks of any Instrumentation System** :- Scope and necessity of instrumentation. Names of important process variable, their units. Building blocks of instrumentation system. Various testing signals

**Basic Concepts :-**Definition of the terms accuracy, precision sensitivity, Linearity, hysteresis gauge factor etc.

**Definitional and Classification of transducers** :-Selection criteria of transducers. Variable Resistance transducers. Construction, working, principle and application of potentiometers, strain gauge, load cell. Hot wire anemometer, photo resistor, humidity sensor. Resistor temperature transducers

**Thermistors :-** Carbon microphones. Variable inductance Transducers. Basic Principles. Electromagnetic pick up. Induction potentiometer. Linear variable differential transformer (LVDT). Variable Reluctance Transducers. Variable Capacitance Transducers

1. Basic principles
2. Capacitance Pick up
3. Condenser microphones
4. Differential Capacitor Pick up

## **UNIT-II**

**Piezoelectric Transducers** :-Basic Principals of Piezoelectric Transducers Piezoelectric crystals and their properties. General forms of Piezoelectric Transducers. Seismic pick up

**Magneto – strictive Transducers :-** Magneto elastic property of nickel and perm alloy, construction of magnetostrictivetransducers.Other types of Transducers. Transducers based on hall effect, eddy current, ionization Optical Transducers – photo diode, Photo transistor, Photo voltaic cell, LDR Digital transducers-single shaft encoders. Tacho generator

**UNIT-III**

**Basic Control Loops and Characteristics :-**Introduction, R, L, C elements in pneumatic, hydraulic and electrical system. Simple process like:

1. Single capacity pressure system
2. Single capacity temperature system
3. Single capacity level system
4. Single flow loop system

**Control system :-** Basic elements of a feedback control system, open loop, feedback and lead forward linear and non-linear, continuous and sampled data control systems digital control, practical examples of the above.

**Control System Components :-**DC and AC servomotors, tacho-generator, potentiometer, synchros, stepper motor, gyroscope, AC position control system. Trends in process control, safety aspects in instrumentation and control system, economics of process instrumentation, selection of key variables for process controls pneumatic and electronic instrumentation.

**Flow Measurement :-**Flow measurement with orifices, magnetic, ultrasonic, vortex flow meters. Level Measurements. Level detectors, float level devices, level gauges, optical level devices, radiation level sensors, thermal level sensors.

## **UNIT-IV**

**Temperature Measurement** :-Temperature sensors-thermocouples, RTD, thermistors, radiation thermometry, IR detectors, fiber-optic temperature sensor; acoustic pyrometer. Pressure measurement. Pressure sensors, below, diaphragm, bourdon and helical types, electronic pressure sensor, manometers, pressure gauges, vacuum sensor, high pressure sensors, pressure repeaters. Measurement systems for density, pH, humidity, moisture and weight. Instrumentation and safety. Alarm and shutdown devices, safety interlock systems. Computer control system – introduction to SDC and DDC and their application in process industries.

**TEXT BOOKS:**

1. Mechanical and Industrial Measurement by RK . Jain, Khanna Publishers, New Delhi
2. Industrial Instrumentation by Donald P Eickman
3. Electrical and Electronic Measurement and Instrumentation by AK Sawhney,

DhanpatRai and company

## **REFERENCE BOOKS:-**

1. Automatic Control System by Kuo, BC, Prentice Hall of India, New Delhi
2. Modern Control Engg. by Ogata K, Prentice Hall of India, New Delhi

Theory and Problems of Feedback control system by Schaum series,Schajit Publishing Co, New.

**Dissertation Phase – I and Dissertation Phase - II**

**Teaching Scheme**

Lab work : 20 and 32 hrs/week for Dissertation Phase- I (MFT -203A)and Phase- II (MFT-202 A) respectively

**Course Outcomes:**

At the end of this course, students will be able to

* 1. Ability to synthesize knowledge and skills previously gained and applied to an in-depth study and execution of new technical problem.
  2. Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design, and justify their design.
  3. Ability to present the findings of their technical solution in a written report. Presenting the work in International/ National conference or reputed journals.

**Syllabus Contents:**

The dissertation / project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study. The dissertation should have the following

1. Relevance to social needs of society

* Relevance to value addition to existing facilities in the
* Relevance to industry need

1. Problems of national importance
2. Research and development in various domain
3. The student should complete the following:

* Literature survey Problem
* Definition Motivation for study and Objectives
* Preliminary design / feasibility / modular approaches
* Implementation and Verification

5. Report and presentation

The dissertation phase- II is based on a report prepared by the students on dissertation allotted to them. It may be based on:

Experimental verification / Proof of concept.

Design, fabrication, testing of Communication System.

The viva-voce examination will be based on the above report and work.

**……..**

**Guidelines for Dissertation Phase – I and Phase-II**

As per the AICTE directives, the dissertation is a yearlong activity, to be carried out and evaluated in two phases i.e. Phase – I: July to December and Phase – II: January to June.

The dissertation may be carried out preferably in-house i.e. department’s laboratories and centers OR in industry allotted through department’s T & P coordinator.

After multiple interactions with guide and based on comprehensive literature survey, the student shall identify the domain and define dissertation objectives. The referredliterature should preferably include IEEE/IET/IETE/Springer/Science Direct/ACM journals in the areas of Computing and Processing (Hardware and Software), Circuits-Devices and Systems, Communication-Networking and Security, Robotics and Control Systems, Signal Processing and Analysis and any other related domain. In case of Industry sponsored projects, the relevant application notes, while papers, product catalogues should be referred and reported.

Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and phase wise work distribution, and submit the proposal within a month from the date of registration.

Phase – I deliverables: A document report comprising of summary of literature survey, detailed objectives, project specifications, paper and/or computer aided design, proof of concept/functionality, part results, A record of continuous progress.

Phase – I evaluation: A committee comprising of guides of respective specialization shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend repeating the Phase-I work.

During phase – II, student is expected to exert on design, development and testing of the proposed work as per the schedule. Accomplished results/contributions/innovations should be published in terms of research papers in reputed journals and reviewed focused conferences OR IP/Patents.

Phase – II deliverables: A dissertation report as per the specified format, developed system in the form of hardware and/or software, A record of continuous progress.

Phase – II evaluation: Guide along with appointed external examiner shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend for extension or repeating the work