



ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION

MINOR

Subject: Food Science & Technology

w.e.f. AY 2023-24

COURSE STRUCTURE

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
I	II	1	Food Biochemistry	3	3
			Food Biochemistry Practical Course	2	1
II	III	2	Food Microbiology	3	3
			Food Microbiology Practical Course	2	1
	IV	3	Food Additives and toxicology	3	3
			Food Additives and toxicology Practical Course	2	1
		4	Food Packaging	3	3
			Food Packaging Practical Course	2	1
III	V	5	Food Safety and Quality Control	3	3
			Food Safety and Quality Control Practical Course	2	1
		6	Baking Science & Technology	3	3
			Baking Science & Technology Practical Course	2	1

SEMESTER-II

COURSE 1: FOOD BIOCHEMISTRY

Theory

Credits: 3

3 hrs/week

Learning Objectives

1. Understand the basic concepts of biomolecules.
2. Explore the concepts of Enzymes and techniques.

Learning Outcomes

Upon successful completion of the course, a student will be able to:

LO1: To Study about Classification structure and functions of Carbohydrates.

LO2: To Study about classification structure and function of Proteins

LO3: To Study about classification, structure and functions of lipids

LO4: To Study about Classification and specificity of Enzymes.

LO5: To know about the Fundamental prosperities of water classification of vitamins and minerals

UNIT –I

Carbohydrates: -Definition structure and isomerism: Classification, properties and uses of monosaccharides, disaccharides, oligosaccharides and polysaccharides and their uses – Reactions of carbohydrates: Hydrolysis, acyclic reactions, dehydration/ thermal degradation, gelatinization caramelization. Hydrophilicity, flavor ligends, Browning, Sweetness. Functions of Polysaccharides: Starch, Cellulose, hemi-cellulose, pentosans, pectin, gums (Alginates, carrageenan, locust bean gum, xanthum gum).Digestion & absorption of carbohydrates.

Unit – II

Proteins: - Amino Acids: classification, chemical properties. Peptides and Proteins: Primary Structure- Spatial relation- Denaturation. Functional Properties: Hydration, Solubility, Viscosity,

Gelatin, Texturization, Emulsification, Foaming. Nutritional Properties. Protein Modification / Processing and storage. Millard reactions. Oxidation of amino acids, De-amination. Oxidative and non-oxidative deamination, transamination, deamination, removal of carboxylic group, Carbon skeleton metabolism. Digestion & Absorption of proteins.

Unit – III

Lipids:-Lipids-definition, classification with examples source and functions of fatty acids, Glycerides- Phospholipids and sterols Physical Aspects: Triacylglycerol Distribution, Positional Distribution, Consistency, Emulsions and emulsifiers-Chemical Aspects: Lipolysis, Auto oxidation, Thermal decomposition, Chemistry of frying. Digestion & Absorption of fats.

Unit- IV

Enzymes:-Definition, holo enzyme, apoenzyme, zymogene forms classification, specificity, catalysis and regulations- Factors influencing activity: Temperature, p^H , water activity and ionic strength/ electrolytes-Mechanisms of enzyme inhibition & enzyme activation - endogenous enzymes: pectic enzymes, amylases, catalases and enzymatic browning. cofactors & co enzyme with examples

Unit – V

Basic Principles and techniques- Fundamental Properties/ Structure: Ice, Water- Availability in foods: Water composition, Isotherms – Effect of Water Activity on Food stability (Shelf life).

Principle & uses of all analytical methods. (Chromatography, Electrophoresis, and Spectrophotometer).

REFERENCES

1. Pomeranz Y and Meloan C E., “Food Analysis: Theory and Practice”, 3rd Edition, CBS Publishers, New Delhi, 1996.
2. Nielsen S S., “Introduction to the chemical analysis of foods”, Jones and Bartlett Publishers, London., 1994.
3. Nielsen S S., “Food Analysis Laboratory Manual”, Chips Ltd, USA. 2003.
4. Principles of Biochemistry: Lehninger AL. CBS Publication, New Delhi.
5. Biochemistry: Voet O, Voet G, John Wiley and Sons Publications. 1994
6. Biochemistry: Stryer L. 4th Edition, 1994

7. Biochemistry :Zubay G . William C Brown , New york. 1997

SEMESTER-II

COURSE 1: FOOD BIOCHEMISTRY

Practical

Credits: 1

2 hrs/week

1. Estimation of Titrable acidity in foods
2. Estimation of Moisture and total solids analysis
 - a. Karl Fischer titration
3. Estimation of Sugars – Reducing, non reducing, total sugars
4. Estimation of Protein by Kjeldhal Method.
5. Estimation of Fat
 - a. Soxhlet method
 - b. Rosegotlib method
6. Estimation of Ash and Acid insoluble ash
7. Determination of Water activity of different food samples
8. Qualitative tests for amino acids.
9. Qualitative tests for proteins.
10. Estimation of minerals a) calcium) phosphorous (Fiske&subbarow),c)iron(wongs)
11. Estimation of vitamins a) ascorbic acid)
12. Fatty acid model for unsaturation
13. Paper chromatography-amino acid detection.
14. Estimation for maltose-DNase method.

SEMESTER-III
COURSE 2: FOOD MICROBIOLOGY

Theory

Credits: 3

3 hrs/week

Learning Objectives

To introduce the fundamental concepts of microbiology.

Learning Outcomes

Upon successful completion of the course, a student will be able to:

LO1: To understand about scope of microbiology & classification of micro organisms & sterilization methods.

LO2: To study about the prokaryotic cells like bacteria, yeast, molds & viruses which are associated with food.

LO3: To learn about physical & chemical factors affecting growth of micro organisms.

LO4: To understand about metabolism & growth of micro organisms.

LO5: To study bacterial genetics & mutation.

UNIT – I

Historical aspects, Scope of microbiology, General classification of microorganisms, morphology, Structure and function of prokaryotic cells and their organelles – Structure and function of eukaryotic cells and their organelles morphological and biochemical characteristics of important groups. Brief survey of microbes as friends and foes. Characteristics, growth and reproduction, Sterilization and disinfections.

UNIT – II

Characteristics of growth and reproduction. Physical and chemical factors affecting growth of microorganisms like temperature, pH, oxygen, Osmotic pressure, nutrients etc, bacteriostatic and

bactericidal. Physiology, Nutritional requirement of bacteria, yeast and fungi, bacterial growth curve. Structure of DNA, Types of RNA and difference between DNA & RNA.

UNIT – III

Microorganisms associated with foods, Sources of microorganisms – Soil, water, plants and of animal origin. Useful microorganisms – Endospore formers, Irregular non-sporing gram positive rods. Yeasts & molds their role in food spoilage, Estimating number of microorganisms, sampling, sample size. Aseptic collection of samples, total cell counts and viable cell counts, plate counters. Indicator organisms. Alternative and Rapid methods for detection of specific microbes and toxins : Dye-reduction tests, Electrical methods, ATP determination – Pure cultures-preparation, maintenance and preservation – Microbiological quality control and HACCP

UNIT – IV

Microbiology of Food commodities, Contamination, preservation and spoilage & beneficial role of microorganisms in Cereals, Pulses, Nuts and Oilseeds, Fruits and Fruit products, Vegetables and Vegetable products Meat, dairy and their products.

Microbiology of water- Contamination and microbial standards.

Food Borne Illnesses Food poisoning, Food borne infections, Food borne Intoxications (*Aeromonashydrophila*, *Bacillus cereus*, *Brucella*, *Camphylobacter*, *Clostridium botulinum*, *Clostridium perfringenes*, *Escherichia coli*, *Salmonella*, *Staphylococcus aureus*, *vibrio*, *yersinia*, *Listeria*) Hepatitis A and B Gastroenteritis viruses.

Spongiform encephalopathy - occurrence, symptoms, Preventive and control measures

UNIT – V

Food preservation Heat processing: Pasteurization and appertization, Determination of D and z values. Heat sensitivity of micro-organisms & Spoilage of canned foods. Aseptic packaging, Irradiation Brief account of microwave, UV and ionizing radiation. Brief account of High pressure

processing Low temperature storage –Chilling and freezing. Effect of chemical and natural preservatives on microbes in food.

REFERENCES:

1. General microbiology – Pelzar
2. Food Microbiology – Frazier
3. Molecular biology of the Cell – Bruce Alberts
4. Cell and molecular biology – De Robertis&De Robertis
5. W.C.Frazier: *Food Microbiology (IV edition)*Mcgraw Hill Book Company, New York (1995)
6. James M jay: *Modern food microbiology IV edition*, CBS publishers, New Delhi (1996)
7. M.R. Adams and M.O. Moss, *Food Microbiology*, Second Edition, Panima Publishing corporation, New Delhi. Third reprint 2004.
8. Gustavo F Gutierrez-Lopez, Gustavo V Barbosa-Canovas *Food Science and Food Biotechnology: CRCPress 2003*
9. Bibek Ray: *Fundamental Food Microbiology*, (Third Edition) CRC Press December 2003

SEMESTER-III
COURSE 2: FOOD MICROBIOLOGY

Practical

Credits: 1

2 hrs/week

1. Identification of microbes by Simple staining
2. Identification of microbes by Gram staining
3. Microbial mobility test (hanging drop method)
4. Determination of size of microbes (micrometry)
5. Direct microscopic count (DMC) of microorganisms
6. Identification of common microorganisms.
7. Identification of fungi in bread, pickles, jam, groundnut etc.
8. Microbiological examination of fresh fruits, vegetables and spices.
9. Microbiological examination of canned foods (acidic and non-acidic foods)
10. Microbiological examination of bottled and aseptically packed beverages
 - a. water (MPN method for determination of coliform count)
11. Microbiological examination of flour, bread, cakes, sugar and cocoa confectionery products
12. Microbiological examination of meat, milk and their products
13. Visit to food microbiology lab.

SEMESTER-IV
COURSE 3: FOOD ADDITIVES AND TOXICOLOGY

Theory

Credits: 3

3 hrs/week

Learning Objectives:

To familiarize with concepts of food additives and toxicology

Learning Outcomes: On successful completion of the course, students will be able to

LO1: To learn about the effective processing on vitamins.

LO2: To study about the flavoring agents & nutritional, preservatives.

LO3: To know about the food colors & sources.

LO4: To learn about the fruits & vegetables composition.

LO5: To understand milk and egg composition and processing effects

Unit – I

Vitamins - Classification, Structure, Sources, Functions, Deficiencies; Minerals- Types, Sources, Functions, Deficiencies, Effect of Processing on vitamins

Unit – II

Introduction to food additives- classifications, nutritional, preservatives/ antimicrobial agents, antioxidants, flavoring agents, sweeteners, enzymes, p^H controls agents and acidulants. Food additives and hypersensitivity. Risks and benefits of different food additives. Food dispersions, solutions, gels, emulsions and foams.

Unit – III

Food colours- sources of food colours, types with reference to natural and synthetic, properties/ reactions reference to processing, food applications. Food flavours- natural, natural identical and synthetic – Flavour enhancers and potentiators and applications

Unit – IV

Fruits & Vegetables Composition, Physico-Chemical Properties, Textural Components; Post Harvest Changes In Fruits And Vegetables- Respiration, Ripening, Colour and Textural Changes, Changes In Fats And Organic Acids.

Unit – V

Chemistry of milk and its constituents- compositions, effect of processing on constituents (heating, fermentation, freezing, homogenization); Egg- composition, proteins of egg, effects of processing on egg and their constituents.

References:

1. Food Chemistry : Mayer , CBS Publications
2. Food Chemistry : Fennema
3. Food Science : Sri Lakshmi
4. Food Science : Potter
5. Dairy Chemistry : Mathur
6. Food & Nutrition : M.S. Swaminathan Vol- I & II
7. Fruit & Vegetable Preservation
8. Principles & Practic : Srivastava R.P, III edition, IBDC Publishers

SEMESTER-IV

COURSE 3: FOOD ADDITIVES AND TOXICOLOGY

Practical

Credits: 1

2 hrs/week

1. Estimation of crude fiber
2. Estimation of Chlorophyll content
3. Estimation of carotenoids
4. Extraction of colors from native source
5. Estimation of calcium in foods
6. Estimation of iron in foods
7. Estimation of total soluble solids using refractometer
8. Estimation of NaCl in butter, pickles and processed foods
9. Estimation of energy content in Foods
10. Visit to food industry / Quality Control lab
11. Fruit & Vegetable Preservation

SEMESTER-IV
COURSE 4: FOOD PACKAGING

Theory

Credits: 3

3 hrs/week

Learning Objective:

To familiarize with the concepts of food packaging

Learning Outcomes:

Upon successful completion of the course, a student will be able to:

LO1: To understand about packing methods of food & preservation.

LO2: To study about food packing materials.

LO3: To understand flexible packing materials.

LO4: To know the evaluation of packing material & packing performance.

LO5: To understand about recent trends in packing

Unit – I

Introduction to packaging: Packaging operation, package-functions and design, Principle in the development of protective packaging, Deteriorative changes in food stuff , packaging methods for prevention, shelf life of packaged foodstuff, methods to extend shelf life

UNIT- II

Food containers: wooden boxes, crates, plywood and wire bound boxes, corrugated and fiber board boxes, textile and paper sacks , Metal containers, tin plate, corrosion of containers, Food packages-bags, pouches, wrappers, cartons, other traditional package

UNIT- III

Flexible packaging materials and their properties; Paper, metal foils, polymers, and laminates, Packaging additives, Considerations in the packaging of perishables and processed foods, Aluminum as packaging material

UNIT-IV

Evaluation of packaging material and package performance, packaging equipment, Metering and filling of different foods, Aseptic filling of foods, Labeling requirements, Bar coding- Printing, package standards and regulation

UNIT-V

Trends in latest packaging, Modified Atmospheric Packing (MAP), Controlled Atmospheric Packaging (CAP), Oxygen scavengers, Shrink packaging, aseptic and retortable pouches , Flexible and laminated pouches, Biodegradable packaging, Active packaging, Packaging of different food materials- Fruit and vegetables, meat, milk and egg, products, oils, RTE foods1

References

1. Painy, F.A. and Painy, H.Y. "A Handbook of Food Packaging" Leonard Hill, Glasgow, UK.1983.
2. Food Packaging. : Westport. Scicharow, S. and Griffin, R.C. 1970.
3. Principles of Food packaging: Stanley Sacharow
4. Food packaging and preservation: Mathlouthi
5. Food packaging (Principles & Practices): Gordan L Robertson
6. Principles of food packaging: Heiss . R
7. Packaging of food Beverages: Day F T

SEMESTER-IV
COURSE 4: FOOD PACKAGING

Practical

Credits: 1

2 hrs/week

- Identification of different types of packaging materials
- Determination of following properties on different packaging materials
 - a) Tensile strength
 - b) Tearing resistance
 - c) Impact test
 - d) Compression resistance
 - e) Sealing strength
 - f) Chemical stability
 - g) Dimensional stability
 - h) Gas transmission rate
 - i) Water vapour transmission rate
 - j) Grease resistance
 - k) Grammage (GSM)
 - l) Bursting strength
- Physical properties of paper
- Determination of tin coating, weight and porosity
- Vacuum/ gas/shrink packaging of food products
- Performance evaluation of transport packages
- Shelf life studies of packaged foods
- Design of labels for food packages

SEMESTER-V

COURSE 5: FOOD SAFETY AND QUALITY CONTROL

Theory

Credits: 3

3 hrs/week

Learning Objectives:

To study the various aspects of quality control and sensory evaluation in food industries.

Learning Outcomes: On successful completion of the course, students will be able to

LO1: To gain the knowledge about the food safety of various hazards involved in it.

LO2: To understand the quality assurance & various voluntary & obligatory food standards.

LO3: To learn the sampling methods & testing of raw materials & finished food products.

LO4: To learn about sensory parameters & its associated subjective & objective tests.

LO5: To study about the sanitation, hygiene & quality assurance in food industries.

Unit – I

- Food safety: characterization and risk analysis
- Food hazards: Physical, chemical and biological Systems for food safety.
- Hazard Analysis Critical Control Point (HACCP) and its implementation.

Unit-II

- Quality assurance: Theoretical and practical considerations
- Description of different systems: GAP, GMP, TQM, ISO.
- Indian food standards- voluntary and obligatory standards
- (PFA, FPO, MMPO, Meat and Meat Products order, AGMARK etc.)
- Food safety and standards act (FSSA)

- Codexalimantarius
- Worldwide food safety issues.

Unit-III

- Sampling methods- random and statistical methods
- Quality assurance
- Quality control and testing of raw material and finished products in
- cereals, fruits and vegetables,
- dairy, confectionery, beverages,
- meat and egg processing plants

Unit-IV

- Sensory evaluation- Requirements and methods.
- Sensory parameters: colour, flavour, texture, taste, aroma, general acceptability
- Subjective and objective test of sensory parameters.
- (Differential tests, Descriptive test, Rating tests, Sensitivity threshold test)

Unit-V

- Cleaning In Place (CIP)
- Different Sanitizers and detergents
- Sanitation and hygiene in quality assurance in different food industries
- (Fruits and vegetables, Meat, Milk, and Cereal based).
- Cost of quality
- Supplier development.

References:

1. Pomeranz Y and Meloan C E, “ Food analysis: Theory And Practice”. 3rd ed. CBS Publishers, New Delhi.1996.
2. Nielsen S S, “ Introduction to the chemical analysis of foods”Jones and Bartlett Publishers, London.1994.
3. Nielson S S. “Food analysis laboratory manual”. Chips Ltd, USA.2003.
4. Lawless H T and Heymann H. “ Sensory Evaluation of Foods Principles And Practices”, Chapman and Hall, New York1998.
5. AOAC, “Official methods of analysis. Association of OfficialAnalytical Chemists”, Arlington 1995.

SEMESTER-V

COURSE 5: FOOD SAFETY AND QUALITY CONTROL

Practical

Credits: 1

2 hrs/week

1. Layout of quality control laboratory for food processing unit the requirements of glassware and equipments.
2. Microbiological quality control of utensils and glassware SWAB, RINSE methods
3. Evaluation of personnel hygiene
4. Evaluation of detergents AOAC method.
5. Evaluation (Sensory and chemical) of canned foods
6. Evaluation (Sensory and chemical) of dairy products
7. Evaluation (Sensory and chemical) of confectionery products
8. Detection of common adulterants
9. Good Laboratory Practices
10. Visit to food industry quality control lab

SEMESTER-V
COURSE 6: BAKING SCIENCE & TECHNOLOGY

Theory

Credits: 3

3 hrs/week

Learning Objectives: To understand the principles of baking science & technology of production.

Learning Outcomes: On successful completion of the course, students will be able to

LO1: To gain knowledge about the bread, formulation & ingredients.

LO2: To learn the bread making & its baking process.

LO3: To understand the methods & ingredients used in biscuit production.

LO4: To learn the principles & procession preparation of cakes.

LO5: To learn the preparation of frozen dough products & application of starches in bakery industry.

UNIT-1

- Bread types, quality assessment and formulations
- Ingredients: wheat flour, components and functions; proteins carbohydrates, lipids and enzymes
- Miscellaneous flours (rye, tricale)
- shortenings; functions, sources, types and mechanisms
- sweeteners; functions; types
- yeast; functions, types and factors influencing the fermentation
- Minor ingredients; yeast foods enzymatic supplements, oxidizing agents, salt, dairy and egg products, mold inhibitors, dough strengtheners/ softeners and enrichment

Unit – II

- Bread making process; straight dough - rapid processing
- mechanical dough development
- Mixing and dough processing; functions of mixing, mixer types
- fermentation, dough transfer system, dough make up
- dividing rounding and pre-moulding
- first proving moulding panning and proving Process; developments
- Baking process, stages, baking reactions and bread cooling
- thermal reactions keeping properties of bread and related products
- Bread spoilage and staling, factors and control measures

Unit – III

- Biscuits; biscuits, cookies and crackers
- ingredient and their functions, wheat flour, granulation, Shortening, sweeteners, chemical leaveners
- Baking powder, function, composition, and reactive rates, neutralizing value
- Preparation of biscuits dough's mixing objectives, mixer types
- fermentation of shaped dough pieces
- Biscuit baking, heat transfer mechanism, changes during baking
- Cooling, packaging and storage

Unit – IV

- Cakes: cake varieties, ingredients and their functions
- wheat flour, components; shortening, egg, baking powder icing, confectionery coating, minor ingredients
- formulations, formula balance

- cake mixing objectives and methods
- Batter specific gravity, temperature and P^H, baking reactions

Unit – V

- Wafers: fermentation, ingredients and their function
- flour, water, shortening, aerating agent and minor ingredients
- mixing, storage and depositing of wafer butter, baking, cooling and conditioning of wafer sheets
- Frozen dough products
- Fat bread technology
- Starches-sources, composition, properties, modifications methods and applications in bakery industry

Reference Books

1. Cauvain & Linda S.Y, “ Technology of Bread making”, Blackie Academy & Professional, London 1998.
2. Matz, S.A. “Bakery Technology & Engineering” 3rd edition, CBS publications Delhi. 1996.
3. Plyer, E.J “Baking Science & Technology” Vol.-I & II, 3rd edition, Sopsland Pub. Kansas, U.S.A 1988.
4. Pomeroy, Y, “Wheat chemistry & Technology” Vol.I & II, 3rd edition A.A.C.C.
5. Wade, P, “Biscuits Cookies & Crackers” Vol.I, Elsevier. 1998.
6. Almond, “Biscuits Cookies & Crackers “Vol.II, Elsevier 1998.

SEMESTER-V

COURSE 6: BAKING SCIENCE & TECHNOLOGY

Practical

Credits: 1

2 hrs/week

FOOD PROCESSING & PRESERVATION LAB

- Bread baking; Effects of water absorption and Dough mixing time, Variation in Fermentation and proofing time
- Effect of Shortenings and surfactants, various oxidants, Flour protein variation and chemical dough development
- Effect of amylases, sweeteners and improvers on bread
- Comparison of various dough procedures
- Preparation of cakes and quality control
- Use of different acidulants in cake
- preparation and evaluation of, cookies, pastry and cake icing

Visit to bakery industries & Biscuit industries