

YASHAVANTRAO CHAVAN INSTITUTE OF SCIENCE, SATARA (Autonomous)

**Draft Syllabus Structure for M.Sc.-I Food Processing and Packaging
(2021-22)**

YASHAVANTRAO CHAVAN INSTITUTE OF SCIENCE, SATARA									
COURSE STRUCTURE UNDER CHOICE BASED CREDIT SYSTEM(CBCS)									
M.Sc.Food Processing and Packaging (ENTIRE)									
M. Sc. I SEMESTER– I (Duration– 6Months)									
Sr. No.	SUBJECT CODE	PAPERNO AND TITLE	TEACHING SCHEME						
			Theory			Practical			
			No. of lectures	Hours	Credits	Subject	No. of lectures	Hours	Credits
1	MFPT 101	Post-Harvest Technology of Fresh Horticulture Produce	4	4	4	MFPP 105: Post Harvesting of Horticulture Produce and New food product development	8	8	4
2	MFPT 102	New Food Product Development	4	4	4				
3	MFPT 103	Introduction to paper and paperboard ,Plastics and Polymer	4	4	4	MFPP--106: Paper and paperboard, Plastics and Polymer packaging and Research Methodology.	8	8	4
4	MFPT 104	Research Methodology	4	4	4				
Total of SEMI			16	16	16		16	16	8

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M.Sc.Food Processing and Packaging (ENTIRE)

M. Sc. ISEMESTER– II (Duration– 6Months)

Sr. No.	SUBJECT CODE	PAPER NO ANDTITLE	TEACHING SCHEME						
			Theory			Practical			
			No. of lectures	Hours	Credits	Subject	No. of lectures	Hours	Credits
1	MFPT 201	Technology of Cereals, Legumes and Oil Seeds	4	4	4	MFPP 206:Technology of Cereals, Legumes and Oil Seeds and Meat and Instrumentation and Process Control	8	8	4
4	MFPT 202	Food Plant Layout	4	4	4				
4	MFPT 203	Packaging Laws and Regulation	4	4	4	MFPP 207:Packaging Laws and Regulation and Instrumentation and Process Control	8	8	4
4	MFPT 204	Instrumentation and Process Control	4	4	4				
Total of SEMII			16	16	16		16	16	8

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M.Sc.Food Processing and Packaging (ENTIRE)

M.Sc. ISEMESTER– III (Duration– 6 Months)

Sr. No.	SUBJECT CODE	PAPERNO ANDTITLE	TEACHINGScheme						
			Theory			Practical			
			No. oflectures	Hours	Credits	Subject	No. oflectures	Hours	Credits
1	MFPT 301	Quality Evaluation of Supply chain of Fresh produce	4	4	4	MFPPP 305 :Quality Evaluation of Fresh produce and Advanced food packaging	8	8	4
2	MFPT 302	Advanced Food Packaging	4	4	4				
3	MFPT 303	Climate Smart and Food Security	4	4	4	MFPP 306 : Research Project	8	8	4
4	MFPT 304 A	Cold Storage and Refrigeration	4	4	4				
5	MFPT304B	Green Storage Technology	4	4	4				
Total of SEMIII			16	16	16		16	16	08

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M.Sc.Food Processing and Packaging (ENTIRE)

M.Sc. II SEMESTER – IV(Duration – 6Months)

Sr. No.	SUBJECTCODE	PAPERNO ANDTITEL	TEACHINGScheme						
			Theory			Practical			
			No. oflectures	Hours	Credits	Subject	No. oflectures	Hours	Credits
1	MFPT 401	Snack Food and Extrusion Technology	4	4	4	MFPP 405: Status Paper cum seminar	8	8	4
2	MFPT 402	Renewable energy in Food Processing	4	4	4				
3	MFPT 403	Packaging Design Concepts and application of computer in Packaging Design	4	4	4	MFPP 406: Internship	8	8	4
4	MFPT 404A	Marketing Management in Food Sector	4	4	4				
5	MFPT 404B	Entrepreneurship in Food Processing	4	4	4				
Total of SEMIV			16	16	16		16	16	8

SEMESTER I

MFPT-101 Post Harvest Management of Fresh Horticulture produce

Learning Objective: Students should-

- Understand and learn the relevance of postharvest management of fruits and vegetables
- Impart knowledge about best practices in fruits and vegetables to reduce postharvest losses

UNIT-I: Introduction of postharvest technology (15 Lectures)

Introduction of postharvest technology (India and abroad); Need of post-harvest technology. Effect of pre-harvest factors (soil, water, climatic factors etc.) on the quality of fresh horticultural produce; Postharvest biology of horticultural crops; Maturity, Maturity indices, ripening, climacteric phenomena and senescence; Harvesting and harvesting systems

UNIT-II: General post-harvest considerations (15 Lectures)

Effects of temperature on postharvest life of horticultural produce (impact of temperature, cooling of produce, methods of cooling); Storage atmosphere (oxygen & carbon dioxide, storage in plastic films, hypobaric storage, ethylene in storage and management.

UNIT-III Packing house unit operations (15 Lectures)

Needs of a packing house Safety and hygiene sanitation; on farm food safety for fresh produce; Evaluation and management of Quality; Packinghouse operations; Quality selection and size-grading, Special treatments after packaging.

UNIT-IV Post harvest handling operations(15 Lectures)

Post-harvest handling for fruits; Preparation for market; Measuring quality; Evaluation and management of quality; Methods for determining quality of fresh commodities, Export regulations and requirement for selected fresh fruits - banana, pomegranate, citrus, mango, guava, apples, lichi and selected vegetables of national importance - lady finger, chilies, tomato, sweet corn.

Recommended Readings:

1. Roberston G.L. 2006. Food Packaging: Principles and Practice. Taylor and Francis.
2. Mattsoon B. and Sonesson U. 2000 Environment-friendly food processing. Woodhead Publishing Ltd.
3. Ahevenainen R. 2003. Novel Food Packaging Techniques. Woodhead Publishing Ltd.
4. J. F. Hanlon, R. J. Kelsey, and H. R. Forcinia, 1985 Handbook of Packaging Engineering, 3rd ed., Technomic Publishing, Basel.

5. Postharvest Technology of Horticultural Crops by Adel Kader
6. Postharvest by R. Wills, B. McGlasson, D. Graham, and D. Joyce
7. Fruits and Vegetable Preservation : Principles and Practices by R.P. Shrivastava and SanjeevKumar
8. Postharvest Physiology, Handling and Utilization of Tropical and Sub-Tropical Fruits andVegetables by E.B. Pantastico
9. Postharvest Technology of Fruits and Vegetables by L.R. Verma
10. IIHR-ICAR document on postharvest losses
11. Handling of fresh fruits, vegetables and root crops - Agricultural Marketing Improvement Prepared By Gaetano Paltrinieri Senior Food Technology and Agro-industries Officer

Course outcomes.

Unit I: After completion of the unit, Student are able to

1. Understand the need for post-harvest technology
2. Understand the harvest and harvesting techniques.

Unit II: After completion of the unit, Student are able to

1. Understand the effect of temperature on post-harvest horticulture produce.
2. Understand the storage and its management.

Unit III: After completion of the unit, Student are able to

1. Evaluate the need, safety and sanitation of fresh produce.
2. Understand the special treatments after packaging

Unit IV: After completion of the unit, Student are able to

1. Understand the know technologies of extending shelf life of fresh horticulture produce
2. Understand Share information about recent trends in research and sharing of domain knowledge and protocols for storing fruits and vegetables.

MFPT 102: New Food Product Development

Learning Objective: Student should:

1. Define New Product, Classification, and reason for food product development.
2. Understand product development process, Product launch process.
3. Understand the nutritional and sensory analysis, shelf life study of new product.

UNIT-I: Introduction and Definition of New food Product**(15 Lectures)**

Introduction, Defining New Food Products, Reason for new food product development, Types new product, Concept of Novel food, Life cycle for a food product, Ideas for the development of a New Food Product: internal and external sources. Advantages and disadvantages of new product development process. Marketplace studies- Focus groups, Interviews, Consumer testing.

UNIT-II: Process of product development**(15 Lectures)**

Concept of product development - product success and failure, factors for success, process of product development, managing for product's success. Innovation strategy. Product development process - product strategy, product design and process development, product commercialization, product launch and evaluation.

UNIT-III: Analysis and Legal requirement for new product**(15 Lectures)**

Nutritional and sensory evaluation of a new product, Shelf life testing- Static, accelerated and use/abuse tests. Industrial criteria. Packaging requirements of new product. Cost estimation. Direct and indirect costs, Legal aspects to be applied in New Food Product Development - Composition, labelling and claims.

UNIT-IV: Marketing of new product**(15 Lectures)**

Role of consumers in product development, managing the product development process, improving the product development process - evaluating product development, innovative matrices, striving for continuous improvement, improving success potential of new products, market exploration and acquisition, legal aspects of new product launch.

Course outcomes.**Unit I: After completion of the unit, Student are able to**

3. Define new product, its classification.
4. Understand the reason and shelf life study of new product.

Unit II: After completion of the unit, Student are able to

3. Understand the product success and failure.
4. Understand the process of product development, product launch and evaluation.

Unit III: After completion of the unit, Student are able to

3. Evaluate the product on the basis of nutritional and sensory analysis.
4. Understand the legal aspects to be applied in New Food Product Development.

Unit IV: After completion of the unit, Student are able to

1. Understand the role of consumers in product development process.

2. Understand improving success potential of new products

Recommended Readings-

1. Clarke & Wright W. 1999. Managing New Product and Process Development. Free Press.
2. Earle and Earle 2001. Creating New Foods. Chadwick House Group.
3. Earle R, Earle R & Anderson A. 2001. Food Product Development. Woodhead Publ.
4. Fuller 2004. New Food Product Development - from Concept to Market Place. CRC.
5. Moskowitz, Howard R. 2009. An Integrated Approach to New Food Product Development. CRC Press

MFPT 103 Introduction to Paper and Paperboard, Plastics and Polymer

Learning Objectives: Students should:

1. Understand the fundamentals of polymer science.
2. Study paper and their manufacturing process
3. Study the different types of plastics and their associated properties.
4. Understand the various testing methods employed on plastic materials

UNIT I: Introduction to Polymers

(15 Lectures)

Introduction to Historical Background of Polymer Science, Various applications of polymers, Raw materials, Market and future of polymers, India in global scenario, Classification of Polymers

Classification based on structure, origin, fabrication, properties, Introduction to polymeric blends and composites: Significance of polymeric blends and composites, miscellaneous materials used in blending and preparation of composites, applications of polymeric blends and composites.

UNIT II: Introduction to paper

(15 Lectures)

Types of papers, Paper properties: Optical properties – Color, brightness, smoothness, gloss, opacity and rub resistance, Strength properties–thickness, grammage, tensile, tear, bursting strength, stiffness, Grain direction, Wire and Felt sides Paper based packaging: Paper bags & Applications- Types of bags- Multiwall Paper bags – Composite containers, Manufacturing & Applications convolute/ spiral/lap winding –Fiber drums- Regenerated Cellulosic films.

UNIT III: Paper Board Manufacture, cartons and Boxes

(15 Lectures)

Paper Board Manufacture: Forming section, wet pressing, drying, and calendaring, paperboard properties and their control during manufacture Folding Cartons – Styles and Applications- Designing and manufacturing-Set up box applications and manufacturing process- Corrugated Fiber Board(CFB) – structure and materials ,Types of flutes and their characteristics- Manufacturing process of CFB- Making of CFB box- Styles of boxes- Properties of CFB Solid Fiber board box manufacturing, materials and applications. Moulded pulp board – moulding process, applications.

UNIT IV: Commodity Plastics in Packaging

(15 Lectures)

Polyethylene (PE): Types, Properties and Applications. Polypropylene(PP): Varieties, Properties and Applications. Polyvinyl Chloride (PVC): Properties, Compounding and Applications. Polystyrene (PS): Types, Properties and Applications. Copolymerization, Alloying and Blending, Applications of Amino plastics (Urea Formaldehyde and Melamine Formaldehyde), Phenolic, Epoxies, Unsaturated Polyesters, Polyurethane. Brief introduction on Biodegradable plastics / Bio plastics.

Course outcomes.

Unit I: After completion of the unit, Student are able to

1. Understand the polymers and its market importance.
2. Understand the applications of polymeric blends.

Unit II: After completion of the unit, Student are able to

- 1.Understand the papers and types of papers.
- 2.Understand the applications of various paper bags.

Unit III: After completion of the unit, Student are able to

1. Understand the manufacturing of paper boats, folding cartons,etc
2. Understand the applications of all the manufacturing process.

Unit IV: After completion of the unit, Student are able to

1. Understand the polyethylene and its types.
2. Understand the applications of plastics in packaging.

Recommended Readings-

1. Gullichsen J. and Paulapuro H., “Papermaking Science and Technology, Book 12: Paper And Paperboard Converting (Ed. Savolainen A.)”, Finnish Paper Engineers’ Association and TAPPI. 2012
2. Gullichsen J. and Paulapuro H., “Papermaking Science and Technology, Book 13: Printing (Ed. Oittinen P. and Saarelma H.)”, Finnish Paper Engineers’ Association and TAPPI.2012

3. Gullichsen J. and Paulapuro H., "Papermaking Science and Technology, Book 17: Pulp and Paper Testing (Ed. Levlin J.-E. and Söderhjelm L.)", Finnish Paper Engineers' Association and TAPPI. 2012
4. Mark R. E., "Handbook of Physical and Mechanical Testing of Paper and Paperboard", Vol. 1&2, Marcel Dekker. 2002
5. Campbell I.M., "Introduction to synthetic polymers", Oxford University Press

MFPT 104 Research Methodology

Learning Objectives: Students should:-

1. Get basic knowledge on the fundamentals of research methodology.
2. Learn how to present research in scientific manner.
3. Get acquainted with different bio statistical tools in modern research.
4. Understand the relationship between statistics and biological research.

UNIT I: Introduction to Research Methodology I (15 Lectures)

A) Research Methods vs. Methodology

- i) Introduction.
- ii) Types: Library research, field research, laboratory research.

B) Defining a Research Problem

- i) Concept.
- ii) Selecting the research problem.
- iii) Techniques involved in defining problem.
- iv) Conclusion of the problem.

C) Research Design

- i) Need for research design.
- ii) Concept in research design.
- iii) Types of research design.

D) Developing a Research Plan

- i) Need.
- ii) Essential characteristics of research plan.

UNIT II: Introduction to Research Methodology II (15 Lectures)

A) Reporting Practical and Project Work

- i) Structure of report
- ii) Title, authors and their institution, abstract, keywords, abbreviations.
- iii) IMRAD technique
 - a) Introduction
 - b) Material and methods
 - c) Result discussion and conclusion
 - d) Acknowledgements.

B) Preparing a Grant Proposal for Research Project

C) Manuscript Submission to Research Journals

- i) Statement of proposal.
- ii) Ethical considerations.
- iii) Publishing editorial issues.
- iv) Preparation and submission.

UNIT III: Descriptive Statistics (15 Lectures)

A) Importance of statistics in Biology

- i) Samples and Population
- ii) Types of data, random sampling methods and sampling errors, scales and variables, accuracy and precision.

B) Measures of Central Tendency

- i) Mean (arithmetic, geometric, harmonic), median, percentile and mode.
- ii) Measures of dispersion – mean deviation, standard deviation and variance.
- iii) Measures of a) Skewness b) Kurtosis.

UNIT IV: Hypothesis Testing (15 Lectures)

A) Introduction to Hypothesis Testing

- i) Null hypothesis

ii) Alternate hypothesis.

B) Statistical Tools

i) Significance level, type I and type II errors, p-value, one tailed and twotailed tests.

ii) Distribution of sample means, standard error and confidence interval, Degrees of freedom

iii) Equality of two population means, proportions: t-tests and ztest

iv) Chi-square test - test for goodness of fit, independence and homogeneity

v) F test and ANOVA

Learning Outcomes: Students will able to:

1. Design a research plan.
2. Present research in scientific language.
3. Analyze research data employing bio statistical tools.
4. Statistically signify the importance of research data.

Recommended Readings

1. N. Gurumani (2010) Scientific thesis writing and paper presentation, MJP Publishers, Chennai – UNIT I, II.
2. C. R. Kothari (2004) Research Methodology; Methods and Techniques, 2nd Ed, New Age International Publishers, New Delhi –
3. Irfan Ali Khan and AtiyaKhanum, Fundamentals of Biostatistics. 3rd Ed. Ukaaz, Publications, Hyderabad –
4. Robert R. Sokal and F. James Rohlf (1969) Introduction to Biostatistics, 2nd Ed, Dover Publications, INC. Mineola, New York –
5. P.N. Arora, P.K. Malhan (2006) Biostatistics, Himalaya Publishing House, Mumbai.

MFPP--105: Post Harvesting of Horticulture Produce and New food product development Practical

1. Estimation of shelf life of packaged fruits and vegetable
2. Non-enzymatic browning and estimation of polyphenol oxidase

3. Active modified atmosphere packaging studies of fruits
4. Determine of Water activity
5. Artificial ripening for fruits
6. Market survey of existing products
7. Idea generation and selection of topic
8. Cost analysis
9. Standardization of product
10. Development of new product
11. Analysis of new products
12. Sensory evaluation
13. Marketing
14. Visit to Startup Company
15. Consumer feedback studies

MFPP 106: Paper and paperboard, Plastics and Polymer packaging and Research Methodology

Practicals

1. To find Grammage and thickness of paper, paperboard and plastic films.
- 2 To find the grain direction, felt and wire side of paper.
- 3 To find Cobb value of paper and board.
- 4 To find Bursting strength and burst factor of paper and CFB.
- 5 To find Tearing Strength of paper.
- 6 To find Stiffness of board.
- 7 To Identify flute types and dimensions of CFB.
- 8 To find individual grammage of CFB plies.
- 9 To find Box Compression strength of a CFB
- 10 To find RCT of paper and ECT of CFB
- 11 To perform tensile strength on paper and plastic films.
- 12 To perform Dart Impact Test on Plastic Films.
- 13 To find the specular gloss of plastics / paper / paperboard
- 14 Abstract writing.

- 15 Review Writing.
- 16 E-poster Presentation.
- 17 Determination of measures of central tendency: a) Mean, b) Median, c) Mode
- 18 Determination of measures of dispersion – a) Mean deviation, b) Standard deviation, c) Coefficient of variation.
- 19 Estimation of confidence interval for a normal distribution.
- 20 T-test and chi-square with test on sample data.

SEMESTER II

MFPT 201 TECHNOLOGY OF CEREALS, LEGUMES AND OIL SEEDS AND FOOD PLANT LAYOUT

UNIT -I

Wheat: Types and physicochemical characteristics; wheat milling -products and byproducts; factors affecting quality parameters; physical, chemical and rheological tests on wheat flour; additives used in bakery products; flour improvers and bleaching agents; manufacture of bakery products, pasta products and various processed cereal-based foods; manufacture of whole wheat atta, blended flour and fortified flour. Production of starch and vital wheat gluten.

UNIT -II

Rice: Classification, physicochemical characteristics; cooking quality; rice milling technology; by- products of rice milling and their utilization; Rice bran stabilization, oil extraction and refining, parboiling methods of rice criteria of quality of rice: aging of rice – quality changes; processed products based on rice

UNIT -III

Corn: Types and nutritive value; dry and wet milling, processing of corn in breakfast cereals, snacks, tortilla etc., production of glucose syrups, dextrose, high fructose corn syrups, modified starches. Barley: composition, milling, malting of barley, chemical and enzymatic changes during malting, uses of malt. Oat: composition, processing of oat, byproducts of oatmeal milling.

UNIT -IV

Legumes and oilseeds: composition, anti-nutritional factors, processing and storage; processing for production of edible oil, meal, flour, protein concentrates and isolates; extrusion cooking technology; snack foods; development of low cost protein foods. Oil extraction process – mechanism, solvent, SCE, oil refining, utilization of biproducts of oil milling.

Recommended Readings

1. Chakrabarthy, M.M. (2003). Chemistry and Technology of Oils and Fats. Prentice Hall.
2. Dendy, D.A.V., & Dobraszczyk, B.J. (2001). Cereal and Cereal Products. Aspen.
3. Hamilton, R.J., & Bhati, A. (1980). Fats and Oils - Chemistry and Technology. App. Sci. Publ.
4. Hosney, R.S. (1994). Principles of Cereal Science and Technology. 2nd Ed. AACC.
5. Kay, D.E. (1979). Food Legumes. Tropical Products Institute. 6. Kent, N.L. (1983). Technology of Cereals. 4th Ed. Pergamon Press.

MFPT 202 FOOD PLANT ORGANIZATION LAYOUT

UNIT I: Introduction of Plant Organization.

(15 lectures)

Operation Research, definition and scope, techniques in operation research. Food plant management factors bearing on location and layout of food plants, Regulatory requirements of food industries.

UNIT II: Structure and Operation of Food Plant.

(15 lectures)

Structure and operation of food plants, Executive design making in a food plant, Decision protocols, Evolution and role of management planning organizing and controlling, Decision processed for raising efficiency, productivity and quality in food plant operation, System analysis, its need and methodology.

UNIT III: Design of Food Plant

(15 lectures)

Classification of Dairy and Food Plants, farm level collection and chilling center, space requirement. Overall design of an enterprise : Plant design, sales planning for plant design , Strength of material – engineering materials, material science, use of various metals, including plastic, glass, etc. in food industry,

UNIT IV: Preparation of a Plant Layout

(15 lectures)

Plant Layout problem, importance, objectives, and classical types of layouts. Evaluation of Plant Layout. Advantages of good layout. Organizing for Plant Layout, Data forms, Common Problems in Plant Layout and Process scheduling, Sitting of Process sections, Equipment selection and capacity determination

Recommended Readings

- 1 Sivarethinamohan, R. Operations Research. Tata McGraw_Hill Pub. Co. Ltd.,2005
- 2 Managerial Economics- Analysis, Problems and cases.Metha, P.L. 2003., Sultan Chand and Sons, New Delhi.(Unit-I,II)
3. Milk Plant Layout H.S. Hall FAO Pub., Rome 1968 2
4. Plant Layout and Design James M.Moore Mac Millan, New York 1971
- 5.Textbook of Dairy Plant Layout and Design --- ICAR, New Delhi 2010
6. Applied guide to process and plant design Sean Moran Elsevier, 2015
7. Facility Planning And Layout Design ChandrashekarHiregoudar Technical Publications, 2017
8. Engineering for Dairy and Food Products A.W. FaralRebert E., Kriger Pub Co., New York 1980 3
9. Practical Plant Layout Richard Muther McGraw Hill, 1955

MFPT 203: Packaging Laws and Regulation

UNIT I

Indian Regulatory System Introduction, Laws and regulations- Need/Importance – Bureau of Indian Standards The Standards of weights and Measures Act (SWMA), Standard Units, Laws, Regulations and Ministries involved, Essential Commodities Act, Agricultural Produce (Grading and Marketing) Act, Prevention of Food Adulteration Act, Codex Standard Act, Export (Quality Control and Inspection) Act, Declarations on Packaged Commodities -Declarations for Interstate Trade and Commerce, Standard Packages, Maximum Permissible Error, Label Declarations, Standard Quantity specifications for various products, Symbols and Units used.

UNIT II

International Laws CE Marking, EU-REACH Regulations in packaging, RoHS (Restriction on Hazardous Substances), Uniform Weights and Measures Law, Details of Violations, offences, Penalties under various sections, ISO 14000 Environment Management System, IMDG (International Maritime for Dangerous Goods), EU Directives, Various storage requirements of Products, Specifications of Raw Materials used, IS Specifications with respect to packaging and Packaging Materials

UNIT III

Introduction to Sustainability Sustainable Development & Processes, Need Today, Three Pillars of Sustainability & their effects on sustainable growth – Relation with environment waste management 05 Relevance of Sustainable Development in Packaging Sector – Traditional Packaging vs. Sustainable Packaging.

UNIT IV

Labelling regulations, Due diligence, Grouping information on the label, Nutritional labelling, Making a claim about vitamins and minerals, Date marking, Allergens declaration, Print size and clarity, Net quantity, Quantitative ingredient declaration/calculation (QUID), Use of symbols or icons, Specific labelling requirement

MFPT 204 Instrumentation and Process Control

UNIT 1

Transducers: Measurement of temperature, flow, pressure, humidity, Gas concentration, Specific gravity, Concept of bio-sensors. Introduction to Fuzzy logic & neural networks.

UNIT 2

Programmable logic controller, Data loggers, Data Acquisition Systems (DAS). Introduction to Direct Digital Control (DDC), Supervisory Control and Data Acquisition Systems (SCADA), Monitoring of plant parameters through Internet with SAP integration.

UNIT 3

Review of Laplace Transforms, concept of poles and zeroes, open and closed loop systems, transfer function, block diagram reduction technique.

UNIT 4

Signal flow graph reduction technique, Stability general concepts, absolute and relative stability, Routh stability criterion, Bode Plots.

Recommended Readings

1. Doebelin EO. 1966. Measurement System - Application and Design. McGraw Hill. Ernest O Doebelin. 1995.
2. Measurement Systems - Application and Design. McGraw Hill. Holman P 1996.
3. Experimental Methods for Engineers. McGraw Hill. Nachtigal CL. 1990.
4. Instrumentation and Control. Fundamentals and Application. John Wiley & Sons.

5. Thomas A.Hughes . Measurement and Control Basics – ISA Press
6. I.J Nagrath ,M.Gopal – Control systems Engineering – New Age International.
7. BeckwithTG. 1996. Mechanical Measurements. Addison-Wesley.

MFPP 205 TECHNOLOGY OF CEREALS, LEGUMES AND OIL SEEDS AND FOOD PLANT ORGANIZATION LAYOUT

Practicals

1. Physical-tests on wheat and rice
2. Physicochemical and rheological properties;
3. Determination of gluten content in wheat flour;
4. Conditioning of wheat; Milling of wheat and rice by laboratory mill;
5. Parboiling of rice
6. Quality tests of rice: Amylose content determination in rice;
7. Malting, puffing and popping of grains
8. Preparation of protein concentrates and isolates and their evaluation for protein content and solubility;
9. Extraction of oil using expeller and solvent extraction methods
10. Visit to related processing industries.
11. Layout of Food storage wares and go-downs
12. Layout and design of cold storage
13. Layout of pre-processing house
14. Design and layout of flow shelf life product plant
15. Design and layout of fruits processing plants
16. Design and layout of vegetable processing plants
17. Layout of multiproduct and composite food plants
18. Evaluation of given layout
19. Waste treatment and management of food plant.

MFPP 206 Packaging Laws and Regulation and Instrumentation and Process Control

Practicals

1. Determination of gas transmission rate of packaging films.
2. Identification of plastic Films
3. Determination of water vapor permeability of packaging material.
4. To determine the static and dynamic tensile strength of paper
5. To measure the resistance of a paper board and corrugated board to puncture.
6. Measuring of bursting strength of paper.
7. Prepackaging of fruits and vegetables.
8. Measurement of temperature.
9. Measurement of liquid level
10. Measurement of Pressure
11. Measurement of Humidity
12. Measurement of Moisture
13. Measurement of Gas
14. Transducers and its applications
15. Development of capstone project related to ENG 559