



ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

Guwahati

Course Structure and Syllabus

(From Academic Session 2020-21 onwards)

M.Voc

**Food Processing and Quality Management
(under CBCS)**

1st Semester



ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY
Guwahati

Course Structure
(From Academic Session 2020-21 onwards)

M.Voc Food Processing and Quality Management
1st Semester: Course Structure

Theory/ Practical	Sl. No.	Sub Code	Subject	Hours Per week			Credit	Marks	
				L	T	P		C	CE
Core									
Theory	1	MFP202101	Principles of Food Processing	3	0	0	3	30	70
	2	MFP202102	Food Chemistry and Analysis	3	0	0	3	30	70
	3	MFP202103	Food Plant Equipment Design and Management	3	0	0	3	30	70
	4	MFP202104	Research Methodology and Biostatistics	3	0	0	3	30	70
Practical	1	MFP202115	Lab-I	0	0	4	2	30	70
	2	MFP202116	Lab-II	0	0	4	2	30	70
Elective-1 (Any One)									
Theory	1	MFP202E101	Technology of Cereals, Pulses, Oil Seeds and Legumes	3	0	0	3	30	70
Practical		MFP202E111	Technology of Cereals, Pulses, Oil seeds and Legumes Practical	0	0	2	1	30	70
Theory	2	MFP202E102	Technology of Fruits and Vegetables	3	0	0	3	30	70
Practical		MFP202E112	Technology of Fruits and Vegetables Practical	0	0	2	1	30	70
Theory	3	MFP202E103	Enzymes in Food Processing	4	0	0	4	30	70
Total				15/16	0	10/8	20	210	490
Total contact hours per week: 25/24									
Total Credit: 20									

Subject code	Subject	Hours per week L-T-P	Credit C
MFP202101	Principles of Food Processing	3-0-0	3

MODULE 1: Introduction

Defining food; classification of food; constituents of foods; food processing; food preservation; food spoilage – introduction, causes of food spoilage, food poisoning, food-borne intoxication and food-borne infection.

MODULE 2: Food Preservation and Processing

Introduction; necessary; methodology; principles and methods of food preservation; High Temperature Preservation: Introduction; blanching; pasteurization; sterilization; canning; Low temperature preservation: Introduction; methods of low temperature preservation; chilling; refrigeration and cold storage; factors affecting refrigerated & frozen storage of foods; effect of freezing on constituents of foods.

MODULE 3: Drying, Dehydration and Concentration

Introduction; purpose; water activity and relative humidity; factors affecting rate of drying and dehydration; drying methods; changes during drying and dehydration; different driers; Concentration- methods of concentration, changes; effect of drying, dehydration and concentration on quality of foods; Food irradiation: Introduction; radiation sources; measurement of radiation dose; mechanism of action; type of irradiation; factors affecting food irradiation; effect of irradiation.

MODULE 4: Preservation Using Sugar, Salt and Acids

Sugar – Introduction, factors affecting osmotic pressure of sugar solution, foods preserved using sugar; salt: introduction, antimicrobial activity of salt, estimation of salt, food products preserved using salt; acid – Introduction, mechanism, common foods preserved using acids Preservation by use of chemicals: Introduction; objectives; factors affecting antimicrobial activity of preservatives; type of chemical preservatives; sulphur dioxide, benzoic acid, etc; use of other chemicals like acidulants, antioxidants, mold inhibitors, antibodies, etc.

MODULE 5: Recent Methods in Processing

Introduction; PEF, HPP, ultrasound, dielectric heating; microwave heating; ohmic heating; infrared heating; UV light, X-rays, membrane processing, ozonization; high intensity electric field in pulses; new hybrid drying technologies.

MODULE 6: Effect of Processing on Nutritional Value of Food

Introduction; consuming raw foods; effect of processing on vitamins; effect of processing on minerals; effect of processing on carbohydrates; effect of processing on lipids.

Textbooks/Reference:

1. Bawa. A.S, O.P Chauhan etal. Food Science, New India Publishing agency, 2013
2. Roday,S. Food Science, Oxford publication, 2011.
3. B. Srilakshmi, Food science, New Age Publishers, 2002
4. Meyer, Food Chemistry, New Age, 2004

Subject code	Subject	Hours per week L-T-P	Credit C
MFP202102	Food Chemistry and Analysis	3-0-0	3

MODULE 1:

Introduction to different food groups and importance of food chemistry; Water in foods and its properties; Water and Ice: Physical properties, structure of water and ice, water soluble interaction, water activity and relative vapor pressure; Dispersed systems: Surface phenomena, colloidal interactions, Liquid dispersions, gels, emulsions and Foam.

MODULE 2: Carbohydrates

Monosaccharide, Oligosaccharides, Polysaccharides, Starch, Cellulose, Guar and Gum, Xanthan, Carrageenans, Pectin and Dietary fiber; Physico-chemical and functional properties; chemistry and structure of homopolysachharides and heteropolysachharides.

MODULE 3: Lipids

Classification, physical aspects, chemical aspects, chemistry of fats and oil processing, role of food lipids in flavor, physiological effects of Lipids; Fats: Sources and physico chemical and functional properties; PUFA [Poly-unsaturated Fatty Acids] hydrogenation and rancidity; Saponification number, iodine value, Reichert-Meissl number, Polenske value; Lipids of biological importance like cholesterol and phospholipids.

MODULE 4: Amino Acids, Peptides and Proteins

Physiochemical properties of amino acids, protein structure, protein denaturation, functional properties of proteins, nutritional properties of proteins, processing induced physical and chemical changes of protein; Common food proteins, Nitrogen balance and nitrogen pool; Evaluation of quality of proteins.

MODULE 5: Food Colorants

Pigments in animal and plant tissues, Permitted Food colors and their permission level in Food, Food flavor and Food additives: Acid, bases, and buffer systems, chelating agent, antioxidant, antimicrobial agent, sweeteners, fat replacers; Food adulteration and adulterant.

MODULE 6: Vitamins & Minerals

Occurrence, physiological function of vitamins and minerals. Introduction to human nutrition; Nutritive values of foods; Basal metabolic rate; Techniques for assessment of human nutrition, Dietary requirements and deficiency diseases of different nutrients.

Textbooks/Reference:

1. Beltz, H.D. 2005. Food Chemistry. Springer Verlag.
2. Fennema, O.R, 2006, Food Chemistry, Academic Press.
3. Meyer, L.H. 1987. Food Chemistry. CBS publishers and Distributors, New Delhi.
4. Potter, N.N. and Hotchikiss, J.H. (2006), Food Sciences, Fifth edition, CBS publishers and Distributors, New Delhi.
5. Fennema, O.R.2006. Food Chemistry. Marcel Dekker.

Subject code	Subject	Hours per week L-T-P	Credit C
MFP202103	Food Plant Equipment Design and Management	3-0-0	3

MODULE 1: Milling Equipment

Types of equipment used for milling rice and wheat, pearling and flaking equipment; dhal mills

MODULE 2: Washing, Filtration & Centrifugation equipment

Different Fruits and Vegetable washing systems; Conveyor belts - types, material of construction, product specific conveyors; Screw, bucket, belt, oscillating and vibratory conveyors; Filtration of liquid foods (dairy, fruit & vegetables); centrifugation systems: Solid bowl and disc bowl centrifuges; cyclone separator.

MODULE 3: Heat Processing & Cooling Equipment

Heat exchangers – Plate, shell and tube etc.; Autoclaves - types, operation; Different Dryers and freezers – Tray, tunnel, Fluidized. Spray dryer, Blast and IQF, Freezers, short tube and pan evaporators.

MODULE 4: Mixing, Blending, Extrusion & Filling Equipment

Agitation and mixing of liquid foods, powders and pastes; Mixers - ribbon blenders, augur, nauta, cone. Cold and hot extruders, single screw, twin screw, extrusion cooking.

MODULE 5: Screening

Types of screens; Grizzly; Revolving screen; Shaking screen, Rotary screen, Vibratory screen; Horizontal screen; Perforated metal screens; Wire mesh screens; Modern storage structures; Storage of agricultural perishables; Controlled and modified atmosphere storage.

MODULE 6:

Introduction to food plant design and layout; location and site selection for food plants; food plant size, utilities and services; food plant layout introduction, planning and experimentation; symbols used for food plant design and layouts; process scheduling and operation; building materials and construction

Textbooks/Reference:

1. Lopez – Gomez, A. and Barbosa – Canovas, G.V. “Food Plant Design”, Taylor & Francis, 2005.
2. Smith, P.G. “Introduction to Food Process Engineering”, Springer, 2005
3. Rao, M.A. Rizvi, S.S.H. and Datta, A.K. “Engineering Properties of Food”, 3rd Edition, Taylor & Francis, 2005
4. Sahay, K.M. and Singh, K.K. UNIT operations of agricultural processing. Vikas Publishing house Pvt. Ltd., 2001

Subject code	Subject	Hours per week L-T-P	Credit C
MFP202104	Research Methodology and Biostatistics	3-0-0	3

MODULE 1: 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.

MODULE 2: Population and Sample

Types of statistical data – collection and classification of data – Frequency tables – Diagrammatic Representation of data – Measures of central tendencies – Mean, Median and Mode: Measures of dispersion – Range, Quartile deviation, standard deviation, Skewness and Kurtosis – Sampling techniques – Simple and Stratified Random Sampling techniques.

MODULE 3: Random Variables and Probability Distribution

Binomial, Poisson, and Normal. Study of relationship between variables – correlation: Simple, Partial, Multiple Correlation (three variables); Regression – Simple, Multiple (three Variables). Measures of association – Chi square test for goodness of fit & contingency table.

MODULE 4: Basic Concept of Hypothesis Testing

Type I and type II errors. Tests based on Means & Proportions on Normal, t & F. One-way analysis of variance (CRD), Two-way analysis of variance (RBD), LSD, - Multiple comparison tests (DMRT, Bonferonni, Dunnett's). Carrying out Data Analysis using MS- excel: Descriptive Statistics – Diagrammatic representation – t test for independent samples, paired samples, F test two sample variances: One-way ANOVA, two-way ANOVA, Correlation & Regression (three variables). UNIT V 9 hours Framing Proposal for acquiring grants: The question to be addressed – Rationale and importance of the question being addressed – Empirical and theoretical framework – Presenting pilot study / data or background information - Research proposal and time frame – Specificity of methodology – Organization of different phases of study – Expected outcome of study and its implications – Budgeting - Available infra-structure and resources - Executive summary

MODULE 5: Computer Software and Programming Language

Binary code and binary system, Algorithms and Flow charts, Operating systems (Dos, Windows, Mac, Linux) Application software's (MS-office, Origin Pro.), Types of computer (Super computer), Network concepts (LAN, WAN) and its topology, Internet protocols HTML, XML, Internet connectivity, search engines and its optimization., Programming concepts in C and C++, MATLAB, SPSS etc.

Textbooks/Reference:

1. Bandarkar, P.L. and Wilkinson T.S. (2000): Methodology and Techniques of Social Research, Himalaya Publishing House, Mumbai.
2. Copper, H.M. (2002). Intergrating research: A guide for literature reviews (2nd Edition). California: Sage
3. Harman, E & Montages, I. (Eds.) (2007). The thesis and the book, New Delhi: Vistar.
4. Mukherjee, R. (1989): The Quality of Life: Valuation in School Research, Sage Publications, New Delhi.
5. Stranss, A and Corbin, J. (1990): Basis of Qualitative Research: Grounded Theory Procedures and Techniques, Sage Publications, California

Subject code	Subject	Hours per week L-T-P	Credit C
MFP202115	Lab-I	0-0-4	2

LIST OF EXPERIMENTS:

1. Introduction to food laboratory.
2. To study different types of blanching of fruits and vegetables.
3. Preservation of food by high concentration of sugar, high concentration of salt/acid and by addition of chemicals.
4. Preservation of food by drying in a drier.
5. Preparation of standard solutions for the chemical analysis.
6. Determination of pH and total acidity of various food samples.
7. Determination of proximate composition of food- moisture, protein, crude fat, crude fiber, ash, total Carbohydrates by standard AOAC procedures
8. Determination of total sugars, reducing and non-reducing sugars in various food samples.
9. Detection of adulterants in various foods.

Subject code	Subject	Hours per week L-T-P	Credit C
MFP202116	Lab-II	0-0-4	2

Part A

1. Formation of frequency distribution and graphical representation
2. Graphical Representation of Statistical data using Histogram, Pie diagram etc.
3. Measurement of central tendencies: Arithmetic & Geometric mean, Mode and Median, sensitivity, resolution
4. Calculation of the measures of dispersion: Mean deviation, Standard deviation and Coefficient of variation
5. Measure of central tendency
6. Application of Chi-square test.
7. Rank correlation coefficient.
8. Application of z test for one and two sample problems.
9. Data interpretation using MS-excel, Origin Pro, MATLAB, SPSS
10. Evaluation of standard error and interpretation of results in terms of accuracy and precision.

PART B

Presentation

Subject code	Subject	Hours per week L-T-P	Credit C
MFP2021E101	Technology of Cereals, Pulses, Oil Seeds and Legumes	3-0-0	3

MODULE 1:

General introduction and production and utilization trends; Structure and composition of common cereals, legumes and oilseeds

MODULE 2:

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

MODULE 3:

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

MODULE 4:

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

MODULE 5:

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

Textbooks/Reference:

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

Subject code	Subject	Hours per week L-T-P	Credit C
MFP2021E111	Technology of Cereals, Pulses, Oil Seeds and Legumes Practical	0-0-2	1

PRACTICALS:

1. Physical-tests on wheat and rice
2. Physicochemical and rheological properties
3. Determination of gluten content in wheat flour
4. Parboiling of rice
5. Malting, puffing and popping of grains
6. Visit to related processing industries

Subject code	Subject	Hours per week L-T-P	Credit C
MFP2021E102	Technology of Fruits and Vegetables	3-0-0	3

MODULE 1:

Indian and global scenario on production and processing of fruits and Vegetables; Pre-processing: Fresh fruits and vegetables – Handling, grading, cleaning, pretreatments, transportation, pre cooling, chilling, modified atmosphere packaging, Controlled atmosphere storage, packaging, transportation, quality assurance

MODULE 2: Freezing of Fruits and Vegetables

Different freezing methods and equipments, problems associated with specific fruits and vegetables

MODULE 3: Dehydration of Fruits and Vegetables

Dehydration – different methods of drying including sun, tray, cabinet, drum, spray, vacuum, tunnel, spray, low temperature drying process, process calculations, osmotic dehydration and other modern methods, choice of suitable methods, preserving the color, flavor and nutrient content of the products

MODULE 4: Canning, Juices and Concentrates

Different unit operations involved in fruit and vegetable Pulp/juice extraction, concentration, Bulk aseptic packaging of fruit and vegetable pulps, juices and concentrates; aseptic packaging of fruit drinks, juices and other products Bottling, canning - essential principles, different types of cans, unit operations in canning, blanching, exhausting, processing conditions. Fruit Juice / pulp/ Nectar/Drinks, concentrates – General and specific processing, different packing including aseptic; Vegetable Purees/pastes - processing of Tomato and tomato products

MODULE 5: Fruit and Vegetable Products & Standards

Ready to eat vegetable products, Jams/Marmalades, Squashes/cordials, Ketchup/sauces, Chutneys, Fruit Bar, Soup powders, Candied Fruits, Natural colors, Fruit and Vegetable Fibres - specific processing, different packing including aseptic, Product specifications and standards; food regulations with respect to fruit and vegetable products

Textbooks/Reference:

1. Potter, N.N. and Hotchkiss, J.H. “Food science”, 5th Edition, CBS, 2001.
2. Vaclavik, V.A. and Christian, E.W. “Essentials of Food Science”, 2nd Edition, Springer, 2005.
3. Salunkhe, D.K. and Kadam, S.S. “Handbook of Fruit Science and Technology : Production, Composition, Storage, and Processing”, Marcel Dekker, 2005.
4. Alzamora, S.M., Tapia, M.S. and Lopez – Malo, A. “Minimally Processed Fruits and Vegetables: Fundamental Aspects and Applications”, Springer, 2005

Subject code	Subject	Hours per week L-T-P	Credit C
MFP2021E112	Technology of Fruits and Vegetables Practical	0-0-2	1

PRACTICALS:

1. Evaluation of pectin content.
2. Preparation of Fruit preserve and candy
3. Preparation of RTS products
4. Dehydrated products of fruits and vegetables.
5. Preparation and analysis of jam, jelly and marmalade.
6. Preparation and analysis of pickles
7. Preparation of various value added products from tomato.
8. Visit to related processing industries

Subject code	Subject	Hours per week L-T-P	Credit C
MFP2021E103	Enzymes in Food Processing	4-0-0	4

MODULE 1:

Enzymes classification, properties, characterization, kinetics and immobilization; fermentative production of enzymes (amylases, proteases, cellulases, pectinases, xylanases, lipases) used in food industry and their downstream processing.

MODULE 2:

Enzymes for starch modification (maltodextrins and corn syrup); solids: liquefaction, saccharification, dextrinization, isomerization for production of high-fructose-corn-syrup, fructose and fructo-oligosaccharides. Enzymes for protein modification-hydrolysates and bioactive peptides; Enzymes for Lipid modification.

MODULE 3:

Enzymes as Processing Aids: Role of enzymes in Dairy processing-cheese making and whey processing; Role of enzymes in meat processing-tenderization and flavor development and fish processing -De-skinning, collagen extraction etc., Egg processing.

MODULE 4:

Role of enzymes in Brewing, Baking (fungal -amylase for bread making; maltogenic –amylases for anti-staling; xylanases and pentosanases as dough conditioners; lipases or dough conditioning; oxidases as replacers of chemical oxidants; synergistic effect of enzymes)

MODULE 5:

Role of enzymes in the production of flavours (enzyme-aided extraction of plant materials for production of flavours, production of flavour enhancers such as nucleotides, MSG; flavours from hydrolyzed vegetable/animal protein)

Textbooks/Reference:

1. Whitehurst,R.J. & Van-Oort,M., (2010), Enzymes in Food technology, Second edition, Blackwell Publishing Ltd
2. Aehle, W. (2007) Enzymes in Industry: Production and application. Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim
3. Rastall,R (2007) Novel enzyme technology for food applications Woodhead Publishing Limited, Abington Hall, Abington, Cambridge CB21 6AH, England
4. Kalaichelvan, P.T., (2002), Bio process technology, MJP publishers, Chen
