

'C2' See.

M. Tech. (Food Processing Technology)

M.Tech. FOOD PROCESSING TECHNOLOGY

General Features

Qualification: Four years degree programme in Food Processing Technology / Food Technology / Food Engineering / Dairy Technology or equivalent Engineering or Technology course from a recognised University.

Training Programme: The students are required to undertake compulsory four to six weeks training (preferably during semester break) in a reputed food industry organization after completion of major courses. 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 will assess. They will be awarded Satisfactory/Unsatisfactory.

M. Tech (FPT)

Distribution of Credits

- A. Major
- B. Minor
- C. Supporting
- D. Seminar
- E. Thesis

Syllabus and Regulations

Organization of Courses

The contents of each course have been organized into:

Objective - to elucidate the basic purpose.

Theory units - to facilitate uniform coverage of syllabus for paper setting.

Suggested Readings - to recommend some standard books as reference material.

This does not unequivocally exclude other such reference material that may be recommended according to the advancements.

Annexure II

2. CURRICULUM

M.Tech. FOOD PROCESSING TECHNOLOGY

2.1 General Features

1. Qualification: Four years degree programme in Food Processing Technology / Food Technology/ Food Engineering/ Dairy Technology or equivalent Engineering or technology course from a recognised University.

2. Training programme: The students are required to undertake compulsory four to six weeks training (preferably during semester break) in a reputed food industry/organization after completion of major courses. 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 will assess the student's performance. They will be awarded Satisfactory/Unsatisfactory grade.

3. Distribution of Credits

- A Major 20 credits
- B Minor 9 credits
- C Supporting 5 credits
- D Seminar 1 credit
- E Thesis 20 credits

Total Credits: 55 (35 course work + 20 Thesis)

4. Organization of Course Contents

The contents of each course have been organized into:

Objective – to elucidate the basic purpose.

Theory units – to facilitate uniform coverage of syllabus for paper setting.

Suggested Readings – to recommend some standard books as reference material.

This does not unequivocally exclude other such reference material that may be recommended according to the advancements.

M. TECH. FOOD PROCESSING TECHNOLOGY

2.2 Course Structure – at a Glance

	Total Credits	<u>Pg. No</u>
A. Major Courses		
✓ FCN 601 ADVANCES IN FOOD CHEMISTRY & NUTRITION	2+1	3
✓ FMC 602 MODERN FOOD MICROBIOLOGY	2+1	4
✓ FPE 603 ADVANCES IN FOOD ENGINEERING	2+1	5
✓ FST 604 FOOD PROCESSING	2+0	6
FPE 605 FOOD PACKAGING	1+1	7
FCN 606 FOOD ANALYSIS	0+2	8
FST 607 FOOD QUALITY SYSTEMS & MANAGEMENT	2+1	9
FPE 608 EQUIPMENT DESIGN & PROCESS CONTROL	1+1	10
B. Minor Courses*		
Total Credits 9		
Group I		
✓ FST 616 CONFECTIONARY TECHNOLOGY ✓	2+1 ✓	12 ✓
FST 617 SNACK FOODS TECHNOLOGY	2+1	13
• FST 618 BEVERAGES TECHNOLOGY	2+1 ✓	14 ✓
Group II		
FST 619 ADVANCES IN MILK PROCESSING	2+1	15
FST 620 TECHNOLOGY OF FAT RICH PRODUCTS	2+1	16
FST 621 TECHNOLOGY OF FERMENTED AND DRIED DAIRY PRODUCTS	2+1	17
Group III		
FST 622 ADVANCES IN FISH BIOCHEMISTRY	2+1	18
FST 623 ADVANCES IN FISH PROCESSING AND ENGINEERING	2+1	19
FST 624 ADVANCES IN FISH QUALITY ASSURANCE	2+1	20
Group IV		
FST 625 ADVANCES IN FRESH MEAT TECHNOLOGY	2+1	22
• FST 626 ADVANCES IN PROCESSING AND PRESERVATION OF MEAT ✓	2+1 ✓	22 ✓
FST 627 MUSCLE AND MEAT BIOCHEMISTRY	2+1	23
FST 628 ADVANCES IN EGG PRODUCTS PROCESSING TECHNOLOGY	2+1	24
C. Supporting Courses **		
Total Credits 5		
FSC 635 STATISTICAL METHODS FOR FOOD SCIENCE	1+1	25
FSC 636 COMPUTER APPLICATIONS IN FOOD INDUSTRY	1+2	25
• FBM 637 BUSINESS MANAGEMENT & INTERNATIONAL TRADE ✓	3+0 ✓	26 ✓
D. Seminar		
Total Credits 1		
FST 649 MASTER'S SEMINAR	1+0	
E. Compulsory Non-credit Courses***		
Total Credits 3		
FPT 641 LIBRARY AND INFORMATION SERVICES	0+1	28
FPT 642 TECHNICAL WRITING AND COMMUNICATIONS SKILLS	0+1	28
FPT 643 INTELLECTUAL PROPERTY AND ITS MANAGEMENT IN AGRICULTURE	1+0	29
F. Research		
Total Credits 20		
FST 650 MASTER'S RESEARCH	0+20	

* Students may take three courses for minor courses from among the courses listed in the four groups for 9 credits;

** Student should take supporting courses for 5 credits

*** Non credit courses are compulsory and will not be considered in total credit calculation or OGPA calculation

M.Tech. FOOD TECHNOLOGY

2.3 Course Contents

MAJOR COURSES

FCN 601 ADVANCES IN FOOD CHEMISTRY AND NUTRITION 2+1

Objective

To expose to the advances in basic chemistry and nutrition, with the aim of developing healthy and nutritious foods for normal and special category of population groups.

Theory

UNIT I

(Lectures 8)

Interactions among food components and their effect on sensory, nutritional and processing quality, Natural antioxidants, mechanisms of action and their evaluation techniques, Advanced glycation end products and their nutritional significance; Free radical chemistry, reactive oxygen, photosensitized oxidation, metal catalyzed reactions. Antioxidants: chemistry and mechanisms of action, techniques of evaluation of antioxidant activity, uses.

UNIT II

(Lectures 7)

Water relationships in foods: water activity and its relevance to deteriorative processes in foods (chemical, enzymic, physical and microbial changes). Glass transitions and molecular mobility in foods, their relevance to quality and stability of food products, Food Carbohydrates: structural, analytical, physicochemical, nutritional and functional aspects of small mol. wt. carbohydrates and polysaccharides of plant and microbial origin.

UNIT III

(Lectures 7)

Fragrance and flavouring compounds: essential oils, terpenoids-oleoresins biochemical pathways for the production of volatile compounds in specific plant species; Chemical structure, distribution, diurnal and seasonal fluctuations; Intra-specific differences in volatiles oil production, differentiation between geographical origins; Turpentine and terpene industry and, biological Interactions among food components and flavours, Interactions among food flavours and packaging materials, Interactions among food additives and their significance in food processing.

UNIT IV

(Lectures 8)

Therapeutic, Parenteral and Geriatric nutrition and relevant food formulations, genetic disorders and nutritional requirements, Gene regulation in secondary metabolism, Tissue specificity (phenyl propanoids) and stress responsiveness (terpenoids indole alkaloids), Compartmentation, storage and transport.

UNIT V

(Lectures 5)

Appetite suppressants, phytosterols, polyphenols, phytoestrogens, ω -fatty acids, glucosinolates, non-digestible oligosaccharides, Glycemic index and its role in human nutrition, Prebiotics and probiotics, Chemistry of Alkaloids, Flavonoids and other Phenolics.

Practical

Study browning reactions in model systems, estimation of natural antioxidants in foods. Estimation of the environmental effects on auto oxidation of processed foods, measurement of water activity and plotting of sorption isotherm of selected foods, determination of physical, chemical, enzymatic and microbial changes in relation to water activity, physicochemical and functional properties of carbohydrates, separation and estimation of essential oils and oleoresins, study of interaction among food components, additives and flavours with food packaging, formulation of therapeutic and probiotics foods, determination of Glycemic index of selected foods.

Suggested Readings

Advances in Food and Nutrition Research. Elsevier Book Series.

Aurand LW, Woods A & Wells MR. 1987. *Food Composition and Analysis*. AVI Publ.

Baynes JW, Monnier VM, Ames JM & Suzanne R. 2005. *The Maillard Reaction: Chemistry at the Interface of Nutrition, Aging, and Disease Thorpe*. Annals of the New York Academy of Science.

Birch GG & Lindley MG. 1986. *Interactions of Food Components*. Elsevier.

Fennema OR. 1996. *Food Chemistry*. Marcel Dekker.

Kumar A & Gaonkar G. 1995. *Ingredient Interaction: Effect on Food Quality*. Marcel Dekker.

FMC 602 MODERN FOOD MICROBIOLOGY

2+1

Objective

To expose to the recent advances and applications in the area of food microbiology.

Theory

UNIT I (Lectures 10)

Foods as ecological niches, Relevant microbial groups, Microbes found in raw materials and foods that are detrimental to quality, Factors that influence the development of microbes in food, newer and rapid methods for qualitative and quantitative assay demonstrating the presence and characterization of microbes, Stress, damage, adaptation, reparation, death.

UNIT II (Lectures 10)

Microbial growth in food: intrinsic, extrinsic and implicit factors, Microbial interactions, Inorganic, organic and antibiotic additives. Effects of enzymes and other proteins, Combination systems, Adaptation phenomena and stress phenomena, Effect of injury on growth or survival, Commercial available databases.

UNIT III (Lectures 8)

Microbial behaviour against the newer methods of food processing, Adoption and resistance development, Microbes as test organisms, as sensors and as tools for future applications in energy production and food and non food industrial products.

UNIT IV (Lectures 7)

Modern methods of cell culture: synchronous and co- cell culture, continuous cell culture in liquid and solid media, Cell immobilization and applications, Pre and probiotics cultures.

Practical

Evaluation of microorganism in raw and processed products by using various techniques, Study of factors influencing growth of microorganisms, determination of effects of various preservatives including antibiotics on the suppression of microbial growth, Development of cell cultures using various techniques, production of newer microbial metabolites of industrial importance, development of probiotics in lab.

Suggested Readings

- Adams M. 2006. *Emerging Food-borne Pathogens*. Woodhead Publ.
Adams MR & Moss MO. 2000. *Food Microbiology*. Panima.
Easter MC. 2003. *Rapid Microbiological Methods in the Pharmaceutical Industry*.
Harrigan W. 2003. *Laboratory Methods in Food Microbiology*. University of Reading, UK, Elsevier.
James MJ, Loessner MJ & David A. 2005. *Modern Food Microbiology*. 7th Ed. Golden Food Science Text Series.
Pederson CS. 1979. *Microbiology of Food Fermentations*. AVI Publ.
Roberts R. 2002. *Practical Food Microbiology*. Blackwell Publ.
Rossmore HW. 1995. *Handbook of Biocide and Preservative*. Blackie
Wood JBB. 1999. *Microbiology of Fermented Foods*. Vols. I, II. Blackwell Academic.
Yousef AE. 2002. *Food Microbiology: A Laboratory Manual*. AVI.

FPE 603 ADVANCES IN FOOD ENGINEERING 2+1

Objective

To acquaint with recent advances of Food Engineering and its Processes.

Theory

UNIT I

(Lectures 6)

Engineering properties of foods, their significance in equipment design, processing and handling of food and food products, steady state and unsteady state heat transfer, Numerical, graphical and analog methods in the analysis of heat transfer. Solution of unsteady state equations, solar radiation.

UNIT II

(Lectures 8)

Mass transfer, molecular diffusion and diffusivity, equilibrium stage process, convective mass transfer co-efficient, mass transfer with laminar and turbulent flow. Design equations for convective mass transfer, simultaneous momentum, Separation by equilibrium stages, immiscible phases, distillation of binary mixtures and multi-component separations.

UNIT III

(Lectures 6)

Aerodynamics and hydrodynamic characteristics, drag coefficient, terminal velocity and Reynold's number, application of aerodynamic properties to the separation, pneumatic handling and conveying of food products, material and energy balance.

UNIT IV

(Lectures 10)

Thermodynamic properties of moist air, kinetics of water absorption, Evaporation and dehydration of foods, design of single and multi-effect evaporators, mechanics of movement

of air through stationary bed, thin layer and thick layer bed drying, simulation models for drying systems, use of weather data for drying operations, design of dryers, New direction in freeze bed drying, cyclic pressure freeze drying. Microwave drying and vacuum drying, efficient drying systems, infrared heating, freezing of foods, freeze concentration and rying, freezing point curves, phase diagrams, methods of freeze concentration, design problems.

UNIT V

(Lectures 5)

Theory of ultra-filtration and reverse osmosis, selection and types of membranes and properties, concentration polarization, mathematical description of flow through membrane, application and use in food industry.

Practical

Determination of engineering properties of foods, Design problems on evaporators; measurement of heat transfer using selected heat exchangers in model study, evaluation of mass transfer and estimation of mass transfer coefficient of selected foods in evaporators and dehydrators, separation of immiscible phase using appropriate centrifuge, fractional distillation of multi component mixtures, air classification and determination of particle size index of powdered food materials, study of pneumatic conveyers using fluidized solids, determination of drying rate and curves under various drying conditions, determination of freezing curves for selected fresh fruits and vegetables, application of ultra-filtration and reverse osmosis in processing of fruit juices.

Suggested Readings

- Charm SE. 1971. *Fundamental of Food Engineering*. AVI Publ.
Cheryan M. 1998. *Ultra-filtration and Micro-filtration Handbook*. Technomic Publ.
Duckworth R. 1975. *Water Relations in Foods*. Academic Press.
Heldman DR & Singh RP. 1984. *Food Process Engineering*. AVI Publ.
Hendrickx and Knorr. Rockland LB & Stewart GF. 1991. *UHP Treatments of Foods*. KA/PP Publ.
Mohsenin NN. 1986. *Physical Properties of Plant and Animal Materials*. Gordon & Breach Science Publ.
Rao MA & Rizvi SS. 1986. *Engineering Properties of Foods*. Marcel Dekker.
Robertson GL. 1992. *Food Packaging (Principles and Practices)*. Marcel Dekker.
Watson EL & Harper JC. 1989. *Elements of Food Engineering*. AVI Publ.

FST 604 FOOD PROCESSING

2+0

Objective

To develop an insight among the students about the existing modern techniques so as to aware them about their methodology and applications in food processing.

Theory

UNIT I

(Lectures 10)

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.

UNIT II (Lectures 10)
Microwave and radio frequency processing: Definition, Advantages, mechanism of heat generation, 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.

UNIT III (Lectures 4)
High Pressure processing: Concept, equipments for HPP treatment, mechanism of microbial inactivation and its application in food processing. Ultrasonic processing: Properties of ultrasonic, application of ultrasonic as processing techniques.

UNIT IV (Lectures 8)
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.

Suggested Readings

- Barbosa-Canovas 2002. *Novel Food Processing Technologies*. CRC.
Dutta AK & Anantheswaran RC. 1999. *Hand Book of Microwave Technology for Food Applications*.
Frame ND. (Ed.). 1994. *The Technology of Extrusion Cooking*. Blackie.
Gould GW. 2000. *New Methods of Food Preservation*. CRC.
Shi J. (Ed) 2006. *Functional Food Ingredients and Nutraceuticals: Processing Technologies*. CRC.

FPE 605 FOOD PACKAGING 1+1

Objective

To provide knowledge about selected trends and development in food packaging technologies and materials aiming at assuring the safety and quality of foodstuffs in order to design an optimized package which satisfies all legislative, marketing and functional requirements sufficiently, and fulfils environmental, cost and consumer demands as well as possible.

Theory

UNIT I (Lectures 4)
Active and intelligent packaging, Active packaging techniques, Intelligent packaging techniques, Current use of novel packaging techniques, Oxygen, ethylene and other scavengers, Oxygen scavenging technology, Ethylene scavenging technology, Carbon dioxide and other scavengers, Antimicrobial food packaging: Constructing an antimicrobial packaging system, Factors affecting the effectiveness of antimicrobial packaging.

UNIT II (Lectures 3)
Non-migratory bioactive polymers (NMBP) in food packaging, Advantages of NMBP, limitations, inherently bioactive synthetic polymers: types and applications, Polymers with immobilized bioactive compounds.

UNIT III (Lectures 3)
Time-temperature indicators (TTIs), Defining and classifying TTIs, Requirements for TTIs, The development of TTIs, Current TTI systems, Maximizing the effectiveness of TTIs, Using TTIs to monitor shelf-life during distribution, Using TTIs to optimize distribution and stock rotation.

UNIT IV (Lectures 4)
Packaging-flavour interactions, Factors affecting flavour absorption, role of the food matrix, role of differing packaging materials, Case study: packaging and lipid oxidation, Modeling flavour absorption, Packaging-flavour interactions and active packaging, Novel MAP applications for fresh-prepared produce, Novel MAP gases, Testing novel MAP applications, Applying high O₂ MAP.

UNIT V (Lectures 4)
Modern packaging systems: Green plastics for food packaging, The problem of plastic packaging waste, The range of biopolymers, Developing novel biodegradable materials, Legislative issues, Current applications, Integrating intelligent packaging, role of packaging in the supply chain, Creating integrated packaging, storage and distribution: alarm systems and TTIs, Traceability: radio frequency identification, Recycling packaging materials: The recyclability of packaging plastics, Improving the recyclability of plastics packaging, Testing the safety and quality of recycled material, Using recycled plastics in packaging.

Practical

Determination of GTR and WVTR in different packaging materials, use of oxygen and ethylene scavengers I packaging of fresh fruits, application of anti microbial packaging for moisture sensitive foods, evaluation of pesticide residue migration from package to food, application of MAP and active packaging in selected foods, determination of oxidative changes in packaged foods, comparative evaluation of flexible and rigid packages for fragile foods, packaging of foods under inert atmosphere.

Suggested Readings

- Ahvenainen R. 2001. *Novel Food Packaging Techniques*. CRC.
Crosby NT. 1981. *Food Packaging Materials*. App. Sci. Publ.
Mahadeviah M & Gowramma RV. 1996. *Food Packaging Materials*. Tata McGraw Hill.
Painy FA. 1992. *A Handbook of Food Packaging*. Blackie.
Palling SJ. 1980. *Developments in Food Packaging*. App. Sci. Publ.
Rooney ML. 1988. *Active Food Packaging*. Chapman & Hall.
Sacharow S & Griffin RC. 1980. *Principles of Food Packaging*. AVI Publ.
Stanley S & Roger CG. 1998. *Food Packaging*. AVI Publ.

FCN 606 **FOOD ANALYSIS**

0+2

Objective

To develop an understanding and methodologies of instrumental techniques in food analysis used for objective methods of food quality parameters.

Practical

Texture analysis of foods, Colour measurements in raw and processed foods, Viscosity measurements and its significance in food quality, Water activity measurements and its significance in food quality, Techniques for dough rheology and starch characterization, Surface tension and its significance in food analysis, Enzymatic methods of food analysis, Microscopic techniques in food analysis (light microscopy, SEM, TEM, XRD, particle size analysis, image analysis etc.), Thermal methods in food analysis (Differential scanning

colorimetry and others), Chromatographic methods in food analysis and separation, Extraction techniques in food analysis, Fluorimetric and polarimetric techniques in food analysis; Application and operating parameters of Spectrophotometer, AAS, GC, HPLC, NMR, FTIR, GC-MS, LC-MS.

Suggested Readings

- Clifton M & Pomeranz Y. 1988. *Food Analysis - Laboratory Experiments*. AVI Publ.
- Gruenwedel DW & Whitaker JR. 1984. *Food Analysis Principles and Techniques*. Vol. I. *Physical Characterization*. Marcel Dekker.
- Gruenwedel DW & Whitaker JR. 1984. *Food Analysis Principles and Techniques*. Vol. II. *Physicochemical Techniques*. Marcel Dekker.
- Gruenwedel DW & Whitaker JR. 1984. *Food Analysis Principles and Techniques*. Vol. III. *Biological Techniques*. Marcel Dekker.
- Gruenwedel DW & Whitaker JR. 1984. *Food Analysis Principles and Techniques*. Vol. IV. *Separation Techniques*. Marcel Dekker.
- Leenheer AP, Lambert WE & van Bocxlaer JF. 2000. *Modern Chromatographic Analysis of Vitamins*. 3rd Ed. Marcel Dekker.
- Nollet LML. 1986. *Handbook of Food Analysis*. Vol. I. Marcel Dekker.

FST 607 FOOD QUALITY SYSTEMS AND MANAGEMENT

2+1

Objective

To acquaint with food quality parameters and control systems, food standards, regulations, specifications.

Theory

UNIT I

(Lectures 12)

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

(Lectures 10)

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; 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 standard.

UNIT III

(Lectures 14)

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; Laboratory quality procedures and assessment of laboratory performance; Applications in different food industries; Food adulteration and food safety. IPR and Patent.

Practical

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 MA *et al* 1965. *Principles of Sensory Evaluation of Food*. Academic Press.
Early R. 1995. *Guide to Quality Management Systems for Food Industries*. Blackie Academic.
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. *et al*. 1994. *Encyclopedia of Food Science & Technology & Nutrition*. Vol. XVI. Academic Press.
Piggot JR. 1984. *Sensory Evaluation of Foods*. Elbview Applied Science.
Ranganna S. 2001. *Handbook of Analysis and Quality Control for Fruit and Vegetable Products*. 2nd Ed. Tata-McGraw-Hill.
Export/import Policy by Govt. of India.

FPE608 EQUIPMENT DESIGN AND PROCESS CONTROL

1+1

Objective

To introduce basic equipment design and various process control mechanisms and related engineering aspects

Theory

UNIT I

(Lectures 7)

Basic Scientific and Engineering principles of equipment design and process control, Properties of substances, chemical equation and stoichiometry, phases and phases rule, material and energy balances, energy balance and open system. Engineering properties of food materials and their significance in equipment design. Principles of CAD and its simple application.

UNIT II

(Lectures 7)

Design of Vessels: Codes and regulations, Materials of construction, Design for pressures, Design pressure and temperature loadings, allowable stresses, minimum thickness after forming, corrosion mechanism, corrosion control, Design for internal and external pressure, cylindrical and spherical shell, formed heads, re-enforcement openings.

UNIT III

(Lectures 7)

Design of food storage tank, horizontal and vertical silos, insulated and uninsulated, process plant piping: codes and regulations, testing, fabrication requirements, overall economic and safety considerations, heat exchangers: shell and tube heat exchangers, construction codes, general design considerations, clad tube sheet, plate type exchangers, air cooled heat exchangers, heat exchanger cost economics.

UNIT IV

(Lectures 7)

Instrument terminology and performance system accuracy, flow sheet symbols, instrument evaluation, electrical, mechanical, magnetic and optical transducers for measurement of process variables like temperature, pressure, flow, level, consistency and humidity, indicating and recording devices: direct acting and servo operated systems, digital indicators, strip and circular chart recorders, electronic data loggers, principles of automatic process control.

UNIT V

(Lectures 7)

Process characteristics, controller characteristics, closed loop system, pneumatic and electric controllers, final controlling elements, control valves, valve sizing, electronic actuators, motor drives and controls, introduction to programmable logic controllers (PLC): internal structure, inter facing with sensors and actuators, binary logic diagrams and ladder diagrams, choosing a PLC system.

Practical

Design of short, intermediate length and long cylindrical vessels, Design of spherical vessels, Design of shell and tube, double pipe, scarped surface and spiral tube heat exchangers, Design of jacketed vessels - insulation thickness, corrosion allowance, Study of various transducers for measurement of pressure, flow, level, humidity, temperature, Study of controller and recorder of pasteurizer, the working of controllers in constant temperature water baths, make ladder diagrams and flow sheet diagrams for control logics, Programme a PLC, design a computer interface of a PLC, visit a food processing plant to study data acquisition and process control system.

Suggested Readings

- Considine DM. 1974. *Process Instruments and Controls*. Mc-Graw-Hill.
 Considine DM. 1964. *Handbook of Applied Instrumentation*. Mc-Graw-Hill.
 Eackman DP. 1972. *Automatic Process Control*. Wiley Eastern.
 Evans FL. 1974. *Equipment Design Hand Book*. Vol. II. Gulf Publ.
 Foust AS et al. 1960. *Principle of Unit Operations*. John Wiley & Sons.
 Hesse ND, C.R. & Ruston JH. 1964. *Process Equipments Design*. Affiliated East-West Press.
Kempe's Engineers Year Book 1996. Miller Information Services, UK.
 Kern DQ. 1965. *Process Heat Transfer*. McGraw-Hill.
 Liptak BG. 1995. *Process Measurement and Analysis*. Butterworth-Heinmann.
 McCabe WL, Smith JC & Harriott P. 1993. McGraw Hill.

MINOR COURSES – GROUP I

FST 616 CONFECTIONERY TECHNOLOGY

2+1

Objective

To provide an understanding of various classes of confectionary products, their manufacture and quality aspects.

Theory

UNIT I

(Lectures 7)

Raw Materials for Confectionery Manufacture, Comprehensive understanding of raw materials used in the confectionery manufacturing and processing industry, including quality control methods. cocoa, Sugar, Dried milk products, Special fats, Emulsifiers, Nut kernels, Alcoholic ingredients, The production of cocoa liqueur from the cocoa bean, Dark, milk and white chocolate, manufacturing processes.

UNIT II

(Lectures 7)

Chocolate Processing Technology, Compound Coatings & Candy Bars, Tempering technology, Chocolate hollow figures, Chocolate shells, Enrobing technology, Manufacture of candy bars, Presentation and application of vegetable fats. Production of chocolate mass.

UNIT III

(Lectures 7)

Sugar Confectionery manufacture, General technical aspects of industrial sugar confectionery manufacture, Manufacture of high boiled sweets–Ingredients, Methods of manufacture–Types–Center–filled, lollipops, coextruded products. Manufacture of gums and jellies–Quality aspects.

UNIT IV

(Lectures 7)

Manufacture of Miscellaneous Products, Caramel, Toffee and fudge–Liquorices paste and aerated confectionery, Lozenges, sugar panning and Chewing gum, Count lines Quality aspects, fruit confections.

UNIT V

(Lectures 7)

Flour confectionary Ingredients and flour specification - Types of dough – Developed dough, short dough, semi-sweet, enzyme modified dough and batters- importance of the consistency of the dough. Indian flour confections manufacture – Flour specification – ingredients – manufacturing process–types of chemically aerated goods.

Practical

Quality assessment of flour, batter rheology, Leavening agents, Different tests for leavening action of baking powder, sodium-bicarbonate and ammonium-bi-carbonate, Preparation of different varieties of sugar, candies, chewing gums, and chocolate, flour confections, fruit confections, Indian traditional confections, chikki, etc.

Suggested Readings

- Bent A, Bennion EB & Bamford GST. 1997. *The Technology of Cake Making*. 6th Ed. Blackie.
- Jackson EB. 1999. *Sugar Confectionery Manufacture*. 2nd Ed. Aspen Publ.
- Junk WR & Pancost HM. 1973. *Hand Book of Sugars for Processors, Chemists and Technologists*. AVI Publ.
- Manley DJR. 1983. *Technology of Biscuits, Crackers, and Cookies*. Ellis Horwood.
- Matz SA. 1992. *Bakery Technology and Engineering*. 3rd Ed. Chapman & Hall.
- Pomeranz Y. 1987. *Modern Cereal Science and Technology*. MVCH Publ.

FST 617 SNACK FOODS TECHNOLOGY

2+1

Objective

To provide knowledge of principles and characteristics of extruders and support systems for effective selection and operation, to review current practices for preparation of fried chips and other extruded snacks and also to demonstrate equipment in operation and familiarize students with practical aspects of snack foods processing technology.

Theory

UNIT I

(Lectures 6)

Technology for grain-based snacks: whole grains – roasted, toasted, puffed, popped and flakes, coated grains-salted, spiced and sweetened; flour based – batter and dough based products; *savoury* and *farsans*; formulated chips and wafers, papads, instant premixes of traditional Indian snack foods.

UNIT II

(Lectures 4)

Technology for fruit and vegetable based snacks: Chips, wafers; Technology for coated nuts – salted, spiced and sweetened; *chikkis*.

UNIT III

(Lectures 4)

Extruded snack foods: Formulation and processing technology, colouring, flavouring and packaging.

UNIT IV

(Lectures 4)

Equipments for frying, Baking and drying, toasting, roasting and flaking, popping, blending, Coating, chipping.

Practical

Preparation of various snack foods based on cereals, legumes, nuts, fruits, vegetables and extrusion cooking their quality evaluation; development of instant food premixes; determination of shelf-life and packaging requirements; Visits to industries manufacturing snack foods.

Suggested Readings

- Edmund WL. *Snack Foods Processing*.
- Frame ND. 1994. *The Technology of Extrusion Cooking*. Blackie Academic.
- Gordon BR. 1997. *Snack Food*. AVI Publ
- Samuel AM. 1976. *Snack Food Technology*. AVI Publ.

Objective

To provide a technical knowledge of beverages and a full discussion of manufacturing processes in the context of technology and its related chemistry as well as a more fundamental appraisal of the underlying science.

Theory

UNIT I

(Lectures 6)

Types of beverages and their importance; status of beverage industry in India; Manufacturing technology for juice-based beverages; synthetic beverages; technology of still, carbonated, low-calorie and dry beverages; isotonic and sports drinks; role of various ingredients of soft drinks, carbonation of soft drinks.

UNIT II

(Lectures 3)

Specialty beverages based on tea, coffee, cocoa, spices, plant extracts, herbs, nuts, dairy and imitation dairy-based beverages.

UNIT III

(Lectures 6)

Alcoholic beverages- types, manufacture and quality evaluation; the role of yeast in beer and other alcoholic beverages, ale type beer, lager type beer, technology of brewing process, equipments used for brewing and distillation, wine and related beverages, distilled spirits.

UNIT IV

(Lectures 3)

Packaged drinking water- definition, types, manufacturing processes, quality evaluation and raw and processed water, methods of water treatment, BIS quality standards of bottled water; mineral water, natural spring water, flavoured water, carbonated water.

Practical

Chemical and microbiological analysis of raw water quality; Preparation of regional fruit juices; Preparation of whey-based beverages; preparation of iced and flavoured tea beverage; Preparation of carbonated and noncarbonated soft drinks; Preparation of wine and beer; Preparation of soy milk, fruit milkshakes, herbal beverages; visit to relevant processing units.

Suggested Readings

- Hardwick WA. 1995. *Handbook of Brewing*. Marcel Dekker.
- Hui YH et al 2004. *Handbook of Food and Beverage Fermentation Technology*. Marcel Dekker.
- Priest FG & Stewart GG. 2006. *Handbook of Brewing*. 2nd Ed. CRC.
- Richard PV. 1981. *Commercial Wine Making - Processing and Controls*. AVI Publ.
- Varnam AH & Sutherland JP. 1994. *Beverages: Technology, Chemistry and Microbiology*. Chapman & Hall.
- Woodroof JG & Phillips GF. 1974. *Beverages: Carbonated and Non Carbonated*. AVI Publ.

MINOR COURSES – GROUP II

FST 619 ADVANCES IN MILK PROCESSING

2+1

Objective

To provide a technical knowledge of advances in processing of milk.

Theory

Status and prospects of dairy industry in India. Milk standards and legislation and related agencies. Principles and practices for production of high quality milk. Milk procurement, quality assessment, detection of adulterants, handling and transportation. Methods of raw milk preservation. Composition, physical and chemical properties of milk and their importance in processing. Chilling, centrifugal separation, clarification, bacto-fugation and homogenization and their implications in processing of milk. Thermal processing-pasteurization, UHT processing, sterilization, bacto-therm and aseptic packaging. Current trends in cleaning and sanitization of dairy equipment, biological detergents, ultrasonic techniques in cleaning; biodegredients. Disposal of dairy effluents.

Application of microwave heating, ohmic heating, high pressure processing and radiation and preservation of milk and milk products. Application of immobilized enzyme in dairy products in dairy and food industry. Application of membrane technology in dairy and food industry-Reverse Osmosis, Ultra Filtration, Nano Filtration and Microfiltration. Fouling, and cleaning of membranes. Processing of cereals and legumes for incorporation in milk and milk products. Use of milk solids in bakery and confectionery products. Application of biotechnology in dairy industry.

Practical

Quality assessment of milk- Methylene blue dye reduction test-Resazurin reduction test; Standard plate count, coliform count and yeast mould count; Analysis of fat-protein and lactose in milk by gravimetric and volumetric methods- detection of adulterants and preservatives - testing for efficiency of cream separation- homogenisation -pasteurisation-sterilisation-sanitization; aseptic packaging -Methods of immobilization of enzymes and their incorporation in dairy and food product preparation; Demonstration of membrane technology-Reverse Osmosis --Ultra Filtration-Nano Filtration and Microfiltration; Preparation of milk products by incorporating cereals and legumes. Preparation of bakery and confectionery products using milk solids.

Suggested Readings

- Walstra *et al*, 2005. *Dairy Technology, principles of milk properties and process*. Marcel Dekker
- Sukumar De, 2010. *Outlines of Dairy Technology*. Oxford
- Mathur, Roy and Dinakar, 2005. *Textbook of Dairy Chemistry*. Indian Council of Agricultural Research
- Webb, Johnson and Alford, 2005. *Fundamentals of Dairy Chemistry*. API Publishing Company
- Milk Industry Foundation, 2009. *Analysis of milk and its products A lab manual*. Biotech books.

Ramakant Sharama, 2009 *Production Processing and quality of milk products*, International book distributing Co.

Jha, 2006 *Dairy and food Processing and Plant maintenance – Theory and Practice*. International Book Distributing Co

Renner and Salam, 1991. *Application of Ultra filtration in Dairy Industry*. Elsevier

Lalat Chander, 2004. *Dairy Plant Layout and Design*. Indian Council of Agricultural Research.

FST 620 TECHNOLOGY OF FAT RICH MILK PRODUCTS

2+1

Objective

To provide a technical knowledge of various fat-rich milk products, and advances in their manufacture, quality assessment and assurance.

Theory

Trends in fat rich dairy products industry in India. Principles and recent advancements in preparation of different types of cream, butter, margarine, fat spreads, butter oil and ghee. Fractionation of fat and its application in dairy and food industry. Health attributes of milk fat. Prospects of innovative health giving products like Cholesterol reduced and cholesterol-free dairy products.

Status of frozen dairy products industry in India. Classification of ice-cream and other frozen desserts. Influence of milk constituents and other ingredients, processing steps, packaging and storage techniques on quality of ice-cream. Manufacturing technologies of plain, fruit, soft-serve, low fat and dietetic ice-creams and novelties. Production technologies and quality attributes of indigenous frozen desserts - kulfi, malai-ka-baraf etc., Usage of newer ingredients in the ice-cream industry.

Status and role of traditional dairy products in Indian dairy industry. Technology and the physico-chemical changes during the preparation of indigenous milk products- paneer-channa- khoa- ghee- dahi and shrikhand and their packaging and storage. Innovations process in the development of khoa, chhana, paneer, rabri, kheer, khoa and chhana-based sweets.

Practical

Preparation of cream-butter-margarine-fat spreads-butter oil- ghee- cholesterol reduced and cholesterol-free dairy products-frozen dairy products- ice cream plain, fruit, soft-serve, low fat and dietetic ice-creams and novelties- kulfi- malai ka baraf-indigenous milk products- dahi-shrikhand- paneer- channa-channa based sweets- khoa- khoa based sweets.

Suggested Readings

Spreer, 2005. *Milk and Dairy Product Technology*. Marcel Dekker

Ramasamy, Shibu and Gopi, 1999. *Dairy technologists hand book*. International Book Distributing Co.

Tamime, 2007. *Structure of Dairy Products*. Blackwell

Sandholm and Saarela, 2000. *Functional Dairy Products*. Woodhead Publishing Company

Clark et al. 2009. *The Sensory Evaluation of Dairy Products*. Springer

FST 621 TECHNOLOGY OF FERMENTED AND DRIED DAIRY PRODUCTS 2+1

Objective

To provide knowledge of various fermented and dried dairy products, their by-products, and advances in their manufacture.

Theory

Status and prospects of cheese, fermented milk products – their nutritional and therapeutic value. Classification of cheese and fermented milks. Manufacture of Cheddar, Gouda, Mozzarella and Swiss cheeses. Role of starter cultures and rennet in cheese quality. Physical and chemical changes during cheese ripening. Manufacture of processed cheese, cheese spread and cheese foods. Mechanization of cheese-making process. Recent concepts in accelerated cheese ripening. Storage and defects. Importance of probiotic dairy products. Production of *dahi*, yoghurt, *shrikhand*, *lassi*, *misti dohi*, acidophilus milk, bulgaricus milk, kumiss and kefir and storage.

Manufacture of condensed milk, evaporated milk and UHT sterilized concentrated milk. Manufacture of Whole milk powder and Skim milk powder . Concepts in technology of newer dairy products and formulations like high-fat powders and ice-cream powder, malted milk and malted milk foods, milk based infant foods and weaning foods,

Recent advances in utilization of dairy byproducts in product development. Manufacturing of casein- caseinate- co-precipitates- whey protein concentrate (WPC) - lactose- dairy whiteners; functional properties of whey proteins- casein- co-precipitates- Ultra Filtration retentate and their modifications.

Practical

Preparation of yoghurt - dahi- shrikhand- lassi, misti dohi-acidophilus milk- bulgaricus milk cheese-cheddar-mozarella and cottage cheese-condensed milk-evaporated milk-whole milk powder-skim milk powder-ice-cream powder-malted milk and malted milk foods, milk based infant foods and weaning foods- -casein-caseinates-co precipitate –WPC- UF retentate; measurement of functional properties of different milk products.

Suggested Readings

- Spreer, 2005. *Milk and Dairy Product Technology*. Marcel Dekker
Caric, 1994. *Concentrated and Dried Dairy Products*. VCH Publishers.
Tamime and Robinson, 1985. *Yoghurt Science and Technology*. Oxford
David, 2007. *Technological Advances Condensed and Dried Milk*. Kitab Mahal, 22-A Sarojani Naidu Marg,
David, 2007. *Technological Advances Cheese and Fermented milk products*. Kitab Mahal, 22-A Sarojani Naidu Marg,
Webb and Whittier, 1970. *By-products from Milk*.
Clark et al. 2009. *The Sensory Evaluation of Dairy Products*. Springer

MINOR COURSES – GROUP III

FST 622 ADVANCES IN FISH BIOCHEMISTRY

(2+1)

Objective

To provide an insight into the biochemistry of fishes, with respect to fish processing.

Seafood Proteins: Sarcoplasmic Proteins: Classification, Enzymes, Pigments, Heme Proteins, Myoglobin, Hemocyanins, Parvalbumins, Antifreeze proteins. Myofibrillar Proteins: Myosin - Isolation, Sub-unit composition, Stability, Gelation, Actin, Tropomyosin, Troponins, Paramyosin, Connectin. Collagen in fish muscle and skin: Location, Characteristics of seafood collagen, Collagen on the quality of seafoods-gaping. Functional properties of seafood proteins: Solubility, emulsification, viscosity, water holding, gelation, Denaturation. Hydrolysis and hydrolysates: Process and applications.

Seafood Lipids: Composition and nutritive value, Lipid types and their variations, fatty acid composition of fish liver and body oils, lipid fractionation, triglycerides, phospholipids, non saponifiables including sterols and vitamins, Polyunsaturated fatty acids, prostaglandins, estimation of lipid fractions. Marine lipids and their beneficial effects on human health. Omega 3 fatty acid as functional ingredients in foods, oxidation of marine lipids: auto-oxidation of fatty acids, pro and antioxidants, oxidation indices, lipid-protein interactions and their impact on quality, rancidity, lipases and phospholipases. Macro and trace elements in fish and shellfish; Minerals of nutritional significance.

Effect of processing: Chemical Reactions in Fish Muscle During Frozen Storage-Protein Denaturation, Mechanisms and Factors Affecting Denaturation, Protein Aggregation, Mechanisms and factors influencing Aggregation, Protein Extractability and Solubility, ATPase Activity, pH, Adverse effect of different processing methods on biochemical constituents of fish, Drying, Canning, High Pressure Processing, Microwave cooking.

Enzymes in different fish processing methods: surimi setting, Enzyme use in PUFA production. Application of enzymes in fish quality determination. Enzymes used in the product development from fish waste:

Flavour of fish and shellfish: Introduction, Very Fresh Fish Aromas -Carbonyls and Alcohols, Sulphur Compounds, Bromophenols, Hydrocarbons.

Practical:

TMA-N, TVB-N, Indole, Lipids - Soxhlet/Bligh and Dyer, fractionation by TLC, PV, FFA, TBA, Fatty acid composition by GLC. Nucleotide and Amino acid Analysis by HPLC. PAGE and SDS-PAGE, Estimation of metals - using AAS/ICP. Separation of selected amino acids/sugars using TLC/paper chromatography. Enzyme assay techniques -ATPase assay.

Suggested Readings

Balachandran, K.K. 2002. *Post harvest technology of fish and fish products*. Daya publishing house, New Delhi.

Gopakumar.K. (Ed). 2002. *Text book of fish processing technology*. ICAR, New Delhi.

Joseph, J. Mathes P.T. Joseph, A.C. and Muralidharan, V. (Eds). 2003. *Product Development and seafood safety*. CIFT, Cohin.

Gopakumar.K. 1997. *Biochemical composition of Indian Food Fishes*, Central Institute of Fisheries Technology, Cochin.

Nair, P.G.V. and Suseela, M. 2000. *Biochemical composition of fish and shellfish*, CIFT Technology Advisory Series, Central Institute of Fisheries Technology, Cochin.

Hall, G.M. (Ed). 1997. *Fish Processing Technology*, 2nd Edition. Blackie & Academic & professional.

Gopakumar, K. 1997. *Tropical Fishery Products*, Oxford and IBH Publishing Co Pvt. Ltd.

FST 623 ADVANCES IN FISH PROCESSING AND ENGINEERING (2+1)

Objective

To provide a technical knowledge of advances in processing of fishes, and its engineering principles.

Drying of fish and seafood: Introduction, Drying principles, classification and selection of dryers, basic process calculations and simulations in drying, transport properties in the drying of solids, spreadsheet aided dryer design, Advanced techniques in drying-spray drying, freeze drying, microwave and dielectric drying, Infrared drying- drying pre-treatment, drying conditions, quality changes in fish during drying, Energy aspects in drying.

Chilling and transportation of fish, calculations; Freezing, Physical-Chemical Principles in Freezing- The structure of water and ice, freezing process, freezing curves, freezing rate, vitrification, mechanism of ice formation, physical and chemical changes during freezing and frozen storage; Glass Transitions in Frozen Foods and Biomaterials- rheological analysis; Overview of Refrigeration Cycles; Thermophysical Properties of Frozen Foods- Freezing point, Ice content, Enthalpy, Specific heat, Latent Heat, Thermal conductivity and diffusivity; Freezing Loads, calculation, freezing rate and thermal center, Freezing Time Calculation, different methods available, Thawing time prediction. Cryoprotection of frozen fishery products, Cryoprotectants, Phosphates, Mechanisms. Accelerated freeze drying (AFD) and its application to fish industry

Canning: Principles of Thermal Processing, Thermal resistance of micro organisms, heat transfer related to thermal processing, Thermal process calculations- Innovations in thermal processing-Ohmic heating, radio frequency dielectric heating, infrared heating.

Extrusion in fish processing and fish based snack food development. Principle and Application of non thermal processing to fish preservation and processing- High Pressure Processing, Irradiation, Pulsed Electric field, pulsed light; Energy calculations in non thermal processing of fish.

Selection of site for fish processing plant, layout and design: Canning plant, fish meal plant, surimi plant, freezing plant. Ideal requirements for construction of cold storage. Seafood waste management, Machinery for handling and processing fish- Debonner, filleting machine, freshness analysers.

Practical:

Preparation of fish mince, surimi, evaluation of physical and chemical properties, gel strength, colour, formulation of different products. Battered and breaded products from prawns / fish / bivalves. IQF products; Evaluation of pasteurisation and sterilisation, determination of TDT and F value, Examination of canned foods, can seams, testing sterility.

Gopakumar.K. 1997. *Biochemical composition of Indian Food Fishes*, Central Institute of Fisheries Technology, Cochin.

Nair, P.G.V. and Suseela, M. 2000. *Biochemical composition of fish and shellfish*, CIFT Technology Advisory Series, Central Institute of Fisheries Technology, Cochin.

Hall, G.M. (Ed). 1997. *Fish Processing Technology*, 2nd Edition. Blackie & Academic & professional.

Gopakumar, K. 1997. *Tropical Fishery Products*, Oxford and IBH Publishing Co Pvt. Ltd.

FST 623 ADVANCES IN FISH PROCESSING AND ENGINEERING (2+1)

Objective

To provide a technical knowledge of advances in processing of fishes, and its engineering principles.

Drying of fish and seafood: Introduction, Drying principles, classification and selection of dryers, basic process calculations and simulations in drying, transport properties in the drying of solids, spreadsheet aided dryer design, Advanced techniques in drying-spray drying, freeze drying, microwave and dielectric drying, Infrared drying- drying pre-treatment, drying conditions, quality changes in fish during drying, Energy aspects in drying.

Chilling and transportation of fish, calculations; Freezing, Physical-Chemical Principles in Freezing- The structure of water and ice, freezing process, freezing curves, freezing rate, vitrification, mechanism of ice formation, physical and chemical changes during freezing and frozen storage; Glass Transitions in Frozen Foods and Biomaterials- rheological analysis; Overview of Refrigeration Cycles; Thermophysical Properties of Frozen Foods- Freezing point, Ice content, Enthalpy, Specific heat, Latent Heat, Thermal conductivity and diffusivity; Freezing Loads, calculation, freezing rate and thermal center, Freezing Time Calculation, different methods available, Thawing time prediction. Cryoprotection of frozen fishery products, Cryoprotectants, Phosphates, Mechanisms. Accelerated freeze drying (AFD) and its application to fish industry

Canning: Principles of Thermal Processing, Thermal resistance of micro organisms, heat transfer related to thermal processing, Thermal process calculations- Innovations in thermal processing-Ohmic heating, radio frequency dielectric heating, infrared heating.

Extrusion in fish processing and fish based snack food development. Principle and Application of non thermal processing to fish preservation and processing- High Pressure Processing, Irradiation, Pulsed Electric field, pulsed light; Energy calculations in non thermal processing of fish.

Selection of site for fish processing plant, layout and design: Canning plant, fish meal plant, surimi plant, freezing plant. Ideal requirements for construction of cold storage. Seafood waste management, Machinery for handling and processing fish- Debonner, filleting machine, freshness analysers.

Practical:

Preparation of fish mince, surimi, evaluation of physical and chemical properties, gel strength, colour, formulation of different products. Battered and breaded products from prawns / fish / bivalves. IQF products; Evaluation of pasteurisation and sterilisation, determination of TDT and F value, Examination of canned foods, can seams, testing sterility.

Heat penetration curve and cooling curve. Preparation of FPC. Chitin, chitosan, glucosamine, carotenoids from shrimp waste.

Suggested Readings

- Sen, D.P. 2006. *Advances in Fish Processing Technology*, Allied Publishers.
- Ayyappan, S. 2006. *Handbook of fisheries and aquaculture*, ICAR, New Delhi.
- Park, J.W. 2005. *Surimi and Surimi Seafood*, CRC Press.
- Suderman, I. Darrel, R. Cunningham, H., Frank, E. 1983. *Batter and breading technology*, The AVI publishing company Inc.
- Vazhiyil Venugopal, 2006. *Seafood Processing: Adding Value Through Quick Freezing, Retortable Packaging and Cook-Chilling*, CRC Taylor and Francis.
- Da-Wen Sun, 2005, *Handbook of Frozen Food Processing and Packaging*, CRC Press.
- Hui, Y.H. et al., (Eds). 2004. *Handbook of frozen products*. Marcel Dekker.
- Ranganna, S. 2000. *Handbook of canning and aseptic packaging*. Tata McGraw Hill Publishing.
- Arun S. Mujumdar 2006. *Handbook of Industrial Drying*, CRC Press.
- Moller, A.B. 2003. *Studies on seafood value addition*. FAO/GLOBEFISH, Special Market Study, FAO, Italy.

FST 624 ADVANCES IN FISH QUALITY ASSURANCE

(2+1)

Objective

To provide a technical knowledge of advances in quality of fishes, their assessment and assurance.

Roles of bacteria and moulds in fish preservation. Modification of intrinsic and extrinsic parameters for fish preservation. Spoilage of fresh fish, chilled fish and processed fish products. Micro-organisms in frozen, canned and dried products, and their control. Human pathogenic bacteria, virus, moulds and parasites in fish and fishery products- Sources of contamination and control measures. Fish quality evaluation and different indices of quality; Quality management in seafood processing- Concepts of Total quality management, HACCP, practical aspects of planning and implementing HACCP systems; Hazards in sea foods; Risk assessment; National and international standards - ISO 9000 series, ISO 22000. Codex alimentarius, ICMSF; Food Safety and Standards Act of India 2006; Role of BIS and EIA; Traceability issues in international trade. Instrumental quality control of fish, Texture profile analysis of fish and fishery products.

Practicals:

Process water analysis for chemical parameters; Examination of filth; Evaluation of sanitary conditions of filth; Isolation, identification, biochemical and serological confirmation of *Escherichia coli*, *Staphylococcus aureus*, *Salmonella*, *Vibrio cholera*, *Vibrio parahaemolyticus*, *Listeria monocytogenes* and *Clostridium botulinum*; PCR confirmation of pathogen; ELISA quantification of antibiotics in seafood.

Suggested Readings

- Huss, H.H. and Ababouch, I. and Gram, L. 2003. *Assessment and management of seafood safety and quality*. FAO Fisheries Technical paper 444. FAO of UN, Rome.
- Terri Boylston, Leo M. L. Nollet 2007. *Handbook of Meat, Poultry And Seafood Quality*, Blackwell Publishing.

Bremner, A. (Ed.) 2002. *Safety and quality issues in fish processing*, Woodhead Publishers, Connell, J.J. 1995. 4th Edn *Control of fish quality*. Fishing News Books, Marton Book Series Iyer, T.S.G., Kandoran, M.K. Thomas, M., Mathew, P.T. (Eds). 2002. *Quality assurance in seafood processing*. 2nd Edn. CIFT and SOFT(I), Cochin.
Surendran, P.K., Nirmala Thampuran, Narayan Nambiar, V. and Lalitha, K.V. 2006. *Laboratory manual on microbiological examination of seafood*. CIFT, Cochin.

To provide an understanding of advances in production of meat, properties of fresh meat, handling of fresh meat, and quality assessment and assurance of fresh meat.

Theory

Development of meat science and meat industry, current trends and prospects of meat industry. Layout, designing - operation and maintenance of slaughter houses and processing plants - disposal of slaughter house effluents and different designs of effluent treatment plants - equipments, organization and Slaughter house, maintenance, record keeping and operation - sanitation of slaughterhouse - Sanitary practices in meat plant and its benefits - BIS standards for slaughterhouse design

Pre-slaughter care - Effect of transport on meat quality - PSE and DFD in meat quality slaughter of meat animals - Humane slaughter - Principles and methods of stunning - Ritual slaughter of food animals and poultry - Equipment for stunning, slaughter, flaying and dressing of food animals and fabrication of carcasses

Structure of muscle and associated tissues - nutritive value of meat - Essential nutrients in meat - Factors affecting quality of meat - Meat microbiology - Chemical residues in meat and their effects on the health of the consumer - BIS standards for meat, MFPO, Food Safety and Standards Act 2006 - Quality control, Quality assurance HACCP, GMP, ISO standards.

Practical

Plan and outfit of modern abattoir - Slaughter and dressing of food animals - Retail and wholesale cuts - Microbial analysis of meat

Suggested Readings

Onoey, Collins and Huey. 1998. *Meat Hygiene*. W.B Saunders Company.

Libby. 1975. *Meat Hygiene*. Lea and Febiger.

Romans et al. 2000. *The Meat we Eat*. Prentice Hall.

Korry, & Korry and Ledward. 2002. *Meat Processing - Improving quality* Woodhead Publishing Company.

Hui et al. 2001 *Meat Science and Applications*. Marcel Dekker Inc.

FAQ. Good Practices in the Meat Industry FAO.

Pearson and Dutson. *Advances in Meat Science series*. Academic press

Lewis. *Developments in Meat Science series*. Elsevier.

FST 626 ADVANCES IN PROCESSING AND PRESERVATION OF MEAT 241

Objective

To provide an insight of advances in preservation and processing of meat, quality of processed meat products their assessment and assurance.

Theory:

Basic principles of preservation - chilling, freezing, thermal processing, dehydration, irradiation, use of chemicals including antibiotics, meat curing and smoking - Effects of preservation on meat quality - Tenderization of meat.

MINOR COURSES – GROUP IV

FST 625 ADVANCES IN FRESH MEAT TECHNOLOGY

2+1

Objective

To provide an understanding of advances in production of meat, properties of fresh meat, handling of fresh meat, and quality assessment and assurance of fresh meat.

Theory

Development of meat science and meat industry, current trends and prospects of meat industry. Layout, designing – operation and maintenance of slaughter houses and processing plants-disposal of slaughter house effluents and different designs of effluent treatment plants - equipments, organization and Slaughter house, maintenance, record keeping and operation-sanitation of slaughterhouse-Sanitary practices in meat plant and its benefits - BIS standards for slaughterhouse design

Pre-slaughter care- Effect of transport on meat quality - PSE and DFD in meat quality slaughter of meat animals- Humane slaughter – Principles and methods of stunning – Ritual slaughter of food animals and poultry – Equipment for stunning, slaughter, flaying and dressing of food animals and fabrication of carcasses

Structure of muscle and associated tissues – nutritive value of meat – Essential nutrients in meat- Factors affecting quality of meat - Meat microbiology –Chemical residues in meat and their effects on the health of the consumer- BIS standards for meat, MFPO, Food Safety and Standards Act 2006- Quality control, Quality assurance HACCP, GMP, ISO standards.

Practical

Plan and outlay of modern abattoir - Slaughter and dressing of food animals - Retail and wholesale cuts- Microbial analysis of meat.

Suggested Readings

Gracey, Collins and Huey. 1999. *Meat Hygiene*. W.B.Saunders Company.

Libby. 1975. *Meat Hygiene*. Lea and Febiger.

Romans *et al.* 2000. *The Meat we Eat*. Prentice Hall.

Kerry, & Kerry and Ledward. 2002. *Meat Processing –Improving quality* Woodhead Publishing Company.

Hui *et al.* 2001 *Meat Science and Applications*. Marcel Dekker Inc.

FAO. Good Practices in the Meat Industry FAO.

Pearson and Dutson. *Advances in Meat Science series*. Academic press

Lawrie. *Developments in Meat Science series*. Elsevier.

FST 626 ADVANCES IN PROCESSING AND PRESERVATION OF MEAT

2+1

Objective

To provide an insight of advances in preservation and processing of meat, quality of processed meat products their assessment and assurance.

Theory:

Basic principles of preservation - chilling, freezing, thermal processing, dehydration, irradiation, use of chemicals including antibiotics, meat curing and smoking - Effects of preservation on meat quality- Tenderization of meat.

Basic meat processing principles – Particle size manipulation – Grinding – Mincing – Chopping – Flaking – Tumbling and massaging - Cured Meat Products – Ham, Bacon – Comminuted Meat Products - – Coarse ground and Emulsion Meat Products - Sausages - Fresh and cooked sausages, - Enrobed Meat Products - Batter formation – Fermented Meat Products – Canned Meat Products – Corned Beef, Luncheon Meat, Meat loaves - Restructured meat products – Restructured steaks, roasts, blocks-,portion, sticks– Dried meat – Pickled, spiced and marinated meat – Prefabricated meat- different cooking methods Microwave cooking - Tandoori- Barbecuing of Poultry.- Effect of processing on quality of product – Equipment used in processing of meat and their design - Design of equipment for handlers safety.

Meat adulteration and substitution – Different techniques for meat speciation – Agar gel immuno - diffusion techniques – CIE, IEF, ELISA, PCR

Principles of packaging-Product characteristics affecting packaging requirements; packaging material and their characteristics - different methods of packaging meat – Vacuum packaging – MAP – Retort pouch processing

Practical

Estimation of Chiller shrinkage, drip loss, cooking loss - Estimation of pH – Colour - Water holding capacity – ERV – Tyrosine value – Thiobarbituric acid number – Estimation of shear force value of meat and texture profile of meat products – Formulation of different meat products, emulsion stability, , Demonstration of CIE, IEF, ELISA, PCR.

Suggested Readings

Lawrie and Ledward. 2006. *Meat Science*. Woodhead Publishing Company.
Aberle *et.al.* 2001. *Principles of Meat Science*. Kendall Hunt Publishing Company.
Varnam and Sutherland. 2002. *Meat and Meat Products- Technology, Chemistry and Microbiology* Chapman and Hall.
Ranken. 2000. *Handbook of Meat Products Technology* Blackwell.
Pearson and Dutson. *Advances in Meat Science series*. Academic press
Lawrie. *Developments in Meat Science series*. Elsevier.

FST 627 MUSCLE AND MEAT BIOCHEMISTRY

2+1

Objective

To provide a comprehensive understanding of the biochemistry of meat, from the standpoint of meat processing.

Theory:

Composition of Muscle – Ultra structure of muscle –
Contraction and Rigor mortis – Post-mortem changes during conversion of muscle to meat –
Ageing of meat –Techniques in acceleration of ageing of meat - Chemistry of meat colour, tenderness and flavour Post –mortem processing characteristics of muscle- Proteins of Muscle – Significance of muscle proteins in processed meats- Physics and chemistry of Comminuted Meat Products .

Practical

Determination of sarcomere length, fibre diameter and myofibrillar fragmentation index. -
Estimation of glycogen, R-value, and myoglobin

Suggested Readings

Lawrie and Ledward. 2006. *Meat Science*. Woodhead Publishing Company.
Aberle *et.al.* 2001. *Principles of Meat Science*. Kendall Hunt Publishing Company.

Pearson and Young. 1989. *Muscle and Meat Biochemistry* – Academic Press.
Pearson and Dutson. *Advances in Meat Science series*. Academic press
Lawrie. *Developments in Meat Science series*. Elsevier.

FST 628 ADVANCES IN EGG PRODUCTS PROCESSING TECHNOLOGY 3(2+1)

Objective

To provide an understanding of production of egg, quality and properties of egg, preservation and processing of egg, and quality assessment and assurance of egg products.

Theory: Female reproductive system-formation of egg- structure of egg -nutritive -organic and functional egg production-functional properties-food & industrial use of egg-egg quality deterioration-changes during quality deterioration and causes for quality deterioration-preservation of egg-egg products- egg products using the functional quality of egg – Angel cake, omelet, mayonnaise etc. other products- whole egg powder, albumen flakes, albumen powder, yolk powder- post oviposition value addition of egg products -candling-grading of eggs as per various standards -specification of egg quality for product preparation- defects in egg- microbial quality for spoilage of egg-pre oviposition value addition-different grades of egg-packaging & transport of egg-factors affecting egg & shell quality-marketing of eggs and its products-export of eggs and regulation-recycling of egg shells and hatchery waste.

Practicals: Measuring the internal and external characteristics and qualities of egg-different methods of preservation of eggs-measuring the functional properties of egg-packaging & transportation for export purpose-preparation of various poultry products and fast foods-utilization of eggs in various industries-blue print for egg powder plant and egg technology laboratory-FAO, WHO & HACCP regulations for table eggs and its products-export regulation and specification.

Suggested Readings

Stadelman and Cotteril, 1995. *Egg Science and Technology*.Routledge.
Mountney and Parkhurst, 1995 *Poultry Products Technology*. Routledge.
Panda, 1998. *Egg and Poultry Technology*.Vikas Publishing House.

S. Chand & Sons.

Gupta SP. 2004. *Statistical Methods*. S. Chand & Sons.

FIC 436 COMPUTER APPLICATIONS IN FOOD INDUSTRY 1+2

Objective

Introduce the role of computerization in processing, particularly for communication, process and quality optimization, automation, simulation, designing and manufacture.

Theory

UNIT I (Lecture 10)

Importance of Computerization and IT in Food Industries Computers, operating environments and information systems for various types of food industries Principles of Communication.

SUPPORTING COURSES

FSC 635 STATISTICAL METHODS FOR FOOD SCIENCE

1+1

Objective

The students will be exposed to various statistical tools required to analyze the experimental data in food research and industry.

Theory

UNIT I

Descriptive statistics, Mean, variance, probability, conditional probability, Probability distribution.

UNIT II

Density functions, Mean variance.

UNIT III

Data and its nature; data representation; diagrams and graphs using MSExcel, Measures of Central tendency; Dispersion, Skewness and Kurtosis; Binomial and Normal Distributions.

UNIT IV

Confidence Interval of mean; Test of significance; Non-parametric tests; Simple, Partial and Multiple correlations.

UNIT V

Estimation, confidence intervals hypothesis testing, Basic principles of Experimental Designs; Analysis of Variance; Elements of Quality Control.

Practical

Exercises as per each of the Units in theory.

Suggested Readings

Aggarwal BL. 2003. *Basic Statistics*. New Age.

Brookes CJ, Betteley IG & Loxston SM. 1966. *Mathematics and Statistics for Chemists*. John Wiley & Sons.

Gupta SC & Kapoor VK. 2003. *Fundamentals of Mathematical Statistics*.

S. Chand & Sons.

Gupta SP. 2004. *Statistical Methods*. S. Chand & Sons.

FSC 636 COMPUTER APPLICATIONS IN FOOD INDUSTRY

1+2

Objective

Introduce the role of computerization in processing, particularly for communication, process and quality optimization, automation, simulation, designing and manufacture.

Theory

UNIT I (Lectures 10)

Importance of Computerization and IT in Food Industries Computers, operating environments and information systems for various types of food industries; Principles of Communication.

UNIT II (Lectures 12)

Role of Computer in Optimization: Introduction to operation Research; A Computer Oriented Algorithmic approach; Queuing systems and waiting models; PERT, CPS and CPM.

UNIT III (Lectures 12)

Food Process Modeling and Simulation; CAD and CAM in Food Industry: instrumentation, process Control, inventory Control, Automation, Robotics, Expert system and artificial intelligence.

Practical

Applications of MS Excel to solve the problems of food technology: Statistical quality control, Sensory evaluation of food, and Chemical kinetics in food processing; Use of word processing software for creating reports and presentation; Familiarization with the application of computer in food industries -Milk plant, Bakery Units, Fruit & Vegetable processing Unit; Familiarization with software related to food industry; Ergonomics application in the same; Visit to Industry and case study problems on computer.

Suggested Readings

Gillett BE. *Introduction to Operation Research* (A Computer Oriented Algorithmic Approach).

Groover MP & Zimmers EW. 1987. *CAD/CAM: Computer Aided Design and Manufacturing*. Prentice Hall. Singh RP. 1996. *Computer Applications in Food Technology*. Academic Press.

FBM 637 BUSINESS MANAGEMENT & INTERNATIONAL TRADE

3+0

Objective

To acquaint with techniques of Business Management & International Trade for food sector.

Theory

UNIT I (Lectures 8)

Concept and functions of marketing; concepts and scope of marketing management; concepts and elements of marketing mix.

UNIT II (Lectures 10)

Concept of market structure, micro and macro environments; Consumer behaviour; consumerism; Marketing opportunities- Analysis, marketing research and marketing information systems.

UNIT III (Lectures 10)

Market measurement- present and future demand; Market forecasting; market segmentation, targeting and positioning, Allocation and marketing resources, Marketing Planning Process, Product policy and planning: Product-mix; product line; product life cycle, New product development process. Product brand, packaging, services decisions. Marketing channel decisions, Retailing, wholesaling and distribution, Pricing Decisions, Price determination and pricing policy of milk products in organized and unorganized sectors of dairy industry, Promotion-mix decisions.

UNIT IV (Lectures 10)

Advertising; how advertising works? Deciding advertising objectives, advertising budget and advertising message, Media Planning, Personal Selling, Publicity; Sales Promotion, Food and Dairy Products Marketing.

UNIT V (Lectures 10)

International Marketing and International Trade, Salient features of International Marketing, Composition & direction of Indian exports; International marketing environment; Deciding which & how to enter international market; Exports- Direct exports, indirect exports, Licensing, Joint Ventures, Direct investment & internationalization process, Deciding marketing Programme; Product, Promotion, Price, Distribution Channels. Deciding the Market Organization; World Trade Organization (WTO).

Suggested Readings

Chhabra TN & Suria RK. 2001. *Management Process and Perspectives*. Kitab Mahal.

Jhingan ML. 2005. *International Economics*. 5th Ed. Virnda Publ.

Kotler P. 2000. *Marketing Management*. Prentice Hall.

Reddy SS, Ram PR, Sastry TVN & Bhavani ID. 2004. *Agricultural Economics*. Oxford & IBH.

UNIT VI TECHNICAL WRITING AND COMMUNICATIONS SKILLS

Objective

To equip the students/scholars with skills to write dissertations, research papers, etc. To equip the students/scholars with skills to communicate and articulate in English (verbal as well as writing).

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; Collocations; Phonemic 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. *M.A. Handbook for Writers of Research Papers*, 5th Ed. Affiliated East-West Press, New Delhi.

Hornby AS. 2000. *Comp. Oxford Advanced Learner's Dictionary of Current English*, 6th Ed. Oxford UP, Oxford.

Krishna Mohan 2005. *Speaking English Effectively*. Macmillan India, New Delhi.

COMPULSORY NON-CREDIT COURSES

FPT 641 LIBRARY AND INFORMATION SERVICES

0+1

Objective

To equip the library users with skills: to trace information from libraries efficiently, to apprise them of information and knowledge resources, to carry out literature survey, to formulate information search strategies, and to use modern tools (Internet, OPAC, search engines etc.) of information search.

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.

FPT 642 TECHNICAL WRITING AND COMMUNICATIONS SKILLS

0+1

Objective

To equip the students/scholars with skills to write dissertations, research papers, etc. To equip the students/scholars with skills to communicate and articulate in English (verbal as well as writing).

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. 5th Ed. Affiliated East-West Press, New Delhi.
Hornby AS. 2000. Comp. Oxford Advanced Learner's Dictionary of Current English. 6th Ed. Oxford UP, Oxford.
Krishna Mohan 2005. Speaking English Effectively. Macmillan India, New Delhi.

Mills Gordon H & John A Walter. 1970. Technical Writing. 3rd Ed. Holt, Rinehart & Winston, New York.

Sethi J & Dhamija PV. 2004. Course in Phonetics and Spoken English. 2nd Ed. Prentice-Hall of India, New Delhi.

Shelton James H. 1994. Handbook for Technical Writing. NTC Business Books, Chicago.

Smith Richard W. 1969. Technical Writing. Barnes & Noble, New York.

Wren PC & Martin H. 2006. High School English Grammar and Composition. S. Chand, New Delhi.

FPT 643 INTELLECTUAL PROPERTY AND ITS MANAGEMENT IN AGRICULTURE **1+0**
(e-Course)

Objective

The main objective of this course is to equip students and stakeholders with knowledge of intellectual property rights (IPR), related protection systems, their significance and use of IPR as a tool for wealth and value creation in a knowledge-based economy.

Theory

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; 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; 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.

Rothschild, Max & Newman, Scott (Ed.). 2003. Intellectual Property Rights in Animal Breeding and Genetics. CABI, Wallingford.

Saha R. (Ed.). 2006. Intellectual Property Rights in NAM and Other Developing Countries: A Compendium on Law and Policies. Daya, Delhi.

The Indian Acts - Patents Act, 1970 & amendments; Design Act, 2000;

Trademarks Act, 1999; The Copyright Act, 1957 & amendments; Layout Design Act, 2000; PPV & FR Act 2001, and Rules 2003; National Biological Diversity Act, 2003.

TAMIL NADU VETERINARY AND ANIMAL SCIENCES UNIVERSITY

ACADEMIC REGULATIONS FOR M.Tech. (FPT) Programme – 2010

1. **Short title and commencement**

(1) These regulations shall be called Tamil Nadu Veterinary and Animal Sciences University Academic Regulations for M.Tech (FPT) Programme – 2010

(2) These shall apply to the students admitted from the **academic year immediately after approval of the same by the University.**

(3) In these regulations, unless the context otherwise requires the words and expressions used in these regulations shall be interpreted to have the same meanings as they have in the Act.

2. **Definitions** - In these regulations, unless the context otherwise requires,

1. **"Act"** means Tamil Nadu Veterinary and Animal Sciences University Act, 1989 (Tamil Nadu Act 42 of 1989)
2. **"Government"** means the State Government of Tamil Nadu.
3. **"Statutes"** means Tamil Nadu Veterinary and Animal Sciences University Statutes.
4. **"Academic Council"** means Academic Council of the University.
5. **"University"** means Tamil Nadu Veterinary and Animal Sciences University;
6. **"Degree"** means the course of post-graduate studies in Food Processing Technology, namely M.Tech. They shall comprise of a course of study consisting of curriculum and syllabus provided by the University spread over a minimum of four semesters for M.Tech and a maximum of eight semesters.
7. **"Academic year"** is a period during which a cycle of study is completed. It shall ordinarily start from August 1 and shall consist of two semesters covering 220 days of instruction including the days of examination.
8. **"Semester"** It is an academic term consisting of not less than 110 instructional days including examination days.
9. **"Syllabus" and "curriculum"** means the syllabus, and curriculum for courses of study as specified by the **Indian Council of Agricultural Research (ICAR)** and approved by the **University.**
10. **"Course"** A course is a unit of instruction or a segment of subject matter to be covered in a semester. It has a specific number, title and credits.
11. **"Major course"** is a course from a set of courses specified by the ICAR and approved by the University, which are to be taken by a student mandatorily.
12. **"Minor course"** is a course taken by a student in a group of courses chosen by the student from among the four different groups of courses offered by the University from time to time.
13. **"Supporting course"** is a course taken by a student from a department unrelated to Food Processing Technology. The supporting course other than Statistical Methods for Food Science shall be as decided by the Advisory committee of a student.
14. **"Thesis"** is one that consists of report of the research activity taken by the student and it includes introduction, review of literature, materials and methods and results and discussion.

15. "Credit hours" means the weekly unit of work. A lecture class of one hour per week shall be counted as one credit whereas a practical class of two to three hours duration.

16. "Internal examination" is an examination conducted thrice at various points of time of the semester by the course teacher concerned for theory and ~~once mid-semester for practical.~~ *once around 55th day*

17. "Semester final examination" is a University examination comprising of a theory and practical examinations separately conducted by the University at the end of each semester.

16 17. "Grade point" of a course" It is a value obtained by dividing the total marks obtained in a course (X) by maximum marks allotted to that course (Y) and multiplied by 10 ($GP = X/Y * 10$). 2.

19 18. "Credit point of course" It is the product of credit hours and grade point obtained by the student in a course.

20 19. "Grade point average" It is the quotient of the total credit points obtained by a student both in theory and practical of various courses including research credits at the end of each semester divided by the total credit hours taken by him / her in that semester. The grading is done on a ten-point scale. 3.

21 20. "Overall grade point average" is the quotient of cumulative credit points obtained by a student in all the courses including research credits both in theory and practical taken by him / her from the beginning of the first semester of the degree course divided by the total credit hours of all the courses which he / she had completed up to the end of a specified semester from the first year. It determines

the overall performance of a student in all courses taken during a period covering more than an academic year.

21. "Advisory committee" means a committee of qualified staff to guide the student during the entire duration of study.

22. "Transcript" means a copy of the consolidated report of marks secured by the student and issued by the University.

3 Description

The degree course of M.Tech(FPT) shall comprise of a course of study consisting of curriculum and syllabus provided in these regulations spread over a minimum of two academic years including compulsory four to six weeks training (preferably during semester break) in a reputed food industry/organization after completion of major courses and a compulsory submission of thesis.

4. Admissions - The admission to the M.Tech degree course shall be made in the beginning of the first semester of the academic year and shall be in accordance with the regulations laid drawn from time to time by the University and State Government. For admission to the M.Tech (FPT) degree course, Four years degree programme in Food Processing Technology / Food Technology/ Food Engineering/ Dairy Technology or equivalent Engineering or technology course from a recognised University is a must.

5. Fees - The fees for application, semester fees, special fees, examination fees and other fees shall be as prescribed by the University from time to time.

6. Advisory system - The students on their admission shall be put under an advisory committee and this committee is responsible for guiding the student in carrying out his/her academic programme.

(1) **Composition** - The advisory committee for M.Tech (FPT) degree candidate shall comprise of a total of three members including a Chairman. Out of them, two members including the Chairman should be from the subject in which the student is majoring and one member should be from the minor subjects.

(2) **Formation of advisory committee** - The proposal for formation of advisory committee in the prescribed proforma should be submitted to the Faculty Dean within 90 days from the commencement of the first semester. The Head of the Department in consultation with the Dean of the college concerned will form the Advisory Committee and send it to the Faculty Dean for approval.

(3) **Duties and responsibilities** - The advisory committee shall guide the student in the choice of courses in the minor and supporting subjects, in the selection of research problem for thesis and in all other matters relating to students' academic activities. The advisory committee is also responsible for fixing the programme of course work, research work, evaluation of research credits, finalisation of thesis draft and conduct of comprehensive qualifying and final viva-voce examinations. However, the Chairman of the advisory committee is fully responsible for the academic performance of the candidate including selection of research topic. The head of department will co-ordinate the academic activities and monitor the progress of the student to ensure the successful completion of the programme by the student.

(4) **Change of advisory committee** - The advisory committee once formed shall not be changed normally till the student completes the programme. However, the change of chairman and members shall be permissible only on grounds of transfer, retirement, resignation or instances where continuous absence of the chairman and members exceeding six months. In such instances the

head of the department shall send the proposal for change of advisory committee clearly stating the reasons to the Faculty Dean for approval. In circumstances where the student requires only a short duration for completion of the programme (i.e. less than one semester) and the chairman / member is retiring or on transfer and if the chairman / member expresses his/her willingness to continue as chairman / member, the same may be permitted by the Faculty Dean under intimation to the University. In such cases, the head of the department shall send necessary proposal. Under extraordinary circumstances in which the chairman is not available and an imminent academic activity has to be carried out, the Dean of the college concerned can nominate the Head of the department / any other member in the advisory committee to act as Chairman under intimation to the University till the advisory committee is reconstituted. In the event of the HOD acting as Chairman and not available within this period, the Dean of the College concerned can act as Chairman and conduct evaluation.

(5) **Eligibility for being chairman / member of advisory committee** - For being chairman of advisory committee of M.Tech programme, he/she should be a recognised PG teacher by the University.

(6) **Limit for being chairman of advisory committee** - Normally no individual should be chairman for more than three advisory committees at any point of time. However, under extraordinary circumstances, where sufficient numbers of PG teachers / PG guides are not available, the University with recommendation of the Faculty Dean may permit an individual to exceed the limit.

(7) **Recognition of PG teacher / guide** - The concerned Faculty Dean normally recognises PG teachers for offering courses and for guiding research students. The recognised teachers shall offer courses as required by the concerned HOD. Normally such courses

should be on their own field of specialisations unless extraordinary circumstances demand offering other course. All the PG teachers are competent to guide M.Tech Students in their research work in their own field of specialisation.

(a) Eligibility for PG guide: Ph.D. degree holders with not less than three years of active experience in the field after completing their Ph.D.

(b) Eligibility of PG teacher: Professors, Associate Professors and Assistant Professors having Ph.D. and three years of service after acquiring Ph.D., or Master's degree and ten years of service are eligible for PG teacher.

(1) The HODs should send necessary proposals for recognition of PG teacher / guide along with a letter of interest from the concerned individuals to be PG teacher / guide to the Faculty Dean through the Dean of the College concerned. All staff may be given the PG teacher / guide recognition once they satisfy the eligibility conditions. However, under extraordinary circumstances, the Faculty Dean may use his discretionary power to recognise individuals as PG teachers and PG guides on need basis. However, this is permissible only on situation where sufficient numbers of qualified teachers are not available to be recognised as PG teacher / PG guide.

7. Registration –

Registration for the first time in the University.-: Students who have received notification of admission from the University will receive on arrival guidelines for registration from the Dean of the respective colleges. A registration programme will be conducted by the Dean of the College for the

benefit of the students joining the University for the first time. **Attendance in respect of fresh students for the first semester shall be reckoned from the first day of the commencement of registration. However, only for the students who are registering late due to late admission, attendance shall be reckoned from the date of their registration and this is only for the first semester of the first year PG programme. The registration will be done in person and failure to register for the first semester before nominated date shall result in forfeiture of admission.**

(1) **Subsequent Registration** - At the beginning of each semester there will be registration for various courses listed under a subject. The students shall have to register for the set of courses and /or research credits with the guidance of the advisory committee.

(2) The payment of fees and other arrears due to the college, Department, Hostel, Library, etc., shall precede the commencement of each semester. The students shall be allowed to register for the semester only after payment of fees and production of clearance certificates from hostel, library and such other places.

(3) The students including new entrants shall register the requisite courses in the beginning of each semester within thirteen working days, the first two working days without fine and the remaining eleven working days with fine as decided by the University from time to time. The attendance will however be reckoned from the day the instruction commences as per the academic calendar (i.e. second day of registration week).

(4) **Preparation of time-table** - The timetable for a semester should be prepared by the head of the concerned department in consultation with course teachers of the semester. The time table should be approved by the Dean of the College concerned before release.

(5) **Lecture and Practical schedule** - At the commencement of a semester, the lecture and practical schedule should be drawn for a course by the course teacher and concerned head of the department and circulated to the students with a copy to the Dean. The instruction should strictly adhere to the schedule.

8. Residential requirement

(1) **Duration** - The minimum duration for the Masters programme shall be four semesters and maximum shall be eight semesters.

(2) **Temporary discontinuance** - All M.Tech students are expected to complete the programme without any break. However, temporary discontinuance is permitted on extraordinary circumstances only after the student successfully completes the comprehensive qualifying examination. No student should temporarily discontinue the course without the prior permission of the Dean of the college. Students who have discontinued temporarily may be permitted by the University to re-join within four semesters the date of leaving the college. The students should send permission letter for re-joining well in advance through the Dean of the College concerned. However, the student should complete his/her graduation requirement within the maximum duration of 8 semesters from the date of first admission. Any student who fails to complete graduation requirements within the maximum permissible period is not entitled for obtaining the degree. When a student leaves the College taking T.C. he/she shall not be eligible for readmission.

(3) **Minimum credit requirement** - The minimum credit requirement shall be 55 excluding non-credit compulsory courses. This minimum limit can be exceeded by few credits at the maximum of 4, but should not be lowered in any case. The increase in credit is applicable only for course work. The distribution of credits into major, minor,

supporting, master's seminar and master's research is as follows. The minor courses are to be taken from a related department. The list of such related departments is as provided by the University from time to time. The supporting courses are to be taken from unrelated departments. Under the supporting courses a course on bio-statistics is compulsory for all postgraduate students. All the non-credit compulsory courses need to be registered by all masters students. The list of non-credit courses are identified by the University from time to time.

Course work	
Major	20
Minor	09
Supporting	05
Masters seminar	01
Sub-total	<u>35</u>
Thesis	20
Total	55

*lower req.
35 + 20 = 55*

(4) **Permissible workload for a semester** - The maximum permissible workload for any semester shall be 20. It does not include non-credit compulsory courses. The permissible work load shall be exceeded by few credits at the maximum of 2 credits per semester. It is applicable only for course work. The maximum permissible research credit shall be 15 per semester. The permissible workload for each semester for a student shall be decided by the advisory committee.

(5) **Credit transfer** - Transfer of course and research credits earned at another University is permissible provided they have studied the same course with same credit load. However, a committee constituted by the University consisting of the Faculty Dean, Controller of Examination and Professor & Head of the Department of the subject concerned may consider such requests and report to the University subject to following conditions.

(a) The courses shall not have been studied earlier than three years from the date of

admission of the students to the programme at this University.

(b) Credits to be transferred shall not however have been used for obtaining a degree / diploma elsewhere.

(6) Attendance Requirements - Every student shall ordinarily attend all classes in a course. However a minimum prescribed attendance in a course shall be 80%. The minimum limit of attendance shall be reckoned for theory and practical separately, for a full period of one semester of study before he/she is eligible for appearing in the final semester examination. A student who fails to put in the minimum attendance either in theory or practical shall not be permitted to appear for the final semester examinations and his/her registration for that paper shall be treated as cancelled. Such of those courses should be reregistered by the student. Dean may depute students on the recommendations of the Vice-President of Student Association / Sports Council Chairman, to represent the College/ University at various functions such as Sports, N.S.S, Medical Aid, etc. and the mandatory minimum requirement of attendance under these circumstances is 75% provided; the Dean is informed well ahead of time at least 2 weeks earlier. However, under no circumstances, absence even on University business, students having less than 75% of attendance in theory and practical together shall be permitted to take the examinations; such of these students shall repeat the course and complete the same, when the course is offered in the subsequent semesters. The Dean should ensure in ordinary circumstances that no student is officially deputed for University purposes so that he/she fails to secure the 75% attendance. A student who fails to put in a minimum requirement of 80% attendance because of sickness, the mandatory minimum may be reduced to 75% on the basis of medical certificate for hospitalisation obtained from a medical officer of Government Hospital or a private

nursing home. The attendance should be maintained by the course teacher and the attendance register should be kept in safe custody by the Head of the Department and the certificate to this effect shall be sent to the University along with attendance in prescribed proforma sufficiently early, to issue hall ticket for semester final examination. Hall Ticket will be issued by the Controller of Examination, based on the prescribed application from the candidate duly filled in and attendance certificate from the Dean. The attendance particulars should reach the Controller of Examination at least 3 days prior to issue of Hall Ticket.

(a) No student will be issued with a hall ticket unless they produce clearance certificate from the competent authority of accounts of Hostel administration.

(b) If a student admitted in the 1st year and does not register the course of first semester or having registered, failed to put in 80% attendance in all the courses, his/her admission stands cancelled, if no prior permission is obtained from the Dean of the College. He/she shall forfeit the admission to the course. However, on seeking re-admission he/she has to undergo the normal admission procedure as a fresh candidate.

(7) Calculation of attendance for a course - Normally the number of classes conducted is calculated by the course teacher from the first working day (i.e. the second day of registration week as per the time table) to the last working day.

(a) Theory class: Number of classes conducted by course teacher from the first working day i.e. the second day of registration week as per the timetable, to the last theory class of the semester.

(b) Practical class: Number of classes conducted by course teacher from the first working day i.e. the second day of registration

week as per the time table, to the last practical class of the semester.

9. Evaluation / Examination - The detailed guidelines for the conduct of examination, internal and final evaluation, comprehensive qualifying examination, research credit evaluation, grading, recording, preparation of Mark lists, transcripts etc. circulated from time to time by the University shall be followed. The schedule of examinations shall consist of internal and final examination in a semester for course work and a research credit evaluation while doing research.

(1) **Internal evaluation:** Internal evaluation may be carried out only for theory by a continuous assessment for a maximum of 20 marks. The course teacher shall conduct three tests of one hour duration each carrying 40 marks during various time points in a semester. The total marks obtained in all the tests put together out of 120 shall be prepared and reduced to 20 marks and rounded to nearest integer.

(2) **Final semester evaluation** - It shall be a University examination comprising of theory and practical examinations separately conducted at the end of a semester. The theory examination shall be for duration of two hours for seventy marks (70) and practical examination shall be for fifty (50) marks. The question paper for theory examination shall be set by the external examiners. The practical examination shall be conducted on the last practical class of the semester. The practical examination shall be conducted by the course teacher and one more teacher nominated by the head of the department concerned. The distribution of practical mark shall be as follows

Record / Project work	- 10
Practical	- 30
Viva-voce	- 10

(3) **Term paper** - A term paper may be given for each course and it may be evaluated for a maximum of ten (10) marks. The detailed

guide lines for topic of term paper, evaluation and its presentation etc. circulated from time to time by the Dean and the University shall be followed.

(4) **Distribution of marks for calculation of grade point of a course** - The distribution of marks for calculation of grade point of a course is as follows:

(a) Course with theory & practical

Internal evaluation	<u>20</u>
Final examination	<u>70</u>
Practical	<u>50</u>
Term paper	<u>10</u>
Total	150

(b) Course with theory alone

Internal evaluation	20
Final examination	70
Term paper	10
Total	100

(c) Course with practical alone

Record/Term paper / Project work	20
Practical	60
Viva-voce	20
Total	100

(5) **Re-examination** - There shall be no supplementary examination for internal or semester final examinations for students absenting themselves due to any reason. The students who absent themselves for internal evaluation may be allowed to write final semester examination by foregoing the 20 marks specified for internal evaluation.

(6) **Withdrawal of examination:** A candidate may for valid reasons be granted permission by the Dean to withdraw from examination in any course or courses of any semester examination. Withdrawal of application shall be valid only if the candidate is otherwise eligible to write the examination and if it is made before the last date for submission of application form for University Semester Examination. Withdrawal shall not be

considered for the appearance for eligibility of a candidate for first class with distinction. Withdrawal from examination is not a matter of right for the student and the reason is subject to verification by the Dean of the College

(7) Comprehensive qualifying examination (CQE) - This is a mandatory examination to be taken by all students after completion of 60% of major and supporting courses separately. Normally it shall be conducted after second semester. The students should not be permitted to register for more than five research credits before successful completion of CQE. The details of conduct of CQE, evaluation details and method of conduct of viva-voce shall be as per the guidelines issued by the Dean and University from time to time. The question paper for CQE shall be set by the external examiner. However, the evaluation of answer books and conduct of viva-voce shall be by the advisory committee alone. The results for CQE shall be graded as Satisfactory / unsatisfactory. The qualifying mark for "satisfactory" shall be 60%. In case of unsatisfactory performance, the student has to reappear for the CQE after 3 months and such re-appearances are restricted to two. In total, the appearances are restricted to three. In such case, the student has to re-register for the programme.

(8) Evaluation of master's seminars - The masters seminar is mandatory for all students with a credit load of 1+0. The advisory committee should assign the seminar topics during the beginning of a semester. The students are expected to prepare a seminar paper after carefully reviewing the literatures and such other materials. The advisory committee shall evaluate the performance of the seminar credits registered by the students during the semester at the end of semester. The evaluation should be conducted during the last fortnight of the semester when all the members of the advisory committee are available. Normally the students are not

expected to absent themselves for seminar credit evaluation. Under extraordinary circumstances a late evaluation within ten working days from the last working day of the semester may be permitted by the Dean of the College concerned on payment of a fine as decided by the University from time to time. In circumstances, where a member of the advisory committee may not be available necessary permission has to be obtained for conduct of evaluation in the absence of one member from the Dean of the College concerned. If more than one member may not be available permission has to be obtained from the University. In circumstances where the chairman is not available for evaluation, late evaluation may be permitted by the Dean within ten working days from the last working day. In extraordinary circumstances where the chairman may not be available even within this period, the head of department can act as chairman after obtaining permission from the Dean of the College concerned. In the event of HOD acting as Chairman and not available within this period, the Dean/nominee of the Dean can act as Chairman and conduct evaluation. The performance of the student should be evaluated by the advisory committee as per the following norms;

Coverage of literature	40%
Presentation	30%
Use of AV aids	10%
Capacity to participate in the discussion	20%

A time schedule regarding the conduct of seminar has to be prepared by the chairman and the same has to be communicated to the respective individuals and advisory committee well in advance. In case of failure, the student has to re-register the credit in the subsequent semester.

(9) Evaluation of research credit - The performance of the research credit registered by the students during the semester shall be evaluated by the advisory committee at the

end of each semester preferably during the last week of semester by the advisory committee. The evaluation should be conducted by all members of the advisory committee. Except the semester in which the student is submitting the thesis, the evaluation of the research credit may be done by the advisory committee on a convenient day during last week of semester in which all members are present on completion of mandatory attendance limit and 100 per cent completion of work committed to do at the beginning of the semester by the student. However, the research credit evaluation and submission of thesis in the last semester should be done on the last working day only. In case of unsatisfactory performance a grade of 'Incomplete' shall be awarded and the student has to re-register for the same block of research credit again in the subsequent semester. The student has to get the permission of Dean of the College concerned for re-registration of incomplete research credits. In case of re-registration of same block of research credit after second time, the matter may be referred to the Deans committee and the University. Normally the students are not expected to absent themselves for research credit evaluation. Under extraordinary circumstances a late evaluation within ten working days from the last working day of the semester may be permitted by the Dean of the College concerned on payment of a fine as decided by the University from time to time. However, it is the prerogative of the Dean to decide whether, the circumstances for late evaluation stated by the student really warrants it. In case of wilful absence, the advisory committee in consultation with Dean of the College concerned may award incomplete grade. Normally all members of the advisory committee should present themselves for evaluation of research credit. Under extraordinary circumstances, in which a member of the advisory committee may not

be available necessary permission has to be obtained for conduct of evaluation in the absence of one member from the Dean of the College concerned. If more than one member may not be available permission has to be obtained from the University. In circumstances where the chairman is not available for evaluation, a late evaluation may be permitted by the Dean within ten working days from the last working day. In extraordinary circumstances where the chairman may not be available even within this period, the head of department can act as chairman after obtaining permission from the Dean of the College concerned. In the event of HOD acting as Chairman and not available within this period, the Dean/ nominee of the Dean can act as Chairman and conduct evaluation. If a student has not got mandatory attendance limit of 80%, a grade of incomplete may be awarded and the student has to re-register for the same block of research credit again in the subsequent semester. The student has to get the permission of Dean of the College concerned for re-registration of incomplete research credits. In case of re-registration of same block of research credit after second time, the matter may be referred to the Dean's committee and University.

(10) Final viva-voce examination - On the basis of recommendation for acceptance of thesis, the University shall forward the reports of the external examiner to the chairman of the advisory committee for conducting final viva-voce examination for students. The thesis shall be sent to one external. The final viva-voce shall be conducted by the advisory committee based on the report of the external examiner for master's programme.. The details and method of conduct of final viva-voce shall be as per the guidelines issued by the Dean and University from time to time. The date for final viva-voce should be fixed by the chairman taking into account the availability of all members of the advisory

committee after verifying the fact regarding carrying out corrections and suggestions specified by the external examiners. Normally all the members of the advisory committee should be present for final viva-voce. In case of extra-ordinary circumstances where a single member may not be available, necessary permission has to be obtained from the Dean of the College concerned. If more than one member may not be available the final viva-voce examination has to be postponed. In circumstances, where the chairman may not be available for a sufficiently longer duration for the conduct of final viva-voce, the Dean of the College concerned may nominate a panel of three suitable persons from the discipline in which the student is majoring to the University and the person selected by the University may act as chairman for the conduct of final viva-voce examination. During the final viva-voce the candidate shall defend the thesis in front of advisory committee, invited staff, students and external expert. The degree shall be awarded on the unanimous recommendation of the examining committee in regard to the thesis itself and the performance of the student in the final viva-voce examination. The performance shall be evaluated as satisfactory/unsatisfactory. The opinion of the majority members shall be taken into account. If difference of opinion arises between members, in such case Chairman of advisory committee's decision shall be the final. In case of failure the student has to reappear for viva-voce examination after three months.

(11) **Unfair means during examinations** - The Dean of the College shall be responsible for dealing with all cases of "Use of unfair means" in the various examinations. The phrase, "Use of Unfair means" includes possession of any information or material by the student, talking to other students, copying from other students or from printed or written material etc. The Invigilator concerned, on finding the use of unfair means by any student may take

the answer scripts of the student and the material evidence, if any, and the explanation from the student. The student may also be sent out of the examination hall immediately. The Invigilator concerned shall report each case of unfair means direct to the Dean immediately with full details of the incident, answer scripts, the available evidence and explanation of the concerned student, if any. The Dean, on receipt of the report, may give an opportunity to the concerned student to represent his case. Considering all the available evidence, the Dean shall take appropriate action immediately. The penalty shall be as indicated below.

(a) A student found using unfair means during an internal examination should be deemed to have failed in that course.

(b) A student found using unfair means during the semester final examination should be deemed to have failed that course. In such case, the student shall not be permitted to take the remaining examinations, if any, in that semester and shall also be deemed to have attempted and failed in the remaining examinations.

(c) The Dean shall report each case falling under (a) and (b) above immediately, after passing orders to the University.

(d) For using unfair means of a serious nature such as ignoring the repeated instructions of Invigilator or abusing or threatening or assaulting the Invigilator, warranting higher penalties than those indicated in clauses (a) and (b) above, the Dean, besides treating the students as failed in all the courses he registered in that semester, may further debar the student for the next semester and succeeding year and the fact informed to the University. If further or more severe punishment is felt necessary, the Dean shall immediately inform the University about the full details of each together with all the material evidence, if any, and his recommendation. The explanation or

representation of the student, if any, may also be sent. The Vice-Chancellor after examining the case, may debar the student for further period or permanently. The decision of the Vice-Chancellor is final.

(e) The parent or the guardian of the student concerned shall be informed of any punishment awarded to the student and the reason therefor.

(12) **Scrutiny of Grades** - The student may apply to the Registrar through the Dean of the College concerned for reevaluation of answer paper in the prescribed format not later than ten working days after declaration of the results / issue of report cards to the students. The fee for the same shall be decided by the University from time to time.

10. Thesis

(1) The thesis should consist of five major sections namely introduction, review of literature, materials and methods, results and discussion. The thesis should be of such a nature as to indicate the student's potentialities for conducting research.

(2) **Topic** - The thesis shall be on a topic falling within the field of the major subjects and shall be the result of the independent work of the students.

(3) **Change of topic** - The topic once chosen and approved for research credit evaluation should not be normally changed. However, in extraordinary circumstances where such a change is warranted it should be done before completion of five research credits. On the recommendation of the advisory committee, such changes can be approved by the Faculty Dean. It is the prerogative of the advisory committee to decide on the proportionate retention within the registered / completed research credits. No changes in the area of the research will be approved once the student completes 5 research credits. In such cases where a change in area of research is warranted after the completion of 5 credits

the student has to reregister for the entire block of research credits.

(4) **Change of title** - The title given in the synopsis shall be taken as final title and title given at the time of approval of the programme of research shall be taken as tentative. However, change in the area of research and objectives are subject to modifications as specified in 10(3).

(5) **Synopsis** - The submission of thesis should be preceded by submission of synopsis to the University between 55 and 60th day of the semester. The synopsis should not exceed ten pages and should consist of brief report of the work done. The synopsis should be accompanied by a sealed cover consisting of a panel of five experts for the University to select external expert(s) for evaluation. The approved programme of research work should also be furnished along with the synopsis.

(6) **Pages** - The number of pages for a M.Tech thesis should not exceed 125. The page number includes pages containing plates, graphs and tables. The annexures need not be included in the page numbers.

(7) **Submission** - The thesis should be submitted only on the last working day of the semester. 2 copies of thesis should be submitted in paper back. After its final approval and after incorporating the suggestions of examiners if any, 5 copies (6 copies for ICAR fellowship holders) of thesis should be bound and be submitted to the University. It should be hard bound only after completion of final viva-voce and carrying out the corrections suggested by the external experts.

(8) **Late submission** - The students should submit thesis on the last working day of the final semester. The students who could not submit their thesis on the last working day should not be evaluated for the research credits. However, students failing to submit the thesis on the last working day, shall

submit the thesis during any time in the extended semester after paying a fee as decided by the University from time to time as late fee for thesis submission. In this case, a proposal should be sent by the Advisory Committee to University through Dean of the College concerned for permission for submission of thesis at any time during the extended semester. In circumstances where a student is not able to submit even after the extended period, the grade "incomplete" may be given and the block of research credit has to be reregistered. However, in circumstances where the student is ready with the thesis but the chairman or more than one advisory committee members are not available on last day of the semester, the Dean of the College concerned may decide the date of submission and evaluation under intimation to the University.

(9) **Publications** - The students are allowed to publish their work even before submitting the thesis. The copies of such publication should be enclosed with thesis while submission. The manuscripts of research papers should be submitted along with the thesis during final submission. One research paper should have been accepted in referred and second submitted or one patent filed at the time of submission of thesis,

(10) Rejection of M.Tech thesis - The M.Tech thesis rejected by one external expert may be sent to another external expert in the panel on the request of the advisory committee for an independent judgement. If the second expert also rejects the thesis, the thesis is considered as rejected and the student has to resubmit the thesis after a gap of one semester doing necessary work and corrections. In case of varied opinion, a committee constituted by the University shall decide on the merit of the thesis for award of degree. In case of rejection for the second time the student has to reregister for the entire block of research credits.

(11) **Final submission** - After the conduct of the final viva-voce, the Chairman of the advisory committee should forward the hardbound thesis along with a certificate for carrying out corrections suggested by the external experts for award of the degree.

11. Academic Status and Scholastic Deficiencies

(1) A student shall secure a OGPA of 6.5 to continue and to obtain degree. The minimum passing grade in a course shall be 6.0 separately in theory and practical.

(2) The failed students shall reappear for the failed courses as and when the examinations are conducted by the University.

(3) Those candidates who have passed a course but fail to secure OGPA of 6.5 shall appear for re-examination of course(s) in which he has scored less, as and when conducted by the University.

12. Year of standing - The year of standing of a student shall be determined solely on the basis of his/her completion of prescribed number of credit hours successfully.

13 ① **Graduation requirements** - The student shall satisfy minimum residential requirement as specified earlier with submission of a thesis.

14 ② **Requirements for M.Tech degree**

(1) A student undergoing course of study leading to award of M.Tech shall pass the course and complete the minimum number of credit hours prescribed therefor, by the Academic Council from time to time by obtaining a minimum OGPA of 6.5 in the 10 point scale along with a successful submission of thesis.

(2) The University shall issue a provisional course completion certificate on passing all final semester examination with successful final submission of thesis.

15. **Student responsibility**- All M.Tech students studying in this University are

expected to know the requirements for the award of M.Tech degree and general academic requirements and assume full responsibility for meeting them. They are expected to keep constantly in touch with their advisory committee so that the latter may watch their progress and guide them along right lines. In no case a regulation will be waived or exemption made simply because a student pleads ignorance to it.

16. Record of Courses- To ensure that requirements for the award of degree have been completed by a student, the University shall keep a record of courses completed by the student. A copy of the same shall be maintained by the Dean of the College concerned.

17. Authorities to approve results and issues pass certificates, transcripts, etc. - The Vice-Chancellor shall approve the results on the recommendation of the Board of examination and Registrar shall issue the provisional pass certificates, transcripts etc. to the candidate.

18. Award of Degree - A Degree under the seal of the University and duly signed by the Officers authorized in this behalf shall be presented at a Convocation to each candidate who has successfully completed the graduation requirements. The award of Degrees of the candidates, who have successfully completed the graduation requirements for the award at convocation in absentia, shall be sent by post. The degree shall set forth the name of the candidate, father's name, degree, month and year of successful completion of the graduation requirements, etc.

19. Amending or Cancellation of results - If the result of a candidate is discovered to be vitiated by error, malpractice, fraud, improper conduct or any other reasons, the Vice-Chancellor shall have the powers to amend the result in such a manner as to accord with the true position, and to make such declaration as the Vice-Chancellor may deem

necessary in that behalf. If it is found that the result of a candidate has been vitiated by malpractices, fraud or other improper conduct whereby he/she has been benefited and that he/she has in the opinion of the Vice-Chancellor, be a party to or conceived at the malpractice, fraud or improper conduct, the Vice-Chancellor shall have the power at any time, notwithstanding the award of a diploma or a Certificate or prize or a scholarship, to amend the result of such candidate and to make such declaration as the Vice-Chancellor may deem necessary in that behalf, including debarring of the candidate from the University for such a period as may be specified and the cancellation of the result of the candidate in such a manner as the Vice-Chancellor may decide.

20. Removal of doubt - In case of any difficulty arises in giving effect to the provisions of these regulations, the Vice-Chancellor as per Statute 29 on recommendation of Academic Council may pass such orders as are necessary for the purpose of removing the difficulty