

Institute of Science and Technology

Master of Science in Food Technology

M.Sc. Food Technology

Curriculum

1999



Curriculum Development Centre

Tribhuvna University

Kirtipur, Kathmandu,

Nepal

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Master of Science in Food Technology
M.Sc. Food Technology

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Tribhuvan University
Kathmandu, Nepal

Introduction

Tribhuvan University introduced the four-years bachelor level degree course in Food Technology (B.Tech Food) in 1980. This program was running for twenty years and there was no opportunity for postgraduate studies in food technology in the country. Tribhuvan University has recently decided to introduce master level program in food technology so as to fulfill the requirement of high level trained manpower in the area of post-harvest technology in the country.

Objectives:

The main objectives of the course are:

1. to provide the students advanced knowledge in food science and the principles underlying food processing technology
2. to give wider knowledge to students in advanced food engineering including computerized process control and plant automation
3. to acquaint students with the recent industrial management practices including quality management
4. to train the students in product specific specialization areas
5. to develop research skill in students to make them capable of carrying out sound research work independently
6. to provide students competitive knowledge in food technology which will be comparable to foreign universities

Eligibility for Admission:

The candidates who have passed bachelor's degree in food technology or a four-years bachelor dairy technology course from Tribhuvan University or an institute recognized by this university shall be considered eligible to apply for admission to M. Tech Food Technology. However, the candidate must have obtained a minimum of 50 % marks in aggregate in his/her bachelor's degree.

Admission Criteria:

An applicant seeking admission to M. Tech Food Technology must appear in an Entrance Examination of two hours duration. An applicant who fails to appear in the Entrance Examination or fails to obtain a minimum qualifying score will not be allowed admission. The selection of students for admission will be based on their merit in the Entrance Examination, the enrollment capacity of the department and abiding any special rule as endorsed by the university.

Course Structure:

The entire M. Tech course in Food Technology is of two academic years. The whole course is divided into two parts each of one year duration and 500 marks. Six theory papers are offered in the first year, out of which each of four papers will carry 70 marks, one paper 50 marks and the remainder one will carry 35 marks. There are also five practical papers. Among them four are of 30 marks and one of only 15 marks. The second year comprises of five theory papers and three practical papers. Three theory papers carry 35 marks each, one 70 marks and another 100 marks. Three of the practical papers carry 15 marks each and one is of 30 marks. Besides these, two additional subjects: Research topic selection and review work of 50 marks and Dissertation of 100 marks are compulsory.

The detailed structure of the course is as follows:

First Year

a. Theory:

Course no.	Course Title	Full Marks	Pass Marks
FT511A	Food Science (Food Chemistry, Biochemistry, Human Nutrition, Food Microbiology)	35	14
FT512	Food Ecology	50	20
FT513A	Food Process Engineering	70	28
FT514A	Food Plant Automation and Numerical Methods	70	28
FT515A	Food Biotechnology and Byproduct Utilization	70	28
Optional	Product Technology – Group A (any one)	70	28
FT516A	Fruit & Vegetable Technology		
FT517A	Grain Technology		
FT518A	Tea & Coffee Technology		
FT519A	Spice & Herbal Food Technology		

b. Practical:

Course no.	Course Title	Full Marks	Pass Marks
FT511B	Food Science (Food Chemistry, Biochemistry, Human Nutrition, Food Microbiology)	15	6
FT513B	Food Process Engineering	30	12
FT514B	Food Plant Automation and Numerical Methods	30	12
FT515B	Food Biotechnology and Byproduct Utilization	30	12
Optional	Product Technology – Group A (any one)	30	12
FT516B	Fruit & Vegetable Technology		
FT517B	Grain Technology		
FT518B	Tea & Coffee Technology		
FT519B	Spice & Herbal Food Technology		

Second Year

a. Theory

Course no.	Course Title	Full Marks	Pass Marks
FT611A	Food Packaging	35	14
FT612A	Technology of Nepalese Indigenous Foods	35	14
FT613A	Food Storage Technology	35	14
FT614A	Industrial Management Science	100	40
Optional	Product Technology – Group B (any one)	70	28
FT615A	Meat Technology		
FT616A	Dairy Technology		
FT617A	Soft Drink Technology		
FT618A	Snack Food Technology		
FT619	Research Topic Selection & Review Work	50	20
FT620	Dissertation	100	40

b. Practical

Course no.	Course Title	Full Marks	Pass Marks
FT611B	Food Packaging	15	06
FT612B	Technology of Nepalese Indigenous Foods	15	06
FT613B	Food Storage Technology	15	06
Optional	Product Technology – Group B (any one)	30	12
FT615B	Meat Technology		
FT616B	Dairy Technology		
FT617B	Soft Drink Technology		
FT618B	Snack Food Technology		

Hours of Instruction:

- a) Working days : 150 days in an academic year
- b) Class hour
 - i) Theory : One theory paper of 100 marks will have 4 hours of lecture per week. The subject with only theory paper of 50 marks in the first year will have 3 hours of lecture per week.
 - ii) Practical: One practical paper of 30 marks will have 4 hours of practical per week. A practical paper of 15 marks will have 4 hours of practical in two weeks time.
- c) Attendance : 70 percent attendance in the class is compulsory.

Examination:

All students will appear in four-hours examination for theory paper of 70 marks as well as 100 marks. A two-hour examination will be held for the theory paper of 35 and 50 marks.

The marks allotted for the course FT619 Research Topic Selection and Review Work will be given by a panel of three examiners deputed by the department.

The dissertation (course no. FT 620) work of a student will be evaluated by a panel of examiners composed of an internal subject expert, an external subject expert, thesis supervisor and the head of the department. The student will have to appear in an oral examination before the panel.

Evaluation:

Pass Marks: Theory – 40 %, Practical – 40 %

A student having passed his/her two years of study will be graded as follows:

Distinction – 75% and above (two years' average)

1st division – 60% (two years' average)

2nd division – 45% (two years' average)

3rd division – 40% (two years' average)

The student will have to pass separately in theory and practical examinations.

**Basic Food Science (Food Chem, Biochem,
Human Nutrition, Food Microbiology)**

Course No.: FT 511A

Nature of the course: Theory

Full marks: 35

Pass marks: 14

Year: I

Course Description and Objective:

Food Chemistry: The main purpose of this course is to provide advanced knowledge in chemistry of food. The syllabus includes the development in carbohydrates, proteins, recent advances in food additives, chemistry of flavors; texture of fruits and vegetables, food colloids and interactions of food components.

Biochemistry: This course contains the regulation of metabolism, the specific role of enzymes and protein in food industries; biochemical changes in foods like meat, milk, fruits and vegetables, cereals. This also contains the role of enzymes, coenzymes and trace elements in metabolism, nutrient deficiency and food preservation.

Human Nutrition: About two third of the population of the developing countries are suffering from different kinds of nutritional problems. Most of the problems are related to the consumption of imbalanced diets and their biological utilization. Those disease could be alleviated through the balance diets and diets therapy. However, the individual's dietary requirements differ from one another and influenced by many factors such as, age, sex, height, weight, cultures, social & economic background, mental and emotional state, food habits, nature of the work, individual likes and dislikes towards foods, climatic conditions, family and medical history, disease conditions.

This shows that serious and scientific diet planning needs proper consultation and advice from an expert in the field. Therefore, the present course is designed to give the input of principle of nutrition and diet therapy to the highly skilled technical man power to work to fulfill the above mentioned purpose.

The course includes the basic principle of nutrition, meal planning and management, therapeutic nutrition and diet, food allergy, public health nutrition and applied nutrition program. The course also includes some practical aspect of nutrition and dietetics such as determination of nutritional status, meal planning for different age groups and disease conditions etc.

Food Microbiology: The present course is advanced course of food microbiology. It contains materials such as biosynthesis of macromolecules, microbial genetics, food industrial application of microorganisms and estimation of microorganisms by advanced techniques. To give insight into the

recent developments in the said areas of microbiology is the objective of this course.

Course Contents:

Food Chemistry:

1. Introduction: Recent development trends in food chemistry. (1 hr.)
2. Developments in carbohydrates: Surface active agents derived from some selected disaccharide, carbohydrate dehydration reactions that affect food quality, molecular basis of starch technology in new food products. (2 hrs.)
3. Developments in proteins: Reactions of food proteins during processing and storage and their nutritional consequences; chemical and enzymatic modifications of food proteins, antinutritional proteins in plants. (2 hrs.)
4. Developments in proteins: Reactions of food proteins during processing and storage and their nutritional consequences; chemical and enzymatic modifications of food proteins, antinutritional proteins in plants. (2 hrs.)
5. Water and fatholding: Water holding and its measurements, Relationship between water holding and microstructure of gel; Fatholding properties of fat, relationships between fatholding and microstructure. (2 hrs.)
6. Food colloids: Introduction, Surface activity, Emulsification, Rheology, Foams and dispersion. (1 hr.)
7. Flavors and colours: Chemistry of flavors and colours. (1 hr.)
8. Advances in food additives: Antioxidant properties of Vit.E, Nonnutritive sweeteners. (1 hr.)
9. Texture: Chemistry of texture with special reference to fruits and vegetables. (1 hr.)
10. Interaction of food components: Water and other food components. (1 hr.)

Biochemistry:

1. Introduction: trends in developments of biochemistry. (1 hr.)
2. Enzymes and co-enzymes: Role of immobilized enzymes in food industries; role of coenzymes in metabolism and vitamin deficiency state; Enzyme deficiency and mal-absorption of disaccharide. (2 hrs.)
3. Regulation of metabolism and mechanism of hormone action. (1 hr.)
4. Role of trace elements in metabolism. (1 hr.)

5. Metabolism of carbohydrates: Chemical events in muscular contraction; interconversion of sugar in nature; diabetes and insulin; and immunological assays. (1 hr.)
6. Metabolism of protein: Metabolism of essential amino acids; glutamine and transamination; mammalian biosynthesis of amino acids. (1 hr.)
7. Lipid Metabolism: Regulation of lipid metabolism; Ethanol metabolism related to fat metabolism; and the prostaglandin. (1 hr.)
8. Biochemical changes in foods such as meat muscle, meat products, milk and milk products, fruits and vegetables, cereals. (1 hr.)
9. Nucleic acid probes for the food industry. (1 hr.)
10. Biochemistry of endocrine glands: Thyroid, pancreas. (1 hr.)
11. Antifreeze proteins and their potential use in frozen foods (1 hr.)
12. Role of lactoperoxidase system on preservation of milk. (1 hr.)

Human Nutrition:

1. Basic Principle of Nutrition: Classification, nutritive value of food, food groups, RDI. (2 hrs.)
2. Meal planning & Management: Basic principle, food exchange list, meal planning for the family, various age groups & adaptation of normal diet for changing needs. (2 hrs.)
3. Food paths: Blocks on food paths and their remedies. (1 hr.)
4. Nutritional requirement: Nutritional & food requirement during old age. (1 hr.)
5. Therapeutic Nutrition & Diet: Principle of diet therapy; modification of diet; special feeding method; pre and postoperative diet; high & low protein diet; high and low calorie diet; diet for different diseases such as diabetic mellitus, gastrointestinal, liver, renal, obesity, surgery & injury, and small and large group. (2 hrs.)
6. Food allergy: Type, reactions, symptoms, diagnosis and treatment (1 hr.)
7. Public health nutrition: multisectorial nature of malnutrition, diagnosis, nutritional assessment and surveillance, group feeding, nutrition education. (2 hrs.)
8. Applied Nutrition Program: Introduction, objectives, training of personnel, action programs, production of protective foods, role of other agencies. (1 hr.)
9. Food adulteration and hygiene: Food adulteration and hygiene (1 hr.)

Food Microbiology:

1. **Biosynthesis of macromolecules: Carbohydrate biosynthesis-gluconeogenesis and biosynthesis of polysaccharides. (1 hr.)**
2. **Lipid biosynthesis: (1 hr.)**
3. **Microorganisms in industrial products: Production of commercial baker's yeast, food yeast, dextrans, amylase, vitamin B 12, single cell protein. (2 hrs.)**
4. **Gene regulation: (1 hr.)**
5. **Microbial genetics and application: Microbial chromosomal theory, parasexual cycle, type of mutation in microorganisms and mutagenic agents, production and isolation of mutant, yeast hybridization for better fermentation rates. (2 hrs.)**
6. **Estimation of microorganisms and their products: DNA-DNA hybridization, ATP measurement, radioimmunoassay, thermostable nuclease, fluorescent antibody, limulus lysate for endotoxin. (2 hrs.)**
7. **Product estimation: Adsorption chromatography, ion exchange chromatography, gel chromatography (2 hrs.)**

**Basic Food Science (Food Chem, Biochem,
Human Nutrition, Food Microbiology)**

Course No.: FT 511B
Nature of the course: Practical

Full marks: 15
Pass marks: 6
Year: I

Course Contents:

Food Chemistry

1. Determination of unavailable carbohydrates in foods.
2. Determination of amino acid sequence in protein.
3. Extraction and Purification of food protein.
4. Determination of emulsifier and stabilizer.

Biochemistry

1. Purification and characterization of proteins based on molecular size, solubility, and electric charge.
2. Estimation of blood cholesterol.
3. Determination of Vit. A, B₁, Niacin by chemical and microbiological procedure.

Human Nutrition

1. Determination of energy value of food sample.
2. Exercise on menu planning and food exchange list.
3. Preparation of postoperative diet.
4. Nutrition survey and food consumption survey.

Food Microbiology

1. Mobility on an agarose gel.
2. Isolation of mutant yeast.
3. Study of fermentation rates using normal yeast and mutant yeast.
4. Detection and quantification of endotoxin(LPS) using limulus lysate.

References:

Food Chemistry

1. Meyer, L. H.; *Food Chemistry*. C. B. S. Publisher and Distributor India, 1987(latest publication)
2. Birch, G. G. and Shallenbergn, ;*Developments in Food Carbohydrates Vol.1*, Applied Science Publisher,London, 1977. (latest publication)
3. Lee, C. K. *Developments in Food Carbohydrates Vol.2*, Applied Science Publisher,London, 1980. (latest publication)

4. Lee, C. K. and Lindley, M. G.; Developments in Food Carbohydrates Vol.3, Applied Science Publisher, London, 1982. (latest publication)
5. Hudson, B. J. F. ; Developments in Food Proteins Vol.1,2,&3. Applied Science Publisher, London, 1983 and 1984 (latest publication)
6. Mitchell, J. R. and Ledward, D. A. ; Functional Properties of Food Macromolecules. Elsevier Applied Science Publisher, London, New York, 1986. (latest publication)
7. Birch, G. G. and Green, L. F.; Molecular Structure and Function of Food Carbohydrates. Applied Science Publisher, London, 1973. (latest publication)
8. Dickson Eric ; An Introduction to Food Colloids. Oxford University Press, New York, Tokyo, 1992

Biochemistry:

9. White, A. and Hondlen, F. ; Principle of Biochemistry. McGraw Hill Kogakusha Ltd. , Tokyo, New Delhi, 1978
10. Tox, P. F. ; Developments in Dairy chemistry, Vol.1, Applied Science Publisher, London and New York, 1981 (latest publication)
11. Lawrie, R.; Developments in Meat Science – Vol2, Applied Science Publisher, London and New York, 1982. (latest publication).
12. Tonine, R. Y. and Robinson, R. K.; Yogurt – Science and Technology. Pergamon Press, Oxford, New York, Sydney, 1985
13. Ranganath Rao, K.; Text Book of Biochemistry, Prentice Hall of India Ltd. New Delhi , 1986.
14. Tennena, O. R. ; Food Science Part-I Food Chemistry. Marcel Dekker Inc., New York and Basel, 1976
15. Lehninger, A. L.; Biochemistry. Worth Publishing Inc., New York 1975.

Human Nutrition:

1. Swaminathan, M. ; Advance textbook on food and nutrition vol. 1 & 2, Printong and Publishing Co.Ltd., Mysore, India, 1973
2. Jellife, D. A. ; Assessment of nutritional status of community, World Health Organization, Geneva, 1966.
3. Kalyan Bagchi ; Public health nutrition in developing countries, Academic Publisher, New Delhi, 1986 (latest publication)
4. Srilakshmi, B.; Dietetics, New Age International P. Ltd, New Delhi, 1996.

5. William S.R. ; Diet therapy, Marby College Publisher St. Louis, Toronto, 1988
6. Robbinsion, Corrinett; Nutrition and diet,. Macreillon, New York 1986
7. Gilbride, J.A. Sinko, M. D. and Cowell,; Nutritional assessment: A comprehensive guide for planning intervention, Aspan Publisher, New York, 1992
8. Kreek, Lothar A. ; Menu analysis and planning
9. King,F.S. and Burgess,A Nutrition for developing countries. ELBS with Oxford university press. 1992.

Food Microbiology:

1. Wulf Crueger and Annliliese Crueger, Biotechnology: A textbook of industrial microbiology , Science Tech Inc.(latest publication)

Food Ecology

Course No.: FT 512
Nature of the course: Theory

Full marks: 50
Pass marks: 20
Year: I

Course Description and Objective: Food is the basic need of life. The health and nutrition of human depend on availability, consumption, and biological utilization of food and in turn, these depend on ecological socio-cultural, economic, demographic, health factors. It is very important to identify and analyse the factors, which influence the production and distribution, consumption and biological utilization of food so that the policy approach of the provision of food could be made for all. Therefore, the present syllabus is designed to give input to the students who could be able to explain and discuss the interrelationship between human and production, processing, consumption and utilization of foods.

Course Contents:

1. Introduction: Scope, terminologies, nutrition and ecology. (3 hrs.)
2. Biology of food organisms: Characteristics of ecosystem and some properties of ecosystem directly relating to food organism(impact of human population, use of fertilizer, use of pesticides, herbicides & use of nutrients). (4 hrs.)
3. Basic concept of food path: Nutritional assessment. (3 hrs.)
4. Food availability: (Production and distribution): Land tenure, food crops; inputs and technology; farming system; animal production; fisheries; post-harvest food conservation; food preservation and processing; food marketing system; food hunger and the physical factors limits to production; food policies. (25 hrs.)
5. Food consumption: Factors influencing - ecological, sociocultural, economic, demographic; food habits, assessment of food consumption. (8 hrs.)
6. Biological utilization of foods: Environmental sanitation and hygiene , environmental condition for life ; infections; factors affecting. (3 hrs.)
7. Food anthropology: Food and population, food anthropology, genesis of food development. (3 hrs.)
8. World population growth and future food supplies: Population growth, increased production of traditional food organisms, potential but unused food organisms; population growth and changed food supplies. (2 hrs.)
9. Socio-economy: Economic and social conditions controlling the food supplies and utilization of foods. (3 hrs.)

10. Food requirement of people: Demographic determinants, food is not just for eating, growing population and rising aspiration. (5 hrs.)
11. Provision of food: Scientific progress in world food production; food from farm to table, new food technologies and their role in the world; future trends in the use of protein resources. (6 hrs.)
12. Constraints on meeting the needs and wants of people: Families who cannot afford to feed themselves; problems of interdependence; physical limitations on the food supply. (4 hrs.)
13. Environmental pollution: Introduction, types of pollution, impact on human population, determination of environmental pollution. (6 hrs.)

References:

1. Blaxter, K.S. and Leslie, F.. Food, Nutrition and Climate, Applied Science Publisher, London, 1982
2. Boughey, A.S. Man and Environment. An introduction to human ecology and evolution., MacMillan Publisher. New York 1975
3. DM Hortog, A.P. and VanStaveren, W. Manual of social Survey in food habits and consumption in developing countries. Wageningen, The Netherland. 1983.
4. Duckman, A.N. Food production and consumption. Netherland. 1966.
5. Duncen, E.R. Dimensions of world food problems. University of Iowa Press. USA. 1977.
6. Jerome, N. Nutritional Anthropometry: Contemporary approaches to diet and culture . USA 1980.
7. King, F.S. and Burgess, A. Nutrition for developing countries. ELBS with Oxford university press. 1992.
8. Rilchcight, M.Jr.(ed) . Man, Food and Nutrition. CRC press. Washington, 1973.
9. Rabson, J.R.K. Food, Ecology, and Culture. Readings in anthropometry of dietary practices. 1980.
10. Turner, M.R. Food and People. London. 1983.
11. Deatherage, F.E. Food for life. Plerum press, New York. 1975.
12. Odum, E.P.. Fundamental of Ecology. WB Sanders Company. 1971
13. Desrosier, N.W. Technology of food preservation. AVI Publishing Co. Inc. Westport 1977.
14. Pasmore, R. and Eastwood, M.A. Human Nutrition and Dietetics. 8th ed. Churchill Livingstone. London 1986.
15. Kordylas, M.J. Processing and Preservation of Tropical and Subtropical Foods. ELBS, London. 1991.

Food Process Engineering

Course No : FT 513A

Nature of the Course : Theory

Full marks : 70

Pass marks : 28

Year: I

Course Description and Objective : The successful application of modern food processing methods permits the conservation of desirable qualities in the stabilized food supplies. Such serialized foods permit their widespread distributions to meet the needs of people wherever they may be. Today, there are many processed products of exceptional quality. With modern food processing technology, preserved foods can compete favorably with their unprocessed counterparts. Many newer food processing methods, viz, ohmic heating and microwave processing, high pressure technology, membrane technology, aseptic canning, hurdle technology etc., are coming into existence and are gaining popularity in food processing technology. A fuller and deeper understanding of their underlying principles and processes will undoubtedly help explore their applicability to diverse food materials.

The ever growing demand for wholesome, nutritional and high quality processed foods is placing greater emphasis on the engineering aspects of processes and equipment utilized during handling, processing and distribution of foods. Food process engineering is a vital aspects of multidimensional food processing system. Deeper understanding of already highly evolved discipline will make the students more conversant when they face the reality of food processing system.

Course Contents:

Group A : Food Processing

1. Thermal Processing: Thermal process evaluation based on slowest heating region and probability of survival in the whole container, evaluation of canning process from external temperature history.
4 hrs.
2. Aseptic processing: Basic concept, thermal treatment and quality, effect of velocity distribution on F value, the Dole process, thermobacteriology of UHT processed foods.
5 hrs.
3. Fresh fruits & vegetables storage systems: i) Controlled atmosphere (CA) storage; Biochemical aspects, mixture of gases and principles underlying their formation, carbon dioxide scrubbing assembly, diffusion gas exchange, atmosphere generating devices, tests for airtightness. ii) Hypobaric storage: Gas diffusion, partial pressure in hypobaric storage, control parameters. iii) Cooling of fruits and vegetables, design of cold stores.
8 hrs.

4. Quantitative analysis and simulation of quality losses during processing & storage, dependence environmental factors, examples of prediction and/or simulation of quality losses, storage under unsteady state temperature conditions, regular sequential time / temperature fluctuations. 6 hrs.
5. Membrane technology: theory, applications and effects on foods. 5 hrs.
6. Food dehydration: Enzyme degradation during drying process, water activity and its control in food processing, effects of water activity on properties of foods, product development through water activity control. Osmotic dehydration: Principle, applications, factors affecting osmotic dehydration, kinetics. 8 hrs.
7. Developments in food preservatives: Toxicology, practical evaluation, mode of action of sulphur dioxide, benzoic acid, and nitrite. 5 hrs.
8. Food freezing: Time- Temperature tolerance of frozen foods, freeze concentration, theory and practice of food thawing. 3 hrs.
9. High pressure, ohmic and microwave technology: Principles and applications to food processing industries. 3 hrs.
10. Food irradiation: Absence of toxic factors in irradiated foods, chemical studies, nutritional value, microbiological studies. 3 hrs.

Group B: Food Engineering

1. Fluid flow: Concept of apparent viscosity, the Non-Newtonian fluids, flow of NNFs in tube flow, pressure drops, friction factors, rotational and tube flow viscometer, and their working relations, use of artificial neural networks in pressure drop estimations. 6 hrs.
2. Heat transfer: Transient condition, lumped heat capacity method, transient heat flow in a semi infinite solid, boundary conditions, Biot and Four-heirs Numbers, Heisler charts, heat transfer in multidimensional systems. The numerical solutions. 6 hrs.
3. Drying of cereal grains: Theoretical, semi-theoretical, and empirical approach of drying; Luikov's approach, single kernel, thin layer and deep- bed dryings. 8 hrs.
4. Freezing and freeze drying: Calculation of rate and time of freezing: Plank, Nagaoka and Neuman's equations; equipments of freezing. Freeze drying: Heat and mass transfer during freeze-drying, condition of sublimation, calculation of time required, limiting heat transfer and limiting mass transfer. 8 hrs.
5. Silo and storage structure design: Flow criteria, mass flow and funnel flow, discharge rate, static and dynamic loads and their

- distribution, Rankin's equation, Airy's equation, Janssen's equation,-design of a deep bin. 7 hrs.
6. Membrane processes: RO and UF, electrodialysis, membrane types, modules with tubes, operation process, mechanisms of transfers, unit fluxes, polarization, mass transfer limited. 5 hrs.
 7. Supercritical fluid extraction process description, design criteria, advantages and application. 4 hrs.
 8. High electric field pulses, oscillating magnetic field pulses, high pressure process, ohmic heating, dielectric & microwave heating: Introduction, principles and uses. 6 hrs.

Food Process Engineering

Course No : FT 513B
Nature of the Course : Practical

Full marks : 30
Pass marks : 12
Year: I

Course Contents:

Group A: Food Processing

1. Determination of cold points in glass and metal containers.
2. Determination of respiratory activity of fruits and vegetables.
3. Determination of cooling parameters of different commodities under different cooling systems.
4. Preparation of IMF.
5. Osmotic dehydration of fruits and vegetables.
6. TTT studies of fruits and vegetables.
7. Application of high pressure technology in fruits and vegetables juice preservation.
8. Application of ohmic and microwave heating in foods processing.

Group B: Food Engineering

1. Determination of consistency coefficient flow behavior index using tube flow and rotational viscometer.
2. Determination of pressure drop gradients in tube flow.
3. Determination of thermal diffusivity and surface heat transfer coefficient of agricultural products by transient conduction.
4. Determination of equation of fit (log or modified log model) for drying process of grains.
5. Determination of freezing time.
6. Experiment related to flow of grains, angle of repose, load calculation in lab. Scale silos.
7. Experiment related to use of membranes.

References:

Food Processing

1. Charm, S.F.: The Fundamentals of Food Engineering (3rd Edition), The AVI Publishing Company, Inc; Westport. (1979)
2. Throne, S. (Ed): Developments in food Preservation, Vol. 2. Elsevier Applied Science Publishers; London. (1981)
3. Heid, J. L.; Joslyn, M.A. (Ed): Fundamentals of Food Processing Operations: Ingredients, Methods, and Packaging: 3rd Edition, The AVI Publishing Company, Inc: Westport. (1969)

4. Downkey, W.K. (Ed) : Food Quality and Nutrition: Research priorities for thermal processing. Applied Science Publishers, London. (1977).
5. Linko, P. and Larinkari, J. (Ed) : Food Process Engineering, Vol 2: enzyme Engineering in Food Processing. Applied Science Publishers, London. (1980).
6. Birch, G.G. and Parker, K.J.(Ed) : Control of Food Quality and Food Analysis, Elsevier applied Science Publishers, London. (1984).
7. Raghavendra Rao, M. R. Chandrasekhara, N., and Ranganath, K.A. (Ed) : Trends in Food Science and Technology: Proceeding of the Second International Food Convention (IFCON-88) Held during Feb.18 tp 23, 1988 at Mysore. AFST (I), CFTRI, Mysore-570 013. (1989).
8. Stumbo, C.R.: Thermobacteriology in Food Processing, Academic Press, New York and London. (1973)

Food Engineering

1. Holdman J.P.: Heat transfer, fifth edition, McGraw-Hill Publishing Company. (1984)
2. Steffee J.F.: Rheological Methods in Food Process Engineering. Frecman Press, East Lansing, Michigan 48823, USA. (1989)
3. Sahay K.M. and Singh K.K.: Unit Operations of Agricultural Processing, Vikas Publishing House Pvt. Ltd. Delhi. (1994)
4. Heldman D.R. and Singh R.P : Food Process Engineering., The AVI Publishing Company, Inc. (1981)
5. Brooker D.B., Bakker-Arkema F. W. and Hall C. W. : Drying Cereal Grains. The AVI Publishing Company, Inc; Westport , Connecticut. (1974)

Food Plant Automation and Numerical Methods

Course No : FT 514A
Nature of the Course : Theory

Full marks : 70
Pass marks : 28
Year : I

Course Description and Objective : The enormous and rapid increase in the measurement, recording and control of critical variables in industrial processes has led to a corresponding expansion of instrumentation technology, To gain full advantage of instruments it is imperative to have a good knowledge of the theory and methods of handling and caring instruments. The objective of this course is to provide theoretical and practical knowledge about instruments that are being used in industries and research institutions.

Micro-computers are increasingly being applied in solving complex problems and calculations in chemical and food industries. Use of micro-computers in integration with numerical methods not only provides wider flexibility in solving a given problem but also helps to systematically solve the otherwise hard-to-solve problems with surprising ease.

Course Contents:

Group A : Food Plant Automation

1. Automatic weighing systems: Analytical balance, spring balance and load cells 4 hrs.
2. Displacement measurements Strain gauge, LVDT, capacitance gauge & piezoelectric transducers. 5 hrs.
3. Measurement of velocity, acceleration & torque: Revolution counter, capacitance tacho, dragcup type tacho, tachogenerator, stroboscope, accelerometer, etc.. 6 hrs.
4. Pressure measurements: Bourdon tubes, diaphragm elements, bellows, vacuum gauges and differential pressure transmitters. 6 hrs.
5. Temperature measurement: Thermocouple, thermopile, thermistors, radiation & optical pyrometer. 5 hrs.
6. Flow measurement: Mass flow meters, positive displacement meters, electrical type flow meters, open channel flow measurement. 6 hrs.
7. Moisture measurement: Standard methods, moisture measurement cells for granular materials, capacitance probe, reasonable method, IR method. 6 hrs.
8. Timers: Classification, electrical timers and design of timers. 4 hrs.
9. Operational aspect of instrument system: Introduction, control centre requisites, control panel, graphic panel, diagrammatic

references- instruments, actuators, valves etc.; line diagrams, aspects of operational convenience; annunciation, scanning and data logging. 8 hrs.

Group B

Numerical Methods

1. Micro-computing hard & softwares: Integrated computing, commercial softwares of concern, errors and precision, the role of numerical computations in food processing realm, high speed computation, computer arithmetic-binary number systems, octanal & hexadecimal systems. (5.hrs.)
2. Numerical Methods: Newton-Raphson, Modified Newton-Raphson, Bisection, Secant methods, solutions of equations. (5.hrs.)
3. Systems of linear equations: Applications of linear equations in problem solving. (3.hrs.)
4. Interpolations Linear and polynomial (2.hrs.)
5. Least square approximation, curve fitting (R^2 and SEE) (5.hrs.)
6. Numerical differentiation: 1st, 2nd, and 3rd derivatives (4.hrs.)
7. Numerical integration: Trapezoid, simpson's and Romberg's methods (5.hrs.)
8. Solutions of ordinary and differential equations: Euler, Modified Euler, Rung-Kuta methods (5.hrs.)
9. Computer application in food processing: Computer modelling of selected food processing systems, data processing systems, binary operations, input-output devices, computer languages. (6.hrs.)
10. Computer control systems: Introduction, general scheme of computer control of process, computer installation in control centre, control computer, the computer control, applications. (5.hrs.)
11. Analytical instruments: Polarography, X-ray methods, viscosity, measurements, gas chromatography, HPLC, NMR, ESR, NQR, UV-IR spectroscopic methods. (5.hrs.)

Food Plant Automation and Numerical Methods

Course No : FT 514B
Nature of the Course : Practical

Full marks : 30
Pass marks : 12
Year : I

Course Contents:

Group A: Food Plant Automation

1. Measurement of fluid pressure by using pilot tube, simple and differential manometers and vacuum gauge.
2. Measurement of temperature by using thermometer and pyrometer.
3. Measurement of fluid flow rate by using rotameter, rectangular notch and anemometer.
4. Measurement of grain moisture by using IR moisture meter.
5. Measurement of deformation by using strain gauge.

Group B : Numerical Methods

1. Calibration of Bourdon tube pressure gauge by a mercury column manometer.
2. Measurement of strain.
3. Study of characteristics of thermocouple and thermistors.
4. Measurement of thermal conductivity of liquids.
5. Measurement of flow of water by head type flow meter.
6. Measurement of high vacuum pirani gauge.
7. Measurement of radioactivity.
8. Simulation of a control system on a desk-top digital computer.
9. Studies on AC timer.
10. Photometric measurement.
11. Studies on automation in any one of the food industries.
12. Infrared spectroscopy.
13. pH measurement using a microprocessor.
14. Studies on characteristics of transducers.

Text Books:

1. Steven C. Chapra and Raymond P. Canale : Numerical Methods for Engineers, International Edition. McGraw Hill Book Company. (latest edition)
2. M.K. Jain, S.R.K. Iyengar, and R.K. Jain. : Numerical Methods for Scientific and Engineering Computation, Wilely Eastern Limited, India, 1985.
3. Patranabis : Principles of Industrial Instrumentation 9th Reprint, Tata McGraw-Hill Publishing Company., New Delhi, 1990.

5. B.F.Gray. Longman : Measurements, Instrumentation and data Transmission, London and New York, 1977.
6. Fribance, A. E. ; Industrial Instrumental Fundamentals, Tata McGraw Hill, New Delhi, 1984
7. Jones, E. B. ; Instrument Technology, Vol 1, Butterworth and Co., London, 1976

Food Biotechnology and By-product Utilization

Course No.: FT 515A

Nature of the course: Theory

Full marks: 70

Pass marks: 28

Year: I

Course Description and objective: The course makes the students familiar with different methods of biotechnology applicable in producing different type of food products. The course covers advanced microbial technology, enzyme engineering & technology, genetic engineering, advanced biochemical engineering and tissue culture technology.

The course is designed to provide insight into the processing and utilization aspects of food industrial by-products and wastes. Utilization of these by-products is important for the viability of the industry. By-products may be seen as new source of food. Lot of works have been done to maximize their uses for their conversion into food. Management of food industrial wastes is important to keep environment clean. To provide knowledge to students about all these aspects is the objective of this course

Course Contents:

Group A Food Biotechnology

1. Isolation, Identification and Quantitative Estimation of Microorganisms. (3 hrs.)
2. Selection, Development and Main Tenance of Culture. (3 hrs.)
3. Biosynthesis of Microbial Products viz. Vitamins, Aminoacids, Enzymes. (4 hrs.)
4. Microbial Food Production. (4 hrs.)
5. Microbial Insecticides. (3 hrs.)
6. Immobilisation of living Microbial. (2 hrs.)
7. Industrial Applications of Immobilised Biomaterials. (2 hrs.)
8. Enzyme Production. (4 hrs.)
9. Recent Developments and Future Aspects of Enzyme Engineering. (2 hrs.)
10. Gene Structure & its Replication. (2 hrs.)
11. Genetics of some Industrial Micro Organisms - Transcription, Genetic Code and Translation. (2 hrs.)
12. Clonning & its Importance. (2 hrs.)
13. DNA Probe & its Application. (2 hrs.)
14. Future of Genetic Engineering. (1 hr.)
15. Fermentation Kinetics - Mass Balance, Stoichiometry, etc. (2 hrs.)
16. Recent Entrances in Sterilisation Practices Via. Colloidal Filter Membrance, Cox Filter Medium, Sall Trinity Filter, D.H. Filter, Echo Air Filters, etc. (2 hrs.)

17. Design and Analysis of Biological Reactors. (2 hrs.)
18. Advances in Continuous Fermentations. (2 hrs.)
19. Mechanical Separation & Disintegration of cells. (2 hrs.)
20. Principles of Tissue culture, Application of Tissue Culture. (2 hrs.)

Group B : By-product Utilization

1. Economic importance of by-products. (1 hr.)
2. Environmental problems due to by-products and wastes. (1 hr.)
3. Waste management. (2 hrs.)

I Meat by-products

1. Yields and nutritional value of meat & poultry by-products. (1 hr.)
2. Blood - industrial uses of blood, blood separation, blood decolorization, Spray dried and frozen plasma. (1 hr.)
3. Mechanically separated meat - Process and uses. (1 hr.)
4. Bone - bone powder, bone protein isolate and hydrolysate. (1 hr.)
5. Gelatine : Manufacture and uses of gelatine. (1 hr.)
6. Technology of collagen casing. (1 hr.)
7. Meat extractives : technology and industrial uses. (1 hr.)
8. Lard and edible tallow : Rendering, processing & uses of lard & tallow. (1 hr.)
9. Organs (Lung, Liver, Heart etc.): Dehydrated & defatted organs, protein concentrate and hydrolysate, texturization of organ protein. (1 hr.)
10. Inedible by-products : general study of the utilization of inedible by-products such as skin, pelt, bone, glands, tail, trachea etc. (Bone meal, meat meal, blood meal, feather meal, inedible tallow & grease, and other industrial application of inedible by-products, pet food, glue, pharmaceuticals preparation, leather) (1 hr.)

II Dairy by-products

1. Definition of dairy by-products: whey, buttermilk and dairy effluents. (1hr.)
2. Type and composition of dairy by-products and effluents. (1hr.)
3. Lactose: definition, isolation, purification, crystallisation; physical and chemical properties and biological value and industrial uses of lactose. (1hr.)
4. Whey proteins: β -lactoglobulin, its isolation and purification. (1hr.)
5. Functional properties of β -lactoglobulin-gelation, denaturation, solubility etc. (1hr.)
6. Nutritional properties of β -lactoglobulin. (1hr.)

7. Chemical reactions of β -lactoglobulin with other milk proteins. (1hr.)
8. Chemical properties of α -lactalbumin and other whey proteins. (1hr.)
9. Minerals: major minerals in whey and buttermilk; isolation of whey minerals by RO and UF; role of whey minerals in whey product concentrates such as whey powder, whey cheese and lactose. (1hr.)
10. Lipids in buttermilk and whey. Separation of lipids from whey and buttermilk. (1hr.)
11. Nutritional value of whey lipids. (1hr.)
12. Treatment of dairy effluents: chemical, physical and biological methods. UF, RO, MF and NF procedure. (1hr.)
13. Uses of dairy effluents. Concentrates as food commodity or fertilizer. (1hr.)
14. Production of buttermilk powder. (1hr.)
15. Production of whey powder. (1hr.)
16. Production of buttermilk liquid drinks. (1hr.)
17. Production of whey alcohol. (1hr.)
18. Production of cheese from whey proteins. (1hr.)
19. Production of cattle feed from buttermilk concentrates and whey concentrates. (1hr.)
20. Environmental concern with whey, buttermilk and dairy effluents and their prevention. (1hr.)

III Fruit and vegetable by-products

1. Preparation of pectin, vinegar, alcohol, candy, essential oil, seed oil, citric acid, jelly and other industrial products from by-products and wastes of fruit and vegetable industry. (10 hrs.)
2. Utilization of by-products and wastes of cereal, fats and oils and sugar industries. (6 hrs.)

Food Biotechnology and By-product Utilization

Course No.: FT 515B

Nature of the course: Practical

Full marks: 30

Pass marks: 12

Year: I

Course Contents:

Group A : Food Biotechnology

1. Production & Recovery of Baker's yeast.
2. Production & Recovery of Food Yeast.
3. Production & Recovery of Enzymes.
4. Production & Recovery of Antibiotics.
5. Determination of Purity of Culture.
6. Production & Recovery of Vitamin B12
7. Production & Recovery of Amino Acids.
8. Design of Waste Treatment Plant.
9. Kinetics of Enzyme Reaction.
10. Evaluation of Size & Density of Microbial Cells.
11. Extraction of DNA from Bacteria and its Colorimetric Estimation.
12. RNA Extraction & Estimation.
13. Determination of Growth Curve for Microorganisms and Setting up a Statistical Model for Growth Rate Correlation.

Group B : By-product Utilization

1. Centrifugal separation of blood into plasma and red cell fraction.
2. Spray-drying of blood plasma and red cells.
3. Preparation of bone powder.
4. Preparation of bone protein hydrolysate.
5. Experimental production of gelatine from pig skin and bone.
6. Preparation and grading of natural casing.
7. Production of essential oils and seed oils.
8. Preparation and grading of pectin from fruit wastes.
9. Preparation and analysis of vinegar and alcohol from fruit wastes and by-products.
10. Isolation and identification of whey protein by gel electrophoresis.
11. Determination of molecular weight of whey proteins.
12. Study of functional properties of whey proteins.
13. Identification and separation of lactose from whey and buttermilk.
14. Production of whey powder concentrate by spray-drying, drum drying, RO, UF
15. Application of whey powder, lactose and whey protein.
16. Preparation of alcohol from by-products of sugar industry.

References:

Food Biotechnology

1. Moo-young edt ,Comprehensive Biotechnology. Vol. I- IV, Pergmon Press (1985)
2. Shuichi AIBA, A.E. Humphrey & N.F. Millis., Biochemical Engineering, Academic Press, Inc. New York & London. (1973).
3. P.F. Stanbury & Whitaker., Principles of Fermentation Technology, Pergamon Press, Oxford, New York, Toronto, Sydney, Paris, Frankfurt. (1984)
4. Pescott & Dunn', Edited by Gerald Reed, Industrial Microbiology, CBS Publishers & Distributors, New Delhi, (1987)

By-product Utilization

1. Pearson A & Dutson T.; Edible Meat By-products, Elsevier Applied Science. (1988)
2. Nobel P.W., Fundamentals of Dairy Chemistry , CBS publication (1988)
3. Dairy handbook , Alpha Laval; Denmark.
4. Betitz G. ; Food chemistry II. Springer Verlage (1999)

OPTIONAL

Fruit and Vegetable Technology

Course No : FT 516A

Nature of the Course : Theory

Full marks : 70

Pass marks : 28

Year : I

Course Description and Objective: This course deals with post harvest physiology and storage of fruits and vegetables in general, and processing and preservation of orange/mandarin, mango, apple, pineapple and tomato in particular. These are given a special attention because orange/ mandarin, mango, apple and pineapple are major fruits and tomato is a major vegetable in Nepal. This course provides intensive knowledge of post-harvest physiology, preservation and processing of major fruits and a vegetables and stimulates food technologists for research in this area.

Course Contents:

1. General: Major fruits and vegetables; composition; nutritive significance; classification; biochemical changes during post-harvest storage; ripening patterns; maturation, ripening and senescence, and their control. (12hrs.)
2. Post-harvest storage : Maturity standard for ripening; role of plant growth regulators in relation to post-harvest storage of fruits and vegetables; fresh fruits and vegetables storage (chilling storage, MA storage, CA storage, hypobaric storage); storage requirement for fresh fruits and vegetables; chilling injury and its control. (25hrs.)
3. Orange and Mandarin: Production; commercial cultivars; composition; fruit quality for processing; methods for preservation; preparation for processing; methods of juice extraction and types of juice extractor; post-extraction operation for the production of concentrated juice; powdered juice; freeze dried juice; enzymes and their application; essence recovery; bitter principle and its removal from the juice. (22hrs.)
4. Tomatoes : Production; varieties; quality of tomatoes; preservation techniques; preliminary processing; crushing; juice extraction and refining; concentration; Tomato paste:- method of manufacture, finished product quality evaluation a specification; handling of tomato paste for tomato products manufacture. (22hrs.)
5. Mango: Production; cultivators; fruits quality for processing; preservation; juice extraction; preparation of pulp and other products. (7hrs.)

6. Apple and Pineapple Production; cultivars; fruits quality for processing; preservation; juice extraction; preparation of RTS drinks and other products. (7hrs.)
7. Legislation :Legislation of processed fruits and vegetables products; food plant sanitation and hygiene. (5hrs.)

Fruit and Vegetable Technology

Course No : FT 516B
Nature of the Course : Practical

Full marks : 30
Pass marks : 12
Year : I

Course Contents:

1. Determination of peroxidase / catalase activities.
2. Determination of malic acid in grape juice and wine.
3. Determination of potassium and phosphorus in fruit juice.
4. Determination of lycopene in orange juice.
5. Extraction and purification of lycopene from tomatoes.
6. Determination of volatile oil in citrus juice.
7. Determination of total anthocyanin in grape juice.
8. Determination of consistency of tomato paste or ketchup by Brookfield synchroelectric viscometer.
9. Determination of ascorbic acid by dinitrophenylhydrazine method.
10. Determination of organic acids and sugar by HPLC method.
11. Spectrophotometric determination of chlorophyll a and b.
12. Different products preparation from orange, mango, apple and pineapple.

References:

1. Ryall, A.L. and Lipton, W.J. : Handling, transportation, and storage of fruits and vegetables, vol. 1&2, AVI publishing. Co. Inc., Westport, Connecticut. (1972).
2. Nagy, S., Shaw, P.E. and Veldhuis, M.K. : Citrus science and technology, AVI publishing. Co. Inc., Westport, Connecticut. (1977).
3. Nelson, P.E. and Tressler, D.K.. : Fruit and vegetable juice processing technology, 3rd edition, AVI publishing. Co. Inc., Westport, Connecticut. (1980).
4. Lal, G., Siddappa, G.S. and Tandon, G.L. : Preservation of fruits and vegetables, ICAR, New Delhi. (1960).
5. Pearson, D.: The chemical analysis of foods. Churchill Livingstone, Edinburgh London and New York. (1976).
6. Goose, P.E. and Binsted, R. : Tomato paste and other tomato products, 2nd edition. Food Trade Press Ltd. (1973).
7. Rangana, S.: Manual of analysis of fruit and vegetable products. Tata McGraw Hill Pud. Co. Ltd, New Delhi. (1977).
8. Kharel, G.P.: Elementary food analysis, Pharabi polytechnique institute, Dharan-1, Sunsari. (1999).

Grain Technology

Course No : FT517A

Nature of the Course : Theory

Full marks : 70

Pass marks : 28

Year : I

Course Description and Objective: Grain is produced heavily throughout the world. General knowledge on grain processing has already been introduced in bachelor level course. In this course an advanced level knowledge on grain processing will be provided to the students. It is expected that the students after completing this course will be able to handle and solve the problems related with grain processing.

Course Contents:

1. Technological properties of grains: Anatomy of grain, microstructure of endosperm, physico-chemical, mechanical, biochemical, thermo- physical and electro- physical properties of grains. 8 hrs.
2. Modern wheat milling: Cleaning, grading, conditioning, break system, scratch system and reduction system. Operation of plainsifter, purifiers and rollers. Modern Bhuler milling system, milling calculation table and grade formation. 20 hrs.
3. Modern rice milling: Modern methods of paddy milling and its machines operations, milling technology, European, Japanese and X-M process. Types and operation of husker, seperators and polishers. 12 hrs.
4. Parboiling of paddy: Modern methods of parboiling, European stake and other new advance methods. By products and their utilization. 8 hrs.
5. Corn technology: Dry milling of corn, corn grits, wet milling of corn. 12 hrs.
6. Other grain technology: Milling and utilization of barley, millet, sorghum, and buckwheat. 12 hrs.
7. Dough testing and baking : Rheology of dough, dough testing and instrumentation. Farianography, Extensography and Amylography. Technology of baking bread, biscuits etc. 18 hrs.
8. Seed processing technology: Modern method of seed processing technology (cleaning, upgrading, drying, treatment, packaging and storage.) 10 hrs.

Grain Technology

Course No : FT517B
Nature of the Course : Practical

Full marks : 30
Pass marks : 14
Year : I

Course Contents:

1. Determination of physical and physico- chemical properties of grains.
2. Experimental milling of wheat, milling table preparation, project work.
3. Experimental milling of paddy, project work.
4. Experiment of parboiling and design of parboiling plant.
5. Preparation of corn grit and corn starch.
6. Preparation of barley malt, millet and sorghum flour, buckwheat flour and grits.
7. Testing of dough for different baking purpose.
8. Experiment of baking and project work on bakery and biscuit industry.
9. Seed processing and testing.
10. Visit to and study of flour mills, rice mills, bakery, biscuit industries and seed processing plants.

References:

1. Kent-Jones, D. W., Amos, A. J.; Modern Cereal Chemistry. Food Trade Press London, 1967
2. Kent N. L., Technology of cereals. Pergamon Press, London, 1975.
3. Bandyopadhaya, S. and Roy N. C. Rice Process Technology. Oxford and IBH publication, New Delhi, 1992
4. Pilluiyar, P.; Rice Post Production manual. Willy Estern Limited, New Delhi, 1988.

Tea and Coffee Technology

Course No.: FT 518A

Nature of the course: Theory

Full marks: 70

Pass marks: 28

Year: I

Course Description and Objective: The course provides in-depth study of the manufacturing process of tea and coffee including instant tea and coffee. Besides, packaging and storage requirements of different types of tea and coffee are considered. Quality and quality evaluation by subjective and objective methods, chemical reactions during processing lie as core study materials.

Course Contents:

1. **General:** Overview of tea and coffee industries, tea and coffee cultivation, statistics of tea and coffee production, marketing prospects. (5 hrs)
2. **Technology:** Manufacture of cherry and parchment coffee, orthodox and CTC tea, grading, packaging and storage, processing plant designs. (26 hrs)
3. **Chemistry and biochemistry of tea and coffee:** Chemistry, composition, chemical reactions during processing of tea and coffee, flavouring components and quality attributes of coffee. (22 hrs)
4. **Quality evaluation:** Cup testing and sensory evaluation techniques, Objective methods of analysis of flavour component. (8 hrs)
5. **Instant tea and coffee:** Technology of instant tea and coffee. (12 hrs)
6. **Quality standards:** Legal aspects, standards and specifications. (11 hrs)
7. **Related beverages:** Use of coffee in other food products, related beverages. (10 hrs)
8. **Adulteration in tea:** Adulteration and detection. (6 hrs)

Tea and Coffee Technology

Course No.: FT 518B
Nature of the course: Practical

Full marks: 30
Pass marks: 12
Year: I

Course Contents:

1. Preparation of cherry and parchment coffee.
2. Proximate analysis of processed coffee.
3. Estimation of caffeine in processed and instant coffee.
4. Cup testing of tea and coffee.
5. Proximate analysis of different types of tea.
6. Estimation of tannin and caffeine.
7. Visit to tea and coffee cultivation and processing facilities.
8. Field works.

References:

1. Clarke, R.J. and Macrac, R. Coffee, Vol. 1,2,3,4, 5, 6. Commercial Technico, London. (1985).
2. Harter, C.R. Tea manufacture. Oxford University Press, London (1963).
3. Eden, T. Tea. 3rd edn. Longmans, London, (1976).

Spice and Herbal Food Technology

Course No.: FT 519A

Nature of the course: Theory

Full marks: 70

Pass marks: 28

Year: I

Course Description and Objective: Important spices have been chosen and all the aspects that relate with quality of the product have been dealt with. Processing techniques of each spice and herb will be described in detail. Special attention is paid to modern processing technologies.

Course Contents:

1. History, botany, cytology, cultivars, ecology, cultivation and harvesting of spices. Yields, products and end uses of spices (ginger, turmeric, cardamom, coriander, cumin, garlic, cinnamon, pepper, cassia, nutmeg, vanilla, clove, pimento, chilies, capsicum spp.). (16 hrs)
2. Chemistry, chemical composition, flavouring components, extraction and evaluation, properties, quality attributes of spices. (12 hrs)
3. Processing of spices: drying, packaging, storage and marketing. (10 hrs)
4. Solvent extraction techniques, volatile oil extraction in large scale. (6 hrs)
5. Modern spice grinding technology and spice mixture formulation. (6 hrs)
6. Layout of modern spice industry. (2 hrs)
7. Ayurvedic concept of man and nature, the concept of health and disease, concept of ayurvedic drug and food, herbal medication, herbal health food, balancing body system (vata, pitta and kapha), concept of complete life (full) and peace, achievement of four purusartha, the goal in life, a highly regulated mode of life, do's and don'ts in life, good and bad aspects of different types of food articles and methods in prevention of diseases. (8 hrs)
8. Major herbals used to balance tridosha siddhanta (vata, pitta and kapha), major food (herbal spices) used in herbal health food - cereals, horticultural products, minerals, animal based products, medicinal herbs, aromatic herbs, spices and culinary herbs. (6 hrs)
9. Chemistry of herbals, active principles responsible for balancing tridosha siddhanta, active principle responsible for medication. (6 hrs)

10. Herbal colour, herbal additive, herbal insecticide and herbals used to preserve food. (6 hrs)
11. Herbal health food formulation and manufacture, trends in the production of herbal health food globally, green movement(back to nature), Over the Counter Products(OTC),herbal tonics. (6 hrs)
12. Major herbals used to alleviate tridosha siddhanta listed in 2 and cure different diseases. (6 hrs)
13. Herbal enzymes, herbal hormones and adaptogenic herbals and tonics chemistry of herbal health foods - aromatic flavours (essential oils, oleoresins, alkaloids and glycosides). (6 hrs)
14. Chemistry, pharmacological action and uses of spices and culinary herbs. (4 hrs)

Spice and Herbal Food Technology

Course No.: FT 519B
Nature of the course: Practical

Full marks: 30
Pass marks: 12
Year: I

Course Contents:

1. Processing of spices and herbs, drying techniques, presentation techniques.
2. Determination of proximate composition of spices and herbs.
3. Gas chromatographic analysis of volatile compounds in spice products.
4. Extraction of oleoresin and volatile oil of spices in pilot scale.

References:

1. Purthi, T.S.; *Spices and Condiments*: National Book Trust, New Delhi, (1976),
2. Parry, J.W.; *Spices. Vol. 1&2*, Chemical Publishing Company Inc., New York, 1969
3. Lewis, Y. S.; *Species and Herbs for the Food Industry*, Food Trade Press, Orpington, 1984

Food Packaging

Full marks: 35

Course No.: FT 611A

Nature of the course: Theory

Pass marks: 14

Year: II

Course Description and Objective: The study of newly developed packaging materials and package design is a special part of this course. Separate place has been provided in the course for bottle and can fabrication, packaging machines and recycling process of packaging materials. Factors affecting shelf-life of packaged food and method of shelf-life determination are dealt with in detail. Due importance is given to modified atmosphere packaging and aseptic packaging, legislation, hazards and care of packaging materials. Advanced techniques of printing and labeling are other important parts of the course. All important tests related with packaging have been included.

The course is designed for students who have completed a course in packaging technology at bachelor level of food technology, and possessed basic knowledge of packaging science and technology.

The objective of this course is to provide advanced, broader and updated knowledge to students in the subject of food packaging.

Course Contents:

1. Introduction: Development trend in food packaging (1hr.)
2. New paper and plastic packaging materials: High strength and barrier paper and plastic packaging materials, hermetically sealing paper fabrication, properties, applications, plastic corrugated board. (3 hrs.)
3. Package design: New package designs, Retortable pouch, hot fill pouch, aseptic packaging pouch, microwavable pouch, packaging for innovative products, laminated tubes, ethylene removing packaging. (3 hrs.)
4. Protective edible coating: Application of protective edible coating and microencapsulation of food. Ingredients, preparation and applications. (2 hrs.)
5. Fabrication of bottle: Recent development in the fabrication technology of bottle; type, design and treatment of bottle, properties & tests, light weight bottle. Bottles for different categories of food. (3 hrs.)
6. Food grade cans: Recent development in can making; type & size of cans; strength; properties & tests; lacquering; interaction of can and product. (3 hrs.)

7. Aseptic Canning and aseptic packaging. Current trend, packaging materials & package for aseptic canning & packaging, safety aspects, marketing. (3 hrs.)
8. Modified Atmosphere Packaging: Factors associated with MAP. Applications and design of MAP. Safety aspects of MAP, polymeric films for MAP application. (2 hrs.)
9. Transport package: Type, fabrication. Quality requirements. Export package. Tests of package performance. (2 hrs.)
10. Aw and Shelf-life: Effect of aw on shelf-life of food. Factors affecting changes in aw of packaged food, mechanisms. (2 hrs.)
11. Kinetics of permeation of gas and water vapour in flexible packaging: Development in the study of permeation kinetics of gas and water vapour; permeation and loss of aroma, volatiles and vitamins. (2 hrs.)
12. Shelf-life determination: Mathematical modeling of prediction of shelf-life of packaged food, shelf-life determination, assignments & case studies. (2 hrs.)
13. Total quality protection by packaging: Factors affecting quality determination of food. Role of packaging in controlling quality changes. Approach to total quality protection by packaging. assignments. (3 hrs.)
14. Printing and labeling: Computerization, legislation, advanced technique (2 hrs.)
15. Recycling and waste management of packaging materials: Recycling process. Economical, environmental and health consideration of packaging material. Present situation (2 hrs.)
16. Hazards of packaging materials and their control: Chemical, physical, mechanical & biological hazards & their control measures. (2 hrs.)
17. Cleaning, washing, sterilization and storage of packaging materials: Methods, equipment & plant, management. (2 hrs.)
18. Packaging machine and packaging engineering: Type, design, automation of packaging machine, Development in packaging technology & engineering. (2 hrs.)
19. Tests of packaging materials: Tensile strength, tear resistance, resistance to abrasion, internal pressure strength, drop test, stack load test, vibration test, overall migration tests, optical tests, machinability tests, elongation impact test, burst strength, unusual test. (4 hrs.)
20. Legislation & Standards: National and international legislation, standards and regulation of packaging materials, constraints of export packaging. (2 hrs.)

21. Packaging and its impact on product marketability: Role of packaging in modern marketing. (1 hr.)
22. Active packaging in polymer films: Oxygen scavenging, moisture control films. (1 hr.)
23. Enzymes as active packaging agents: Use of enzymes in packaging. (1 hr.)

Food Packaging

Course No.: FT 611B
Nature of the course: Practical

Full marks: 15
Pass marks: 06
Year: II

Course Contents:

1. Determination of shelf-life of packaged food stuffs in different flexible packaging materials.
2. Performance evaluation of transport package.
3. Exercises in package design
4. Assignment / project work.
5. Physical tests of packaging materials.
6. Determination of barrier properties of packaging materials.
7. Analysis of gas in food package.

References:

1. Willhoft_E.M.A Ed., Aseptic processing and packaging of particulate foods , Blackie Academic & Professional (1993)
2. Mathlouthi, . M Ed; Food Packaging and Preservation, Elsevier Applied Science Publishers (1994)
3. Athalye, A.S. ;Plastics in Packaging, Tata McGraw Hill Publishing Company Ltd. India (1992)

Technology of Nepalese Indigenous Foods

Course No.: FT 612A
Nature of the course: Theory

Full marks: 35
Pass marks: 14
Year: II

Course Description and Objective: There are different types of indigenous food products which have had been continuously using by people from the time immemorial in Nepal. Some products are specific to the tribes and some are specific to the geographical location. Many of them are not documented yet and prepared traditionally. There is a need to document and improve these products. For this purpose the course is proposed and designed to include the most important and popular indigenous food products of Nepal and abroad to study their preparation, food value, quality and marketing aspects and improvement on them. There is a room to explore other indigenous food products which are important, less popular and not included in the syllabus.

Course Contents:

1. Introduction: Introduction to indigenous food products and historical development of indigenous foods. (1hr.)
2. Indigenous Fermented Food Products of Nepal:
 - a) Gundruk and Sinki: Introduction, raw materials, principle of fermentation, Method of preparation and processing, defects, spoilage and storage, composition, food value, need of improvement and market. (4 hrs.)
 - b) Pickles: Introduction, types, raw materials, requirement and methods of preparation and processing, quality standards, composition, food value, defects, spoilage and storage, need of improvement and market (5 hrs.)
 - c) Bamboo shoot(Tama): Introduction, varieties of bamboo used for tama, requirements and method of preparation and processing, composition quality, defects, spoilage and storage, uses, need of improvement and market. (2 hrs.)
 - d) Kinema: Introduction, raw materials, principle and method of preparation, composition, food value, quality, defects, spoilage and storage, uses, need of improvement and market. (3 hrs.)
 - e) Jand, Chhang and Rakshi: Introduction, raw material, mercha preparation, principle and method of preparation, composition, food value, quality and defects, storage, need of improvement and market. (5 hrs.)
 - f) Curd (Dahi): Introduction, raw materials, requirements, method of preparation, composition, quality and defects, food value. (2 hrs.)

3. **Non-fermented Indigenous food Products:**
 - a) **Maseura:** Introduction, basic ingredients, method of preparation, drying, composition, food value, quality and defect, storage, uses and market. (3 hrs.)
 - b) **Chhurpi:** Introduction, requirements, method of preparation, drying, composition, quality and defects, storage and packaging, uses and market. (3 hrs.)
 - c) **Dried vegetable products (eg. Cauliflower, pumpkin, radish, etc.):** Introduction, preparation, drying, composition, quality and defects, storage, uses and market. (3 hrs.)

4. **Meat and Fish Products:**
 - a) **Sukuti (Dried meat):** Introduction, requirements, method of preparation, smoking and drying, composition, quality and defects, storage and packaging. (2 hrs.)
 - b) **Chhoyala and Kachilla :** Introduction, method of preparation, quality and defects, food value, and market. (2 hrs.)
 - c) **Sekuwa :** Introduction, method of preparation, quality, food value (1 hr.)
 - d) **Dried fish and Fish cake:** Introduction, varieties of fishes, method of preparation, drying, storage, food value , quality and defects, uses and market. (2 hrs.)

5. **Cereal Products:**
 - a) **Beaten Rice (Chiura):** Introduction, method of preparation, composition, food value, uses. Quality improvement, market. (2 hrs.)
 - b) **Puffed Rice (Murai):** Introduction, method of preparation, composition, food value, uses (2 hrs.)
 - c) **Bhakka, Selroti :** Introduction, method of preparation, composition food value, uses (2 hrs.)

6. **Selected Indigenous Food Products of Abroad:**
 - a) **Soya sauce, Natto, Hemanatto, Tofu, Pickled fish, others.** (4 hrs.)

7. **Survey of other Indigenous Food Products and processes of Nepal.** (2 hrs.)

Technology of Nepalese Indigenous Foods

Course No.: FT 612B
Nature of the course: Practical

Full marks: 15
Pass marks: 06
Year: II

Course Contents:

1. Preparation analysis and improvement of traditional food products: Gundruk and Sinki, Fermented bambooshoot., kinena, jand and chang, rakshi, masura, churpi, sukuti, chhoyola, kachila, beaten rice, puffed rice, tofu, etc.
2. Development and design of traditional food product industries.
3. Survey of different traditional indigenous food products of Nepal.

References:

1. Gajurel. C.L and Vaidya K. K. ; Nepal's Traditional Technologies. Curriculum Development Centre, TU, Nepal (1979)
2. Smith A. K. and Cirde S. J. ; Soya bean Chemistry and Technology, Volume 1, AVI Publishing Company Inc. Westport, Connecticut. (1978).

Course No.: FT 613A
Nature of the course: Theory

Full marks: 35
Pass marks: 14
Year: II

Course Description and Objective: The course provides deeper and wider understanding of the principles and modern practices of food storage. Modern perception to saving food from loss and safety associated with the use of pesticides. Justified food storage techniques have been given due importance in this course.

Course Contents:

1. Factors affecting self- life of food commodities. (4 hrs.)
2. Storage of fresh commodities-grain, fruits and vegetables. (4 hrs.)
3. Storage of processed product grains- and vegetables. (4 hrs.)
4. Pretreatment of food grain and seed before storage: cleaning, drying etc. (3 hrs.)
5. Mycotoxin-occurrence, chemistry, determination and control. (3 hrs.)
6. Intregated pest management: Background, concept and application. (3 hrs.)
7. Infestation detection and monitoring techniques. (3 hrs.)
8. Advances in infestation control techniques: Sterility, attractants, repellents and antifeedants. Nutritional control and control by hormonal imbalance of stored pests and insects. (5 hrs.)
9. Food security system and food storage. (2 hrs.)
10. Present status of irradiation of grains, seeds, fruits and vegetables. (3 hrs.)
11. Organic food concept : definition and marketing. (2 hrs.)
12. Safety aspects of pesticides and quality assurance of treated food. (4 hrs.)
13. International legislation pertaining to infestation control, storage and distribution of materials. (3 hrs.)
14. Environmental impact studies (7 hrs.)

Food Storage Technology

Course No.: FT 613B

Nature of the course: Practical

Full marks: 15

Pass marks: 06

Year: II

Course Contents:

1. Measurement of properties of food commodities: Physical, chemical, biological, thermal, electrical, etc.
2. Field study to assess loss of grains, fruits and vegetables during harvesting, transportation, storage and distribution.
3. Detection and quantification of mycotoxin in infested grains, oil seeds and nuts
4. Development of model storage structure
5. Bulk fumigation of cereals, oil seeds and retail-packed processed food and assessment of effectiveness.
6. MA and CA storage of fruits and vegetables.
7. Shelf- life assessment of processed food and fresh food.
8. Storage/ warehouse design.
9. Exercise on selection and design of packaging and storage facilities for fresh and processed food materials.

Reference:

1. Brooker Donald B., Food W. Bapper-Arkema and Carl W. Hall: Drying and storage of grains and oil seeds, CBS Publication, New Delhi (1997)
2. Baur Fred J., Insect management for food storage and processing, American Association of cereal chemists. Minesota, USA, (1992)
3. Hall D.W. Handling and storage of food grains in tropical and subtropical areas, Oxford and IBH publisher, FAO, Rome (1970)

Industrial Management Science

Course No.: FT 614

Full marks: 100

Pass marks: 40

Nature of the course: Theory

Year: II

Course Description and Objective: The main objective of the course (TQM) is to make the students aware of the modern concept of management system in the food industries. The course contain TQM, FQC, TQC, SQC, Human Resource Management, quality circle, KAIZEN ISO-9000- series, ISO14000, HACCP Principles etc. which covers the necessary elements of good manufacturing practices (GMP) Total quality management system.

The course helps in developing managerial skills such as co-ordinating, delegating, communicating, decision making and planning and control. The objective of the course is to activate the function in which various administrative tasks are carried out and skill is used in career to achieve desired results.

Course Contents:

Group A : Total Quality Management (TQM)

1. Introduction and Philosophy of TQM. The essence of Quality Control. (1hr.)
2. The Management of QM, TQM with generating KAIZEN. (1hr.)
3. Why Focussed Quality Management? (1hr.)
4. TQC as thought revolution in management. (1hr.)
5. People of Team Building. (1hr.)
6. Variation (people, machine, material operation Process etc.). (1hr.)
7. Statistical Quality Control and the utilization of statistical methods. (1hr.)
8. Problem solving- by brain storming exercises like Pareto Principle, frequency distribution, Histograms, Probability Plots, specification, capability index, Process flow chart, Critical Control points, cause and effect diagram, variables and Attributive charting, X-Bar & R, Bar Chart developments, Co-relation charting, Scatter diagrams etc. (20hrs.)
9. Sample and sampling methods. (1hr.)
10. Quality assurance & Quality control for sub-contracting, QC for purchasing. (2hrs.)
11. Identification in marketing distribution in Food/Service Industries. (1hr.)
12. Communications in the Food Industries. (1hr.)
13. The cost of quality and QC audit. (3hrs.)

14. Design of experiments (i.e. OVAT, 2 FIS, ANOVAD Distribution etc.). (3hrs.)
15. Quality and duty of Top & middle management. (2hrs.)
16. Rewards and recognition in Human Resource Management. (2hrs.)
17. Basics of Quality Control Circle and their activities. (2hrs.)
18. Introduction and use of ISO-19000 Series ISO 14000 in the Food Industries. (2hrs.)
19. HACCP Principles and practices. (2hrs.)
20. Non-destructive methods of analysis. (2hrs.)

Group B

Industrial Management

1. Management technique: (1 hr.)
2. Corporate management: General management, strategic management, portfolio planning, organization management. (2 hrs.)
3. Marketing management: An overview of marketing management, marketing planning and evaluation, market research, product life cycle analysis, sales planning and forecasting, market mix and target, pricing. (8 hrs.)
4. Operation management: An overview of operation management, manufacturing system, computer aided design (CAD), computer aided manufacturing (CAM), production planning and control system (PPCS), Material requirement planning, manufacturing resource planning, optimized production theory, distribution planning, project management. (10 hrs.)
5. Financial management: An overview of financial management, financial planning, financial analysis, cash management. (8 hrs.)
6. Human resource management: An overview of human resource management, human resource planning, human selection testing, performance management, job analysis and evaluation, salary structure design and control system, systematic training technique, management development and quality circle. (8 hrs.)
7. Information technology: An overview of information technology, data processing and database management, system analysis and design, office automation, information system for decision making. (10 hrs.)
8. Planning and resource allocation: Network analysis, line of balance. (3 hrs.)

References:

Total Quality Management (TQM)

1. Ishikawa. Kaoru What is total Quality Control ,The Japanese Way- Prentic Hall of India P. Ltd. New Delhi (1985)
2. Kaoru Ishikawa; Guide to Quality Control , Asian Productivity Organisation (APO) Tokyo, Japan (1991)
3. Gould W A; T Q M for Food Industries, CTI Publication Institute USA (1992)
4. Kano Nariaki, Guide to T Q M in Service Industries, , Asian Productivity Organisation (APO) Tokyo, Japan (1996)
5. Kobata Tomozo; Managing by Fact; the result oriented approach Quality-, , Asian Productivity Organisation (APO) Tokyo, Japan (1996)
6. Nagashima Soichiro 100 management charts-, , Asian Productivity Organisation (APO) Tokyo, Japan (1996)
7. Senju. Shizuo; T Q C and T P M-, , Asian Productivity Organisation (APO) Tokyo, Japan (1996)
8. Anands K.K ;Quality Management Hand Book, Vikash Publications, India (1993)

Industrial Management

1. M. Armstrong, Handbook of Management Technique - Excel books, New Delhi (1995)
2. RG Murrdick, Information System for Modern Management - Tata McGraw Hill Publishing Company Ltd. India (1996)
3. P Chandra, Manager's Guide for Finance and Accounting - Tata McGraw Hill Publishing Company Ltd. India (1985)
4. K Philip, Marketing Management - Tata McGraw Hill Publishing Company Ltd. India (1985)

Meat Technology

Course No.: FT 615A

Nature of the course: Theory

Full marks: 70

Pass marks: 28

Year: II

Course Description and Objective: In depth and thorough study of the processing technology of variety of meat products constitutes the main part of this course. Necessary inputs required for a post-graduate student on subjects such as equipment, plant layout and meat laws have been given. All important tests have been included. The course incorporates recent advancement in the field of meat technology. Due importance has been placed on practical aspect of meat processing, safety and quality aspects of meat & meat product.

This course is intended for higher level of study. Students studying this course are expected to have had basic knowledge of meat science and production, processing and preservation of meat. Hence, a course in meat technology at bachelor level of Food Technology is considered pre-requisite.

To provide wider and updated knowledge to students in the field of meat technology is the objective of this course.

Course Contents:

1. Meat processing equipment: Type, construction, working principle, automation. (5 hrs.)
2. Slaughterhouse and meat processing plant: layout and designing slaughterhouse and meat processing plant. (4 hrs.)
3. Ground and Emulsion sausage: Raw materials & ingredients, process of manufacture, type, stuffing, smoking, cooking, cooling, packaging storage, quality defects. (6 hrs.)
4. Semi dry and dry sausage: Type, raw material, ingredients, starter culture, process of manufacture, stuffing, ripening, drying, smoking, packaging, storage, spoilage and quality defects. (6 hrs.)
5. Liver and blood sausage: Type, raw material, ingredients, manufacturing process, stuffing, cooking, cooling, storage, quality defects. (5 hrs.)
6. Raw cured Meat: Type, raw material, ingredients, manufacturing process, packaging, storage, quality defects. (5 hrs.)
7. Cooked cured Meat: Type, raw material, ingredients, manufacturing process, cooking, cooling, packaging, storage, quality defects. (5 hrs.)
8. Canned meat and sausage: Type, raw material, ingredients, canning process, process schedule, cans, spoilage. (5 hrs.)

9. Self-stable meat products: General about the product, type, principle of preservation, manufacturing process. (3 hrs.)
10. Fancy meat products: Type, raw material, ingredients, manufacturing process, packaging, storage, chilling, freezing. (7 hrs.)
11. Bio-meat: Meaning of bio-meat, type, features, acceptability, merits and demerits, commercial production. (3 hrs.)
12. Restructured meat: Restructuring process, different methods of restructuring meat. (3 hrs.)
13. Meat tenderization: Tenderization process, different methods of meat tenderization, changes in meat during tenderization process, factors affecting tenderization. (4 hrs.)
14. Physical and Chemical Characteristics of meat: Colour, aroma, taste, connective tissue free meat protein, texture, water and fat binding. (5 hrs.)
15. Food Safety: Mycotoxins, parasites, zoonotic diseases, residues, health-hazardous smoke constituents. (4 hrs.)
16. New Ingredients: New starter cultures, transglutaminase, new functional ingredients. (4 hrs.)
17. Quality measurement of meat and meat products: Meaning & importance, measurement time & technique, use of PSE & DFD meat in processing. (4 hrs.)
18. Analysis of meat and meat products: Chemical and instrumental methods of determining meat protein, non-meat protein, collagen, identification of animal species by electrophoresis, immunology & molecular biology method, measurement of emulsifying and gelling capacity of meat, determination of carbohydrate, contaminants & residues, determination of density, Eh, conductivity, dielectric constant and optical properties, measurement of texture, quick estimation methods. (8 hrs.)
19. Sensory evaluation of meat products: Schemes of sensory tests of meat products. (5 hrs.)
20. Meat laws & regulations: National and international laws and standards of meat and meat products. (2 hrs.)
21. Meat Selection System: General study of the subject. (3 hrs.)
22. Meat preservation methods: Advances and development in meat preservation methods. (4 hrs.)

Meat Technology

Course No.: FT 615B
Nature of the course: Practical

Full marks: 30
Pass marks: 12
Year: II

Course Contents:

1. Preparation of ground and emulsion sausage.
2. Preparation of semi-dry and dry sausage.
3. Preparation of liver and blood sausage.
4. Preparation of raw cured meat.
5. Preparation of cooked cured meat.
6. Preparation of canned meat and sausage.
7. Preparation of self-stable products.
8. Preparation of fancy meat products.
9. Analysis of meat and meat products - physical & chemical properties, microbiological examination, analysis for residues and contaminants.
10. Sensory evaluation of meat products.
11. Layout of slaughterhouse and meat processing plant.
12. Visit to slaughterhouse & meat factories.

References:

1. Orlando, San Diego,; Muscle as food, Academic Press, Inc. (1990)
2. Bailey A. J.; Connective tissue in meat and meat products, Elsavier Applied Science Publisher, London. (1989)
3. Kramlich, W. C. , Pearson A. M. and Tauber, I. W.; Processed Meats, AVI Publishing Co. Inc., West part, Connecticut, (1982)
4. Vernam A. H.; Meat and meat products, Chapman and Hall Publisher, India, (1985)

Dairy Technology

Course No.: FT 616A
Nature of the course: Theory

Full marks: 70
Pass marks: 28
Year: II

To be designed latter

Dairy Technology

Course No.: FT 616B
Nature of the course: Practical

Full marks: 30
Pass marks: 12
Year: II

To be designed latter

Soft Drink Technology

Course No.: FT 617A
Nature of the course: Theory

Full marks: 70
Pass marks: 28
Year: II

Course Description and Objective: The present course is a full course of soft drink technology. The contents have been so arranged that the course provides in-depth knowledge about the technology of soft drink. Microbiology and quality aspects of soft drink are also dealt with in considerable detail. Additional space has been provided for the study of equipment and plant design. The assignments and case studies will help students learn lot more about practical aspects of the product.

To provide thorough knowledge about soft drink technology is the objective of the course.

Course Contents:

1. Introduction: Historical development of soft drink industry, definition and type of soft drinks. (3 hrs.)
2. Water: Sources, impurities and treatment, preparation of mineral water. (15 hrs.)
3. Ingredients other than water: Type, functions, quality. (15 hrs.)
4. CO₂ Production and purification of CO₂. (4 hrs.)
5. Formulation of soft drinks. Process and methods of soft drink formulation. (4 hrs.)
6. Process of manufacture: Syrup preparation, blending, carbonation, filling, capping, cooling. (9 hrs.)
7. Powdered soft drink mixes: Ingredients, nutritional fortificants, processing, packaging. (7 hrs.)
8. Packaging materials and package: Type, treatment, washing, sterilization, storage. (8 hrs.)
9. Plant and equipment: Plant layout, sanitation, carbonator, filler, cooler, capping machine, bottle washers. Type, working principle. (10 hrs.)
10. Microbiology of soft drink: Spoilage flora, hygienic consideration, microbiological standards, preservation of soft drink, analysis. (10 hrs.)
11. Quality of soft drink: Sensory quality of drink and its evaluation, quality requirement, specifications, tests, HACCP, quality assurance. (7 hrs.)
12. Soft drink market: Survey of soft drink and soft drink industries. (3 hrs.)
13. Assignments and case studies. (5 hrs.)

Soft Drink Technology

Course No.: FT 617B

Nature of the course: Practical

Full marks: 30

Pass marks: 12

Year: II

Course Contents:

1. Physical and chemical analysis of water.
2. Determination of purity of ingredients: Sweeteners, acidulants, colour etc.
3. Preparation of syrup and measurement of syrup strength.
4. Microbiological examination of soft drink: Coliform, Yeast and mould count.
5. Proximate and ultimate analysis of finished product: TSS, acidity, pH, artificial sweeteners, stabilizer, preservative, CO₂ volume, extraneous matter, physical tests.
6. Analysis of heavy metals, lead, copper, arsenic, iron.
7. Sensory test of soft drink.
8. Assignment in soft drink making: composition and related calculations.

References :

1. L.F. Green Ed., Developments in Soft Drink Technology, Applied Science Publishers (1978)
2. H.W. Houghton Ed., Developments in Soft Drink Technology, Applied Science Publishers (1981)
3. H.W. Houghton Ed., Development in Soft Drink Technology, Applied Science Publishers (1984)
4. नेपाल गुणस्तर हलुका पेय पदार्थ, नेगुण : ५८२०४१ यू.डी.सी. ६६३.८१ ;, ५४३,०५.०६४ : ५७६.९ श्री ५ को सरकार उद्योग मन्त्रालय, नेपाल गुणस्तर तथा नापतौल विभाग, काठमाडौं

Snack Food Technology

Course No.: FT 618A

Nature of the course: Theory

Full marks: 70

Pass marks: 28

Year : II

Course Description and Objective: Consumption of snack food is increasing day by day. Snack industries are also gradually increasing with newly developed advanced technology. The student studying in master degree should get sufficient and thorough knowledge of snack food production, formulation, development of new technology This course is designed to fulfill this need and is the major objective of this course.

Course Contents:

1. Composition & nutritive value: Composition and nutritive value of different snack foods. 3 hrs.
2. Potato based snacks: Raw materials, types: a) Potato Chips, b) Frozen Potato Products, c) Potato Granules, d) Potato Flakes, e) Miscellaneous Potato Products. Quality factors, storage stability and packaging. 12 hrs.
3. Meat based snacks: Type, raw materials, processing, packaging, storage stability. 7 hrs.
4. Snacks based on pop corn: Different types of popcorn, raw materials, popping, procedures factors affecting the quality of popcorn, packaging and storage stability. 12 hrs.
5. Puffed snacks and corn chips : Type, raw materials : a) Puffed rice, b) Corn Chips and Cheese ball c) Others: Processing, Packaging, Storage. 10 hrs.
6. Nut-based snacks: Raw materials, types, peanuts, soy products and others processing, packaging, storage stability. 6 hrs.
7. Snack food based on wheat flour: Raw materials, types: a) Extruded Macaroni Products, b) Instant Noodles. c) Baked Snack: Processing, drying, packaging, storage stability. 10 hrs.
8. Breakfast snacks: Rice flakes, corn flakes, wheat flakes. Raw materials, processing, formulation of different breakfast snacks, drying, quality of the products, packing, storage stability. 8 hrs.
9. Protein product snacks: Raw materials, type, spun fiber type meat analog, extruded cooked type meat analog, heat-gelled type meat analog, tofu cheese and others: quality, packaging. 6 hrs.
10. Other snack foods: Miscellaneous snack products. 5 hrs.
11. Machines and equipment: Extruding equipment: a) Use, design and operation, complete plant process. b) Heat transfer mechanisms: ovens, electronic ovens, dryers, toasting ovens and frying. c) Oil,

powder and granule applicators, transfer, and storage, equipment, measuring and weighing equipment. d) Popping equipment (popplers, sifters, coasters, caramel corn plants). Other different machine and equipment used in snack production. 21 hrs.

Technology of Snack Foods

Course No.: FT 618B

Nature of the course: Practical

Full marks: 30

Pass marks: 12

Year : II

Course Contents:

1. Preparation of potato chips and quality evaluation, shelf-life study.
2. Preparation of meat based snack food, shelf-life study.
3. Preparation of popcorn, quality evaluation.
4. Preparation of puffed snack and corn chips.
5. Preparation of nut based snacks.
6. Preparation of macaroni products and instant noodles.
7. Preparation of break fast cereals, quality, shelf-life study.
8. Preparation of snack protein products.
9. Different snack food formulation. Its technology development.
10. Design of snack food industries.
11. Study and visit to different snacks processing industry.
12. Survey of other snack products.

References:

1. Matz. A. Samuel: Snack Food Technology, AVI Publishing Company Inc., Westport, Connecticut, 1984
2. Hosney R. Carl: Principles of Cereals Science and Technology, American Ass. of Cereal Chemist Minncsota, U.S.A. 1986
3. Proceeding of the Second International Soybean Processing and Utilization Conference , Bangkok, Thailand, 1996.
4. Talburat William F, Smith Ora : Potato Processing, AVI Publishing Co. Inc., Westport. Connecticut, 1978
5. Smith Ora : Potatoes Production, Storing, Processing, AVI Publishing Co. Inc. Westport. Connecticut, 1977

Compulsory:

Research Topics Selection and Review Work

Course No.: FT 619

Nature of the course: Practical

Full marks: 50

Pass marks: 20

Year : II

Course Contents:

The students will study the scientific literature, select the research topics and submit a proposal with report on the literature review for dissertation work prepared with the consultation of the resource persons and institutions for the approval of the department. The department will decide the schedule for the submission of the research proposal.



Research Dissertation

Course No.: FT 620
Nature of the course: Practical

Full marks: 150
Pass marks: 60
Year : II

Course Contents:

The students will carry out dissertation works on the topic approved the department. The department will decide the schedule for the submission of the thesis and for the final examination.

TEXT BOOK



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