DEPARTMENT OF TECHNOLOGY

FINAL YEAR B.TECH.

FOOD TECHNOLOGY

Scheme of Teaching and Examination
Semester – VII

Subject Code	Subject	Teaching Scheme (Hours / Week)				Examination Scheme (Marks)					
						Theory			Practical		
		L	T	P	Total	Scheme	Max. Marks	Minimum Marks for Passing	Scheme	Max. Marks	Minimum Marks for Passing
FT 411	Meat, Poultry and Fish Processing Technology	4	-	-	04	CIE	50	20	-----	----	----
						SEE	50	20	----	-----	-----
FT 412	Legume and Oilseed Technology	4	-	-	04	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
FT413	Waste Management of Food Industries	3	-	-	03	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
FT414	Food Biotechnology	4	-	-	04	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
FT415	Elective -I	3	-	-	03	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
FT 411	Meat, Poultry and Fish Technology Lab	-	-	2	02	--------	--------	--------	IOE	25	10
									EOE	25	10
FT 412	Legume and Oilseed Technology Lab	-	-	2	02	-------	-------	--------	IOE	25	10
									EPE	50	20
FT 416	# Industrial Training Report & * Seminar	-	-	2	02	--------	--------	--------	*IOE	50	20
									# EOE	25	10
FT413	Waste Management of Food Industries Lab	-	-	2	02	--------	--------	--------	IOE	25	10
									---	---	----
FT414	Food Biotechnology Lab	-	-	2	02	------	-----	-----	IOE	25	10
									----	-----	-------
FT417	Major Project Phase- I	-	-	4	04	-----	-----	----	IOE	50	20
									-----	------	------
	Total	**18**	**-**	**14**	**32**		**500**	**----**		**300**	**----**

Marks of Industrial Training Report will be evaluated by External Examiner based on viva & report (EOE : 25 Marks)
* Marks of Seminar will be evaluated by Internal Examiners Panel based on presentation and report. (IOE: 50 Marks)

Elective – I

1. Functional Foods & Nutraceuticals (FT 415.1)
2. Beverages Technology (FT 415.2)

CIE : Continuous Internal Evaluation

SEE : Semester End Examination

IPE : Internal Practical Evaluation

EPE : External Practical Evaluation

IOE : Internal Oral Evaluation

EOE : External Oral Evaluation

DEPARTMENT OF TECHNOLOGY
FINAL YEAR B.TECH

FOOD TECHNOLOGY

Scheme of Teaching and Examination
Semester – VIII

Subject Code	Subject	Teaching Scheme (Hours / Week)				Examination Scheme (Marks)					
						Theory			Practical		
		L	T	P	Total	Scheme	Max. Marks	Minimum Marks for Passing	Scheme	Max. marks	Minimum Marks for Passing
FT 421	Post Harvest Technology of Plantation Crops	4	-	-	04	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
FT422	Food Plant Design and Layout	4	-	-	04	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
FT 423	Industrial Economics and Management	3	-	-	03	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
FT 424	Design and Development of New Products	3	-	-	03	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
FT 425	Elective -II	4	-	-	04	CIE	50	20	--------	-------	--------
						SEE	50	20	--------	-------	--------
FT 424	Design and Development of New Products Lab	-	-	2	02	--------	-----	------	IPE	50	20
									EOE	25	10
FT 426	Major Project Phase- II	-	-	6	06	--------	--------	--------	IOE	50	20
									EOE	50	20
FT 421	Post Harvest Technology of Plantation Crops Lab	-	-	2	02	----	----	----	IOE	25	10
									EPE	50	20
FT427	Entrepreneurship Development for Food Technologists	2	-	-	02				IOE	50	20
									----	-----	-----
	Total	**20**		**10**	**30**		**500**	**----**		**300**	**-----**

Elective-II

1. Flavors Technology (FT 425.1)
2. Snack Foods Technology (FT 425.2)

CIE : Continuous Internal Evaluation

SEE : Semester End Examination

IPE : Internal Practical Evaluation

EPE : External Practical Evaluation

IOE : Internal Oral Evaluation

EOE : External Oral Evaluation

Detailed Examination Scheme

1. Out of total 100 theory marks, 50 marks are assigned for Continuous Internal Evaluation (CIE). In each subject, in CIE, minimum 20 marks are required to become eligible for Semester End Examination (SEE) of that particular subject. A student will be given an additional attempt to acquire passing marks in CIE. Upon failing to clear the CIE in the additional attempt, he/she will be allowed to appear for the Continuous Internal Evaluation scheme of the respective subject in the next semester. The tests will be conducted by the subject teacher. Only after passing the CIE, the particular student will become eligible for the Semester End Examination.
2. CIE (50 marks) includes:
   - Surprise Test – I of 10 marks in 4^{th} week
   - Mid Semester Test of 30 marks in 8^{th} week
   - Surprise Test - II of 10 marks in 12^{th} week

3. For the Semester End Examination (SEE), 100 marks (3 hrs.) paper will be set and finally it will be converted to 50 marks, in which student must secure minimum 40% i.e. 20 marks as university examination passing head.

4. Final theory marks (out of 100) will be the addition of CIE (out of 50 marks) and SEE (out of 50 marks).

5. IPE means Internal Practical Evaluation in which students have to demonstrate the practical work of his Project Topic as an internal examination at the term end.

6. IOE means Internal Oral Evaluation in which students have to face an internal oral examination at the term end. This examination is based on the practical work carried out by them throughout the year

7. EPE means External Practical Examination in which students have to demonstrate the practical work of his Project Topic as an external examination at the term end. It is as university passing head.

8. EOE means External Oral Examination in which students have to face an external oral examination at the term end. It is as university passing head.

Final Year UG Programme
(Branch : Food Technology)

SEMESTER VII

MEAT, POULTRY AND FISH TECHNOLOGY (FT 411)

Teaching Scheme	**Examination Scheme**
Lectures: 4 Hrs/ Week	**Theory: CIE (50) + SEE (50) =100 marks**
Practical: 2 Hrs/ Week	**IOE: 25 Marks**
	EOE : 25 Marks

UNIT I Introduction (06 Hrs)

Sources and developments of meat and poultry industries and importance in national economy

UNIT II Muscle (08 Hrs)

Muscle structure, chemical composition and physico-chemical properties of meat muscle Abattoir design and layout

UNIT III Slaughtering &Post-mortem changes of meat (08 Hrs)

Slaughtering of animals and poultry, post-mortem inspection and grading of meat.
Factors affecting post-mortem changes, properties and shelf life

UNIT IV Processing and preservation of meat (08 Hrs)

Processing and preservation of meat- mechanical deboning, aging or chilling, freezing, pickling, curing, cooking and smoking of meat and Meat tenderization

UNIT V Egg (08 Hrs)

Egg structure, composition, quality characteristics, processing, preservation of eggs and their products.

Unit VI Fish (12 Hrs)

Fish Types, examination, care in handling & transportation, processing, freezing, canning salting & drying of fish. Fish sauce and protein concentrates.

PRACTICALS:

1. Pre-slaughter operations of meat animals and poultry birds
2. Slaughtering and dressing of meat animals
3. Meat cutting and handling
4. Preservation of meat by different methods and preparation of meat and poultry products
5. Evaluation of meat quality
6. Evaluation of egg quality

TEXT BOOKS/ REFERENCES:

Principles of Meat Science	F. J. Forrest
Meat Hand Book	Albert Levie
Developments in Meat Science Vol. I and II	Ralston Lawrie
Poultry Production	R. A. Singh
Meat Technology	Gerard

LEGUME AND OILSEED PROCESSING TECHNOLOGY (FT 412)

Teaching Scheme	Examination Scheme
Lectures: 4 Hrs/week	Theory: CIE (50) + SEE (50) =100 marks
Practical: 2 hr/week	IOE : 25 marks
	EPE: 50 marks

UNIT I Present Status and future prospects of legumes and oil Seeds (06 Hrs)

Major legumes, oilseeds and pulses grown in the country and their application, present Status and future prospects of Pulse milling industry in India.

UNIT II Morphology and classification of legumes, oilseeds and pulses. **(06 Hrs)**

Morphology and Classification of legumes, oilseeds and pulses. Chemical composition and nutritional value. Antinutritional factors, their chemistry, methods of removal of antinutritional factors

UNIT III Dehulling and Milling of oilseeds, legumes and pulses. (06 Hrs)
Methods of dehulling-. Home, cottage and commercial scale. Modern techniques of dehulling. Milling of oilseeds, legumes and pulses : Dal milling principles, methods, equipments and effect on quality. Principle products, fermented products of legumes.

UNIT IV Processing of oilseeds, legumes and pulses. **(16 Hrs)**
Soaking principles, methods of soaking, sprouting, puffing, and roasting. Physical and bio-chemical changes during these processes.
Protein foods: tofu, miso, texturized vegetable protein, hydrolyzed vegetable protein, formulation and quality control

UNIT V Cooking quality of dhal (04 Hrs)
Cooking quality of dhal, methods, factors affecting quality of dhal, cooking of dhal, quick cooking of dhal and instant dhal.

UNIT VI Oil extraction and Refining of oils (10 Hrs)
Oil extraction methods: mechanical Pressing. Solvent extraction process: principle, pretreatment - breaking, cracking, flaking, extraction principle and Desolventization. Factors affecting the extraction process.
Refining of oils :
Refining, degumming, neutralization, bleaching, filtration, deodorization of oils and their principles and process controls.

PRACTICALS:

1. Physical properties of legumes and oil seeds
2. Methods and principles of dehulling
   a) Application oil
   b) Application red earth slurry.

3. Dal milling process.
4. Cooking quality of dal
5. Fermented product of legumes- dosa, idli, wada, dhokala,
6. Production of protein rich product.
7. Visit to dal mill and oil industry.

TEXT BOOKS/ REFERENCE BOOKS

1	Post Harvest Biotechnology of Legumes	D.K. Salunkhe *et al.*
2	Post Harvest Biotechnology of Oil Seed	D.K. Salunkhe *et al.*
3	Processed Protein Food Stuff	A.M. Alschule
4	The Chemistry and Technology of Edible Oils and Fat	A.E. Baily
5	Post Harvest Technology of Cereals, Pulses and Oil seeds	Chakraborthy
6	Oil Seed Processing Technology	B.D. Shukla

WASTE MANAGEMENT OF FOOD INDUSTRIES (FT 413)

Teaching Scheme
Lectures: 3 Hrs/week
Practical: 2 hr/week

Examination Scheme
Theory : CIE (50)+ SEE(50)=100 marks
IOE : 25 marks

UNIT – I Introduction (6Hrs)
Types of waste and magnitude of waste generation in different food processing industries, concept, scope and importance of waste management and effluent treatment. Environmental Protection Act and specification for effluent of different food industries.

UNIT –II Waste characterization (4Hrs)
Temperature, pH, Oxygen demands (BOD, COD, TOD), fat, oil and grease content, metal content, forms of phosphorous and sulphur in waste waters, microbiology of waste, other ingredients like insecticide, pesticides and fungicides residues

UNIT-III Effluent Treatment (12Hrs)
Pre-treatment of waste: sedimentation, coagulation, flocculation and floatation
Secondary treatments: Biological oxidation – trickling filters, oxidation ditches, activated sludge process, rotating biological contractors, lagoons
Tertiary treatments: Advanced waste water treatment process-sand, coal and activated carbon filters, phosphorous, sulphur, nitrogen and heavy metals removal

UNIT-IV Treatment methods for solid wastes (6Hrs)
Biological composting, drying and incineration; Design of Solid Waste Management System: Landfill Digester, Vermi composting Pit.

UNIT-V Waste utilization of agro industries (10Hrs)
Characterization and utilization of by-products from cereals (breweries), pulses, oilseeds, fruits & vegetables (wineries) and plantation crops (sugar industries)

UNIT- VI Waste utilization of animal and marine product industries (10 Hrs)
Characterization and utilization of by-products from dairy, eggs, meat, fish and poultry processing industries.

Practical :
1. Waste characterization:
(a) temperature (b) pH (c) solids content (d) turbidity (e) BOD (f) COD
2. Visit to effluent treatment plant attached with food industry and city
3. To estimate residual chlorine
4. Evaluation effect of lime treatment on waste water in respects of BOD, COD, solids content, phosphate content
5. Visits to various industries using waste and food by-products
6. Visit to BiogDas plant and vermin-culture centre
7. Extraction of banana fiber , Alcohol from molasses,
8. Isolation and purification of pectin from organic waste,

9. Extraction of volatile oils from organic waste

REFERENCE BOOKS

Food Processing work Management by Green and Krammer; CBS publication
AFST(I) & CFTRI Proceedings of the Symposium on By-products From food Industries: Utilization and Disposal

TEXT BOOKS

Principles of food sanitation by Mariett, N.G. CBS publication
Post Harvest Technology of fruit and vegetables- Handling, Processing,Fermentation and waste Management by LR Verma and VK Joshi; Indus Publishing Co. New Delhi.
A. D. Bhide, “Solid waste management”
Pavoni,”Solid waste management handbook”

FOOD BIOTECHNOLOGY (FT 414)

Teaching Scheme
Lectures: 4 Hrs/week
Practical: 2 hr/week

Examination Scheme
Theory : CIE (50)+ SEE(50)=100 marks
IOE : 25 marks

UNIT-I Introduction (4 hrs)
History and development of biotechnology. Regulatory and social aspects of biotechnology of foods.

UNIT–II Strain Improvement Techniques (8hrs)
Methods of molecular cloning, immobilization of microbial and cultured plant cells. Plant and animal tissue culture.

UNIT III Application of Genetics (6hrs)
Application of genetics to food production. Genetically modified foods (GMF).

UNIT-IV Upstream Processing Improvement Techniques (10hrs)
Metabolic Engineering, Production of alcohol, organic acids, enzymes and immobilization of enzymes.

UNIT-V Downstream Processing (12hrs)
Principles of designing of downstream processing. Product recovery of food flavor, color, polysaccharides, amino acids, vitamins, other volatiles , baker's yeast and single cell protein.

UNIT-VI Improvement Techniques in Fermented foods (8hrs)
Traditional fermented foods like idli, dosa etc. Soy fermented foods. Other foods like beer, wine, distilled liquor vinegar.

Practicals based on :
Isolation and Preservation of industrial important Microorganism.
Stabilization of strains of micro organisms useful in fermentation.
Scale up kinetic studies in different fermentation processes.
Contamination of fermentations and its control.

TEXT BOOKS/ REFERENCES :
Bains W. 1993, Biotechnology from A to Z, Oxford Univ. Press, Oxford.
Crueger, W. and Crueger A. 1984. Biotechnology: A Textbook of Industrial Microbiology. Science Tech. Madison, USA.
Joshi, V.K. and Pandey, A. Ed. 1999. Biotechnology. Food Fermentation, (2 Vol. set). Education Publ. New Delhi.
Knorr, D. 1982. Food Biotechnology. Marcel Dekker, New York.
Stanburry P.P. and Whitaker, A. 1984. Principles of Fermentation Technology. Pergamon Press, Oxford UK.
Steinkraus, K.H. 1983. Handbook of Indigenous Fermented Foods.Marcel Dekker,N. York.

ELECTIVE- I (415)
ELECTIVE-I : FUNCTIONAL FOODS AND NUTRACEUTICALS (FT 415.1)

Teaching Scheme **Examination Scheme**
Lectures: 3 Hrs/week **Theory: CIE (50) + SEE (50) =100 marks**

UNIT I Introduction (8 Hrs)
Scope, importance and renewed emphasis on specicality foods, health foods, functional foods. Neutraceuticals, infant and baby foods, adolescent/ teen age foods, foods for pregnant ladies and nursing mothers, geriatric foods.

UNIT II Specific consumer oriented foods (8Hrs)
Defense persons, Space / astronought, High altitude mountain climbers, Disaster situation – crises, care, and maintenance

UNIT III Transgenic plant foods with health claims (8 Hrs)
Prebiotics and Probiotics , Genetically modified foods, Proprietary foods, Supplementary foods

UNIT IV Beneficial Effects Functional Foods and Neutraceuticals (8 Hrs)
Beneficial Effects of Spices, gamma-linolenic acid, Spirulina, antioxidants and other food constituents

UNIT V Bioactive components (8 Hrs)
Sources, extraction methods, uses and health benefits.

UNIT VI Development of Functional Foods (4 Hrs)
Low sugar,low calorie foods.

TEXT BOOKS/ REFERENCES:

1. 'Human Nutrition' Benzamin T. Burton, Mc Graw Hill.
2. 'Nutrition and Dietetics' Shubhangini A. Joshi, Tata Mc Graw Hill Co. Ltd.
3. 'Dietetics' by B. Shrilakshmi, New Age International (P) Ltd. New Delhi.
4 Food Science Potter
5 Processed Protein Food Stuffs Alchule
6 Food and Nutrition M Swami Nathan
7 Therapeutic Diets NIN
8 Supplementary Foods NIN

ELECTIVE I : BEVERAGES TECHNOLOGY (FT 415.2)

Teaching Scheme **Examination Scheme**
Lectures: 3 hrs/ week **Theory: CIE (50) + SEE (50) =100 Marks**

Unit I Introduction (4Hrs)
Types of beverages and their scope and importance; status of beverage industry in India;

Unit II Fruits Beverages (8 Hrs)
Manufacturing technology for juice-based beverages; synthetic beverages; low-calorie and dry beverages; isotonic and sports drinks;

Unit III Water Treatments (6 Hrs)
Water treatment and quality Specification for beverage water, Alkalinity reduction, filtration of water, water softening,

Unit IV Carbonated Beverages (12 Hrs)
History and types of soft drinks, role of various ingredients of soft drinks, carbonation of soft drinks. Packaging aspects in soft drink

Unit V Quality control in soft drink (8 Hrs)
Quality control in soft drink –Chemical and sensory Quality control in soft drink – Microbiological quality

Unit VI Packaged drinking water (10 Hrs)
Definition, types, manufacturing processes, quality evaluation and raw and processed water, BIS quality standards of bottled water; mineral water, natural spring water, flavoured water, carbonated water.

TEXT BOOKS/ REFERENCES:
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 NonCarbonated. AVI Publ.

INDUSTRIAL TRAINING REPORT & SEMINAR (FT 416)

Teaching Scheme	**Examination Scheme**
Lectures: 2 Hrs/week	***IOE: 50 Marks**
	# POE : 25 Marks

*** SEMINAR:** **(IOE : 50 Marks)**

A seminar topic will be allotted to individual student according to his/her area of interest (students are also suggested to propose topics with relevant published information during the time of allotment), on which a report should be prepared and submitted after presentation as per schedule.

 # INDUSTRIAL TRAINING REPORT: **(POE: 25 Marks)**

The industrial training will be undertaken by each student during the summer recess after the completion of the 6th semester examination and prior to commencement of the 7th semester. A report on the training which is required to be submitted should consist of:

1 A general overview of the plant.
2. The products & raw material sources of the plant.
3. Detail description of different processing and other equipment.
4. Scheduling of plant operations.
5. Conclusion.

Viva of 25 marks will be conducted after submission of the report by external examiner .

MAJOR PROJECT (FT 417)
Phase: I

Teaching Scheme	**Examination Scheme**
Practical: 4 Hrs/week	**IOE : 50 marks**

Each student shall undertake project work assigned to him/ her related to design or R&D in the area of food technology under the supervision of a faculty member. In principle, the research /design work has to be carried out by the student himself/herself taking advice from his/her supervisor when problem arises. The work will be allotted at the beginning of the seventh semester specifying the different aspects to be carried out by the student.

The project undertaken by the student at the commencement of the 7^{th} semester will be continued till the end of the 8th semester. At the end of the semester the student will submit a report on his/ her work in typed and bound form.

Final Year UG Programme
(Branch : Food Technology)

SEMESTER VIII

POST HARVEST TECHNOLOGY OF PLANTATION CROPS & SPICES (FT 421)

Teaching Scheme	**Examination Scheme**
Lectures: 4 Hrs/week	**Theory: CIE (50) + SEE (50) =100 marks**
Practical: 2 hr/week	**IOE: 25 Marks**
	EPE: 50 Marks

Unit I Introduction (4 Hrs)
Production and processing scenario of spice & plantation crops and its scope

Unit II Tea (10Hrs)
Occurrence, chemistry of constituents; harvesting; types of tea –green, oolong and CTC; chemistry and technology of CTC tea; manufacturing process for green tea and black tea manufacture; instant tea manufacture; quality evaluation and grading of tea.

Unit III Coffee (10 Hrs)
Occurrence, chemical constituents; harvesting, fermentation of coffee beans; changes taking place during fermentation; drying; roasting; process flow sheet for the manufacture of coffee powder; instant coffee technology; chicory chemistry; quality grading of coffee.

Unit IV Other Plantation Crops (4 Hrs)
Vanilla, Annatto, Cashewnut, processing and quality control

UNIT V Major Spices (12 Hrs)
Major Spices, Post Harvest Technology, Composition, Processed products of spices : Ginger, Chill, Turmeric, garlic, Pepper and Cardamom.

UNIT VI Minor spices (08 Hrs)
Minor spices, Ajwan, coriander, cumin, cinnamon, fenugreek, garlic, mustard, mace, nutmeg, onion, saffron, tamarind, cloves, mint and asafetida

PRACTICALS:

(1) Estimation of extractives, caffeine in tea and coffee;
(2) Analysis of tea & coffee
(3) Extraction of oleoresins-Turmeric, ginger, pepper, clove
(4) Steam distillation of spices
(5) detection of microbial quality and adulteration in spices
(6) Determination of curcumin content in turmeric
(7) Study of standard specification of spices
(8) Preparation of curry powder
(9) Preparation of Indian Masala for different foods
(10) storage and packaging of spices;
(11) Visit to spice industry

TEXT BOOKS/ REFERENCE BOOKS

1. Spices – vol. II - Parry J.W.
2. Spice and condiments - Pruthi J.S.
3. Herbs and spices - Rosemery Hemphill
4. The book of spices - Rosen garten, F. and Livington Jr.
5. Spices and herbs for the Food Inudstry - Lewies, Y.S.
6. Spices Vol. I and II; Tropical Agril. Series C.L. - Purseglove, J.W. Brown E.G., Green And Robbins SRJ.
7. Food Flavourings - P.R. Ashust
8. Food Flavouring composition, manafacture and uses. - J.Merrory

1. Tea Production and Processing. Oxford Univ. Press2002..- Banerjee B.
2. Chocolate, Cocoa and Confectionery Technology. 3rd Ed. Aspen Publ. 1999. - Minifie BW.
3. Handbook on Spices. National Institute of Industrial Research Board, Asia Pacific Business Press Inc.,2004 - NIIR

Coffee Processing Technology. AVI Publ. 1963. - Sivetz M & Foote HE.

FOOD PLANT DESIGN AND LAYOUT (FT 422)

Teaching Scheme **Examination Scheme**
Lectures: 4 hrs/week **Theory : CIE (50)+ SEE(50)=100 marks**

Unit I Introduction (4 hrs)
Basic concepts of plant layout and design with special reference to food process industries. Application of HACCP concept, ISO, FPO & MPO requirements in food plant layout and design.

Unit II Plant Location (6 hrs)
Influence of location on plant layout, location factors, location theory and models, Economic plant size, types of manufacturing processes like continuous, repetitive and intermittent processes.

Unit III Plant Layout (8hrs)
Preparation of a Plant Layout, Plant Layout problem, importance, objectives, classical types of layouts. Evaluation of layout. Advantages of good layout

Unit IV Plant Building (10 hrs)
Considerations in building design, type of factory buildings, choice of building construction, material for floors, foundation, walls, doors, windows, drains etc, ventilation, fly control, mold prevention and illumination in food processing industries.

Unit V Plant layout & Equipment Layout (14 hrs)
Plant layout and design of bakery and biscuit industries; fruits and vegetables processing industries including beverages; milk and milk products; meat, poultry and fish processing industries.

Equipment layout in Food Industries :
Basic understanding of equipment layout and. Preparation of flow sheets for material movement and utility consumption in food plants.

Unit VI Cost Analysis (6 hrs)
Fixed cost, variable cost, depreciation, method of economic analysis, profitability analysis of a plant.

REFERENCE BOOKS/ TEXT BOOKS

1 Milk Plant Layout H.S. Hall (1963). FAO Pub., Rome
2 Plant Layout and Design James M.Moore (1962), Mac Millan, New York
3 Production Engg. & Industrial mgmt. O.P. Khanna Dhanpat rai & sons
4 Plant Design for Chemical Engg. Peterse & Timmerhaus, McGraw Hil
5 Project Engg. of process plan Rase & Brrow t John Willey & Sons

INDUSTRIAL ECONOMICS AND MANAGEMENT (FT 423)

Teaching Scheme
Lectures: 3 hrs/ week

Examination Scheme
Theory: CIE (50) + SEE (50) =100 Marks

Unit I Economic problem (06 Hrs)
Law of demand, equilibrium between demand and supply, concepts of costs, cost curves and revenue curves of a firm, equilibrium of a firm under perfect competition, break-even analysis, break-even point.

Unit II National income (05 Hrs)
Concept of national income, estimation of national income, difficulties in measurement of national income, uses of national income figures.

Unit III Inflation (04Hrs)
Meaning, types of inflation, causes, effects, control of inflation, value of money, index numbers, construction, utility, limitations, business cycles, phases of business cycles.

Unit IV Industrialization (05 Hrs)
Need, capital requirement, block and working, raising, finance, cottage and small scale industries, role in the Indian economy, problems of small scale industries, remedies.

Unit V Principles of management (07Hrs)
Definition, nature, levels of management, functions of management.
i. Planning: Nature, importance, types of plans, planning process, decision making.
ii. Organization: Principles of organization, organizational structure.
iii. Directing: Theories of motivation, communication, process and barriers, leadership styles.
iv. Controlling: Control techniques.

Unit VI Production management (04 Hrs)
Selection of site, plant layout, its type, functions of P.P.C. Materials management, purchase, inventory control, production and quality control.

Unit VII Finance management (04 Hrs)
Scope and importance, capital structure planning, working capital management, sources of funds, financial industries of India.

Unit VIII Marketing management (04 Hrs)
Marketing concepts, physical distribution, advertising and sales promotion, marketing research, sales management.

TEXT BOOKS/REFERENCES:

1. Stonier, A. W. and Hague, D. C., "A Text Book of Economic Theory", Longman.
2. Bach, George Leland, "Economics -Analysis, Decision Making and policy", Prentice-Hall Inc. Englewood Cliffs N. J.
3. Bonham F., "Economics", Sir Isaac Pitman and Sons Ltd., London.
4. Seth, M. L., "Principles of Economics", Lakshmi Narayan Agarwal, Agra.
5. Agarwal, A. N., "Indian Economy", Vikas Publishing House Pvt. Ltd., New Delhi.
6. Datta R. and Sundharam, K. P. M., "Indian Economy" S. Chand & Co. Ltd., New Delhi
7. Peter F. Drucker, "The Practice of Management", Allied publishers pvt. ltd.,Bombay.
8. Barat, Nikhil, "Production management & Control", Academic Publishers, Calcutta.
9. Garrett, Leonard J. & Silver, Milton, "Production Management Analysis", Harcourt Brace Jovanovich, Inc. New York.
10. Kuchhal, S. C., "Financial Management: An- Analytical & Conceptual Approach",Chaitanya Publishing House, Allahabad.
11. Pandey, L. M., "Financial Management", Vikash Publishing House Pvt. Ltd., New Delhi.
12. Kotlel, Philip, "Marketing Management: Analysis, Planning & Control", Prentice –Hall of India Pvt. Ltd: New Delhi
13. Sinha, J. C., "Marketing and Salesmanship", S. Chand & Co., Delhi.
14. H.L. Ahuja, "Modern economics", S. Chand and co. ltd., New Delhi.

DESIGN AND DEVELOPMENT OF NEW PRODUCTS (FT 424)

Teaching Scheme	Examination Scheme
Lectures: 3 Hrs/week	**Theory: CIE (50) + SEE (50) =100 marks**
Practical: 2 hr/week	**EOE: 25 marks**
	IOE : 25 marks

UNIT I Introduction and Scope (4 Hrs)

Need, importance and objectives of formulation for new product development.

UNIT II Formulation of New Product (10 Hrs)

Ideas, business philosophy and strategy of new product,Formulation based on sources availability and cost competitiveness for concept developments of new products

UNIT III Technology for New Product (6Hrs)

Adaptable technology and sustainable technology for standardized formulation for process development.

UNIT IV Scale up and Trials (6 Hrs)

Process control parameters and scale-up, production trials for new product development at lab and pilot scale

UNIT V Quality Assessment (8 Hrs)

Quality assessment of new developed products

UNIT VI Marketing, Economics of New Product, Commercialization and Launching (14Hrs)

Market testing and marketing plan, Costing and economic evaluation of developed products, Commercialization / product launch for marketing

PRACTICALS:

1. Market survey of existing various products
2. Formulation of new products based on corporate decision /need based
    a) Protein-energy rich
    b) Low calorie (fat replacer)
    c) Low sodium content
    d) Glycemic index based
    e) Cholestrolemic index based

3. Product development based on above formulation depending on local sources/ technology
4. Quality assessment
    a) New product development for
    b) Infant / weaning foods
    c) Geriatric
    d) Physiological status

TEXT BOOKS/ REFERENCES:

1	New Food Product Design and Development	Beckley, Blackwell Publishing Oxford UK
2	Sensory and Consumer Research in Food Product Design and Development	Moskowitz, Blackwell Publishing Oxford UK

ELECTIV-II (FT 425)
ELECTIVE –II : FLAVOURS TECHNOLOGY (425.1)

Teaching Scheme **Examination Scheme**
Lectures: 4 hrs/ week **Theory: CIE (50) + SEE (50) =100 Marks**

UNIT I Introduction (4 Hrs)
Production and processing scenario of flavour

UNIT II Types and sources of flavors (8 Hrs)
Types of flavours,Sources of flavours (natural, processed and added), Flavour composites (natural, semi-synthetic and synthetic). Flavours production in fermented foods.

UNIT III Biogenesis of flavours (8 Hrs)
Biogenesis of flavours in food – natural and processed foods (Maillard Reaction and Lipid Oxidation).

UNIT IV Extraction and analysis of flavor components (12Hrs)
Extraction of flavours from various sources, conditions and extracting agents. Analysis of flavours components (Subjective and objective).

UNIT V Sensory evaluation (6Hrs)
Sensory evaluation of flavours, selection of flavourist, flavours and legal issues.

UNIT VI Flavors in industries (10 Hrs)
Formulations of flavours. Flavours of soft drinks, Baking and confectionery industries. Standards specification of flavours. Adulterations in Flavour emulsions.

TEXT BOOKS/REFERENCES :

1. Ashurst PR. 1994. *Food Flavorings*. 2nd Ed. Blackie.
2. Burdock GA. 2004. *Fenaroli's Handbook of Flavor Ingredients*.5th Ed.CRC Press.
3. Deibler D & Delwiche J. 2004. *Handbook of Flavor, Characterization:Sensory Analysis, Chemistry and Physiology*. Marcel Dekker.
4. Heath HB & Reineccius G.1986. *Flavor Chemistry and Technology*. AVI Publ.
5. Taylor A. 2002. *Food Flavour Technology*. Sheffield Academic Press.

ELECTIVE-II : SNACK FOODS TECHNOLOGY (FT 425.2)

Teaching Scheme **Examination Scheme**
Lectures: 4 hrs/ week **Theory: CIE (50) + SEE (50) =100 Marks**

Unit I Introduction (4 hrs)
Importance and scope of snack food technology. Present status of snack foods industries.

Unit II Various types of snack food (12 hrs)
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 III Technology for fruit and vegetable based snacks (6 hrs)
Technology for fruit and vegetable based snacks: Chips, wafers;

Unit IV Technology for coated nuts (6hrs)
Technology for coated nuts – salted, spiced and sweetened; *chikkis* .

Unit V Extruded snack foods (8 hrs)
Formulation and processing technology, colouring, flavouring and packaging, Raw materials &their role

Unit VI Equipments (12 hrs)
Equipments for frying, Baking and drying, toasting, roasting and flaking, popping, blending, Coating, chipping.

TEXT BOOKS/ REFERENCES:
Edmund WL. *Snack Foods Processing*. AVI Publ.
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.
Extruded foods Matz.
Extrusion of Food, Vol 2; Harper JM; 1981, CRC Press.
New protein foods, vol.I,II, A.L. Altschul.

MAJOR PROJECT (FT 426)
Phase : II

Teaching Scheme	**Examination Scheme**
Practical: 6 Hrs/week	**IOE : 50 marks**
	EOE : 50 Marks

Each student shall undertake project work assigned to him/ her related to design or R&D in the area of food technology under the supervision of a faculty member. In principle, the research /design work has to be carried out by the student himself/herself taking advice from his/her supervisor when problem arises. The work will be allotted at the beginning of the seventh semester specifying the different aspects to be carried out by the student.

The project undertaken by the student at the commencement of the 7^{th} semester will be continued till the end of the 8th semester. At the end of the semester the student will submit a report on his/ her work in typed and bound form.

ENTREPRENEURSHIP DEVELOPMENT FOR FOOD TECHNOLOGISTS (FT 427)

Teaching Scheme	**Examination Scheme**
Lectures: 2 hrs/week	**IOE: 50 Marks**

Unit I Entrepreneurship (4 hrs)
Concept/Meaning, Need, Competencies/qualities of an entrepreneur

Unit II Entrepreneurial Support System (6 hrs)
District Industry Centers (DICs), Commercial Banks, State Financial Corporations, Small Industries Service Institutes (SISIs), Small Industries Development, Bank of India (SIDBI), National Bank for Agriculture and Rural Development (NABARD), National Small Industries Corporation (NSIC), Khadi Village and Industries Commission (KVIC), other relevant institutions/organizations/NGOs at State level

Unit III Market Survey and Opportunity Identification (Business Planning) (6 hrs)
Identification and Guidance Business Plant, Market, Assessment, Procedures for registration of small scale industry, List of items reserved for exclusive manufacture in small scale industry, Assessment of demand and supply in potential areas of growth, Understanding business opportunity, Considerations in product selection, Data collection for setting up small ventures,

Unit IV Project Report Preparation (6 hrs)
Preliminary Project Report, Techno-Economic feasibility report, Project Viability

Unit V Managerial Aspects of Small Business (8 hrs)
Principles of Management (Definition, functions of management viz planning, organization , coordination and control, Operational Aspects of Production, Inventory Management, Basic principles of financial management, Marketing Techniques, Personnel Management, Importance of Communication in business

Unit VI Legal Aspects of Small Business (6 hrs)
Elementary knowledge of Income Tax, Sales Tax, Patent Rules, Excise Rules, Factory Act and Payment of Wages Act,

RECOMMENDED BOOKS

1. A Handbook of Entrepreneurship, Edited by BS Rathore and Dr JS Saini; Aapga Publications, Panchkula (Haryana)
2. Entrepreneurship Development by CB Gupta and P Srinivasan, Sultan Chand and Sons, New Delhi
3. Environmental Engineering and Management by Suresh K Dhamija, SK Kataria and Sons, New Delhi
4. Environmental and Pollution Awareness by Sharma BR, Satya Prakashan , New Delhi