

Master of Food Technology and Bio-Chemical Engineering

FIRST YEAR FIRST SEMESTER

Subject	Pds/Week			Marks	
	L	P	S	Exam	Sessional
One paper from basic Subject	3	0	0	100	
One paper from Departmental core subjects	3	0	0	100	
One paper from Interdisciplinary Core subjects of other departments/ Departmental Core subjects	3	0	0	100	
Three papers from field of study/ Specialization	3x3	0	0	3x100	
Laboratory – I	0	4	0		100
Assignment- I	0	4	0		100
Seminar	0	4	0		0
Sub: - Total	18	12	0	600	200
Total	30			800	

FIRST YEAR SECOND SEMESTER

Subject	Pds/Week			Marks	
	L	P	S	Exam	Sessional
Four papers from Field of Study / Specialization	4x3	0	0	4x100	

Assignment – II	0	4	0		100
Term Paper Leading to Thesis	0	6	0		100
Seminar (Report+viva)	0	4	0		200
Sub- Total	12	14	0	400	400
Total	26			800	

Basic Core Subjects

Course No	Subject	To be offered by
PG/T/BC/Math/01	Advanced Mathematics	Mathematics Dept.
PG/T/BC/Prod./E/02	Operation Research	Production Engg. Dept
PG/T/BC/IEE/04	Instrumentation & Measurement Techniques	Instrumentation & Electronic Engg. Dept
PG/T/BC/Civil-Chem/05	Environmental Management & Ecology	Civil Engg. Dept & Chemical Engg. Dept.
PG/T/BC/SOES/06	Energy Systems & Management	School of Energy Studies
PG/T/BC/FTBE-Pharm. Tech./08	Adv. Fermentation Tech	FTBE Dept. & Pharm. Tech. Dept. FTBE. Dept.
PG/T/BC/FTBE/09	Bio-Process Engg	FTBE. Dept.
PG/T/BC/CSE/07	Information Systems	Computer Science
PG/T/BC/ME/01	Industrial Pollution & Control	Mechanical Engineering
PG/T/BC/ME/02	Safety Engineering	Mechanical Engineering

Interdisciplinary Core Subjects

Course No	Subject	To be offered by
PG/T/DC-Int/CE/06	Environmental Pollution & Management	Civil Engg.
PG/T/FS/MTRL/02	Materials Science.	Metallurgical Engg.
PG/T/INT/ME/04	Optimisation Techniques for Engineers	Mechanical Engg.
PG/T/INT/ME/06	Quantitative Methods for Engineers	Mechanical Engg.
PG/T/DC-INT/ChE/31	Advanced Numerical Methods	Chemical Engg.

Basic Core Subjects to be offered by the department

Course No	Subject	To be offered by
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PG/T/BC/FTBE-Pharm. Tech./08	Adv. Fermentation Tech	FTBE Dept. & Pharm. Tech. Dept.
PG/T/BC/FTBE/09	Bio-Process Engg.	FTBE. Dept

Interdisciplinary Core Subjects to be offered by the department Nil

Areas of Specialisation

Food Technology

Bio-Chemical Engg.

Subjects from Field of Study / Area of Specialisation

First Semester

Course No	Subject
PG/T/FTBE/1	Adv. Food Technology & Nutrition
PG/T/FTBE/2	Adv. Biochemical Engg.
PG/T/FTBE/3	Adv. Food Bio-Technology

Second Semester

Course No	Subject
PG/T/FTBE/8	Dairy Engineering
PG/T/FTBE/9	Cereal Process Engineering
PG/T/FTBE/10	Advanced Protein Technology
PG/T/FTBE/11	Advanced Enzyme Engineering and Technology
PG/T/FTBE/12	Modern separation and purification processes

PG/T/FTBE/13	Cryogenics
PG/T/FTBE/14	Entrepreneurship Development Programme

Food Technology & Bio-Chemical Engineering

PG/T/FTBE /1 – Advanced Food Technology & Nutrition

Recent advances in Food Technology on different Techniques of food preservation including thermal processing dehydration low temperature and CA storage, irradiation, fermentation, control of water activity and food additives.

Food flavour and flavour evaluation. Colour of Food and colour measurement. Rheological properties of foods.

Studies of various packaging materials. Enrichment and fortification of food. By-products utilisation.

Role of different constituents of foods in human nutrition. Problems on human nutrition in India. Determination of nutritional status of individuals. Different approaches to solve nutritional in India. Determination of nutritional status of individuals. Different approaches to solve nutritional problems.

PG/T/FTBE /2 Advanced Biochemical Engg.

Recent advances in Enzyme Engineering. Fermentation kinetics. Recent advances in sterilisation practice.

Transport phenomenon in microbial system. Design and analysis of biological reactors. Recent advances in waste water Engineering. Advances in continuous fermentation. Mechanical separation and disintegration of cells.

PG/T/FTBE /3 Advanced Food Biotechnology

Perishability of food and general principles of preservation. Advances in preservation of Food by various biotechnological processes. Technology on fermented foods for fruits, vegetables, cereals, legumes, milk, meat, fish etc. Role of lactic acid bacteria on preservation of food items. Extraction and clarification of fruit/vegetable juice by enzymes. Fermentative production of enzymes like amylase, proteases, pectinase, glucose isomerase, glucose oxidase cellulase, xylanase, lipases etc. Purification of enzymes by downstream processing. Production of alcohol, lactic acid and acetic acid from various food materials. Bacteriocin production and uses in food preservation, Biotechnological

processes for manufacture of functional foods: nutraceuticals and probiotics. Biotechnological process for food fortification, prebiotics & oligosaccharides. Treatment of waste from food industries by biotechnological application. Improvement of quality of food by biotechnological processes.

PG/T/FTBE /4 Advanced Microbial Technology

Morphology and physiology of industrial microorganisms (Bacteria, yeasts, molds and actinomycetes). Isolation : identification and quantitative estimation of microorganisms, Microbiological assay in Microbial nutrition. Genetics of some industrial microorganisms, Microbiology of soil, Selection, development and maintenance of cultures.

Chemistry and biosynthesis of microbial products e.g. vitamins, amino acids, enzymes, steroids, antibiotics and polymers. Metabolic regulations in industrial fermentation. Microbial transformation of alkanes, alkaloids, terpenes, aromatic compounds and naturally occurring polymers. Microbial food production. Spoilage microorganisms in foods and their control. Applied microbiology in animal nutrition. Mycotoxins Microbial insecticides.

PG/T/FTBE /5 Fermenter design, control and optimisation

1. Different types of fermenters in use and operation.
2. Aseptic operation of fermenters
3. Probes for D.O., pH, temp, substrates etc. used for fermenters.
4. Power requirement in fermenters.
5. O₂ Supply and demand in microbiological processes. Single and multiple bubble aeration. Design of spargers and aeration equipment. O₂ transfer in fermentation broth and scale up.
6. Factors that determine the choice of material of construction.
7. Automatic control of a fermenter with the help of microprocessor.

PG/T/FTBE/6 ADVANCED FOOD PROCESS ENGINEERING

General methods of preservation of food. Thermal processing of food- canning, pasteurization, sterilization. Design of various sterilizers for food processing, aseptic sterilization, Plate heat exchanger, Evaluation of process time in canning. Cold storage, modified and controlled atmospheric storage. MAP, MAC systems. Design of storage units, freezing system in food, slow and quick-freezing. Different freezers used in food industry including cryogenic freezing system. Modern design used in food industry including freeze drying, spray drying. Microwave processing of food. High-pressure sterilization. Extrusion technology- single & twin screw system. Super critical fluid extraction technology. Freeze concentration, Homogenization Membrane separation process, Reverse osmosis. Purification of component by crystallization, filtration, centrifugation. Modern techniques of processing of food, Quality control.

PG/T/FTBE /7 Advanced Fruit and Vegetable Technology

General introduction. Application of recent advanced techniques of food preservation in fruits and vegetables. Low cost methods of preservation. Use of additives for various products development. Enzyme and its application. Controlled ripening.

Nutritional and biochemical changes during post harvest storage, processing and post process storage. Metal contaminants and pick up in stored processed products. Use of pesticides in fields, its limit and identification. Processing equipment. Measurement of colour and texture. Characterisation, stimulation of fruit flavour, retention of flavour.

Legislation of processed fruit and vegetable products. Analysis and detection of contaminants and adulterants and quality control; . Factory sanitation and hygiene. Microbiology of fresh and processed products and its control.

Packaging. Waste utilisation.

PG/T/FTBE /8 Dairy Engineering

1. Chemical composition of milk and effect on processing.
2. Continuous automated process of milk.
3. Applied biochemical kinetics of pasteurisation sterilisation of milk.
4. Equations related to transfer of mass, heat and momentum in milk and milk product processing.
5. Efficiency and dairy plant mechanisation.

6. Designing of dairy equipment.
7. Packaging of milk and milk products.
8. Critical path planning and management of dairy industry.

PG/T/FTBE /9 Cereal Process Engineering.

General chemistry of starch. Degradation products and starch derivatives. Use of starch in food.

World production and trade in grains, rice milling, rice products, rice based products.

Wheat milling and cleaning equipment, bulgur wheat, byproducts of wheat, macaroni. Fermented and leavened products of wheat, macaroni. Fermented and leavened products from wheat Testing of mill stocks by suitable equipment like amilograph farinograph etc. Corn milling, corn flour and other related products, break fast cereal and sugar containing process.

Snacks and fried products including potato, chips, corn chips, expanded snack products extrusion cooking of cereal based products. Milling of barley oats, rye, sorghum, millets etc. National and international standards of quality of various cereal at cereal products.

By-products utilisation of cereal process industry. Cereal based animal feed, wheat germ, corn oil. Storage of cereal grain. Insect infestation control measures. Detection of insect and rodent infestation of cereals.

PG/T/FTBE /10 Advanced Protein Technology

Amino acid composition and primary structure of proteins. Modified proteins. Protein hydration, protein solubility, ionic charge of protein, viscosity and diffusion of proteins in solution, flow birefringence, sedimentation equilibrium. Ultra centrifugation in protein mixture, spectroscopy, X-ray and electron microscopy in determining protein structure, Conformation of proteins in solution. Modern aspects of protein denaturation protein aggregates and gels. Chemistry of milk proteins, fish proteins, egg proteins, meat proteins, leaf proteins, protein stabilised food emulsions.

Protein interactions and degradation. Major protein system and factor affecting them. Biological effects of protein interactions. Functional properties of proteins. Adv. Technology of protein foods. New protein sources. Texturisation of plant proteins.

Application of unconventional proteins in protein foods.

Elective subjects in subsidiary/emerging fields – *Second Semester* 4-Th: pds/week

PG/T/FTBE/11 Advanced Enzyme Engineering & Technology

Large scale production and purification of biomolecules. Application of biocatalysts for new reactions and organic synthesis. (Immobilised enzymes and synzymes – Application in organic synthesis. Immobilisation of living microbial cells and transformation of steroids. Enzyme kinetics and mass transfer or two liquid phase, Heterogeneous systems. New immobilisation techniques of biomaterials and their application.

Industrial applications of immobilised biomaterials. Biomass conversion with energy production Analytical application of immobilised enzymes. Recent studies on Antibiotics and low molecular weight Enzyme inhibitor.

Medical application of enzyme technology

Genetic Engineering for enzyme production

Recent development and future aspects of enzyme Engineering.

PG/T/FTBE /12 Modern separation and purification processes

Fixed bed processes : Ion exchange , molecular sieve.

Membrane Techniques : Reverse osmosis, Ultra filtration, electrodialysis. Types of system design (a) continuous process (b) Batch process (c) feed and bleed process (d) Internally staged process.

i) Process based on chromatography : partition chromatography adsorption chromatography – ion exchange chromatography, Affinity chromatography.

ii) Diffusional process : Gaseous diffusion, Thermal diffusion.

iii) Electrophoresis, isoelectric focussing gel filtration.

iv) Alternative processes for alcohol recovery and purification.

v) a) solvent extraction b) A.D. little CO₂ extraction process c) vapour recompression system d) low temperature benign with gasoline e) dehydration f) molecular sieve adsorption g) membrane technology

PG/T/FTBE /13 Cryogenics

Introduction to general cryogenics. Physical and thermophysical properties of cryogenics. Manufacture of cryogenic fluids. Design and functioning of air separation plants. Recent developments in the manufacture of cryogenic fluids. Storage and transport of cryogenic fluids. Handling of cryogen. Design of such vessels. Application of Cryogenics in preservation of food biological materials, medicine and others.

PG/T/FTBE/14 Entrepreneurship Development Programme

Basic concept, purpose of the programme, target groups, opportunity identification and selection including process, preparation of personal profile and OS framework; Generation of ideas including natural resource, anticipated industries, market driven opportunities, service sector opportunities, modification of work-content and creative effort; errors in selection; options and the choice; Matter of judgement and faith in selection of business opportunity; Trainer job including major tasks, pre-EDP work, selection of resource persons; Networking and facilitating, Counseling and monitoring, Common issues; S & T graduates; Women entrepreneurs; Rehabilitates; Self employment seekers and disadvantaged groups; Need for information; Facilities and financial resources; Project preparation and feasibility studies; Production and trade statistics; Event management system; Motivation and aptitude development practice & fieldwork.

PG/T/BC/FTB-Pharm.Tech/08 : Advanced Fermentation Technology(For students of other department only)

Morphology and physiology of industrial microorganisms(Bacteria, Yeast & Actinomycetes) ; Microbial nutrition, Isolation, Preservation and improvement of industrial microorganisms, microbial growth kinetics, Sterilization processes. Different types of bioreactors, Oxygen supply and demand in aerobic fermentation, design of sparger, Aeration and agitation, Materials of construction. Determination of K_a , Rheology of fermentation broth.

Scale up of bioreactor. Production, Recovery and purification of different bio-chemical products & pharmaceutically important compounds like Penicillin, tetracycline, riboflavin, citric acid, dextran.

The microbiological transformation of steroids, General fermentation processes economics.

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PG/T/BC/FTBE/09: Bio-Process Engg(For students of other department only)

Introduction to biochemical and biotechnological processors.

Stoichiometric and thermodynamic aspects of microbial metabolism, cell cultivation, cell growth kinetics Immobilization techniques of cell. Bioreactor design and scale up.

Kinetics of enzymatic reactions, Immobilization techniques of enzymes.

Basic concepts of genetic engineering (gene cloning, definition of plasmid,) Reaction engineering kinetics of Recombinant cultures.

Transport phenomena in bioprocesses, Downstream processing and basic analytical techniques (Chromatography etc.) in bioprocesses. Structured and unstructured modeling of bioprocesses, Instrumentation and control of bioprocesses. Bioprocess economics.