



Course Upgradation
MSc. Food Science and Technology
(A Two-Year Course)

Under
A faculty of School of Advanced Agriculture Sciences and Technology
Department of Food Technology

Proposed by
Dr. Hradesh Rajput
Dr. Sudhir Kumar

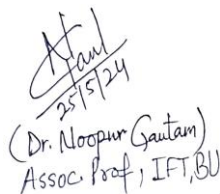


CHHATRAPATI SHAHU JI MAHARAJ UNIVERSITY, KANPUR
STRUCTURE OF SYLLABUS FOR THE
PROGRAM: M.Sc., SUBJECT: FOOD SCIENCE AND TECHNOLOGY

Board of Studies

Proposed Syllabus for MSc. in Food Science and Technology (Degree)

Syllabus Developed by				
Name of BOS Convenor / BOS Member	Designation	Department	College/ University	Signature
Prof. A. K. Pandey	Dean & Convenor	Department of Horticulture	CSJMU, Kanpur	
Prof. Alak Kumar Singh	Professor & Head (External Expert)	Department of Food Technology Contact: 8840773376 Email: alakksingh@rediffmail.com	HBTU, Kanpur	
Dr. Noopur Gautam	Associate Professor (External Expert)	Department of Food Technology Contact: 8400246749 Email: nupoor_gautam@yahoo.co.in	BU, Jhansi	 (Dr. Noopur Gautam) Assoc. Prof, IFT, BU
Dr. Himanshu Trivedi	Director, (Member)	School of Advanced Agriculture Sciences and Technology Contact: 7376102877 Email: himanshu@csjmu.ac.in	CSJMU, Kanpur	
Dr. Sudhir Kumar	Assistant Professor (Member)	School of Advanced Agriculture Sciences and Technology, FT Contact: 8840224961 Email: sudhir@csjmu.ac.in	CSJMU, Kanpur	
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Course Title with Credit Load M.Sc. in Food Science and Technology

Details of Courses		Minimum 55 Credits
Core Courses		Minimum 20 Credits
FST 501	Food Chemistry and Nutrition	2+1
FST 502	Food Microbiology	2+1
FST 503	Technology of Milk and Milk Products	2+1
FST 504	Food Processing and Preservation Technology	2+1
FST 505	Food Packaging	2+1
FST 506	Techniques in Food Analysis	1+2
FST 507	Food Safety & Quality Systems, Laws & Management	2+1
FST 508	Technology of Fruits and Vegetable Processing	2+1
FST 509	Food Engineering	2+1
Core Course taken		21 Credits
Minor/Elective Courses*		Minimum 08 Credits
FST 510	Technology of Cereals, Pulses and Oilseeds	2+1
FST 511	Technology of Meat, Poultry and Fish Processing	2+1
FST 514	Technology for Plantation Crops and Spices	2+1
FST 517	Food Biotechnology	2+1
FST 518	Post Harvest Management of Fruits & Vegetables	2+1
FST 520	Food Additives and Ingredients	2+1
Minor Courses taken**		09 Credits
Supporting Courses		06 Credits
FBM 503	Food Processing Entrepreneurship and Start up	0+1
STAT 511	Experimental Designs	2+1
MCA 512	Information Technology in Agriculture	1+1
Seminar		

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FST 550	Master's Course Seminar	1+0
Research		
FST 560	Master's Research	30+0
Compulsory Non-Credit Courses***		
PGS 501	Library and Information Services	0+1
PGS 502	Technical Writing and Communication Skills	0+1
PGS 503	Intellectual Property and Its Management in Agriculture	1+0
PGS 504	Basic Concepts in Laboratory Techniques	0+1
PGS 505	Agricultural Research, Research Ethics and Rural Development programmes (e-course)	1+0
PGS 506	Disaster Management	1+0

Note:

*Students should take at least one course from each group; Department/College can offer the minor courses from other faculties, depending upon local need, facilities & expertise available. If required, any other courses not listed under optional courses can be designed offered.

**** Minor Courses:** Related Discipline other than major discipline in which a student offers at least nine credits of courses shall constitute his/her minor discipline.

***** Compulsory Non-Credit Courses** are of general nature and are compulsory for Masters Program.

Project Training: The students are required to undertake compulsory four to six-weeks training (preferably during semester break after 1st year) in a reputed food industry/academic/research organization. On completion of the training, the students are required to submit a report. The departmental committee on the basis of certificate from host industry/organization, training report, and viva voce/seminar will assess the student's performance. They will be awarded Satisfactory/Unsatisfactory grade.

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Semester wise titles of Papers in M.Sc. (Food Science and Technology)

IST YEAR / IST SEM							
Course code	Type	Course title	Min credits	Internal		End Term	Total Marks
				Theory	Practical		
FST 501	Core	Food Chemistry and Nutrition	2+1	20	30	50	100
FST 502	Core	Food Microbiology	2+1	20	30	50	100
FST 507	Core	Food Safety & Quality Systems, Laws & Management	2+1	20	30	50	100
FST 510	Minor	Technology of Cereals, Pulses and Oilseeds	2+1	20	30	50	100
FBM 503	Supporting	Food Processing Entrepreneurship and Start up	0+1	-	50	50	100
PGS 501	Compulsory Non-Credit	Library and Information Services (MOOC)	0+1	-	50	50	100
PGS 502	Compulsory Non-Credit	Technical Writing and Communication Skills (MOOC)	0+1	-	50	50	100
TOTAL			15				700
IST YEAR / IIND SEM							
FST 505	Core	Food Packaging	2+1	20	30	50	100
FST 503	Core	Technology of Milk and Milk Products	2+1	20	30	50	100
FST 518	Minor	Post Harvest Management of Fruits & Vegetables	2+1	20	30	50	100
STAT 511	Supporting	Experimental Designs	2+1	20	30	50	100
PGS 503	Compulsory Non-Credit	Intellectual Property and Its Management in Agriculture (MOOC)	1+0	20	30	50	100
PGS 504	Compulsory Non-Credit	Basic Concepts in Laboratory Techniques (MOOC)	0+1	-	50	50	100
TOTAL			14				600
IIND YEAR / IIIRD SEM							
FST 504	Core	Food Processing and Preservation technology	2+1	20	30	50	100
FST 509	Core	Food Engineering	2+1	20	30	50	100
FST 511	Minor	Technology of Meat, Poultry and Fish Processing	2+1	20	30	50	100
MCA 512	Supporting	Information Technology in Agriculture	1+1	20	30	50	100
FST 550	Seminar	Master's Course Seminar	1+0	20	30	50	100
PGS 505	Compulsory Non-Credit	Agricultural Research, Research Ethics and Rural Development programmes (MOOC)	1+0	20	30	50	100
PGS 506	Compulsory Non-Credit	Disaster Management	1+0	20	30	50	100
FST 560	Research	Master's Research (Thesis/Dissertation)	10+0	-	-	-	S
TOTAL			24				600
IIND YEAR / IVTH SEM							
FST 560	Research	Master's Research (Thesis/Dissertation) Thesis Report Viva-Voce Examination	20+0	-	-	300	S
TOTAL			20				S
GRAND TOTAL			73				1900

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Preamble

MSc. Food Science and Technology is a Two years course that a students can pursue after the completion of graduation where MSc. Food Science and Technology is divided in to four semesters. After completion of two years MSc. Food Science and Technology degree is awarded.

Program Educational Objectives (PEOs)

Post-Graduates of Food Science and Technology program will be able to,

PEO1: To inculcate in-depth knowledge of Food Engineering and Technology with an ability to analyze, evaluate, design, discriminate, interpret, create and integrate existing and new knowledge.

PEO2: To analyze technological problems and judge independently to create information for conducting research and think to conceptualize and carry out the solutions of a potential problem and derive out optimal solutions in the area of Food Science and Technology.

Program Outcome (PO):

PO1: An ability to apply the knowledge of science, microbiology and technology

PO2: An ability to apply the knowledge of underlying chemistry, properties and effects of processing on food components

PO3: An ability to use the techniques, skills, and modern tools necessary food processing operations

PO4: Demonstrate knowledge and understanding of technology and management principles, manage projects efficiently in food science and technology and multidisciplinary environments after consideration of economic and financial factors

PO5: An ability to design and conduct experiments, as well as to analyze and interpret data

PO6: An ability to apply knowledge for production of safe food and shelf-life extension of food products

PO7: An ability to identify, formulates, and solve food science and technology problems

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PO8: An ability to extract information pertinent to unfamiliar problems through literature survey and experiments, apply appropriate research methodologies, techniques and tools, design, conduct experiments, analyze and interpret data

PO9: Contribute individually/in group to the development of scientific/technological knowledge in food science and technology.

PO10: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO12: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Program Specific Outcome (PSO)

PSO 1: To inculcate technical writing and communicating ability for effective documentation and presentations and develop strong research aptitude through research work to enable the students to opt for higher levels of learning in the field of Food Processing Technology.

PSO 2: To acquaint and equip students with professional and intellectual integrity, ethics of research and scholarship, impact of research outcomes on professional practices and responsibilities to contribute positively in the sustainable development of society.

PSO 3: To enable the students to get engaged in lifelong learning independently with the vigor and zeal and become capable to start-up their own businesses.

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Detailed Syllabus for M. Sc. (Food Science and Technology)

1. CORE COURSES

FST 501 FOOD CHEMISTRY AND NUTRITION

(2+1)

Course Outcomes: -

Upon successful completion of the course, the student:

- 1- Will have an overview of human nutrition and learn about the water properties its bonding and Chemistry.
- 2- Will be able to understand classification structure and properties of Carbohydrates, its role in Food Industry and also know about different carbohydrates and Browning reaction in foods.
- 3- Learn about the classification structure properties purification and denaturation of protein and its interaction and also understand about various types of proteins from different food product classification and properties of food enzyme its activity.
- 4- Have a clear understanding of classification physico-chemical properties of food lipids also knows about refining of crude oil different fat product and flavour changes in fats and oils.

Theory

Unit-I (06 Lecture)

Role of Indian knowledge system in food chemistry in nutrition. Definition and importance; major food constituents and their physicochemical properties; role of water in food.

Unit-II (06 Lecture)

Carbohydrates, proteins and lipids: classification, physical, chemical, nutritional, and functional properties and their structural correlations, auto-oxidation of lipids and rancidity.

Unit-III (06 Lecture)

Properties of minerals, vitamins, pigments, anti-oxidants, flavour components, allergens, toxins and anti-nutritional factors in foods, Interaction of constituents in food systems; Changes during storage and processing; Browning reactions in foods.

Unit-IV (06 Lecture)

Essential nutrients- sources, functions, deficiency diseases; requirements and recommended dietary allowances; protein quality evaluation.

Practical

Proximate analysis of foods; calorific value of foods; TSS; pH; acidity; estimation of

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browning intensity; determination of vitamin C and beta carotene, sugars; estimation of calcium, phosphorus and iron; antinutritional factors in foods, Enzyme activity, adulterants etc.

Suggested Readings

Bamji MS, Rao NA & Reddy V. 2003. *Textbook of Human Nutrition*. Oxford & IBH.
Belitz HD.1999. *Food Chemistry*. Springer Verlag.
DeMan JM. 1976. *Principles of Food Chemistry*. AVI.
Fennema OR.1996. *Food Chemistry*. Marcel Dekker.
Meyer LH. 1987. *Food Chemistry*. CBS.
Swaminathan M. 1974. *Essentials of Foods and Nutrition*. Vol. II. Ganesh & Co.

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FST 502 FOOD MICROBIOLOGY

(2+1)

Course Outcomes: -

- 1- Understand the important genera of microorganisms associated with food and their characteristics, their growth pattern, and parameters
- 2- Comprehend the role of the microorganisms in spoilage of foods and methods of their preservation.
- 3- Knowledge about the beneficial role of microorganisms and different types of fermented foods.
- 4- Identify the role of microorganisms in food borne diseases and control measures

Theory

Unit-I (06 Lecture)

Growth and survival of microorganisms in foods; spoilage organisms of milk, fruits, vegetables, grains and oilseeds, meat and poultry; Physical and chemical methods to control microorganisms. Contribution of Indians in food microbiology.

Unit-II (06 Lecture)

Biochemical changes caused by microorganisms; Microbes in food fermentation, putrefaction, lipolysis; Antagonism and synergism in microorganisms; Food poisoning and food borne infections; Microbial toxins.

Unit-III (06 Lecture)

Food hygiene and sanitation: Contamination during handling and processing and its control; indicator organisms; Rapid methods in detection of microorganisms.

Unit-IV (06 Lecture)

Food Fermentations; Traditional fermented foods of India and other Asian countries; Probiotics and prebiotics; Fermented foods based on milk, meat and vegetables; Fermented beverages.

Practical

Microscopic examination of bacteria, and yeast and molds; Standard plate count; Yeast and mould count; Spore count; Detection and enumeration of pathogenic and indicator organisms in food; MPN of coli forms; Enumeration of physiological groups- psychrophile, thermotolerant, osmophiles and halophiles. Evaluation of microbiological quality of commonly consumed street foods.

Suggested Readings

- Banawart GJ. 1989. *Basic Food Microbiology*. 2nd Ed. AVI Publ.
- Frazier J & Westhoff DC. 1988. *Food Microbiology*. 4th Ed. McGraw Hill.
- Garbutt J. 1997. *Essentials of Food Microbiology*. Arnold Heinemann.
- Jay J M, Loessner MJ & Golden DA. 2005. *Modern Food Microbiology*. 7thEd. Springer.
- Ray B. 2004. *Fundamentals of Food Microbiology*. 3rd Ed. CRC.
- Robinson RK. (Ed.). 1983. *Dairy Microbiology*. Applied Science.
- Steinkraus KS. 1996. *Handbook of Indigenous Fermented Foods*. Marcel Dekker.

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FST 503 TECHNOLOGY OF MILK AND MILK PRODUCTS

(2+1)

Course Learning Outcomes: -

- 1- Understand the physicochemical properties of milk and various technologies and techniques involved from collection to distribution of milk.
- 2- Understand the technology of fermented milk products and manufacturing techniques, storage, marketing and defects of cheese and butter.
- 3- Understand the technology of frozen milk products technology of evaporated and dried milk technology of condensed milk and their defects and control.
- 4- Understand the technology of dairy by product and their utilization, technology of indigenous milk product and process of manufacturing.

Theory

Unit-I (06 Lecture)

Contribution of Indians in dairy technology. Present status of milk & milk products in India and Abroad; market milk- Composition of milk of various species, quality evaluation and testing of milk, procurement, transportation and processing of market milk, cleaning & sanitization of dairy equipment's.

Unit-II (06 Lecture)

Special milks such as flavored, sterilized, recombined & reconstituted toned & double toned. Condensed milk- Definition, methods of manufacture, evaluation of condensed & evaporated milk; dried milk- Definition, methods of manufacture of skim & whole milk powder, instantiation, physiochemical properties, evaluation, defects in dried milk powder.

Unit-III (06 Lecture)

Cream- Definition, classification, composition, cream separation, sampling, neutralization, sterilization, pasteurization & cooling of cream, evaluation, defects in cream; Butter- Definition, composition, classification, methods of manufacture, theories of churning, evaluation, defects in butter. Ice cream- Definition, composition and standards, nutritive value, classification, methods of manufacture, evaluation, defects in ice cream, and technology aspects of softy manufacture.

Unit-IV (06 Lecture)

Cheese: Definition, composition, classification, methods of manufacture, cheddar, Gouda, cottage and processed cheese, evaluation, defects in cheese. Indigenous milk products - Present status, method of manufacture of yoghurt, *dahi*, *khoa*, *burfi*, *kalakand*, *gulabjamun*, *rosogolla*, *srikhand*, *chhana*, *paneer*, *ghee*, *lassi* etc; probiotic milk products.

Practical

Study on basics of reception of milk at the plant; platform tests in milk; estimation and fat and SNF in milk; Operation of LTLT & HTST Pasteurization; Preparation of special milks; Cream separation & standardization of milk; Preparation and evaluation of table butter, icecream, cheese and indigenous milk product such as *khoa*, *chhana*, *paneer*, *ghee*, *rosogolla*, *gulab jamun*, *shrikhand*, *lassi*, *burfi* etc.; Visit to dairy plants.

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Suggested Readings

- Aneja RP, Mathur BN, Chandan RC & Banerjee AK. 2002. *Technology of Indian Milk Products*. Dairy India Publ.
- De S. 1980. *Outlines of Dairy Technology*. Oxford Univ. Press.
- Henderson JL. 1971. *Fluid Milk Industry*. AVI Publ.
- Rathore NS *et al.* 2008. *Fundamentals of Dairy Technology - Theory & Practices*. Himanshu Publ
- Spreer E. 1993. *Milk and Dairy Products*. Marcel Dekker.
- Walstra P. 1999. *Dairy Technology*. Marcel Dekker.
- Walstra P. (Ed.). 2006. *Dairy Science and Technology*. 2nd Ed. Taylor & Francis.

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FST 504 FOOD PROCESSING AND PRESERVATION TECHNOLOGY (2+1)

Course Outcomes: -

1. Gain knowledge of principles of Unit operations involved in food processing industry.
2. Learn fundamentals of food processing technology and its process.
3. Understand concepts of various engineering principles and processing and preservation methods and their application.
4. Understand various post processing operations important from industrial point of view.

Syllabus
Theory

Unit-I (06 Lecture)

Role of Indian knowledge system in food preservation. Introduction: Definition and scope of Food Science and Technology, historical development of food processing and preservation, general principles of food preservation. Types of preservation: Preservation of foods by use of sugar, salt, chemicals and antibiotics and by smoking. Effect of various food processing operations on the nutrients of foods. Preservation by heating: Principles of the method, Types of microorganisms, bacterial load, sterilization and commercial sterility, thermal resistance of the microorganisms and enzymes. Canning and bottling: General aspects of canning and bottling, processing operations exhausting and sealing, retorting, ultra-high temperature processes, determination of thermal process time, processing equipment's, canning/ bottling of various food products.

Unit-II (06 Lecture)

Membrane technology: Introduction to pressure activated membrane processes: micro-filtration, UF, NF and RO and their industrial application. Supercritical fluid extraction: Concept, property of near critical fluids NCF and extraction methods. Microwave and radio frequency processing: Definition, Advantages, mechanism of heat generation,

Unit-III (06 Lecture)

Application in food processing: microwave blanching, sterilization and finish drying. Hurdle technology: Types of preservation techniques and their principles, concept of hurdle technology and its application. High Pressure processing: Concept, equipment's for HPP treatment, mechanism of microbial inactivation and its application in food processing.

Unit-IV (06 Lecture)

Ultrasonic processing: Properties of ultrasonic, application of ultrasonic as processing techniques. Newer techniques in food processing: Application of technologies of high intensity light, pulse electric field, ohmic heating, IR heating, inductive heating and pulsed X-rays in food processing and preservation. Nanotechnology: Principles and applications in foods.

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Practical

Seaming and testing of cans; Tin coating measurement and tests for sulphide stain and crystal size of tin plates; Determination of thermal inactivation time of enzymes; Thermal processing of foods; Dehydration of foods; Refrigeration Freezing of foods; Concentration of foods; Use of chemicals in preservation of foods; Fermented food products; Extrusion cooking of foods; Visit to a food processing plant.

Suggested Readings

- Arsdel WB, Copley MJ & Morgan AI. 1973. Food Dehydration. 2nd Ed. Vols. I, II. AVI Publ.
- Barbosa-Canovas 2002. *Novel Food Processing Technologies*. CRC.
- Desrosier NW & James N. 1977. Technology of Food Preservation. 4th Ed. AVI. Publ.
- Dutta AK & Anantheswaran RC. 1999. *Hand Book of Microwave Technology for Food Applications*.
- Fellows PJ. 2005. Food Processing Technology: Principle and Practice. 2nd Ed. CRC.
- Frame ND. (Ed.). 1994. *The Technology of Extrusion Cooking*. Blackie. Gould GW. 2000. *New Methods of Food Preservation*. CRC.
- Jelen P. 1985. Introduction to Food Processing. Prentice Hall.
- Potter NN & Hotchkiss 1997. Food Science. 5th Ed. CBS.
- Potty VH & Mulky MJ. 1993. Food Processing. Oxford & IBH.
- Ramaswamy H & Marcotte M. 2006. Food Processing: Principles and Applications. Taylor & Francis.
- Shi J. (Ed) 2006. *Functional Food Ingredients and Nutraceuticals: Processing Technologies*. CRC.

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FST 505 FOOD PACKAGING

(2+1)

Course Outcomes: -

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

- 1- Comprehend the overview of the scientific and technical aspects of food packaging
- 2- Understand packaging machinery, their types, systems, and testing
- 3- Understand the overall process of packaging from material handling to package sterilization techniques, cushioning, unitizing and containerization
- 4- Discover the evaluation of packaging materials. toxicity, corrosion prevention and minimization of transport losses

Theory

Unit-I (06 Lecture)

Definitions, objectives and functions of packaging and packaging materials; Packaging requirements and selection of packaging materials; Types of packaging materials: Paper: pulping, fibrillation and beating, types of papers and their testing methods; Glass: composition, properties, types of closures, methods of bottle making; Metals: Tinplate containers, tinning process, components of tinplate, tin free steel (TFS), types of cans, aluminium containers, lacquers; Plastics: types of plastic films, laminated plastic materials, co-extrusion, edible films, biodegradable plastics.

Unit-II (06 Lecture)

Properties of materials such as tensile strength, bursting strength, tearing resistance, puncture resistance, impact strength, tear strength, their methods of testing and evaluation; Barrier properties of packaging materials:

Unit-III (06 Lecture)

Theory of permeability, factors affecting permeability, permeability coefficient, gas transmission rate (GTR) and its measurement, water vapour transmission rate (WVTR) and its measurement, prediction of shelf life of foods, selection and design of packaging material for different foods.

Unit-IV (06 Lecture)

Food packaging systems, Packaging equipment and machinery: Vacuum, CA and MA packaging machine; gas packaging machine; seal and shrink-packaging machine; form and fill sealing machine; aseptic packaging systems; bottling machines; carton making machines, Food transportation, active packaging. Food storage and transportation. Advanced packaging system.

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Practical

Identification and testing of packaging materials; To perform sulphide stain test; Determination of equilibrium moisture content; Grading of glass bottles for alkalinity; Determination of water vapour transmission rate of packaging material; To perform vacuum packaging of food sample and carry out its storage study; Testing the compression strength of the boxes, Testing the strength of filled pouches by drop tester.

Suggested Readings

Crosby NT.1981. *Food Packaging: Aspects of Analysis and Migration Contaminants*. App. Sci. Publ.
Kadoya T. (Ed). 1990. *Food Packaging*. Academic Press.
Mahadeviah M & Gowramma RV. 1996. *Food Packaging Materials*. Tata McGraw Hill.
Palling SJ. (Ed). 1980. *Developments in Food Packaging*. App. Sci. Publ.
Painy FA. 1992. *A Handbook of Food Packaging*. Blackie Academic.
Sacharow S & Griffin RC. 1980. *Principles of Food Packaging*. AVI Publ.
Stanley S & Roger CG.1970. *Food Packaging*. AVI Publ. 22

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FST 507 FOOD SAFETY & QUALITY SYSTEMS, LAWS & MANAGEMENT (1+2)

Course Outcomes: -

1. Have a clear understanding about the quality assurance food quality and food safety.
2. Have knowledge of various quality parameters of raw material and finished food and evaluation procedure and have clear understanding of sensory analysis of food.
3. Understand about various food standards and laws of national international level and also have knowledge of nutritional labeling.
4. Will have gained insight on water quality and its analysis and waste treatment using various methods.

Theory

Unit-I (06 Lecture)

Concept of quality: Quality attributes- physical, chemical, nutritional, microbial, and sensory; their measurement and evaluation; Sensory vis-à-vis instrumental methods for testing quality.

Unit-II (06 Lecture)

Concepts of quality management: Objectives, importance and functions of quality control; Quality management systems in India; Sampling procedures and plans; Food Safety and Standards Act, 2006; Food Regulations Scenario in India and Role of FSSAI-Scope and Key Provisions;

Unit-III (06 Lecture)

Domestic regulations; Global Food safety Initiative; Various organizations dealing with inspection, traceability and authentication, certification and quality assurance (PFA, FPO, MMPO, MPO, AGMARK, BIS); Labeling issues; International scenario, international food standards, EU and USFDA Food Standards.

Unit-IV (06 Lecture)

Quality assurance, Total Quality Management; GMP/GHP; GLP, GAP; Sanitary and hygienic practices; HACCP; Quality manuals, documentation and audits; Indian & International quality systems and standards like ISO and Food Codex; Export import policy, export documentation; Applications in different food industries; Food adulteration, Food Safety Authority, Food Safety Management Systems.

Practical

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STRUCTURE OF SYLLABUS FOR THE
PROGRAM: M.Sc., SUBJECT: FOOD SCIENCE AND TECHNOLOGY

Testing and evaluation of quality attributes of raw and processed foods; Detection and estimation of food additives and adulterants; Quality assurance procedure, GMP, GAP documentation; Preparation of quality policy & documentation, Application of HACCP to products, Preparation of HACCP chart; Preparation of documentation & records, Visit to Units with ISO systems; Visit to Units with HACCP certification; Visit to Units implementing GMP, GAP; Mini-project on preparation of a model laboratory manual.

Suggested Readings

- Amerine M. A., Pangborn R. M. & Rosslos E. B. 1965. Principles of Sensory Evaluation of Food. Academic Press.
- Early R. 1995. Guide to Quality Management Systems for Food Industries. Blackie Academic.
- Export/Import policy by Govt. of India.
- Furia TE. 1980. Regulatory status of Direct Food Additives. CRC Press.
- Jellinek G. 1985. Sensory Evaluation of Food - Theory and Practice. Ellis Horwood.
- Krammer A & Twigg BA. 1973. Quality Control in Food Industry. Vol. I, II. AVI Publ.
- Macrae R, Roloson R & Sadlu MJ. 1994. Encyclopedia of Food Science & Technology & Nutrition. Vol. XVI. Academic Press.
- Piggot JR. 1984. Sensory Evaluation of Foods. Elbview Applied Science.

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FST 509 FOOD ENGINEERING

(2+1)

Course Outcomes: -

- 1- To study the various engineering properties of food materials under different condition
- 2- To study about the different methods of determining the quality and properties of different foods
- 3- Understand and comprehend the principle of unit operations
- 4- Students can be familiarized with basic principles of refrigeration, freezing, fluid flow, heat and mass transfer, steam, psychrometrics etc. from food industrial point of view

Unit-I (04 Lecture)

Process time calculations; Sterilizers and accessories used in canning industries; Engineering aspects of pasteurizer; homogenizer, evaporators (basic principle and single-effect evaporator) and concentrators used in food industries; Seaming machine.

Unit-II (03 Lecture)

Construction of cold storage; Different types of freezers including plate contact freezer, air blast freezer, cryogenic freezing and refrigerated vans.

Unit-III (02 Lecture)

Various types of driers (basic principle and drying time) – Tray drier, roller drier, spray drier, fluidized bed drier, freeze drier and solar drier.

Unit-IV (04 Lecture)

Heat exchangers (including paraflow HEs); Extruders – Basic principles and types, Difference between single- and twin-screw extruders; Kneader; Oil expeller.

Thermal Properties of Foods: Definitions - specific heat, enthalpy, conductivity and diffusivity, surface heat transfer coefficient. Measurement of thermal properties like specific heat, thermal conductivity and thermal diffusivity

Unit-V (04 Lecture)

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Aerodynamic property-definition-drag coefficient, terminal velocity - application in handling and separation of food materials. Frictional property-coefficient of friction, angle of repose, angle of internal friction, application in food handling and storage

Practical

Determination of viscosity of Newtonian fluid, non-Newtonian fluids; Design of pumping systems; Determination of thermal properties of foods such as thermal conductivity, thermal diffusivity, calorific value and specific heat; Calculation of freezing time for some typical foods; Study of different types of freezers; Calculation of thermal process time in canning of some foods; Determination of 'U' for PHE; Determination of 'U' for SSHE; Study of blast freezer; Visit to Food Processing Plants.

Reference Book

1. The Fundamentals of Food Engineering; Charm SE; 1963, AVI Pub.
2. Bakery Technology & Engineering; Matz SA; 1960, AVI Pub.
3. Dictionary of Food Science & Technology, Blackwell Publishing
4. Engineering Properties of Foods; Rao MA & Rizvi SSH; 1986, Marcel Dekker Inc.
5. Fundamentals of Food Process Engineering; Toledo RT; 2nd ed, 2000, CBS Publishers.
6. Food process engineering, D. R. Heldman and R. P. Singh

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2. MINOR/ ELECTIVE COURSES –

FST 510 TECHNOLOGY OF CEREALS, PULSES AND OILSEEDS (2+1)

Course Outcomes: -

- 1- Will be able to understand the structure, composition of different types of grains and learn about various types of enzymes present in wheat it's milling and processing of various types of wheat products like, bread, biscuit etc.
- 2- Will be able to understand about the structure, composition, and anti- nutritional factors of legumes.
- 3- Will be able to understand about the structure, composition, wet and dry milling of corn and different processing method for manufacturing corn products
- 4- Will be able to understand and learn about the composition and processing of oil seed as protein concentration and what is the properties and uses of oilseed meal, technologies used for vegetable protein isolates,

Theory

Unit-I (06 Lecture)

Role of Indian knowledge system in cereals technology. General introduction and production and utilization trends, Structure and composition of common cereals, pulses and oilseeds.

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

Unit-II (06 Lecture)

Rice: Classification, physicochemical characteristics; cooking quality; rice milling technology; by- products of rice milling and their utilization; Parboiling of rice- technology

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and effect on quality characteristics; aging of rice - quality changes; processed products based on rice.

Unit-III (06 Lecture)

Corn: Types and nutritive value; dry and wet milling, manufacture of value-added products; processing of barley, oats, sorghum and millets.

Unit-IV (06 Lecture)

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.

Practical

Physical-tests on wheat and rice; Physicochemical and rheological properties; Determination of gluten content in wheat flour; Conditioning of wheat; Milling of wheat and rice by laboratory mill; Parboiling of rice; Quality tests of rice; Amylose content determination in rice; Malting of barley; puffing and popping of grains; experimental parboiling and assessment of degree of polishing; Preparation of protein concentrates and isolates and their evaluation for protein content and solubility; Extraction of oil using expeller and solvent extraction methods; visit to related processing industries.

References

Dendy DAV & Dobraszczyk BJ. 2001. *Cereal and Cereal Products*. Aspen.
Hamilton RJ & Bhati A. 1980. *Fats and Oils - Chemistry and Technology*. App. Sci. Publ.
Hoseney RS. 1994. *Principles of Cereal Science and Technology*. 2nd Ed. AACC.
Kay DE. 1979. *Food Legumes*. Tropical Products Institute.
Kent NL. 1983. *Technology of Cereals*. 4th Ed. Pergamon Press.
Kulp K & Ponte GJ. 2000. *Handbook of Cereal Science and Technology*. 2nd Ed. Marcel Dekker.

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FST 511 TECHNOLOGY OF MEAT, POULTRY AND FISH PROCESSING (2+1)

Course Outcomes: -

- 1- Learns about the scope of meat industry structure, chemical composition, and nutritive value of meat and gain knowledge of various changes in postmortem, meat cut, meat tenderization and utilization of by-products.
- 2- Understand preservation techniques used for meat and poultry.
- 3- Learns about the catching to transportation processing and preservation techniques and spoilage of fish.
- 4- Acquires knowledge about eggs its structure, composition and nutritive value. Students are also able to do internal evaluation of eggs and grade them, also learn about preservation and production processes of various egg product.

Theory

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Unit-I (06 Lecture)

Meat composition from different sources; muscle structure and compositions; post-mortem muscle chemistry, meat colour and flavours; meat microbiology and safety. Modern abattoirs, typical layout and features, Ante-mortem handling and design of handling facilities; Hoisting rail and traveling pulley system; Stunning methods; steps in slaughtering and dressing; inedible by-products; operational factors affecting meat quality; effects of processing on meat tenderization; abattoir equipment and utilities

Unit-II (06 Lecture)

Chilling and freezing of carcass and meat; curing and smoking; prepared meat products, intermediate moisture and dried meat products; meat plant hygiene; Packaging of meat products.

Unit-III (06 Lecture)

Poultry industry in India, measuring the yields and quality characteristics of poultry products, Poultry meat processing operations, equipment used – De-feathering, bleeding, scalding etc.; refrigerated storage of poultry meat, by products

Unit-IV (06 Lecture)

Eggs, egg products, Whole egg powder, Egg yolk products, their manufacture, packaging and storage. Preservation of Postharvest fish freshness; grading and preservation of fish, pickling and preparation of fish protein concentrate, fish oil and other by-products.

Practical

Slaughtering and dressing of meat animals; study of post-mortem changes; meat cutting and handling; evaluation of meat quality; Preservation by dehydration, freezing, canning, curing, smoking and pickling of fish and meat; evaluation of quality of eggs; estimation of meat: bone ratios; preparation of meat products- barbecued sausages, loaves, burger, fish finger; visit to meat processing plants.

Suggested Readings

- Govindan TK. 1985. *Fish Processing Technology*. Oxford & IBH.
Hui YH. 2001. *Meat Science and Applications*. Marcel Dekker.
Kerry J. *et al.* 2002. *Meat Processing*. Woodhead Publ. CRC Press.
Levie A. 1984. *Meat Hand Book*. 4th Ed. AVI Publ.
Mead M. 2004. *Poultry Meat Processing and Quality*. Woodhead Publ.
Mead GC. 1989. *Processing of Poultry*. Elsevier.
Pearson AM & Gillett TA. 1996. *Processed Meat*. 3rd Ed. Chapman & Hall.
Stadelman WJ & Cotterill OJ. 2002. *Egg Science and Technology*. 4th Ed. CBS.

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FST 514 TECHNOLOGY OF PLANTATION CROPS AND SPICES (2+1)

Course Outcomes: -

1. To know about the importance of various types of spices which are used in the food industry and their applications
2. To understand the processing steps involved in spice processing
3. To know about value added products from spices
4. To know various processing steps involved in plantation crop processing

Theory

Unit-I (06 Lecture)

Coffee: Occurrence, chemical constituents; harvesting, fermentation of coffee beans; changes taking place during fermentation; drying; roasting; process flow sheet for the manufacture of coffee powder; instant coffee technology; chicory chemistry; quality grading of coffee.

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Unit-II (06 Lecture)

Tea: Occurrence, chemistry of constituents; harvesting; types of tea – green, oolong and CTC; chemistry and technology of CTC tea; manufacturing process for green tea and black tea manufacture; instant tea manufacture; quality evaluation and grading of tea.

Unit-III (06 Lecture)

Cocoa: Occurrence, chemistry of the cocoa bean; changes taking place during fermentation of cocoa bean; processing of cocoa bean; cocoa powder; cocoa liquor manufacture; chocolates–types, chemistry and technology of chocolate manufacture; quality control of chocolates.

Unit-IV (06 Lecture)

Major spices: Pepper, cardamom, ginger, chili and turmeric–Oleoresins and essential oils; method of manufacture; chemistry of the volatiles; enzymatic synthesis of flavour identicals; quality control; fumigation and irradiation of spices. Other spices: Cumin, coriander, cinnamon, fenugreek, garlic, mace, clove, mint and vanilla; present trends in synthesis of volatiles; microbial and chemical contaminants, plant suspension cultures.

Practical

Estimation of extractives, caffeine in tea and coffee; the aflavin and thearubigens of tea and total solids; moisture and volatile oil content of spices; detection of microbial quality and adulteration in spices; aromatic compounds in spices; capsaicin content and Scoville Heat Units in chilies, curcumin content of turmeric; storage and packaging of spices; visit to spice processing Units.

Suggested Readings

Banerjee B. 2002. *Tea Production and Processing*. Oxford Univ. Press.
Minifie BW. 1999. *Chocolate, Cocoa and Confectionery Technology*. 3rd Ed. Aspen Publ.
NIIR. 2004. *Handbook on Spices*. National Institute of Industrial Research Board, Asia Pacific Business Press Inc.
Sivetz M & Foote HE. 1963. *Coffee Processing Technology*. AVI Publ.

FST 517 FOOD BIOTECHNOLOGY

(2+1)

Course Outcome: -

- 1- The subject Fundamental Biochemistry is designed to under graduate students of biotechnology for describing basic concepts of biophysical chemistry, bimolecular and their types.
- 2- The course aims to provide an advanced understanding of the core principles and topics of Biochemistry and their experimental basis, and to enable students to acquire a specialized knowledge and understanding.
- 3- To discuss how Bimolecular provides basis for structural and chemical biology including nucleic acid structure and interactions
- 4- The course prepares the student to understand the biological material and its relation to living matter and elaborates the structure and functions of different bimolecular.

Theory

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Unit-I (06 Lecture)

Prospectus of Biotechnology - definition, scope and applications, Application of Biotechnology in food (Food industries), pharmaceuticals and agriculture, Application of biotechnology for food plant waste utilization, biogas plants.

Unit-II (06 Lecture)

Biological role of DNA in cell metabolism, Molecular genetics i.e. fundamentals of molecular biology with special reference to chemistry and biology and DNA, (Primary secondary and tertiary) structures.

Unit-III (06 Lecture)

GMO, genetic recombination mechanisms and technique used for improvement in microbial strains, Recombinant-DNA technology (plasmids and cloning), Expression of foreign genes, Promoters (Enzyme), Biomass production by using various microorganisms.

Unit-IV (06 Lecture)

Applications of genetical control mechanism in industrial fermentation process, (Induction, manipulation and recombination). Cell and tissue culture, Continuous cultures, Secondary metabolites synthesis.

Practical

Study of auxotroph, Micropropagation through tissue culture, Strain improvement through U.V. mutation for lactose utilization, Chemical mutagenesis using chemical mutagens (Ethidium bromide), Determination of survival curves using physical and chemical mutagens, Isolation and analysis of chromosomal / genomic DNA from *E.coli* and *Bacillus cereus*, Separation of protoplast using cellulytic enzymes, Production of biogas from organic waste, Introduction of ELISA / Southern blot / DNA finger printing etc., Agarose gel electrophoresis of plasmid DNA, Pesticide degradation by *pseudomonas spp.*

Suggested Readings

Bains W. 1993. *Biotechnology from A to Z*. Oxford Univ. Press.
Joshi VK & Pandey A. 1999. *Biotechnology: Food Fermentation*. Vols. I, II. Education Publ.
Knorr D. 1982. *Food Biotechnology*. Marcel Dekker.
Lee BH. 1996. *Fundamentals of Food Biotechnology*. VCH.
Perlman D. 1977-1979. *Annual Reports of Fermentation Processes*.
Prescott SC & Dunn CG. 1959. *Industrial Microbiology*. McGraw Hill.
Ward OP. 1989. *Fermentation Biotechnology*. Prentice Hall.

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FST 518 POST HARVEST MANAGEMENT OF FRUITS AND VEGETABLES (2+1)

Course outcome: -

- 1- Students will understand the importance, current status, nutritional composition and reasons of spoilage of fruit and vegetables.
- 2- They will learn different preservation methods such as pasteurization, sterilization, canning, freezing, refrigeration etc.
- 3- They will get the knowledge about processing of canning, spoilage of canned food, different packaging materials used for canned food.
- 4- They will learn about processing of different fruits and vegetables product

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Unit-I (06 Lecture)

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Importance & scope of post-harvest management of fruits and vegetables in Indian economy. Composition of fruits and vegetables; maturity indices and standards for selected fruits and vegetables; methods of maturity determinations. Harvesting and handling of important fruits and vegetables, Field heat of fruits and vegetables and primary processing for sorting and grading at farm and cluster level; factors affecting post-harvest losses.

Unit-II (06 Lecture)

Storage of fresh fruits and vegetables. Containers: Tin, glass and other packaging materials used in fruits and vegetables preservations. Canning and bottling: quality of raw materials, preparation of materials, preparation of syrups and brines, canning and bottling, effect of canning and bottling on nutritive value, spoilage of canned foods.

Unit-III (06 Lecture)

Fruit and vegetable juices: Preparation of juice, syrups, squashes, cordials, and nectars; concentrations and drying of juice, packaging, storage, concentrations, and powders. Preparation of preserve and candied fruits. Food additives: Use in fruit and vegetable preservation. Vinegar: General methods of preparation, food standards and quality control. Uses

Unit-IV (06 Lecture)

Storage practices: CA and MA, hypobaric storage, pre-cooling and cold storage, Zero energy cool chamber; Commodity pretreatments - chemicals, wax coating, pre-packaging, VHT and irradiation.

Practical

Studies on morphological features of some selected fruits and vegetables; Studies of maturing indices; Studies of harvesting of fruits and vegetables; Determination of RQ; Studies of export of pre cooling and storage of fruits and vegetables; Studies on pretreatments on selected fruits; Studies on use of chemicals for ripening and enhancing shelf life of fruits and vegetables; Studies of regulations of ripening of banana, mango, papaya; Studies on various storage systems and structures; Studies on pre-packaging of fruits; Studies on pre-packaging of vegetables; Studies on physiological disorders - chilling injury of banana and custard apple.

Suggested Readings:

Kadar AA.1992. *Post-harvest Technology of Horticultural Crops*. 2nd Ed. University of California.
Lal G, Siddapa GS & Tandon GL.1986. *Preservation of Fruits and Vegetables*. ICAR.
Pantastico B. 1975. *Post Harvest Physiology, Handling and Utilization of Tropical and Subtropical Fruits and Vegetables*. AVI Publ.
Salunkhe DK, Bolia HR & Reddy NR. 1991. *Storage, Processing and Nutritional Quality of Fruits and Vegetables*. Vol. I. *Fruits and Vegetables*. CRC.
Thompson AK. 1995. *Post Harvest Technology of Fruits and Vegetables*. Blackwell Sci.
Verma LR. & Joshi VK. 2000. *Post Harvest Technology of Fruits and Vegetables*. Indus Publ.

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FST 520 FOOD ADDITIVES AND INGREDIENTS

(2+1)

Course outcome: -

- 1: learn the uses, needs, classification and toxicological evaluation of food additives.
- 2: Principles of chemical preservation of foods.
- 3: Role of different food additives in the processing of different foods and their specific functions in improving the shelf life, quality, texture and other physical and sensory characteristics of foods.
- 4: Regulations and the monitoring agencies involved in controlling the safer use of additives in foods.

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Unit-I (06 Lecture)

Food additives- definitions, classification and functions, Preservatives, antioxidants, colors and flavors (synthetic and natural), emulsifiers, sequesterants, humectants, hydrocolloids, sweeteners, acidulants, buffering salts, anticaking agents, etc. –

Unit-II (04 Lecture)

chemistry, food uses and functions in formulations; indirect food additives; toxicological evaluation of food additives.

Unit-III (08 Lecture)

Flavor technology: Types of flavors, flavors generated during processing – reaction flavors, flavor composites, stability of flavors during food processing, analysis of flavors, extraction techniques of flavors, flavor emulsions; essential oils and oleoresins; authentication of flavors etc.

Unit-IV (06 Lecture)

Proteins, starches and lipids as functional ingredient; isolation, modification, specifications, functional properties and applications in foods and as nutraceuticals Manufacturing and applications of fibres from food sources, fructo-oligo-saccharides.

Practical

Estimation of preservatives, sweeteners, fibres, colours, antioxidants, flavour enhancers; Isolation, modification, and functional properties of native and modified proteins, starches and lipids; extraction of essential oil and oleoresins; applications of additives and ingredients in foods.

Suggested Readings

Branen AL, Davidson PM & Salminen S. 2001. *Food Additives*. 2nd Ed. Marcel Dekker.
George AB. 1996. *Encyclopedia of Food and Color Additives*. Vol. III. CRC Press.
George AB. 2004. *Fenaroli's Handbook of Flavor Ingredients*. 5th Ed. CRC Press.
Morton ID & Macleod AJ .1990. *Food Flavours*. Part A, BC. Elsevier.
Nakai S & Modler HW. 2000. *Food Proteins. Processing Applications*. Wiley VCH.
Stephen AM. (Ed.). 2006. *Food Polysaccharides and Their Applications*. Marcel Dekker.

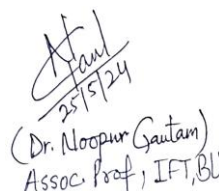
3. SUPPORTING COURSES

FBM 503 FOOD PROCESSING ENTREPRENEURSHIP AND START-UP (0+1)

Practical/Assignments/Case studies

- Study of a regulated market,
- Study of a fruit and vegetable market,
- Study of State and Central Warehousing Corporation
- Study of functioning of a regional rural bank and commercial bank for loan.
- Study of food processing enterprise,


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- Formulation of project reports for financing food Industry,
- Working out repayment plans,
- Legal Issues in Product Development, Marketing and Market Segments
- Case studies: Innovations in Dairy industry, Bakery industry, fats and oils industry, fruit and vegetable industry, primary and secondary processing of cereals, brewing industry.

Note: In practical of plant design and project engineering a plant design problem should be assigned to a group of (3-4) students. The students should carry out the conceptual design, flow sheeting, material and energy balance calculations, and cost and profitability analysis of any Food Plant.

Suggested Reading

- Hu, R. 2005. Food Product Design A Computer-Aided Statistical Approach, Technomic Publishers.
- Moskowitz H R, Saguy S. and Straus T. 2006. An Integrated Approach to New Food Product Development, CRC Press
- Moskowitz H R, Porretta S. and Silcher M. 2006. Concept Research in Food Product Design And Development, Blackwell Publishing Ltd.
- Peters MS and Timmerhaus KD. 2005. Plant Designs and Economics for Chemical Engineers, McGraw Hill, 5th Edition,
- Ahmad T. 2009. Dairy Plant Engineering and Management., Kitab Mahal, 8th Edition.

STAT 511 EXPERIMENTAL DESIGNS

(2+1)

Course outcome: -

1. Students should understand how insightful and intelligent data is produced.
2. fundamental statistical concepts and help you gain a better understanding of the common applications of statistics in food science.
3. Statistics for Food Scientists course includes topics that cover applications in both of these areas.
4. there is now much material on multivariate applications for the more advanced reader.

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Theory

Unit-I (08 Lecture)

Basic principles of experimental designs. Uniformity trials. Completely randomized design, randomized block design and latin square designs. Multiple comparison tests.

Unit-I (08 Lecture)

Missing plot techniques. Analysis of covariance. Factorial experiments: 2², 2³ and 3². Split plot design. Strip plot design. Factorial in split plot design.

Unit-I (08 Lecture)

Crossover designs. Balanced incomplete block design. Response surface designs. Groups of experiments.

Practical

Uniformity trials. Completely randomized design. Randomized block and latin square designs. Missing plot and analysis of covariance Split plot designs. Factorial in split plot design. Strip plot designs. Cross over and balanced incomplete block designs. Groups of experiments

MCA 5012 INFORMATION TECHNOLOGY IN AGRICULTURE

1+1

Course Outcome: -

1. Students will get the knowledge of designing and manufacturing farm machinery,
2. They will understand the structures of agriculture and rural engineering, pump engineering & hydraulic control
3. Students will understand the instrumentation, and control engineering in agriculture.
4. Students will understand the skills, knowledge, aptitudes and attitudes as a precondition for successful life,

Unit-I (04 Lecture)

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Introduction to Information technology in agriculture. Digital and communication competences and other key combinations of skills, knowledge, aptitudes and attitudes as a precondition for successful life, business, learning in agriculture. Main terms, definitions and brief history

Unit-II (04 Lecture)

Communication technology and tools. Specific features of agricultural information exchange. Environmental information technologies. Remote sensing and geographical information systems in agriculture.

Unit-III (04 Lecture)

Introduction to use of information technology for plants growing, irrigation, protection, irrigation. Precision farming. Sustainable agriculture and information technology. Social aspects of information technology. Safety of information and its features in rural areas and agriculture

Practical

Practical related the geographical information systems in agriculture. Handling the instruments. Digital and communication competences and other key combinations of skills, knowledge, aptitudes. Sustainable agriculture and information technology.

Suggested Readings

1. Agricultural Extension – An Overtime Israeli Perspective.<http://departments.agri.huji.ac.il/economics/volfson-gelb-gal.pdf>
2. Altman H. B. Writing a syllabus. 1992.<http://honolulu.hawaii.edu/intranet/committees/FacDevCom/guidebk/teachtip/writesyl.htm>
3. Balkan Agricultural Engineering Review. <http://baer.uni-ruse.bg/>
4. Berns K., E. von Puttkamer. Autonomous land vehicles. Steps towards Service Robots. Wiesbaden, 2009.
5. Creating a Syllabus.<http://www.cpd.fsu.edu/ctl/explore/onlineresources/docs/Chptr3.pdf>
6. CIGR Journal of Scientific Research and Development. <http://www.cigr.org/ElectronicJournal->

4. COMPULSORY NON-CREDIT COURSES

PGS 501 LIBRARY AND INFORMATION SERVICES

(0+1)

Course Outcome: -

1. To acquaint students with the basic concepts of information and information science.
2. To understand the concept communication of information, models of communication and role of libraries in information communication in society.
3. To make students understand and appreciate the concept of information society and information policies formulated for societal development

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4. To get familiarize with the concepts of economics and management of information and knowledge.

Practical

Introduction to library and its services; Role of libraries in education, research and technology transfer; Classification systems and organization of library;
Sources of information- Primary Sources, Secondary Sources and Tertiary Sources;
Intricacies of abstracting and indexing services (Science Citation Index, Biological Abstracts, Chemical Abstracts, CABI Abstracts, etc.);
Tracing information from reference sources; Literature survey; Citation techniques/Preparation of bibliography; Use of CD-ROM Databases, Online Public Access Catalogue and other computerized library services; Use of Internet including search engines and its resources; e-resources access methods.

PGS 502 TECHNICAL WRITING AND COMMUNICATIONS

(0+1)

Course Outcome: -

1. Develop the student's ability to use English language accurately and effectively by enhancing their communication skills
2. Mastering the art of a professional business presentation
3. Distinguish different communication process and its practical application
4. More effective written communication

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Practical

Technical writing

Various forms of scientific writings- theses, technical papers, reviews, manuals, etc; Various parts of thesis and research communications (title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion); Writing of abstracts, summaries, précis, citations etc.; commonly used abbreviations in the theses and research communications; illustrations, photographs and drawings with suitable captions; pagination, numbering of tables and illustrations; Writing of numbers and dates in scientific write-ups; Editing and proof-reading; Writing of a review article.

Communication skills

Grammar (Tenses, parts of speech, clauses, punctuation marks); Error analysis (Common errors); Concord; Collocation; Phonetic symbols and transcription; Accentual pattern: Weak forms in connected speech: Participation in group discussion: Facing an interview; presentation of scientific papers.

Suggested Readings

Robert C. (Ed.). 2005. Spoken English: Flourish Your Language. Abhishek, Chandigarh.
Chicago Manual of Style. 14th Ed. 1996. Prentice-Hall of India, New Delhi.
Collins' Cobuild English Dictionary. 1995. Harper Collins, New York.
Gibaldi, Joseph. 2000. MLA Handbook for Writers of Research Papers. 5thEd. Affiliated East-West Press, New Delhi.
Hornby AS. 2000. Comp. Oxford Advanced Learner's Dictionary of Current English. 6th Ed. Oxford UP, Oxford.

**PGS-503 INTELLECTUAL PROPERTY AND ITS MANAGEMENT IN
AGRICULTURE (1+0)**

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1. To recognize the importance of IP and to educate the pupils on basic concepts of Intellectual Property Rights.
2. To identify the significance of practice and procedure of Patents.
3. To make the students to understand the statutory provisions of different forms of IPRs in simple forms.
4. To learn the procedure of obtaining Patents, Copyrights, Trade Marks & Industrial Design

Theory

Unit-I (04 Lecture)

Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPs Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs;

Unit-II (04 Lecture)

Indian Legislations for the protection of various types of Intellectual Properties; Fundamentals of patents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks, protection of plant varieties and farmers' rights and biodiversity protection;

Unit-III (04 Lecture)

Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection; National Biodiversity protection initiatives; Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement.

Suggested Readings

Erbisch FH & Maredia K.1998. Intellectual Property Rights in Agricultural Biotechnology. CABI, Wallingford.
Ganguli, Prabudha. 2001. Intellectual Property Rights: Unleashing Knowledge Economy. McGraw-Hill, New Delhi.
India, Ministry of Agriculture. 2004. State of Indian Farmer. Vol. 5. Technology Generation and IPR Issues. Academic Foundation, New Delhi.
Intellectual Property Rights: Key to New Wealth Generation.2001. NRDC and Aesthetic Technologies, New Delhi.

PGS 504 BASIC CONCEPTS IN LABORATORY TECHNIQUE

(0+1)

Course outcome: -

1. Understand the role of laboratory in food industry

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2. Understand the laboratory techniques to detect, quantify, and identify analytical methods in foods
3. Students will learn the procedure for the analysis of different food samples.
4. Students will understand the Do and Don't rules of laboratories.

Practical

- Safety measures while in Lab;
- Handling of chemical substances;
- Use of burettes, pipettes, measuring cylinders, flasks, separatory funnel, condensers, micropipettes and vaccupets;
- Washing, drying and sterilization of glassware;
- Drying of solvents/ chemicals;
- Weighing and preparation of solutions of different strengths and their dilution;
- Handling techniques of solutions;
- Preparation of different agro-chemical doses in field and pot applications;
- Preparation of solutions of acids;
- Neutralisation of acid and bases;
- Preparation of buffers of different strengths and pH values;
- Use and handling of microscope, laminar flow, vacuum pumps, viscometer, thermometer, magnetic stirrer, micro-ovens, incubators, sandbath, waterbath, oilbath;
- Electric wiring and earthing;
- Preparation of media and methods of sterilization;
- Seed viability testing, testing of pollen viability;
- Tissue culture of crop plants;
- Description of flowering plants in botanical terms in relation to taxonomy

Suggested Readings

Furr AK. 2000. *CRC Hand Book of Laboratory Safety*. CRC Press.

Gabb MH & Latchem WE. 1968. *A Handbook of Laboratory Solutions*. Chemical Publ. Co.

PGS 505 AGRICULTURAL RESEARCH, RESEARCH ETHICS AND RURAL DEVELOPMENT PROGRAMMES (e-Course) (1+0)

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1. To enlighten the students about the organization and functioning of agricultural research systems at national and international levels,
2. Students will understand the research ethics, and rural development programmes and policies of Government.
3. Students understand about various government programs to develop profitable agriculture system
4. Impart knowledge and understanding of fundamental concepts and techniques of maintaining and enhancing agriculture worldwide.

Theory

Unit-I (04 Lecture)

History of agriculture in brief; Global agricultural research system: need, scope, opportunities; Role in promoting food security, reducing poverty and protecting the environment; National Agricultural Research Systems (NARS) and Regional Agricultural Research Institutions; Consultative Group on International Agricultural Research (CGIAR): International Agricultural Research Centres (IARC), partnership with NARS, role as a partner in the global agricultural research system, strengthening capacities at national and regional levels; International fellowships for scientific mobility.

Unit-I (02 Lecture)

Research ethics: research integrity, research safety in laboratories, welfare of animals used in research, computer ethics, standards and problems in research ethics.

Unit-I (06 Lecture)

Concept and connotations of rural development, rural development policies and strategies. Rural development programmes: Community Development Programme, Intensive Agricultural District Programme, Special group – Area Specific Programme, Integrated Rural Development Programme (IRDP) Panchayati Raj Institutions, Co-operatives, Voluntary Agencies/Non-Governmental Organisations. Critical evaluation of rural development policies and programmes. Constraints in implementation of rural policies and programmes.

Suggested Readings

Bhalla GS & Singh G. 2001. *Indian Agriculture - Four Decades of Development*. Sage Publ.
Punia MS. *Manual on International Research and Research Ethics*. CCS, Haryana Agricultural University, Hisar.
Rao BSV. 2007. *Rural Development Strategies and Role of Institutions - Issues, Innovations and Initiatives*. Mittal Publ.
Singh K.. 1998. *Rural Development - Principles, Policies and Management*. Sage Publ.

PGS 506 DISASTER MANAGEMENT

(1+0)

Course Outcome: -

1. The students will get an insight and deep understanding of the relationship between vulnerability, disasters, disaster prevention and risk reduction.

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2. The course also develop rudimentary ability of students responding to their surroundings with potential disaster response in areas where they live, with due sensitivity.
3. Students will familiar with the basics of natural disasters as well as anthropogenic factors and various approaches for disaster managements.
4. students to gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR) and awareness of institutional processes in the country and abroad.

Theory

Unit-I (02 Lecture)

Natural Disasters-Meaning and nature of natural disasters, their types and effects. Floods, Drought, Cyclone, Earthquakes, Landslides, Avalanches, Volcanic eruptions, Heat and cold Waves,

Unit-II (04 Lecture)

Climatic Change: Global warming, Sea Level rise, Ozone Depletion. Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire. Oil fire, air pollution, water pollution, deforestation, Industrial wastewater pollution, road accidents, rail accidents, air accidents, sea accidents.

Unit-III (04 Lecture)

Disaster Management- Efforts to mitigate natural disasters at national and global levels. International Strategy for Disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, Community-based organizations, and media.

Unit-IV (02 Lecture)

Central, State, District and local Administration; Armed forces in Disaster response; Disaster response: Police and other organizations.

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FST 560: MASTER'S RESEARCH (RESEARCH PROJECT/DISSERTATION/INDUSTRIAL TRAINING/SURVEY) (30+0)

Course Outcomes:

Upon successful completion students should be able to:

- 1: In-plant Training is intended to expose the students to an environment in which they are expected to be associated in their future careers.
2. Employ the finalized methodology to solve the problem which has been undertaken.
3. Analyze the data which has been generated by carrying out several experiments.
4. Evaluate the data – accuracy and precision, sources of errors, specificity, sensitivity and

Note:

1. Project/training work will involve experimental work.
2. Students are required to do an individual research project/Industrial training.
3. Students are required to submit a report for assessment and need to demonstrate the working of research/training findings.
4. Students will be asked their choice for Project/Industrial work at the end of II semester and all formalities of topic (if they choose project) and mentor selection will be completed by this time.
5. The IPR rights of all such work lie with the University only
6. Organize the inferences to prove the hypothesis. detection limits, regression analysis, reporting results.

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