JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
(Established by Govt. of A.P., ACT No.30 of 2008)
ANANTHAPURAMU – 515 002 (A.P) INDIA

M.Sc. IN FOOD TECHNOLOGY AND MANAGEMENT

COURSE STRUCTURE

SEMESTER – I

S. No.	Course codes	Course Name	Category	Hours per week			Credits
				L	T	P	
1.	21G13102	Instrumental Methods in Food Analysis	PC	4	-	-	4
2.	21G13103	Advances in Food Microbiology	PC	4	-	-	4
3.	21G26101	Management of Food Processing Industries	PC	4	-	-	4
4.	21G13105	Food additives and flavor Technology	PC	4	-	-	4
5.	21G13104	Research Methodology and Biostatistics	PR	4	-	-	4
6.	21G13107	Instrumental Methods in Food Analysis	PC	-	1	2	2
7.	21G13108	Advances in Food Microbiology Lab	PC		1	2	2
8.	21G26102	Management of Food processing Industries Lab	PC	-	1	2	2
9.	21G13109	Biostatistics and computer applications Lab	PC	-	1	2	2
		Total		22	3	6	28

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COURSE STRUCTURE

SEMESTER – II

S.No.	Course codes	Course Name	Category	Hours per week			Credits
				L	T	P	
1.	21G13201	Advances in Nutritional Biochemistry	PC	4	-	-	4
2.	21G13203	Food Processing and Packaging Technology	PC	4	-	-	4
3.	21G13204	Advances in Spices, Condiments & Confectionery Foods	PC	4	-	-	4
4.	21G26201	Institutional Food Service and Management	PC	4	-	-	4
5.	21G26202	Food Industrial Waste Management	PC	4	-	-	4
6.	21G13206	Advances in Nutritional Biochemistry Lab	PC	-	1	2	2
7.	21G13208	Food Processing and Packaging Technology lab	PC		1	2	2
8.	21G13207	Advances in Spices, Condiments & Confectionery Foods Lab	PC	-	1	2	2
9.	21G13209	Skill oriented course (Product design, development, packaging and marketing. Ex: Traditional foods, Pathiri rice based products, and local area products such as Tomato, groundnuts, millets etc) Mango seed utilization, Rice porridge dried in hot plate and coated with ghee and sugar	SC	-	1	2	2
		Total		20	4	8	28

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COURSE STRUCTURE

SEMSTER - III

S.No.	Course codes	Course Name	Category	Hours per			Credits
					T	P	
1.	21G13301	Advances in Cereals, Legumes and Oil Seed Technology	PC	4	-	-	4
2.	21G13303	Food Laws and Regulations	PC	4	-	-	4
3.	21G26301	Food Marketing and Advertising	PC	4	-	-	4
4.	21G13205	Advances in Food Preservation and Processing	PC	4	-	-	4
5.	21G13202	Advances in Technology of Animal based Foods.	PC	4	-	-	4
6.	21G13306	Advances in Cereals, Legumes Processing and Oil Seed Technology Lab	PC	-	1	2	2
7.	21G26302	Food Quality Analysis Lab	PC		1	2	2
8.	21G26303	Food Marketing & Advertising Lab and Advances in Technology of Animal based Foods Lab	PC	-	1	2	2
9.	21G26304	Co-curricular Activities					2
10	21DAC101	English for Research Paper writing	MC	2	-	-	0
		Total		22	3	6	28

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COURSE STRUCTURE

SEMESTER - IV

S.No.	Course codes	Course Name	Category	Hours per week			Credits
				L	T	P	
1.	21G13401a 21G26401a 21G26401b	**Program Elective:** Food Product Development and Commercialization Supply Chain Management Entrepreneurship and Business Management	PE	3	-	-	3
2.	21DOE301b 21DOE301a 21DOE301e	**General Elective** Industrial Safety Cost Management of Engineering Projects Waste to Energy	GE	3	-	-	3
3.	21G26402	Research Work				20	10
4.	21G26403	Comprehensive Viva voce		2			2
		Total		**8**	**-**	**20**	**18**

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COURSE STRUCTURE

Course Code	INSTRUMENTAL METHODS IN FOOD ANALYSIS	L	T	P	C
21G13102		4	0	0	4
	Semester	I			

Course Objectives:

- This course aims to provide the student to
- Acquire basic principles of simple instrumental methods for estimation of organic/inorganic species.
- Gain basic knowledge of limitations of analytical methods.
- Characterize the Materials synthesized by chemical industry.
- Understand the chromatographic techniques for the separation of impurities in the industrially synthesized compounds.

Course Outcomes (CO): Student will be able to

- **After completion of the course student shall be able to**
- Analyse the statistical data for the analysis in analytical chemistry.L3
- Acquire enough knowledge on industrial processes and Identification of Products using different analytical and instrumental techniques.L5
- Learn the basic principles of spectrophotometry like UV-Vis and IR.L1
- Gain the knowledge on HPLC and GC L1
- Learn the basic principles of GC-MS/MS and LC-MS/MS L1

UNIT - I

INTRODUCTION TO ANALYTICAL CHEMISTRY

Role of analytical chemistry in food technology –Volumetric and Gravimetric analysis. Preparation of standards, working standards and solutions of known concentration (percent, molar, molal, normal, ppm and ppb) and their dilution.

Classical analytical techniques: Gravimetry, Titrimetry, Refractometry and Polarimetry: Principle, Instrumentation and applications of each technique in food analysis.

UNIT - II

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COURSE STRUCTURE

CHROMATOGRAPHIC TECHNIQUES

Fundamentals of chromatographic separations and their classification. The plate theory, capacity factor and resolution factor, Chromatographic efficiency, Partition coefficient etc. Principle and applications of paper (Ascending, Descending, Radial, Two dimensional) Partition, Thin layer chromatography, HPTLC, size exclusion and ion exchange chromatography, Gas Chromatography.
High performance Liquid Chromatography (HPLC): Basics of liquid chromatography, HPLC columns and Stationary phase, mobile phases, isocratic and gradient elution, Detectors, applications in food analysis.

UNIT - III		

SPECTROSCOPY

Introduction of spectroscopy.Basic components of a spectrometer.UV- Visible spectrometry; Beer-Lamberts law, Absorbance, Transmittance, Molar absorptivity. Components and functioning of an UV-vis spectrophotometer. Single beam and Double beam. Calibration curve. Introduction-origin of IR spectra-instrumentation, group frequencies, applications of IR spectra analysis spectral data of alcohols-aldehydes and ketones –carboxylic acids –amines –amino acids –proteins, applications of in food analysis.

UNIT - IV		

ATOMIC ABSORPTION, ATOMIC EMISSION SPECTROSCOPY & ICP-MS

Principles- Atomization process, atomic line widths and radiation sources for AAS, temperature gradients, cells detectors, interferences. Atomic Emission spectroscopy: Atomic spectra, sources, Merits, demerits and applications. Basic principles and instrumentation of ICP-MS. Application of ICP-MS for analysis of metallic contaminates in food, Applications in food analysis.

UNIT - V		

HYPHENATED TECHNIQUES & BIOLOGICAL TECHNIQUES

Introduction to Mass spectrometry. GC-MS/MS, LC-MS/MS. DNA/Protein based: Fundamental principles and instrumentation of the systems. Measurement techniques and result interpretations of Polymerase chain Reaction (PCR) technique, Applications in food analysis

Textbooks:

1. Douglas A. Skoog, Donald M. West and F.James Holler, Analytical Chemistry and Introduction, Saunders college publishing, New York, 1990.
2. J. Bassett, R.C Denny, G.Jeffery and J.Mendham. Vogel's Text book of Inorganic Quantitative Analysis, 4th edition, Longman group Ltd, Harlow, 1985.
3. Sharma BK, Analytical chemistry , Krishan prakashan publication,vol 1, 2014
4. Gurudeep R, Chatwal and sham k, Anand, Instrumental Methods of Chemical Analysis, Himalyan publication house, vol 1, 2012.

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Reference Books:

Pietrazyk and Frank. Analytical Chemistry, 1990.

2. OmachonuV.K.and Ross J.E. Principles of Total Quality, S.Chand & Co.Ltd., New Delhi, 1997.
3. Werner Funk, Vera Damman, Gerhild Donnervert. Quality Assurance in Analytical Chemistry VCH Publishers, New York, NY (USA), 1997.
4. Y.Anjaneyulu, Quality Assurance and GLP- IGNOU Publications, New Delhi-99.

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COURSE STRUCTURE

Course Code	ADVANCES IN FOOD MICROBIOLOGY	L	T	P	C
21G13103		4	0	0	4
	Semester	I			

Course Objectives:

This course aims

- To provide the knowledge of microorganisms (probiotic, pathogens and spoilage)Associated with foods and their origin and role.
- To familiarize the factors that determine the presence, growth and survival of Microorganisms in food.
- To train the students on general principles of food microbiology.
- To acquire the knowledge on various fermentation processes

Course Outcomes (CO): Student will be able to

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

- Explain the interactions between microorganisms and the food environment, and Factors influencing their growth and survival.L2
- Explain the significance and activities of microorganisms in food L2
- Describe the characteristics of foodborne, waterborne and spoilage microorganisms, and methods for their isolation, detection and identification.L2
- Explain why microbiological quality control programs are necessary in food Production L2
- Explain the effects of fermentation in food production and how it influences the microbiological quality and status of the food product.L2

UNIT - I

Introduction to Biology-branches of biology-diversity among living organisms-classification system-(Two kingdoms, three kingdoms, five kingdoms) metabolism, catabolism, and anabolism.Origin of microbiology-definition, History, Scope of microbiology-Branches of microbiology. Microscopic Study of bacteria (Gram positive and Gram negative), yeast molds, viruses, with respect to morphology, reproduction growth, and nutritional requirements. Growth curve and reproduction.

UNIT - II

Culturing of microorganisms –methods of sterilization, disinfection and sanitation (Maintenance of aseptic conditions) Isolation, preservation and maintenance of pure culture. General and selective media for different types of microorganisms. Rapid methods of microbial analysis

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COURSE STRUCTURE

UNIT - III		
Food microbiology - Microbes in manufacturing of important food ingredients. Factors affecting spoilage of foods; Micro flora associated with various food groups their spoilage potential & control. Microbiological spoilage problems associated with typical food products. Microorganisms in food fermentation.		
UNIT - IV		
Harmful /deleterious effects –food borne infections, food poisoning, Microbial toxins, newer pathogens. Detection methods for *E. coli*, *Staphylococci*, *Yersinia*, *Campylobacter*, *Cereus*, *Cl.botulinum & Salmonella* from food samples.		
UNIT - V		
Industrial productions – fermentations, machines, fermentation types, chemo stat. Industrial production of alcoholic, distilled beverages, citric acid, lactic acid bread enzymes (amylase), acetic acid.Microbial food products, mushrooms, single cell proteins, dairy products-yogurt,curd, cheese, flavored milk.		
Textbooks:		
1. V. Ramesh, Food microbiology, MJP publishing, 2007. 2. W.C. Frazier, Food microbiology, Mc graw Hill Pub. Co. New York,5th Edition, 2013; 3. J.M. Jay Modern Food Microbiology, CBS publisher, 2nd edition, 2005.		
Reference Books:		
1. Atlas R.M, Basic and practical Microbiology, MacMillan Publication Company, New York,1934. 2. Cruger J.G. Black J.G. and Davison V.E. Microbiology principles and applications Prentice Hall of India Pvt. Ltd., 1990: 3. Hary W.S. Paul J and Van Denmark Microbes in action – a laboratory manual of Microbiology. Tarporwalsd. B. & sons, & Co., Ltd., Bombay. 1972: 4. Brock & Brock Basic Microbiology, CBS Publishers & Distributors, Prentice – Hall (India) Ltd., New Delhi. 1996.		

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COURSE STRUCTURE

Course Code	MANAGEMENT OF FOOD PROCESSING	L	T	P	C
21G26101	INDUSTRIES	4	0	0	4
	Semester	I			

Course Objectives:

This course aims to provide the student to

- To Introduce Management Concepts and Functions
- To Learn about various Functional areas of Management.
- To understand the selection of plant location.
- To get familiarize with basics of accountancy
- To study various methods of optimization applicable in business.

Course Outcomes (CO): Student will be able to

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

- Understand various types of business, managerial concepts, principles and functions of management.L2
- Understand roles and responsibilities of various functional areas of Management L2
- Aware Plant Location and Layouts for the Organization.L1
- Prepare Financial Statements for a typical business entity.L2
- Understand various methods of optimization of resources.L2

UNIT - I

MANAGEMENT INTRODUCTION

Types of business - Proprietorship, Partnership, Public Limited, Private Limited.
Management – Definition –Principles - Functions – Planning – Organizing – Coordinating – Directing – Controlling. – Organization Structures – types - advantages and disadvantages of each type.

UNIT - II

FUNCTIONAL MANAGEMENT SYSTEMS AND DEMAND & SUPPLY

Brief description of Functional Management systems - Financial Management, Human Resource Management, Production Management and Marketing Management. Labour welfare and safety measures – Forecasting the demand for the product and demand analysis – Supply and demand relationships.

UNIT - III

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COURSE STRUCTURE

PLANT LOCATION AND LAYOUT

Selection of project – Selection of Location – Economics of Site Location – Urban Vs Suburban Location – Plant layout – Types of Lay out – Flow lines – Material handling Equipment – Selection of Handling Equipment for Food Processing Industries – Introduction to production systems.

UNIT - IV		

BASICS OF ACCOUNTING

Introduction to Accounting – Stages of Accounting – types of Accounts - Journal & Ledger postings – Discussion on Trial Balance – Trading & Profit and Loss accounts – Balance sheet – Branches of Accounting: Financial Accounting, Management Accounting & Cost accounting – Types of Cost Accounting Methods - Methods of preparing cost sheet for the product manufactured.

UNIT - V		

OPERATIONS RESEARCH

Introduction to Operations Research – Model building – Brief description with simple examples of Linear Programming – Resource allocation model – Transportation model – Assignment model – Inventory Management – EOQ model – ABC, JIT, FIFO, FILO, VED and FSN analysis .

Textbooks:

1. O.P. Khanna, Industrial Engineering and Management – Dhanpat Rai publications,
2. Lisa Jordan, Food Industry: Food Processing and Management, Callesto Reference, 2015.

Reference Books:

1. V .K .Kapoor, Operations Research, Sultan Chand and sons, 2012
2. Ambrish Gupta Financial Accounting for Management – Pearson Education, 6th edition, 2018.
3. Kishore R.M, Cost & Management Accounting – Taxmann publications pvt ltd, 4th edition, 2006.
4. L.M. Prasad.Principles of Management, Sultan Chand and sons, 8th edition, 2013.

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COURSE STRUCTURE

Course Code	FOOD ADDITIVES AND FLAVOUR TECHNOLOGY	L	T	P	C
21G13105		4	0	0	4
	Semester	I			

Course Objectives:

This course aims

- To provide the knowledge of benefit of different types of additives and their estimation .
- To familiarize the antioxidants and their stability with applications.
- To train the students on general principles of food additives and flavor technology.
- To acquire the knowledge on various sweeteners, emulsifiers and food colours in food preparation processes

Course Outcomes (CO): Student will be able to

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

- Explain the different types of food additives and preservatives and their factors.L2
- Explain the significance and functions of preservatives and flavouring agents in food L2
- Describe the functional aspects of enzyme action and applications.L2
- Explain why food additives and flavoring agents necessary in food L2 Production
- Explain the Quality control of flavourings and their raw materials with their applications.L2

UNIT - I

Introduction: Types of additives, benefits of additives, risk of additives, regulations. Estimation of food additive intake- NOEL, ADI, toxicological classification of food additives Nutritional additives: Vitamins- chemistry, units and requirements, properties, commercial forms, amino acids, fatty acids, minerals and trace minerals, regulations and nutritional additives. FSSAI permitted food additives and their limits

UNIT - II

Preservatives (antimicrobials): Chemical and biological preservatives. Mechanisms of action.
Antioxidants: phenolic antioxidants- applications, natural antioxidants; oxidation and use of antioxidants. Oxidation measurement, oxidative stability and antioxidant effectiveness, analysis of antioxidants, regulation of phenolic antioxidants.

UNIT - III

Sweeteners: theory of sweetening, non-nutritive sweeteners, nutritive sweeteners, choice of sweeteners.
Food colours: History of the use of colours, role and use of colorants, types of colorants,

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COURSE STRUCTURE

toxicological considerations.
Emulsifiers: Emulsifier chemistry, emulsifier function and mechanism of action, emulsifier selection.
Application in foods: Cereal-based products, dairy products, candy products and miscellaneous applications.
Polysaccharides in foods: Starch, chemically modified starches, glycogen, cellulose and hemicelluloses, pectic substances, plant gums.

UNIT - IV

Enzymes: Functional aspects, mechanism of enzyme action, application of enzymes in the food, industry, regulations on the use of enzymes, toxicology.
Acid, bases and buffers (pH control agents)
Miscellaneous food additives: Firming agents, formulation aids, processing aids, propellants, solvents, chelating agents, synergists.
Methods used in safety evaluation. Hypersensitivity to food additives. Risks and benefits of food additives.

UNIT - V

Flavour technology: Flavouring agents- flavours – their nature, creation and production.
Function of flavours and their utilization, flavour regulations, flavour safety.
Flavour enhancers: Chemical properties, function in food, use of glutamate in food and regulations, toxicology, applications. Synthetic ingredients of food flavourings.
Quality control of flavourings and their raw materials, beverage flavourings and their applications.
Fruit juices, flavouring of confectionery and bakery products, flavours of snack and crisps. Thermal process of flavourings. Dairy flavourings.

Textbooks:

TEXT BOOKS:

1. NIIR Board of Consultants and Engineers, Food Colours, Flavours and Additives Technology Handbook, National Institute of Industrial Research.
2. Wood, R., Foster, L., Damant, A., & Key, P, Analytical methods for food additives. Elsevier, 2004.

Reference Books:

1. Attokaran Mathew, Natural Food Flavors and Colorants © Blackwell Publishing Ltd. And Institute of Food Technologists, 2011, ISBN: 978-0-813-82110-8
2. Mahindru, S.N, Food Analysis: Characteristics, Detection and Estimation. APH Publishing Corporation, 2008..
3. Msagati, T. A, The chemistry of food additives and preservatives. John Wiley & Sons, 2012.

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4. Rahman, M.S, Handbook of Food Preservation, 2nd edn. CRC Press, 2007.

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COURSE STRUCTURE

Course Code	RESEARCH METHODOLOGY AND BIOSTATISTICS	L	T	P	C
21G13104		4	0	0	4
	Semester	I			

Course Objectives:

This course aims

- To develop a research orientation among the students and acquaint them with fundamentals of research methods
- To have a knowledge about research and how research is conducted.
- To understand the data collection methods the sampling methods and the data analysis method.
- To create awareness about the importance of research in all fields.

Course Outcomes (CO): Student will be able to

Learning Outcomes:

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

- Obtain knowledge on various kinds of research questions and research design L2
- Describe qualitative, quantitative and mixed methods research.L2
- Design a good quantitative purpose statement and hypotheses.L6
- Explain the various types of quantitative sampling techniques and conditions use.L2
- Describe the various steps involved in coding qualitative data.L2
- Apply the various statistical tools to test the hypothesis , drawing inferences and obtain knowledge on writing different types of report.L3

UNIT - I

RESEARCH METHODOLOGY

Meaning, objectives and types of research. Research approaches, Significance of research, Research and scientific methods, Research process and Criteria of good research. Definition and Identification of a Research Problem – Selection of Research problem, Justification, Theory, Hypothesis, Basic assumptions, Limitations and delimitations of the problem.

UNIT - II

RESEARCH DESIGN AND MEASUREMENT

Explain the various types of quantitative sampling techniques and conditions use. Describe the various steps involved in coding qualitative data. Apply the various statistical tools to test the hypothesis & drawing inferences. Obtain knowledge on writing different types of report. Develop

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COURSE STRUCTURE

independent thinking for critically analyzing research reports.		
UNIT - III		
SAMPLING AND DATA COLLECTION SamplingTechniques–ProbabilityandNon–probabilitysamplingmethods-DataCollection Types of data–Primary and Secondary data–Methods of primary data collection–Observation, Interview, Questionnaire and schedule– Construction of questionnaire– pilot study–case study, literature survey.		
UNIT - IV		
DATA PREPARATION, ANALYSIS AND STATISTICS Data Preparation – editing – Coding –Data entry-Test of significance – Assumptions about Parametric and nonparametric tests. Parametric tests-Introduction ANOVA- Application of Statistical software for data analysis. Introduction to Descriptive Statistics–Hypothesis Testing–T-test–Analysis of Variance–Linear Regression.		
UNIT - V		
REPORT DESIGN AND WRITING Introduction-Research Report-Research Proposal –Different types –Contents of report– Important Parts – Title, Table of Contents – Synopsis, bibliography- Introductory Section –Research Design-Result– Sampling Techniques–Probability and Non probability sampling methods-Data Collection– Types of data– Primary and Secondary data Methods of primary data collection–Observation, Interview, Questionnaire and Schedule– Construction of questionnaire– pilot study–case study.		
Textbooks:		
1. Kothari, C.R., Research Methodology",Methods and Techniques, New Age International, 6th Edition, 2010.		
Reference Books:		
1. Panneerselvam,R., "Research Methodology", Prentice-Hall of India, New Delhi,7th Edition, 2004. 2. Donald R.Cooper, PamelaS. Schindle and JKSharma, Business Research Methods,11th Edition, Tata McGraw Hill, New Delhi, 2012.		

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COURSE STRUCTURE

Course Code	INSTRUMENTAL METHODS IN FOOD ANALYSIS LAB	L	T	P	C
21G13107		0	1	2	2
	Semester	**I**			

Course Objectives:

- This course aims to provide the student to
- The experiment is intend to know the conductance and potentiality of metals
- TLC method is able to separate the amino acids and sugars.
- Isolation methods are used to analyse the various organic compounds.

Course Outcomes (CO): Student will be able to

After completion of the course student shall be able to

- Student will be able to measure conductance and potentiality of various essential metals.L3
- Separation of amino acids and sugars by TLC method will be known to the student.L3
- Student will be able to analyze various organic compounds by isolation and spectrophotometric method.L3

List of experiments

1. Conductometric titrations.
2. Potentiometric titrations.
3. Separation of amino acids and Sugars by TLC/Paper chromatography.
4. Isolation of plant pigments by column chromatography
5. Verification of Beer's law and determination of molar extinction coefficient using p-nitro phenol.
6. Isolation and spectrophotometric characterization of plant pigments.
7. Isolation of amino acids by Electrophoresis.
8. Measurement of refractive index of oil sample.
9. Estimation of food sample by HPLC techniques
10. Estimation of fatty acids by GC.

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Reference Books:
1.Analytical Chemistry: Theory and Practice by Verma R.M 3rd edition ,2007. 2. Ms. Pooja R.Popat Practical book of Analytical Chemistry First Edition,2012.

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COURSE STRUCTURE

Course Code	ADVANCES IN FOOD MICROBIOLOGY LAB	L	T	P	C
21G13108		0	1	2	2
	Semester	I			

Course Objectives:

This course aims to provide the student to

- Acquire knowledge about microbiologically based laboratory equipment.
- Cultivate and enumerate microorganisms from various food samples.

Course Outcomes (CO): Student will be able to

At the end of each unit of learning, students will be able to

- Illustrate the role of microorganisms in food safety.L2
- Identify the microorganisms found in food.L2
- Experiment the techniques in control of food spoilage.L4
- Practice the methods for microbial examination for food.L2
- Able to detect microbial spoilage in foods.L2

List of experiments

1. Preparation of media for culturing autotrophic and heterotrophic microorganisms (agar medium, nutrient medium, Mcconkey agar and Blood agar).
2. Microscopic observation of lactic acid bacteria.
3. Estimation of alcohol during fermentation.
4. Isolation of microorganisms from spoiled fruits and vegetables.
5. Isolation of microorganisms from meat and meat products.
6. Enumeration and identification of E.coli from different water samples.
7. Enumeration and identification of coli forms in food samples.
8. Detection of food borne pathogens.

Reference Books:

1. Ahmed E. Yousuf, Carolyn carlstrom ,Food microbiology: A laboratory Manual, Wiley – inter science. edition 1,2003.
2. Karl. Mathews, Kalmia E.Kniel, Thomas J. Montville, Food Microbiology, ASM press; Edition 4,2017.

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COURSE STRUCTURE

Course Code	MANAGEMENT OF FOOD PROCESSING INDUSTRIES LAB	L	T	P	C
21G26102		0	1	2	2
	Semester	I			

Course Objectives:

This course aims to provide the student

- To Prepare Organization Charts of various organizations
- To List out Functions of various Areas of Management.
- To Study process of preparing Financial Statements of an organization
- To Develop Inventory Model of an organization.

Course Outcomes (CO): Student will be able to

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

- Prepare various types of organization charts, noting advantages and disadvantages of each.L2
- Listing out Duties of various types of Managers in an organization.L1
- Listing out factors to be considered for plant location L1
- Design plant lay out for various types of food processing units.L6.
- Inventory planning of typical Food Processing unit L3

List of experiments

1. Visiting an Organization and drafting Organization Chart
2. Identifying various types of Managers in an organization and listing out their functions
3. Planning for plant location for Process Industry
4. Planning for Plant Location for Product Industry
5. Planning for Plant Location of Service Industry
6. Preparing Plant Layout of one proposed organization
7. Preparing Accounts of an organization viz., Journal Book, Ledger Posting, Trail Balance,
8. Preparing Trading & Profit and Loss Account, Balance Sheet.
9. Finding out EOQ for a given Organization
10. Case study on resource allocation of a typical food industry.

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COURSE STRUCTURE

Course Code	BIOSTATISTICS AND COMPUTER APPLICATIONS LAB	L	T	P	C
21G13109		0	1	2	2
	Semester	I			

Course Objectives:

This course provides an introduction to

- A variety of statistical methods of use in describing and analyzing biological data.
- It includes a laboratory component in which biological data are analyzed using statistical software.

Course Outcomes (CO): Student will be able to

At the end of each unit of learning, students will be able to...

- Recall the basic components of computer.L1
- Explain how computer is used in various phases of research.L2
- Summarize the advantages and disadvantages of use of computers in research.L3
- Can calculate the mean, mode of median.L4
- Able to perform‘t’ test and X^2 test.L3

List of experiments

1. Selection of random sample, using tippets random number tables.
2. Preparation of questionnaire
3. Preparation of research proposal
4. Tabulation of data
   i) Calculation of averages-arithmetic mean, mode of median
   ii) Calculation of standard deviation.
5. Calculation of ‘t’ test to give inference for small sample and large sample
6. Calculating X^2 test to find the significance of association.
7. Analysis of one way Anova and two way Anova
8. Basics of SAP(System Applications and Products).
9. Basics of SPSS(System Applications and Products).

Reference Books:

Sharma S.R “statistical methods in educational research”, Anmol publications p(ltd), New-Delhi,1994.

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COURSE STRUCTURE

Course Code	ADVANCES IN NUTRITIONAL BIO-CHEMISTRY	L	T	P	C
21G13201		4	0	0	4
	Semester	**II**			

Course Objectives:

This course provides an introduction to

- The students will learn how nutrients effect biochemical process and nutritionally related diseases.
- To review the biological system of energy metabolism and the chemical/biochemical properties and metabolic pathways of carbohydrates, lipids, and proteins. ---
- To examine the regulatory mechanisms of macronutrient metabolism and associated signaling pathways.

Course Outcomes (CO): Student will be able to

After completion of the course, the student should be able to

- Capable of describing biochemical pathways relevant in nutrient metabolism.L2
- To understand biochemical techniques that are relevant for the investigation of the nutrient metabolism.L2
- Able to define the types and biosynthesis and the digestion, absorption and transports in blood circulation of nutrients.L1
- Able to understand nutrition deficiency disorders and helps in its prevention and able to define the nutrition and healthy diet planning.L2

UNIT - I

Introduction to biochemistry, sub cellular components and functions
Enzymes - General Properties, Classification, Co-enzymes and co-factors, Kinetics and Mechanisms of action Michelias Menten reactions, factors responsible for catalytic efficiency of enzymes, examples inhibitors and activators.

UNIT - II

Carbohydrate metabolism: Digestion, absorption and biochemical functions of carbohydrates, glycolysis, TCA cycle, oxidative phosphorylation and elements of bioenergetics.

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COURSE STRUCTURE

Lipid Metabolism: Digestion, absorption and functions of lipids, Oxidation of fatty acids, Biosynthesis of fatty acids.

UNIT - III

Protein metabolism: - Digestion, Absorption and functions. End products of protein metabolism.
Hormones Definition, Classifications, functions, mode of action, special emphasis for gastrointestinal hormones.
Mineral Metabolism:- Biochemical functions of minerals. Active transport and ion absorption. Calcium, Phosphorous and Iron metabolism.

UNIT - IV

Functions of Food, energy value of Food. Nutritive value of Foods nutritional significance of Carbohydrate, Proteins, Fats, vitamins and minerals. Deficiency diseases. Fortification of foods.
Nutritional requirements – Balanced diets – Food tables. Nutrition of infants, preschool children, adolescent and adult, expectant and nursing mothers, geriatric and industrial workers. Recommended Dietary Allowances.

UNIT - V

Supplementary and special dietetic foods. Effect of cooking and processing on the nutritive value of Foods. Causes and prevention of malnutrition. Social psychology and Philosophy of Food habits. Theoretical aspects of techniques in nutrition research. Activities of international Organizations in the field of nutrition.

Textbooks:

1. Vioet and Vioet, Principles of Biochemistry. John Willey & Sons, 5th edition, 2018.
2. Swami Nathan. Essentials of Food and Nutrition by .The Bangalore Printing and Publishing Company,vo 1,1991.
3. U.Satyanarayana and U.Chakrapani.Text book of Biochemistry by, generic, 5th edition, 2019.
4. Harper's Illustrated Biochemistry by Murray, Bender, Botham, Kennelly, Rodwell, and Well. McGraw Hill Publishers, 29th edition, 2019.

Reference Books:

1. Martin etal.Principles of Biochemistry .CBS Publishers, vol 2, 1990
2. Rama Rao, A.V.S.S.L.K. S.Text Book of Biochemistry Publishers 5th edition, 1986
3. Wilson, K. and Goulding, K.H. Abiologists Guide to principles and Techniques of Practical Biochemistry, 3rd Edition, 1986.
4. M. Zubay, Maxwell. Text Book of Biochemistry, MacMillan.2nd edition, 1989.

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5. Passmore, R and East Wood, M.A. Davidson's. Text Book of Biochemistry , Nutrition and Dietetics , M.A. Longman publications,8th edition,1986.

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COURSE STRUCTURE

Course Code	FOOD PROCESS AND PACKAGING TECHNOLOGY	L	T	P	C
21G13203		4	0	0	4
	Semester	II			

Course Objectives:

This course aims to provide the student to

- To apply engineering principles to design process in food process engineering
- To emphasize the various unit operations, processing technologies and material handling equipment used in food processing industries.

Course Outcomes (CO): Student will be able to

After completion of the course, the student should be able to

- Demonstrate the concept of heat and mass transfer in food processing and its integration to actual process design. L2
- Able to understand different unit operations and equipment needed for it in food industry.L2
- Analyze the complexity of fluid flow problems associated with food operations.L3
- Design and estimate the performance of food processing equipment.L6
- Interpret the properties of materials used for food processing equipment and corrosion control.L3

UNIT - I

FLUID FLOW

Types of flow, Reynolds number, Viscosity, Concept of boundary layer, basic equations of fluid flow, valves, flow meters, manometers and measurement of flow and pressure. Material handling systems; Liquid handling: Classification of pumps, Gas handling: Classification of fans, blowers and compressors, Solid handling: Bins, Bunkers, Conveyors

HEAT TRANSFER

Sources of heat, heat transfer by conduction, convection and radiation, with examples, steady state and unsteady state heat conduction individual and overall heat transfer co-efficient. Heat exchange equipment's, types, relative merits and demerits.

UNIT - II

EVAPORATION AND DRYING

Types of evaporators, single effect and multiple effect evaporators. Freezing and Thawing principles, applications and equipment. Moisture content and mechanism of drying, equilibrium moisture content, rate of drying and time of drying calculations. Classification and types of dryers. Dryers used in food industries and special drying methods.

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COURSE STRUCTURE

SIZE REDUCTION and MIXING

Definition, objectives of size reduction, factors affecting size reduction, laws governing energy and power requirements of mill, types of mills including ball mill, hammer mill, fluid energy mill etc. Properties of particulate solids, screening and industrial screening equipment-sieves and screens, magnetic separators, electrostatic separators, froth flotation. Sink and Float Method. Theory of mixing, mixing time, power used in agitated vessels, powers consumption of mixing, rate of mixing viscous materials and pastes. Solid-solid, solid-liquid and liquid-liquid mixing equipment's

UNIT - III		

FILTRATION, CENTRIFUGATION AND CRYSTALLIZATION

Theory of filtration, filter aids, filter media, industrial filters including filter press, rotary filter, edge filter, etc. Factors affecting filtration.

Introduction, Principles of sedimentation and centrifugation, equations for centrifugal force, equations for rate of settling in centrifuge, industrial centrifugal filters- tubular, disc bowl filters, gas-solid cyclone separators and centrifugal sedimenters.

Characteristics of crystals like, purity, size, shape, geometry, habit, forms size and factors affecting it. Super saturation theory and its limitations. Nucleation mechanisms, Crystal growth. Classification of crystallizers.

UNIT - IV		

UNIT IV:
Introduction to packaging – Definition and types of food packaging – Factors involved in the creation of food package, designing successful packaging – Packaging materials and forms – Testing of packaging materials, paper, paper board, plastics(PET,LDPE,HDPE, PVC, PP,PS,PC), glass packaging, metal packaging (tin and aluminum). Vacuum and modified atmosphere packaging, Packaging regulations (FSSAI)

UNIT - V		

UNIT V:
Packaging Machinery, Production and packaging line requirements – Bottling, layout of bottling line and details of individual steps on the automatic line – wrapping operations – form, fill and seal machines, liquid filling, paste filling machines, labeling machines, shrink and stretch packaging.

Textbooks:

1. D.G Rao, "Fundamentals of Food Engineering" PHI Learning Private Limited, New Delhi. 2010.

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2. J.S. Subrahmanyam, J.Timmasetty et al. Pharmaceutical Engineering Unit operations, Delhi vallabah prakashan, Delhi.second edition. 2011.
3. Warren, L. McCabe, J.C. Smith and Harriot, "Unit Operations of Chemical Engineering McGraw Hill International Edition, Singapore, ISBN-007-424740-6, 2005.

Reference Books:

1. Earle, R.L, "Unit Operations in Food Processing". Pergamon.2nd edition, UK,2003.
2 Coles, R., Dowell, D.M., Kirwan, J, Food Packaging Technology, Black Well Publishing Ltd., 2009.

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COURSE STRUCTURE

Course Code	ADVANCES IN SPICES, CONDIMENTS AND CONFECTIONERY FOODS	L	T	P	C
21G13204		4	0	0	4
	Semester	**II**			

Course Objectives:

This course aims to provide the student to

- The objective of this course is to make students aware of various techniques involved in processing of spices, condiments, confectionery foods and their value addition.
- Analyze chemical composition of spices and condiments.
- To provide knowledge of confectionery raw materials.

Course Outcomes (CO): Student will be able to

After completion of the course, the student should be able to

- Understand scope, processing and production of spices L2
- Suggest a technology for extraction of essential oils from different spices L3
- Can develop value added confectionery foods.L6
- Able to explain chocolate manufacturing process and can develop candies.L2
- Able to explain different processing techniques in confectionery preparation.L2

UNIT - I

Flavoring materials of natural origin: Natural flavors and flavorings, sources of natural flavoring materials – Herbs and spices, standards of purity and sensory assessment of herbs and spices, classification of herbs and spices, Culinary Herbs, Spice processing; milling, Microbiology of spices, gas sterilization of spices, gamma irradiation, Heat treatment, Distillation or Extraction. Distillation of volatile oils, Spice essential oils, Application of spice essential oils, Essential oil content of spices. Oleoresins; Extraction, Quality and, Application of oleoresins.

UNIT - II

Plants as source of essential oils Citrus Fruits-Citrus essential oils, Composition of Citrus oils, processed citrus oils, methods of deterpenization, Citrus leaf and Flower oils. The Mints: Peppermint - Cultivation and Distillation, Rectification. Corn mint- Cultivation and Distillation, Demethylation. Spearmint-Blended Peppermint, Composition of Mint oils. Other Commercially Important Sources-Fruit, Fruit Juices and Concentrates.

Vanilla –Introduction, Curing Process, Classification, Flavor, The Chemistry of Vanilla flavor, Precursors and the Development of Flavor, Beverage flavors – Cacao, Chocolate, Coffee, Tea, and Aromatic vegetables.

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COURSE STRUCTURE

UNIT - III		
Introduction to sugar confectionery. Types of sugar and their manufacturing process. Ingredients of confectionery- sugars, starch, Glucose syrups and starch hydrolysates. Color and flavor- colors for the sugar confectioner, Flavorings flavor strength, functions of carrier solvents and powders, factors affecting stability of flavoring compounds, refined glucose syrups, Gums, gelling agents and thickenings – properties and its applications.		
UNIT - IV		
Manufacture of high-boiled sweets, ingredients, prevention of recrystallization and stickiness, manufacturing methods for high boiled sweets, product types. Caramel, toffee and fudge, ingredients, structure of toffee, formulation, processing, toffee stability, fudge. Cocoa, chocolate and related products: Cocoa beans, cocoa fruit, pulp, fermentation, drying Sequence of processes chocolate receipts, cocoa powder, mixing, refining, conching and tempering of chocolate. Aerated confectionery; methods of aeration, marshmallow, Nougat.		
UNIT - V		
Bakery Raw Materials; General Ingredients-Wheat Flour-Manufacturing and Characteristics of wheat flour for Bakery industry. Sugar and its uses, Shortenings, Milk, yeast-Uses and specifications-Salt and its uses-Egg and Egg Products-Chemical Leavening Agents, Cocoa Chocolate, Flavors, Emulsifiers, lecithin, Bread improvers, Enriching agents, Water and miscellaneous Ingredients, Bread making process. Biscuits; Classification, dough consistency, baking techniques and Packaging. Cookies and Crackers; ingredients, formulation aspects, baking, decoration, production aspect of different cookies-sugar, coconut, anise cookies and sugar wafers.		
Textbooks:		
1. Vijaya Khader, Text Book of Food Science and Technology. ICAA, New Delhi.2001 2. Spices: Morphology, History, Chemistry, J W Parry, Chemical Publishing Co., New York 3. Shanmugavelu K G. Spices and PlantationCrops. Oxford& IBH Publishing Co., New Delhi 4. Manufacturing of snacks food, namkeen, pappad and potato products- EIRI Publications, Delhi. 9th edition, 2001.		
Reference Books:		
1. EE.B. Jackson, Sugar Confectionery Manufacture, Blackie Academic and Professional Glasgow, 2nd Edition, 1996. 2. R.Loes .Sugar Confectionery and Chocolate Manufacture, Leonard Hill Books, International Text Book Company Limited 2nd edition, 1973. 3. R.Gordan Booth separation- Snack food .A scientific approach-Meera Rao Patankar , Anmol		

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Publications New Delhi.4 th edition,2004.
4. The chemistry and technology of cereal food and feed-Samuel, CBS publications,4th edition.2001.
5. Biscuit, cracker and cookies recipes for the food industry, Duncan Manley, Wood head Publishes, Cambridge, England, 5th edition.1990.

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COURSE STRUCTURE

Course Code	INSTITIUTIONAL FOOD SERVICE MANAGEMENT	L	T	P	C
21G26201		4	0	0	4
	Semester	II			

Course Objectives:

This course aims to provide the student to

- Understand units of food service
- Understand infrastructure requirements of food service units
- Understand legal and safety requirements of maintaining food service unit
- Understand testing facilities at units
- Understand basic managerial activities of service unit.

Course Outcomes (CO): Student will be able to

Learning Outcomes:

After completion of the course, the student should be able to

- Classify food service units vis-à-vis location L2
- Design layouts and identifying equipment required L6
- Develop safe and hygiene food service unit L6
- Prepare basic accounting statements, HR documents. L2

UNIT - I

- Introduction to food service industry, management and types of food service establishments.
- Principles and functions of food service management.
- Need and importance
- Tools of management.
- Management of resources.
- Types: hotels and restaurants –hotels/motels , restaurants, cafes, clubs public houses ,wine bars, specialty restaurants, fast foods, take away, street foods etc.,
- Welfare and industrial- residential establishments- school, colleges, hostels, old people house, hospitals, nursing homes, industrial canteens, temple feeding & marriage feeding. Transport –railway, airlines and sea.

UNIT - II

INFRASTRUCTURE AND EQUIPMENT

- Building plans, outlays of work places- kitchen spaces, storage spaces and service areas.

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COURSE STRUCTURE

- Equipment – classification of equipment, selection of equipment, design, installation, operation and maintenance.
- Food service, operation and types of food services- systems of service -mechanics of waiter service, self-service, vending and mobile catering.
- Computers in service- introduction, catering controls.
- Food services systems-introduction, standards of hygiene.

Cook –chill system and benefits.
Cook – freeze system and benefits.
Sous- vide.

UNIT - III

FOOD SAFETY IN PUBLIC CATERING.

- Health and hygiene of personnel.
- Laws governing food service in public catering.
- Sanitation of food service establishments.
- Food safety in hotels, restaurants, street foods, industry and canteens, hospitals, hostels, airlines, railways, temple and mass feeding programs.

UNIT - IV

- Laboratory support services in food safety.
- Food borne diseases and importance of surveillance
- Food safety awareness programs to food handlers and consumers.
- Role of media in food safety education.

UNIT - V

FINANCIAL AND HUMAN RESOURCE MANAGEMENT

- Definition and scope of financial management.
- Cost concept, cost control and pricing.
- Book keeping and accounting.
- Personal management- recruitment, selection and induction, job analysis, description- monitoring work employee facilities and benefits, in-service training, skills required to operate and manage food service system.

Textbooks:

1. Kinton, R., Cessarani, V and Foskett, D, The Theory of Catering, Hodder and Stoughton, 2000.
2. Tripathi, P.C. Personnel Management and Industrial Relations, Sultan Chand and Sons, 2000.

Reference Books:

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1. Kaufman, R. Mega planning- Practical tools for Organizational Success, Sage Publications Inc, 2000.
2. Shring Y, P. Effective Food Service Management, Anmol publications Pvt Ltd, New Delhi, 2001.
3. Stephen, B, , Williams, S, R, "Bill Jardine, and Richard, J, N, Introduction to Catering, Ingredients for Success, Delmar- Thomson learning, 2001.
4. Yadav, C, P. Management of Hotel and Catering Industry, Anmol publications Pvt Ltd and Institute of sustainable development, Luck now, New Delhi, 2001

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COURSE STRUCTURE

Course Code	FOOD INDUSTRIAL WASTE MANAGEMENT	L	T	P	C
21G26202		4	0	0	4
	Semester	**II**			

Course Objectives:

This course aims to provide the student to

- Understanding of problems of food processing industrial waste
- Knowledge of legal, institutional and financial aspects of management of food wastes.
- Become aware of Environment and health impacts food waste mismanagement.
- Understand engineering, financial and technical options for waste management.

Course Outcomes (CO): Student will be able to

After completion of the course student shall be able to

- To-do sampling and characterization of food waste; L2
- Analysis of hazardous waste constituents including QA/QC issues; L3
- Understand health and environmental issues related to food waste management; L2
- Apply steps in food waste management-waste reduction at source, collection techniques, materials and resource recovery/recycling, transport, optimization of food waste transport, techniques; L3
- Innovative food products development by industrial food waste and innovate ideas and techniques to convert food waste to industrial use.L6

UNIT - I

Types and formation of by-products; Magnitude of waste generation in different food processing industries; Uses of different agricultural by-products from rice mill, sugarcane industry, oil mill etc.

UNIT - II

Concept, scope and maintenance of waste management and effluent treatment, Temperature, pH, Oxygen demands (BOD & COD), fat, oil and grease content, metal content, forms of phosphorous and Sulphur in waste waters, microbiology of waste, other ingredients like insecticide, pesticides and fungicides residues

UNIT - III

Waste utilization in various industries, furnace sand boilers run on agricultural wastes and by products, briquetting of biomass as fuel, production of charcoal briquette, generation of electricity using surplus biomass, producer gas generation and utilization,

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COURSE STRUCTURE

UNIT - IV		
Waste treatment and disposal, design, construction, operation and management of institutional community and family size biogas plants, concept of vermi-composting, Pre-treatment of waste: sedimentation, coagulation, flocculation and floatation, Secondary treatments: trickling filters, oxidation ditches, activated sludge process, rotating biological contractors, lagoons.		
UNIT - V		
Tertiary treatments: Advanced waste water treatment process using sand, coal and activated carbon filters. Removal of heavy metals, Phosphorous, Sulphur, nitrogen. Assessment, treatment and disposal of solid waste; and biogas generation. Effluent treatment plants, Environmental performance of food industry to comply with ISO-		
Textbooks:		
1. Abbas Kazmi, Peter Shuttleworth. "The Economic Utilization of Food Co Products", Royal Society of Chemistry Publishing. 2013. 2. A.M. Martin. "Bioconversion of Waste Materials to Industrial Products", Springer Science & Business Media Publishing.2012. 3. Marcos von Sperling. "Basic Principles of Wastewater Treatment", IWA Publishing ,2007.		
Reference Books:		
1. Kreit F & Goswami DY, Energy Management and Conservation Handbook. CRC Press, 2nd edition, 2016 2. Murphy WR &Mc kay G, Energy Management. Butterworth- Heinemann ltd,1981 3. Patrick DR., Fardo SW, Richardson RE & Steven, Energy Conservation Guidebook. The Fairmont Press, 3rd edition, 2015. 4. Wulfinghoff DR. Energy Efficiency Manual, Energy Institute Press, 1999		

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COURSE STRUCTURE

Course Code	ADVANCES IN NUTRITIONAL BIO-CHEMISTRY LAB	L	T	P	C
21G13206		0	1	2	2
	Semester	**II**			

Course Objectives:

This course aims to provide the student to

- To gain knowledge of practices for proper literature reviews and evaluation of appropriate methods for food analysis.
- To interpret various methodologies for analysis of components in foods.

Course Outcomes (CO): Student will be able to

Learners who successfully complete this course will be able to:

- Demonstrate the presence of protein, lipid, and carbohydrate in food using chemical methods.L2
- Aware of how analytical techniques used to determine food composition and quality L1
- Able to carry out qualitative analysis of carbohydrates, proteins, lipids.L3
- Apply their knowledge in food biochemistry and nutrition in designing new range of products with improved nutritional characteristics L3
- Able to isolate and quantify proteins.L3

List of experiments

1. Preparations: Albumin from egg. Casein from milk, starch from potato.
2. Estimation of protein by biuret method.
3. Estimation of amino acids by Ninhydrin method.
4. Estimation of sugar by Dinitrosalysilate / Nelsonsomogyi method.
5. Estimation of phosphorous in food sample.
6. Estimation of Calcium in food sample.
7. Estimation of beta carotene in food sample
8. Estimation of Lycopene in tomato and tomato products.
9. Estimation of Iron in foods.

Reference Books:

- ArunbBahl and B. S. Bahl: Advanced Organic Chemistry, Vol (2), S. Chand publications, 2019.

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COURSE STRUCTURE

Course Code	FOOD PROCESSING & PACKAGING TECHNOLOGY LAB	L	T	P	C
21G13208		0	1	2	2
	Semester	II			

Course Objectives:

This course aims to provide the student to

- To know the various types of equipment's used in the food industry.
- To learn the operation and utilization of equipment's involved.
- To choose suitable techniques for the food processing operation.
- To identify the factors that will affect the design of equipment's

Course Outcomes (CO): Student will be able to

After completion of the course, the student should be able to

- To select the critical variables for the design of equipment's.L1
- To compute the moisture content and drying characteristics of food materials.L4
- To describe and demonstrate the humidity and psychometric charts.L2
- To find out filtration rate and efficiency and factory affecting it.L2

List of experiments

Food Process Engineering

1. Evaluation of filter media, determination of rate of filtration and study of factors affecting filtration including filter aids.
2. Determination of Humidity – use of dry bulb and wet bulb thermometers and psychometric charts.
3. Determination of rate of drying, free moisture content and bound moisture content.
4. Experiments to illustrate the influence of various parameters on the time of drying.
5. Estimation of heat coefficient by natural/forced convection
6. Studies in separation by sink and float method
7. Estimation of average particle size using any crushers/ball mill

Packaging Technology

8. Measurement of thickness, basis weight, grease resistance, bursting strength and tear resistance of paper/paperboard.
9. Determination of Water vapour transmission rate(WVTR) of packaging material.
10. Determination of Impact breakage, thermal shock resistance for glass material

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COURSE STRUCTURE

11. Determination of continuity and porosity of tin coating
12. Performance evaluation of tertiary packages.

Reference Books:

1. Paul Singh R, and Dennis R.Heldman "Introduction to Food Engineering". Academic Press – ElsevierIndia Private Ltd. New Delhi," 4th Edition 2008.
2. EIRI Board of Consultants and Engineers, New Delhi; Modern Packaging Technology
3. Coles, R., Dowell, D.M., Kirwan, J, Food Packaging Technology, Black Well Publishing Ltd., 2009.

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COURSE STRUCTURE

Course Code	ADVANCES IN SPICES, CONDIMENTS & CONFECTIONERY FOODS LAB	L	T	P	C
21G13207		0	1	2	2
	Semester	II			

Course Objectives:

This course aims

- To develop an awareness of various processing procedure for major spices & minor spices.
- To provide knowledge how on the machinery and process involved in the baking and confectionery process.
- To understand the various types of sugar and its grades.

Course Outcomes (CO): Student will be able to

At the end of this course, students will be

- To develop value added products from plantation products and spices.L2
- To demonstrate appropriate technique for the extraction of spice oil and oleoresin with able to identify adulterants in spices.L2
- Capable to carry out proximate analysis for bakery and confectionery foods.L3
- To evaluate the steps involved in the process and improve existing technologies.L2
- To design and create newer process and products that are better economically, nutritionally like gluten free foods.L6

List of experiments

1. Proximate analysis for different variety of spices
2. Detection of adulterants in spices
3. Preparation of condiments (ketchups and sauces)
4. Preparation of different spice powders
5. Packaging of spices
6. Analysis of Confectionery products.
7. Preparation of RTS beverages
8. Milling of spices
9. Shelf life studies of spices
10. Drying of Spices (different techniques)
11. Identification of insects in spice products

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12. Estimation of active principles present in spices
Reference Books:
1. Handbook on Spices, National Institute of Industrial Research (NIIR) Board, Asia Pacific BusinessPress Inc., New Delhi 2004 2. Stanley Cauvain and Linda S. Young, "Technology of Bread making", Springer, ISBN: 038785657,9780387385655, 2007. 3. Gupta S. Hand Book of Spices and Packaging with Formulae. Engineers India Research Institute, New Delhi. 2016.

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COURSE STRUCTURE

Course Code	ADVANCES IN CEREALS, LEGUMES AND OIL-SEED TECHNOLOGY	L	T	P	C
21G13301		4	0	0	4
	Semester	III			

Course Objectives:

This course aims to provide the student to

- To develop good expertise on the technical aspects of dhal milling, oil milling and various legumes and oil seeds.
- To prepare cereals, legumes and oil seed-based products and preservation.

Course Outcomes (CO): Student will be able to

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

- Understand the basic composition and structural parts, importance of physio-chemical properties of food grains. L2
- Understand the basics of milling operations and to identify the problems associated with milling of food grains and their solutions.L2
- To know about different pulses processing aspects and preparation of products with pulses L4
- To learn about different oil seeds, oil milling by expellers, solvent extraction of oils, refining of oils and utilization of oil seed meals for different food uses.L2
- To learn processing food grains into value added products.L2

UNIT - I

Rice: Chemical composition and structure. Methods of quality assessment, Methods of parboiling, milling operations, changes during ageing, cooking quality, methods for accelerated ageing rice, drying of rice.
Wheat: Nature of Grain, Chemical constituents and processing quality. Milling of wheat, Operations and fractionation, and utilization of products of milling. Dough rheology.
Millets and millet based products.
Preparation of wheat products, dalia Karah parathas and maize fried products: golgappas-popcorn-bhelpuri-expanded and extruded snacks

UNIT - II

Milling of pulses, wet milling and dry milling, commercial milling of pulses, traditional milling methods. Dhall milling equipment and effect on quality, principal products.
Storage, handling and transportation of pulses.
Processing Legumes and pulses. Legume based foods: raw materials, -papads, vadia, besan laddoos,

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COURSE STRUCTURE

chikki, sevian.

UNIT - III

Position of oilseeds and oils in India, Sources and classification of Oils and Fats- Structure and composition of oils and fats Definition, distinction between oils and fats – Simple and mixed triglycerides, mono-and di-glycerides Non-glyceride components of oils and fats: - Phosphatides, sterols, carotenoid pigments, Tocopherols and other antioxidants – Vitamin A, D and E.

UNIT - IV

sting technology of oil seeds. Storage and pretreatment of oilseeds, Oil seed milling, Mechanical expression of oil, Solvent extraction.

Oil extraction:traditional methods, Ghani, power ghani,Hydraulic press, expellers. Solvent extraction process, pretreatments, breaking, creaking, flaking, factors effecting extraction process

UNIT - V

Refining and Bleaching: - Degumming, alkali refining, (Batch process), Miscella refining, refining losses – Bleaching by Absorption – Continuous bleaching.

Hydrogenation: - Mechanism – Selectivity – continuous process – preparation of Raney Nickel catalyst.Fat splitting (Twitch ell and Autoclave methods), Distillation of fatty acid.

Textbooks:

1. Bailey's Industrial Oils and Fats products, by Ed. D. Sworn, Wiley-Inter Science Publications, N.Y., John Wiley & Sons (1982).
2. Chakravarti A, Post-harvest technology of Cereals, Pulses and Oilseeds, 3rd Edition Oxford & IBH Publishing Co. Ltd., Calcutta, 2019.
3. Shukla B D Srivastava P K and Gupta R K. Oilseed Processing Technology. Central Institute of Agricultural Engineering, Bhopal.

Reference Books:

1. Watson SA; Ramstad PE. Corn: Chemistry and Technology, AACC, 1988.
2. K.M. Singh and K.K. Sahay Unit Operations of Agricultural Processing, Vikas publishing house ltd, 2004.
3. Manuals on Rice and its processing by CFTRI Mysore and IIT Kharagpur.
4. Potter NN Cereal Technology, AVI Publication.
5. Neelam Khatarpaul, Rajbala Grewal & Sudesh Jood, Bakery Science & Cereal Technology, Daya publishing house, 2012.
6. Matz SA, Bakery Technology and Engineering, CBS Publication, 2008.

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COURSE STRUCTURE

Course Code	FOOD LAWS AND REGULATIONS	L	T	P	C
21G13303		4	0	0	4
	Semester	**III**			

Course Objectives:

This course aims to provide the student to

- To study importance of Food Safety
- To understand the regulating authorities for food safety world over

Course Outcomes (CO): Student will be able to

After completion of the course, the student should be able to

- To understand the regulations followed in various food industries.L2
- To define the food labeling patterns.L1
- To analyze the safety operations involved in food system L3
- To prepare HACCP standards for food industries.L2
- To learn CIP, Hygine practices in plant.L2

UNIT - I

Introduction to concepts of food quality, food safety, food quality assurance and food quality management; objectives, importance and functions of quality control

UNIT - II

Role of national and international regulatory agencies, Bureau of Indian Standards (BIS), AGMARK, Food Safety and Standards Authority of India (FSSAI), Introduction to WTO agreements: SPS and TBT agreements, Codex Alimentarius Commission, USFDA, International organization for standards (ISO) and its standards for food quality and safety (ISO 9000 series, ISO 22000, ISO 15161, ISO 14000)

UNIT - III

Quality assurance, Total Quality Management; GMP & GHP; GLP, GAP; Sanitary practices; HACCP; Quality manuals, documentation and audits; Export import policy, export documentation; Laboratory quality procedures and assessment of laboratory performance; Applications in different food industries; IPR.

UNIT - IV

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COURSE STRUCTURE

Food Standards and Laws: International and national food laws. Food adulteration: Definition, common adulteration in natural and processed foods, contamination, and methods of detection. Prevention of Food Adulteration (FSSAI).		
UNIT - V		
Food labelling – Safety issues – Labelling of organic and GM foods – Approach of US and EU and Food safety. Effluent treatment and laws governing the same.		
Textbooks:		
1. A Hand Book of Food packaging by EIRI publications, vol (6), 2001. 2. Coles, R., Dowell, D.M., Kirwan, J, Food Packaging Technology, Black Well Publishing Ltd., 2009.		
Reference Books:		
1. Stanley Sacharow and Roger C. Griffin .Principles of Food packaging, AVI Publishing Company, Estport, 2nd Edition.1994. 2. M.Mathlouthi (Edited) Food Packaging and Preservation., Blackte Academic Professional, Chapman &Hall, 1994. 3. Jung H. Han, Innovations in Food Packaging, Academic Press, 2014. 4. Scott A. Morris, Food and Package Engineering, Wiley-Blackwell Publishing, 2011.		

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COURSE STRUCTURE

Course Code	FOOD MARKETING AND ADVERTISING	L	T	P	C
21G26301		4	0	0	4
	Semester	III			

Course Objectives:

This course aims to provide the student to

- Understand concept of marketing and market mix
- Understand the product life cycle and pricing policies
- Understand various types of distribution channels
- Understand forecasting demand of a product
- Understand concept of advertising and branding

Course Outcomes (CO): Student will be able to

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

- Learn about 4p's of marketing L1
- Take product oriented decisions viz., product mix, new product development, branding.L3
- Prepare pricing schemes of a product L2
- Indentify suitable distribution channel L2
- Plan promotion mix and determining advertisement effectiveness L6
- Understand contemporary issues of marketing. L2

UNIT - I

Introduction: Concept, nature, scope and importance of marketing; Marketing concept and its evolution; Marketing mix; Strategic marketing planning – an overview.

Market Analysis and Selection: Marketing environment – macro and micro components and their impact on marketing decisions; Market segmentation and positioning; Buyer behavior; consumer versus organizational buyers; Consumer decision making process.

Product Decisions: Concept of a product; Classification of products; Major product decisions; Product line and product mix; Branding; Packaging and labelling; Product life cycle – strategic implications; New product development and consumer adoption process.

Pricing Decisions: Factors affecting price determination; Pricing policies and strategies; Discounts and rebates.

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COURSE STRUCTURE

UNIT - II		
Distribution Channels and Physical Distribution Decisions: Nature, functions, and types of distribution channels; Distribution channel intermediaries; Channel management decisions; Retailing and wholesaling. **Promotion Decisions**: Communication Process; Promotion mix – advertising, personal selling, sales promotion, publicity and public relations; Determining advertising budget; Copy designing and testing; Media selection; Advertising effectiveness; Sales promotion – tools and techniques.		
UNIT - III		
Marketing Research: Meaning and scope of marketing research; Marketing research process. **Marketing Organization and Control**: Organizing and controlling marketing operations		
UNIT - IV		
Issues and Developments in Marketing: Social, ethical and legal aspects of marketing; Marketing of services; International marketing; Green marketing; Cyber marketing; Relationship marketing and other developments of marketing. Advertising, Its role in the marketing process; Legal, Ethical and Social aspects of advertising. Communication - processes of communication; integrated marketing communications, Its evolution, reasons for its growth and its role in branding.		
UNIT - V		
The promotional mix; segmentation, Targeting and positioning and their role in promotion. Promotional objectives, determination, types and approaches, DAGMAR approach, problems in setting Objectives; Advertising budget, establishment and allocation, budgeting approaches. Advertisement copy, its components and types; The importance of creativity in advertising, creative strategy and process, implementation and evaluation.		
Textbooks:		
Kotler, P., Keller, K. L., Koshy, A., & Jha, M. (2012), Marketing Management A South Asian Perspective, 14th Edition, Pearson Education, New Delhi. 2. Ramaswamy, V. S., &Namakumari, S. (2017), Marketing Management: Indian Context with Global Perspective, McGraw hill.		
Reference Books:		
1. Kotler, Philip. Marketing Management, Millennium Edition. Intl ed. US: Prentice Hall, 2002.ISBN: 8120316096. 2. Principles of Marketing, Kotler and Armstrong, Pearson, 12th edition., 2008, ISBN: 978-81-317-1547-5Aaker, David A. etc., Advertising Management, 4th edition, PHI, 1985		

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3. Belch, George E. and Belch, Michael A.; Advertising and promotion, Tata McGraw Hill, New Delhi
4. Ogilvy David, Ogilvy on Advertising, London, Longman.
5. Jones, John Philip, What's in a brand, Tata McGraw Hill, New Delhi
6. Chunawalla, S.A., Advertising, Sales and Promotion Management, Himalaya Publishing House, Mumbai.
7. Mohan, Manendra; Advertising Management, Tata McGraw Hill, New Delhi
8. Sandage and Fry burger, Advertising Management
9. Kotlar, Philip, Marketing Management, Prentice Hall, New Delhi.
10. Stanton, Etzel, Walker, Fundamentals of Marketing, Tata-McGraw Hill, New Delhi.
11. Saxena, Rajan, Marketing Management, Tata-McGraw Hill, New Delhi.
12. McCarthy, E.J., Basic Marketing: A managerial approach, Irwin, New York

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COURSE STRUCTURE

Course Code	ADVANCES IN FOOD PRESERVATION AND PROCESSING	L	T	P	C
21G13205		4	0	0	4
	Semester	**III**			

Course Objectives:

- To acquaint students with the industrial techniques used to preserve and process foods, extend their shelf-life and improve their palatability characteristics
- To familiarize students with advances in food processing techniques

Course Outcomes (CO): Student will be able to

After completion of the course, the student should be able to

- Describe the significance in food preservation.L2
- Explain various thermal preservation techniques.L2
- Describe the different freezing technquest.L2
- Discuss the methods of preservation of animal based foods.L3.
- Explain the comprehend the processing techniques utilized in food industries.L2
- Identify various preservative methods for food in industrial settings L2

UNIT - I

INTRODUCTION TO FOOD PRESERVATION

Principles of Food Preservation, Water Activity and its significance in food preservation, Overview of the Traditional Methods of Food Preservation, Natural and Chemical Food Preservatives – *types, permissible limits, safety aspects*, Psychrometric Charts

UNIT - II

THERMAL PRESERVATION

Blanching, Pasteurization, Sterilization, Canning, Extrusion Cooking, Baking, Roasting, Grilling Dehydration, Concentration, Evaporation, Intermediate Moisture Foods

UNIT - III

PRESERVATION BY THE USE OF LOW TEMPERATURES

Refrigeration, Freezing, Lyophilisation, Cryogenic Freezing, Dehydrofreezing, Freeze Concentration, IQF

UNIT - IV

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COURSE STRUCTURE

NON-THERMAL PRESERVATION

Microwave Processing, Hurdle Technology, Irradiation, Pulsed Electric Field Electroporation, Biopreservation, High-Pressure processing, Hydrodynamic pressure processing, Membrane Technology, Cold Plasma Technology

UNIT - V		

FOOD PROCESSING

Definition and Difference between Food Processing and Food Preservation; Functions, Benefits and Drawbacks of Food Processing, Primary Processing Techniques – dicing, slicing, mincing, macerating, liquefaction, emulsification,

Secondary Processing Techniques (ex: extrusion etc) & Tertiary Processing Techniques (ex: Pigment extraction, high value products etc.,); Novel Food Processing – mushrooms, algae, leaf protein concentrates, protein from petroleum yeast, food analogues, edible insects, Performance Parameters for Food Processing – hygiene, energy efficiency, minimization of waste, labour, Overview of the types of food processing industries

Textbooks:

1. Bhat R, Alias AK, and Paliyath G, Progress in Food Preservation. First Edition. Wiley-Blackwell, 2012.
2. Ivasankar B. 2009. Food Processing and Preservation. First Edition. PHI Learning, 2009.

Reference Books:

1. Desrosier NW, Fellows PJ. 2016. Food Processing Technology Principles and Practice. Fourth Edition. Woodhead Publishing .
2. Ramaswamy HS and Marcotte M. 2005. Food Processing: Principles and Applications. Taylor & Francis
3. Shapton DA and Shapton NF. 1998. Principles and Practices for the Safe Processing of Foods. Butterworth-Heinemann .

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COURSE STRUCTURE

Course Code	ADVANCES IN TECHNOLOGY OF ANIMAL BASED FOODS	L	T	P	C
21G13202		4	0	0	4
	Semester	**III**			

Course Objectives:

This course provides an introduction to

- To understand of the chemistry of milk constituents and animal based foods.
- To learn the milk and various dairy products and meat, sea food their chemical, physical and biological changes that occur during processing of dairy products and animal based foods.
- To understand the post mosterm changes in animal based foods.

Course Outcomes (CO): Student will be able to

After completion of the course, the student should be able to

- Describe the composition of milk, identify the approximate content of individual types present, and describe physicochemical characteristics of the main components.L2
- Explain how dairy products such as fluid milk, yogurt, butter, powder, cheese) are made and the key functions of the processing steps involved.L2
- Describe the changes that occur during the post mortem and rigor mortis of meat.L2
- Discuss the methods of preservation of animal based foods.L3
- Explain the hygiene and quality standards of milk and animal based foods.L2

UNIT - I

Meat preservation by refrigeration and freezing, thermal processing, dehydration, irradiation, Chemicals and Antibiotics. Meat byproducts.

Cold Storage and Freezing, canning, Smoking, curing and pickling of marine products – Fish pastes, Sauces, Oils, Protein concentrates, meal and other products. Preservation and processing of Shrimp, Lobsters.

Packaging of meat and meat products.

UNIT - II

Introduction on meat and poultry industry. Glossary of market terms for meat animals and birds. Effect of feed, breed and environment on production of meat and its quality.Anti mortem examination of Meat Animals. Slaughter of meat animal and dressing carcasses. Modern abattoir practices.Post-mortem examination of meat, retail and whole sale cuts, grading, factors influencing quality of fresh and cured most.

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COURSE STRUCTURE

Meat hygiene, quality control of meat production, processing, specification of meat products
Poultry processing's.
Egg and Egg products: Preservation and measures of Egg quality. Dehydrated egg powder, frozen egg,
Packaging of meat, egg and egg products.

UNIT - III

tion to milk – Milk composition and nutritive value, – physical and chemical properties of milk, processing of Milk – Receiving of milk, platform tests, filtration, clarification, Homogenization. Definitions – standardization of milk(calculations for different types of milk), single toned, double toned flavored milk. Microbiology of milk, pasteurization.

UNIT - IV

Cream – Cream separation– Factors governing richness of cream and fat percentage.
Butter – Introduction, composition – Process involved, cream neutralization, addition of starter, cream ripening, churning, working of butter,– Factors influencing churning, over run in butter, butter defects, their causes and prevention.
Cheese: Introduction-History-Definition-Classification, composition, Nutritive value, Manufacture of processed cheese, Swiss cheese, cottage cheese & Cheddar Cheese, their defects and control.

UNIT - V

Condensed Milk: History-Composition-Types of condensed milk. Methods of manufacture, vacuum, pan, condensing, defects in condensed milk,
Dry Milk (Milk Powder): History- Types of dry milk, composition of each dry milk -Methods of manufacture - Drum drying , Spray drying, Freeze drying, proportion of dry milk bulk density, solubility, solubility index, wettability, dispensability – defects in dry milk.
Ice Cream: History- Definition- Classification- Composition- Ingredients used- Sweeteners, Stabilizers- Flavors etc. - Preparation of Ice cream, Pasteurization of milk, homogenization, ageing, freezing. Defects and over run in ice cream.,
Packaging of milk and milk products

Textbooks:

1. Pauline C. Paul and Helen H. Palmer 'Food Theory and Applications'. John Wiley and Sons, New York, 5 thedition, 1972.
2. Vijaya Khader Text Book of Food Science and Technology, ICAA, New Delhi .vol (2).2001.
3. Sukumar De, Outlines of Dairy Technology, Mc grath Oxford;1st edition,2001.

Reference Books:

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1. Walstra, J. T. M. Wouters and T. J Geurts. Taylor &Francis. Dairy Science and Technology, Second Edition 2006.
2. Shahidi F and Botta JR, Seafoods: Chemistry, Processing, Technology and Quality, Blackie Academic & Professional, London, 1994.
3. M.K.Srivastava. Hand book analysis on Milk .CBS publication & distributers, 1nd Edition, 2015.
4. Fidel toldra .Dry cured meat Products. Wiley-Blackwell, 1st edition, 2005.

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COURSE STRUCTURE

Course Code	ADVANCES IN CEREALS, LEGUMES PROCESSING	L	T	P	C
21G13306	AND OIL SEED TECHNOLOGY LAB	0	1	2	2
	Semester	III			

Course Objectives:

This course aims to provide the student to

- To study the physico-chemical properties of food grains
- Preparation of malt.
- To Determine gluten content in wheat flour
- Processing of value-added products from cereals and pulses

Course Outcomes (CO): Student will be able to

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

- Understand the basic composition and structural parts of food grains.L2
- Aware the importance of physico-chemical properties of food grains L1
- Understand the basics of milling operations for food grains L2
- Identify the problems associated with milling of grains and their solution.L2
- Know processing food grains into value added products L2

List of experiments

1. Determination of moisture content of legumes and oil-seeds
2. Study of mini-dhal mill and pre-treatments
3. Cereals and millets processing- effects of different processing methods –soaking, malting, germination.
4. Pulses processing - effects of different processing methods –soaking, malting, germination
5. Preparation of breakfast cereals, evaluation of readily available cooked products (ready to eat foods) in the market.
6. Determination of gluten in the flour
7. Determination of Acid Value of the oil.
8. Determination of alcoholic acidity in cereal flours.
9. Determination of Iodine Value
10. Determination of peroxide value
11. Determine the purity of groundnut oil by bellier turbidity test(BTT).

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12. Determination of Specific gravity and refractive index for oils.
13. Test to detect adulteration of mustard oil.

Reference Books:

1. Karel Kulp and Joseph P Pante:Hand Book Of Cereal Science and TechnologyMercel Dekkar, 1st edition, 1991.
2. Sahay K M, and Singh K K. Unit operations of Agricultural Processing. Vikas Publishing House, Pvt Ltd, 2nd edition, 2004.

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COURSE STRUCTURE

Course Code	FOOD QUALITY ANALYSIS LAB	L	T	P	C
21G26302		0	1	2	2
	Semester	III			

Course Objectives:

This course aims to provide the student to

- To learn about quality management in food production chain and understand the significance of safe processing of foods
- To train the student to analyze food components and to about physical and chemical contaminants in foods

Course Outcomes (CO): Student will be able to

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

- To understand the principles and framework of food safety. L2
- To understand food laws and regulations governing the quality of foods.L2
- To identify the wide variety of parameters affecting food quality.L2
- To learn about the standards and specifications of FSSAI and its limits in all food commodities.L1
- To understand harmful effects of adulterants and toxicity of foods.L2

List of experiments

1. Examination of cereals & pulses from one of go-downs and market shops in relation to FSSAI specifications.
2. Detection of adulteration and examination of ghee for various standards of AGMARK & FSSAI standards.
3. Detection of adulteration and examination of spices as per AGMARK and FSSAI standards,
4. Detection of adulteration and examination of milk and milk products as per FSSAI standards,
5. Detection of adulteration and examination of fruit products such as jams, jellys, marmalades as per FSSAI specification
6. Study of registration process and licensing procedure under FSSAI.
7. Study of sampling techniques from food processing establishments.

Reference Books:

1. Early ,R. Text book of Guide to Quality Management Systems for Food Industries .Blackie Academic publications.1995.
2. Krammer A & Twigg BA. Text book of Quality Control in Food Industry. Vol. I, II. AVI

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Publications,1973.
3. Vasconcellos , J. Andres. "Quality Assurance for the Food Industry: A Practical Approach",CRC Press.2003.

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COURSE STRUCTURE

Course Code	FOOD MARKETING & ADVERTISING LAB/ ADVANCES IN TECHNOLOGY OF ANIMAL BASED FOODS LAB	L	T	P	C
21G26303		0	1	2	2
	Semester	**III**			

Course Objectives:

This course aims to provide the student to

- Develop market mix of various products
- Prepare the product life cycle
- List out various types of distribution channels
- Forecasting demand of a product
- To study the Adulterants in milk
- To measure the percentage of fat.
- To Determine Texture properties of meat

Course Outcomes (CO): Student will be able to

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

- Formulate and describe 4p's of marketing L2
- Prepare Product Life Cycle of various productsL2
- Preparing product mix.L2
- Prepare pricing budget a product L2
- Planning suitable distribution channel L6
- Analyze Freshness of meat/poultry/fish L3
- Calculate total solid content of milk L4

List of experiments

Food Marketing & Advertising Lab

1. Preparing Marketing Mix of a given product
2. Developing Product Mix of a given Product
3. Developing Promotion Mix of a given Product
4. Preparing Product Life Cycle for a given Product

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5.	Designing Channels of Distribution for typical types of products
6.	Estimating demand by forecasting Techniques
7.	Developing Advertisement for a given product
8.	Building Branding for a given product
9.	Developing Product Launching Strategy for a given product
10.	Estimating Effectiveness of Advertisement

Advances in Technology of Animal based Foods Lab

11.	Adulterants in milk
12.	Egg quality
13.	Freshness of meat/poultry/fish
14.	Percentage of fat
15.	Total solid content of milk
16.	Texture properties of meat

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COURSE STRUCTURE

Course Code	ENGLISH FOR RESEARCH PAPER WRITING	L	T	P	C
21DAC101a		2	0	0	0
	Semester	**III**			

Course Objectives: This course will enable students:

- Understand the essentials of writing skills and their level of readability
- Learn about what to write in each section
- Ensure qualitative presentation with linguistic accuracy

Course Outcomes (CO): Student will be able to

- Understand the significance of writing skills and the level of readability
- Analyze and write title, abstract, different sections in research paper
- Develop the skills needed while writing a research paper

UNIT - I		Lecture Hrs:10
1Overview of a Research Paper- Planning and Preparation- Word Order- Useful Phrases - Breaking up Long Sentences-Structuring Paragraphs and Sentences-Being Concise and Removing Redundancy -Avoiding Ambiguity		
UNIT - II		Lecture Hrs:10
Essential Components of a Research Paper- Abstracts- Building Hypothesis-Research Problem - Highlight Findings- Hedging and Criticizing, Paraphrasing and Plagiarism, Cauterization		
UNIT - III		Lecture Hrs:10
Introducing Review of the Literature – Methodology - Analysis of the Data-Findings - Discussion-Conclusions-Recommendations.		
UNIT - IV		Lecture Hrs:9
Key skills needed for writing a Title, Abstract, and Introduction		
UNIT - V		Lecture Hrs:9
Appropriate language to formulate Methodology, incorporate Results, put forth Arguments and draw Conclusions		

Suggested Reading

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
Model Curriculum of Engineering & Technology PG Courses [Volume-I]

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2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

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COURSE STRUCTURE

Course Code	FOOD PRODUCT DEVELOPMENT AND COMMERCIALIZATION PROGRAM ELECTIVE 1	L	T	P	C
21G13401a		4	0	0	4
	Semester	IV			

Course Objectives:

This course aims to provide the student to

- This course is intended to familiarize students with the product food product development including preliminary product description, prototype development, product testing phases.
- Students will learn the importance of teamwork, product specification, food formulation, food ingredient technology, ingredient interaction and how to conduct and terminate a project in an orderly manner.

Course Outcomes (CO): Student will be able to

After completion of the course, the student should be able to

- Critically analyse the role of food product development in food industry management and identify the reasons for its success or failure.L3
- Understand and critically analyze methods of organizing for food product development, including the relationship between different industry specialists (specifically NPD technologists, marketing and production) and how to manage them. L2
- Evaluate the usefulness of new product development models for the food industry and understand the role of accurate product costing.L5
- Computer aided ingredient analysis and designing, labeling and formulation.L6
- Review the process of food product development for both retail and food service food products L6

UNIT - I

New food product requirements

Market survey and its importance in; designing a questionnaire to find consumer needs for a product or a concept. Developing a Product to Meet the Requirements. Product life cycle. Creating brand value for the Product. The SWOT analysis, standardization of foods

UNIT - II

New product design and Development

New Food Product Development (NPD) process and activities, The Stage-Gate model NPD success factors, new product design, food innovation case studies, market-oriented NPD methodologies,

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COURSE STRUCTURE

organization for successful NPD; Recipe Development; use of traditional recipe and modification; involvement of consumers, selection of materials/ingredients for specific purposes; modifications for production on large scale, cost effectiveness and return on investment, nutritional needs or uniqueness; use of novel food ingredients and novel processing technologies.
Statistical designs for new product optimization and standardization- Response surface methodology, and other statistical tools. Process design, equipment needed; establishing process parameters for optimum quality; Sensory Evaluation;

UNIT - III		

Specialty food products
Health foods, Medical foods, Therapeutic foods, Herbal foods, Fortified foods.Infant foods, Geriatric foods, Sports drink.Functional foods, Designer foods and Neutraceuticals. Prebiotics, Probiotics and Synbiotics.

UNIT - IV		

Quality evaluation and regulatory requirements:
Product Stability; evaluation of shelf life; changes in sensory attributes and effects of environmental conditions; accelerated and ambient shelf life testing; developing packaging systems for maximum stability and cost effectiveness; Regulatory Aspects; whether standard product and conformation to standards; Approval for Proprietary Product.

UNIT - V		

Product commercialization:
Outcomes and activities in product commercialization, Pre-launch trial, Steps in product launch, Evaluation of the Launch, product performance testing, developing test market strategies, Case Studies of some successes and failures, food choice models and new product trends, branding and warehousing.

TEXT BOOKS

1. Fuller, G.W. New food product development: from concept to market place .CRC Press, New York, vol (3), 1994.
2. Man, C.M.D. and jomes A.A. Shelf life evaluation of foods. Blackie academic and professional, London, 1994.
3. Howard R. Moskowitz, I. Sam Saguy& Tim Straus, An Integrated Approach to New Food Product Development. Taylor and Francis Group, LLC.USA, 2009.

Reference Books:

1. Shapton, D.A. and shapton, N.F. Principles and practices for the safe processing of foods, Butterworth Heinemann Ltd, oxford.1991.
2. Graf, E. and saguy, I.S. , Food product development: from concept to the market Place, van no strand Reinhold new York.1991.

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3. Oickle, J.G.New product development and value added. Food development division agriculture, Canada.1990.
4. Maroulis Z.B. and Saravacos G.D. "Food Process Design", CRC Press, 2003

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COURSE STRUCTURE

Course Code	SUPPLY CHAIN MANAGEMENT	L	T	P	C
21G26401a	PROGRAM ELECTIVE-I	4	0	0	4
	Semester	**IV**			

Course Objectives:

This course aims to provide the student to

- Know various global market forces on global logistics
- Understand risk Management, sources of risk, particularly, at global levels and ways to manage global risk.
- Study international supply chain management and issue and comparison of supply chain management regional products with international.
- Know the Performance Expectation and Evaluation of logistics in various aspects viz., regional, cultural and geographical
- Understand global strategy implementation and requirements for Global Strategy –Global Strategy implementation and human resources role and importance

Course Outcomes (CO): Student will be able to

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

- State the various factors influencing global market forces.L1
- Identify global risk, sources of risk and manage global risk L2
- List the issues in international supply chain management.L1
- Clarify the regional and cultural differences in logistics.L2
- Elaborate the requirements of global strategy.L2
- Explain the global strategy implementation.L2
- State the role of human resource in global strategy.L1

UNIT - I

Global Logistics

Introduction – Global Logistics Meaning and Definition – Global market forces–Factors Influencing Global Market Forces–Factors Influencing Technological Forces— Global Cost Forces – Political and Economic Forces- international vendors and international competitive advantage.

UNIT - II

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COURSE STRUCTURE

Risk Management

Introduction–Risk Management–Meaning and Definition–Many Sources of Risks–Managing the Unknown Factors –Introduction to Global Risks-Global Risks– Managing Global Risks –Risk management process – risk administration -Managing risk in supply chain

UNIT - III

International Supply Chain Management

Introduction to International Supply chain–Issues in International Supply Chain Management International versus Regional Products –role of logistics services providers in supply chain – design of international multi stage networks global production global production network design.

UNIT - IV

Performance Expectation And Evaluation

Regional differences in Logistics – Cultural differences in different places – Geographic information Systems-Infrastructure – Performance Expectation and Evaluation- managing inventory for short life cycle products, multiple items, mulitiple loction inventory management, pricing and revenue management.

UNIT - V

Global Strategy Implementation

Requirements for Global Strategy –Global Strategy implementation –Information system Availability–Human Resources– role– significance - building partnership and trust in supply chain value of information –bullwhip effect – effective forecasting – coordinating the supply chain.

TEXT BOOKS

1. Pierre David, International Logistics: The Management of International Trade Operations Paperback –Import, 1 Dec.2013.
2. John Mangan, Chandra Lalwani,"Global Logistics and Supply Chain Management", Tim Butcher John Wiley & Sons, 2nd Edition, 2011.

Reference Books:

1. David Simchi, Levi, Philip Kaminsky, Ravi Shankar, "Designing & Managing the Supply Chain", Tata Mc Graw Hill, 14th Edition, 2010.
2. Ross.D.F, "Competing through Supply Chain Management", Chapman & Hall, 6thEdition, 2009.
3. Woods.D,A.Barone,P.Murphy,D.Wardlow,"Internationallogistics",Chapman & Hall, 1998.
4. Martin Christopher, Logistics & Supply Chain Management 5th Edition, Prentice Hall, 2016.

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COURSE STRUCTURE

Course Code	ENTREPEURNUSHIP AND BUSINESS MANAGEMENT PROGRAM ELECTIVE 1	L	T	P	C
21G26401b		4	0	0	4
	Semester	**IV**			

Course Objectives:

This course aims to provide the student to

- To develop an understanding of entrepreneurship and small business management by studying entrepreneurial strategies, the identification.
- Pursuit of new venture opportunities,
- The development of business plans.
- Students will also study the FSM macro environment and how it directly or indirectly influences entrepreneurship and the establishment and growth of small businesses in the FSM
- To make students understand the nature of entrepreneurship, and its importance to business.

Course Outcomes (CO): Student will be able to

The student will be able to:

- Discuss basic concepts in organizational behavior L3
- Demonstrate an understanding of the intricacies of marketing planning and overall marketing L2
- Demonstrate an understanding of the concepts underlying corporate financial decision making L2
- Demonstrate an understanding of the role of entrepreneurship and small business in the FSM economy L2
- Demonstrate basic knowledge of international business L2
- Demonstrate an understanding of economic development issues
- List statistical methods of sampling and estimating population statistics L1

UNIT - I

Nature and Forms of Entrepreneurship:

Features - Entrepreneur's competencies, attitude, aptitude, qualities, functions. Entrepreneurial scenario in India and Abroad. Small Business, Importance in Indian Economy, Types of ownership, sole trading, partnership, Important features of various types of businesses - corporate entrepreneurship, intrapreneurship - Role of Government in the promotion of Entrepreneur.

UNIT - II

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COURSE STRUCTURE

Aspects of Promotion and Financial Aspects of the Entrepreneurship:
Idea generation – opportunities - SWOT Analysis - patents and trademarks, Intellectual Property Rights. Source of Capital, Debt capital, seed capital, venture capital - Informal Agencies In financing entrepreneurs, Government Grants and Subsidies, Types of Investors and Private Offerings.

UNIT - III		

Project Planning and Feasibility Studies:
The Concept of Project, Project Life Cycle - Project Planning, Feasibility – Project proposal & report preparation.

UNIT - IV		

Entrepreneurial Strategy:
Generation of new entry opportunity, Decisions under Uncertainty, entry strategy, new entry exploitation, environmental instability and First-Mover disadvantages, Risk Reduction strategies, Market scope strategy, Imitation strategies and Managing Newness.

UNIT - V		

UNIT V

Rural Entrepreneurship and EDPs:
Scope of entrepreneurship in the rural areas, promotional efforts supporting entrepreneurs in India - Successful cases of entrepreneurs.-Need, Rural Industrialization – Role of NGO's - Organising EDPs – Need, Objectives, Evaluation of Entrepreneurship Development Programmes

Reference Books:

1. S.S. Khanka, Entrepreneurial Development, S. Chand and Company Limited, revised edition, 2007.
2. H. Nandan Fundamentals of Entrepreneurship, PHI, 2007
3. Robert D Hisrich, Michael P Peters, Dean A Shepherd Entrepreneurship 8e,McGraw Hill Education, 8th edition, 2013.
4. Vasanth Desai The Dynamics of Entrepreneurial Development and Management ,Himalaya publishing house, 6th edition, 2011.
5. Bholanath Dutta Entrepreneurship Management – text and cases, Excel Books, 2009.
6. Holt Entrepreneurship – New venture Creation, PHI, 1991.
7. Barringer, Ireland, Entrepreneurship- Successfully Launching New Ventures, Pearson, 2nd edition, 2008.
8. Roy R, Entrepreneurship, Oxford university press, 2nd edition, 2011.

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OPEN ELECTIVES

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COURSE STRUCTURE

Course Code	INDUSTRIAL SAFETY	L	T	P	C
21DOE301b		3	0	0	3
Semester		IV			

Course Objectives:

- To know about Industrial safety programs and toxicology, Industrial laws , regulations and source models
- To understand about fire and explosion, preventive methods, relief and its sizing methods
- To analyse industrial hazards and its risk assessment.

Course Outcomes (CO): Student will be able to

- To list out important legislations related to health, Safety and Environment.
- To list out requirements mentioned in factories act for the prevention of accidents.
- To understand the health and welfare provisions given in factories act.

UNIT - I Lecture Hrs:

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, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT - II Lecture Hrs:

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 - III Lecture Hrs:

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working andapplications, 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 - IV Lecture Hrs:

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.

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UNIT - V		Lecture Hrs:
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		
Textbooks:		
1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services. 2. Maintenance Engineering, H. P. Garg, S. Chand and Company.		
Reference Books:		
1. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication. 2. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.		

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COURSE STRUCTURE

Course Code	COST MANAGEMENT OF ENGINEERING PROJECTS	L	T	P	C
21DOE301a		3	0	0	3
	Semester	IV			

Course Objectives:

- To explain cost concepts and objectives of costing system and cost management process
- To provide knowledge and explain Cost behaviour in relation to Volume and Profit and pricing decisions.
- To know the concepts of target costing, life cycle costing and activity based cost management in a project or business.
- To discuss on budget and budgetary control , type of budgets in a business to control costs
- To provide knowledge on project, types of projects, stages of project execution, types of project contracts and project cost control.

Course Outcomes (CO): Student will be able to

- Know the cost management process and types of costs
- Learn and apply different costing methods under different project contracts
- To understand relationship of Cost-Volume and Profit and pricing decisions.
- Prepare budgets and measurement of divisional performance.
- Acquires knowledge on various types of project contracts, stages to execute projects and controlling project cost..

UNIT - I	Lecture Hrs:10

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	Lecture Hrs:12

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; Pareto Analysis Just-in-time approach, Theory of constraints.; Divisional performance management: - Measurement of Divisional profitability - pricing decisions - transfer pricing.

UNIT - III	Lecture Hrs:10

Target costing- Life Cycle Costing - Activity-Based Cost management:- Activity based costing- Value-Chain Analysis- Bench Marking; Balanced Score Card.

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UNIT - IV		Lecture Hrs:10
Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.		
UNIT - V		Lecture Hrs:12
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 non-technical 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.		
Textbooks: 1. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting 2. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher		
Reference Books:		
1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi 2. Charles T. Horngren and George Foster, Advanced Management Accounting 3. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd		
Online Learning Resources:		
https://nptel.ac.in/courses/105/104/105104161/ https://nptel.ac.in/courses/112/102/112102106/		

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COURSE STRUCTURE

Course Code	**WASTE TO ENERGY**	**L**	**T**	**P**	**C**
21DOE301e		**3**	**0**	**0**	**3**
	Semester	**IV**			

Course Objectives:

- Introduce and explain energy from waste, classification and devices to convert waste to energy.
- To impart knowledge on biomass pyrolysis, gasification, combustion and conversion process.
- To educate on biogas properties ,bio energy system, biomass resources and their classification and biomass energy programme in India.

Course Outcomes (CO): Student will be able to

- To know about overview of Energy to waste and classification of waste.
- To acquire knowledge on bio mass pyrolysis, gasification, combustion and conversion process in detail.
- To gain knowledge on properties of biogas, biomass resources and programmes to convert waste to energy in India.

UNIT - I	Lecture Hrs:10
Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors	
UNIT - II	Lecture Hrs:10
Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.	
UNIT - III	Lecture Hrs:12
Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation	
UNIT - IV	Lecture Hrs:12
Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.	
UNIT - V	Lecture Hrs:10

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COURSE STRUCTURE

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification -

Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification- pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

Textbooks:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 2018
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., TMH, 2017

Reference Books:

1. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
2. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996

Online Learning Resources:

https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-ch13/
https://www.youtube.com/watch?v=x2KmjbCvKTk