

**Revised Syllabus For  
B. Tech. (Food Technology)  
As Per IV<sup>th</sup> Deans Committee  
(From 2007-2008)**



**Associate Dean and Principal  
College of Food Technology  
Marathwada Agricultural University  
Parbhani**

**FACULTY OF FOOD TECHNOLOGY  
MARATHWADA AGRICULTURAL UNIVERSITY  
PARBHANI**

**Degree programme : B. Tech. (Food Technology)**

**Duration : 4 years-8 Semesters**

**Course work - 6 Semesters  
Hands on training-I Semester  
Inplant training- I Semester**

**New Syllabus**

**a. Total credits upto VI Semester : 125 credits**  
**b. Hands on training in VII Sem. 25 credits**  
**c. Inplant training VIII Sem. : 30 credits**

**Total Credits : 180 credits**

**Other courses recommended by : 07 credits**  
**4<sup>th</sup> Dean Committee**

**1. Physical education : 01credit (Non credit course)**  
**2. Mathematics (Deficiency courses): 04 credit (Non credit courses)**

### Summary of the major changes approved by IV<sup>th</sup> Dean Committee-2007

1.	Title of the degree	Existing B. Tech. (Food Science)	<b>Proposed B. Tech. (Food Technology)</b>
2.	Nomenclature of College	College of Agril. Technology	<b>College of Food Technology</b>
3.	Departments in College of Food Technology	Dept. of Food Science and Tech.	<b>1. Dept. of Food Science and Technology</b>
		Dept. of Biochemistry and Applied Nutrition	<b>2. Dept. Food Chemistry and Nutrition</b>
		3. Dept. of Food Engineering	<b>3 .Dept. of Food Engineering</b>
		Dept. of Microbiology and Fermentation Technology	<b>4. Dept. of Food and Industrial Microbiology</b>
		Dept. of Animal Products Technology (Merged with Dept. of Food Science and Technology	<b>5. Dept. of Food Trade Business Management</b>

## COURSE OUT LAY DEPARTMENT-WISE

### 1) Department of Food Science and Technology

Sr. No.	Course No.	Course Title	Credits	Semester
1	FST-111	Principles of Food Processing	2+1=3	I
2	FST-112	Food Production Trends and Programs	2+0=2	I
3	FST-123	Postharvest Management of Fruit and Vegetable	2+1=3	II
4	FST-124	Cereal Processing	2+1=3	II
5	FST-235	Legume and Oilseed Technology	2+1=3	III
6	FST-236	Meat, Poultry and Fish Technology	2+1=3	III
7	FST-237	Wheat Milling and Baking Technology	2+1=3	III
8	FST-238	Confectionery Technology	1+1=2	III
9	FST-249	Fruit and Vegetable Processing	2+1=3	IV
10	FST-2410	Food Quality	1+1=2	IV
11	FST-2411	Processing of Milk and Milk Products	1+1=2	IV
12	FST-2412	Spice and Flavor Technology	2+1=3	IV
13	FST-3513	Food Industry By-Products and Waste Utilization	1+1=2	V
14	FST-3514	Carbonated Beverage Technology	1+1=2	V
15	FST-3615	Product Development and Formulation	1+1=2	VI
16	FST-3616	Speciality Foods	2+1=3	VI
17	FST-3617	Extrusion Technology	1+1=2	VI
18	FST-3618	Quality Assurance and Certification	2+1=3	VI
		<b>Total</b>	<b>29+17= 46</b>	

### 2) Department of Food Chemistry and Nutrition

Sr. No.	Course No.	Course Title	Credits	Semester
1	FCN-111	Bio-chemistry	2+1=3	I
2	FCN-112	Food Chemistry-I	2+1=3	I
3	FCN-123	Food Chemistry –II	2+1=3	II
4	FCN-124	Human Nutrition	2+1=3	II
5	FCN-235	Techniques in Food Analysis	1+2=3	III
6	FCN-246	Food Additives	2+1=3	IV
7	FCN-247	Environmental Science	2+1=3	IV
		<b>Total credits</b>	<b>13+8= 21</b>	

### 3) Department of Food Engineering

Sr. No.	Course No.	Course Title	Credits	Semester
1	FE-111	Engineering Drawing	0+1=1	<b>I</b>
2	FE-112	Fluid Mechanics and Hydraulics	1+1=2	<b>I</b>
3	FE-123	Energy Generation and Conservation	2+1=3	<b>II</b>
4	FE-124	Heat and Mass Transfer	1+1=2	<b>II</b>
5	FE-235	Food Processing Equipments-I	2+1=3	<b>III</b>
6	FE-236	Food Packaging	2+1=3	<b>III</b>
7	FE-247	Food Processing Equipments-II	2+1=3	<b>IV</b>
8	FE-358	Refrigeration Engineering and Cold Chain	2+1=3	<b>V</b>
9	FE-359	Bio-Chemical Engineering	2+1=3	<b>V</b>
10	FE-3510	Instrumentation and Process Control	2+1=3	<b>V</b>
11	FE-3611	Food Plant Design and Layout	1+2=3	<b>VI</b>
		<b>Total credits</b>	<b>17+12=29</b>	

### 4) Department of Food and Industrial Microbiology

Sr. No.	Course No.	Course Title	Credits	Semester
1	FIM-111	Fundamentals of Microbiology	2+1=3	<b>I</b>
2	FIM-122	Food Microbiology	2+1=3	<b>II</b>
3	FIM-233	Fermentation and Industrial Microbiology	2+1=3	<b>III</b>
4	FIM-244	Food Safety and Microbial Standards	2+1=3	<b>IV</b>
5	FIM-355	Food Bio-technology	2+1=3	<b>V</b>
6	FIM-366	Food Hygiene and Sanitation	2+1=3	<b>VI</b>
		<b>Total credits</b>	<b>12+6= 18</b>	

### 5) Department of Food Trade and Business Management

Sr. No.	Course No.	Course Title	Credits	Semester
1	FTBM-351	Co-operation, Marketing and Finance	2+1=3	<b>V</b>
2	FTBM-352	Business Management and International Trade	2+0=2	<b>V</b>
3	FTBM-363	Entrepreneurship Development and Communication Skills	1+1=2	<b>VI</b>
4	FTBM-364	Food Laws and Regulations	2+1=3	<b>VI</b>
5	FTBM-365	Seminar	0+1=1	<b>VII</b>
		<b>Total credits</b>	<b>7+4=11</b>	

**Annexure-II**  
**Lay out of courses of B. Tech (Food Technology) semester wise**

**Semester -I**

<b>Sr. No.</b>	<b>Course No.</b>	<b>Course title</b>	<b>Credits</b>
1	FST-111	Principles of Food Processing	2+1=3
2	FST-112	Food Production Trends and Programs	2+0=2
3	FCN-111	Biochemistry	2+1=3
4	FCN-112	Food Chemistry-I	2+1=3
5	FE-111	Engineering Drawing	0+1=1
6	FE-112	Fluid Mechanics and Hydraulics	1+1=2
7	FIM-111	Fundamentals of Microbiology	2+1=3
8	Phy. Edn.-111	Physical Education	0+1=1 (NC)
9	AL-111	Mathematics ( Deficiency Course)	2+0 =2 (NC)
		<b>Total Credits</b>	<b>13+7=20</b>

**Semester-II**

<b>Sr.No.</b>	<b>Course No.</b>	<b>Course title</b>	<b>Credits</b>
1	FST-123	Postharvest Management of Fruit and Vegetable	2+1=3
2	FST-124	Cereal Processing	2+1=3
3	FCN-123	Food Chemistry-II	2+1=3
4	FCN-124	Human Nutrition	2+1=3
5	FE-123	Energy Generation and Conservation	2+1=3
6	FE-124	Heat and Mass Transfer	1+1=2
7	FIM-122	Food Microbiology	2+1=3
8	AL-122	Mathematics ( Deficiency Course)	1+1=2 (NC)
		<b>Total Credits</b>	<b>14+8=22</b>

### Semester-III

Sr.No.	Course No.	Course title	Credits
1	FST-235	Legumes and Oilseed Technology	2+1=3
2	FST-236	Meat, Poultry and Fish Technology	2+1=3
3	FST-237	Wheat Milling and Baking Technology	2+1=3
4	FST-238	Confectionery Technology	1+1=2
5	FCN-235	Techniques in Food Analysis	1+2=3
6	FE-235	Food Processing Equipments-I	2+1=3
7	FE-236	Food Packaging	2+1=3
8	FIM-233	Fermentation and Industrial Microbiology	2+1=3
		<b>Total Credits</b>	<b>14+9=23</b>

### Semester-IV

Sr.No.	Course No.	Course title	Credits
1	FST-249	Fruit and Vegetable Processing	2+1=3
2	FST-2410	Food Quality	1+1=2
3	FST-2411	Processing of Milk and Milk Products	1+1=2
4	FST-2412	Spice and Flavor Technology	2+1=3
5	FCN-246	Food Additives	2+1=3
6	FCN-247	Environmental Science	2+1=3
7	FE-247	Food Processing Equipments-II	2+1=3
8	FIM-244	Food Safety and Microbial Standards	2+1=3
		<b>Total Credits</b>	<b>14+8=22</b>

### Semester-V

Sr.No.	Course No.	Course title	Credits
1	FST-3513	Food Industry By-products and Waste Utilization	1+1=2
2	FST-3514	Carbonated Beverage Technology	1+1=2
3	FE-358	Refrigeration Engineering and Cold Chain	2+1=3
4	FE-359	Biochemical Engineering	2+1=3
5	FE-3510	Instrumentation and Process Control	2+1=3
6	FIM-355	Food Biotechnology	2+1=3
7	FTBM-351	Co-operation, Marketing and Finance	2+1=3
8	FTBM-352	Business Management and International Trade	2+0=2
		<b>Total Credits</b>	<b>14+7=21</b>

### Semester-VI

Sr.No.	Course No.	Course title	Credits
1	FST-3615	Product Development and Formulation	1+1=2
2	FST-3616	Speciality Foods	2+1=3
3	FST-3617	Extrusion Technology	1+1=2
4	FST-3618	Quality Assurance and Certification	2+1=3
5	FE-3611	Food Plant Design and Layout	1+2=3
6	FIM-366	Food Hygiene and Sanitation	2+1=3
7	FTBM-363	Entrepreneurship Development and Communication Skills	1+1=2
8	FTBM-364	Food Laws and Regulations	2+1=3
9	FTBM-365	Seminar	0+1=1
		<b>Total Credits</b>	<b>12+10=22</b>

Total credits load of B. Tech. degree programme is 125 as per AICTE Norms. As per the academic regulations recommended by MCAER, Pune vide serial No.9 (Credit load) each semester must have maximum credit load of 21. However, this could be increased to 25 as a special case on recommendations of concerned ADP.

In B. Tech. (Food Technology) programme total credit load of 125 + 45= 180 out of which 125 credit, are to be accommodated in six semester (3 years) only. Therefore the credit load of each semester is more than 21 but less than 25. Hence every semester must be treated as special case.

#### SEMINAR

The topics of the seminar will be proposed by the faculty under the chairmanship of Associate Dean and Principal ( Food Technology). The students will be given freedom to choose the topics based on their merit/ CGPA. The marks distribution for it are given below.

1	Script of the seminar	10
2	Use of audio visual aids	10
3	Mode of presentation	20
4	Clarification of queries raised in discussion	10
	<b>Total</b>	<b>50</b>



**In VII Semester- 25(15+10)** credits are recommended for Hands on Training, **on campus** (15 credits) in various Departments of College and **off the Campus** training in other Colleges of Food Technology (10 credits)

**HANDS ON TRAINING: Experiential Learning** It is recommended that “Hands on training” in at least two areas should be offered to the students during VII semester by the college as detailed below, depending upon local needs and industrial demands.

MAU, Parbhani: 1) Fruit and Vegetable Technology 2) Bakery and Confectionery  
3) Grain Processing Technology.

- MPAUT, Udaipur: 1) Fruit and Vegetable Technology 2) Bakery and confectionary
- ANGRAU, Bapatla: 1) Spices Processing 2) Fruit and Vegetable Technology.

#### **Distribution of Credit Hours for Hands on Training**

Sr. No.	Topics	Credits	
		On Campus Training	Off Campus Training
1	<b>Preparation of Business plan:</b> (6 Credits) Selection of product to be manufactured Innovativeness Creativity Realistic plan Overall project report and project presentation	3	3
2	<b>Organization of production</b> (3 credits) i) Organization of resources ii) Organizing utility iii) Time management	2	1
3	<b>Production and Marketing</b> (5 credits) Regularity in production Product quality Positioning of product in market Evaluation of presentation Adhering to rules and regulations Adhering to plan	3	2

4	<b>Sales</b> (3 credits) Sales performance Sales volume Profit generated including C/B ratio and Pay back period, etc.	2	1
5	<b>Documentation and reports</b> (3 credits) Book keeping People management Preparation of manual Preparation of final report	2	1
6	<b>Oral examination</b> (5 credits) i) Presentation ii) Oral performance	3	2
	<b>Total</b>	15	10

### **VIII Semester- 30 (0+30):** Implant training for six months (off campus in Industries/ Institutions)

- |                               |            |
|-------------------------------|------------|
| 1. Im-Plant Training          | 25 (15+10) |
| 2. Training Report Evaluation | 5 (0+5)    |

Thirty Credits (Semester-VIII): One academic staff member of the college will coordinate and monitor the im-plant training program. Each student or a batch of student will be sent to the Food industries for industrial training. The evaluation shall be done by the host industry and one academic staff member of the College nominated by the Associate Dean of the College concerned. It is recommended that students be placed /attached to an organization/industry for one semester. Out of 30 credits assigned to this experience 15 credits will be counted in the results while 15 credits will be evaluated as satisfactory/unsatisfactory. The evaluation should be done jointly by the college and the placement organization. The marking scheme recommended for 15 credits is as follows.

#### **Marks distribution of 15 credits allotted to implant training for evaluation**

Sr.	Parameters for evaluation	Institute/	Industry
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<b>No.</b>		<b>College (Credits)</b>	<b>(Credits)</b>
1	Regularity, sincerity and devotion (25 %)	2	1
2	Initiative, confidence and skill acquisition (35%)	4	2
3	Project report and presentation (30%)	3	1
4	Viva-voce (10%)	2	--
	<b>Total (11+4)=15</b>	<b>11</b>	<b>4</b>

## **DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY**

<b>Sr. No</b>	<b>Course No.</b>	<b>Course Title</b>	<b>Credits (T &amp; P)</b>	<b>Semester</b>
1	FST-111	Principles of Food Processing	2+1=3	<b>I</b>
2	FST-112	Food Production Trends and Programs	2+0=2	<b>I</b>
3	FST-122	Post harvest Management of Fruit and Vegetable	2+1=3	<b>II</b>
4	FST-123	Cereal Processing	2+1=3	<b>II</b>
5	FST-235	Legume and Oilseed Technology	2+1=3	<b>III</b>
6	FST-236	Meat, Poultry and Fish Technology	2+1=3	<b>III</b>
7	FST-237	Wheat Milling and Baking Technology	2+1=3	<b>III</b>
8	FST-238	Confectionery Technology	1+1=2	<b>III</b>
9	FST-249	Fruit and Vegetable Processing	2+1=3	<b>IV</b>
10	FST-2410	Food Quality	1+1=2	<b>IV</b>

11	FST-2411	Processing of Milk and Milk Products	1+1=2	<b>IV</b>
12	FST-2412	Spice and Flavour Technology	2+1=3	<b>IV</b>
13	FST-3513	Food Industry By-Products and Waste Utilization	1+1=2	<b>V</b>
14	FST-3514	Carbonated Beverage Technology	1+1=2	<b>V</b>
15	FST-3615	Product Development and Formulation	1+1=2	<b>VI</b>
16	FST-3616	Speciality Foods	2+1=3	<b>VI</b>
17	FST-3617	Extrusion Technology	1+1=2	<b>VI</b>
18	FST-3618	Quality Assurance and Certification	2+1=3	<b>VI</b>
		<b>Total</b>	<b>29+17= 46</b>	

## **DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY**

### **FST-111 PRINCIPLES OF FOOD PROCESSING 3(2+1)**

#### **Theory**

<b>No. of Units</b>	<b>Topics</b>	<b>No. of Lectures</b>
1	Introduction, sources of food, scope and benefit of industrial food preservation, perishable, non perishable food, causes of food spoilage	2
2	Preservation by salt and sugar – Principle, method, equipment and effect on food quality	1
3	Thermal processing methods of preservation – Principle and equipments : Canning, blanching, pasteurization, sterilization, evaporation	3

4	Use of low temperature – Principal, equipment and effect on quality Chilling, cold storage, freezing	3
5	Preservation by drying dehydration and concentration – Principle, Methods, equipment and effect on quality : Difference, importance of drying and dehydration over other methods of drying and dehydration, equipments and machineries, physical and chemical changes in food during drying and dehydration Need and principle of concentration, methods of concentration – Thermal concentration, freeze concentration, membrane concentration, changes in food quality by concentration	5
6	Preservation by radiation, chemicals and preservatives Definition, methods of irradiation, direct and indirect effect, measurement of radiation dose, dose distribution, effect on microorganisms. Deterioration of irradiated foods- physical, chemical and biological; effects on quality of foods Preservation of foods by chemicals, antioxidants, mould inhibitors, antibodies, acidulants etc. Preservation by fermentation- Definition, advantages, disadvantages, types, equipments	5
7	Recent methods in preservation : Pulsed electric field processing, High pressure processing, Processing using ultrasound, dielectric, ohmic and infrared heating. Theory, equipments and effect on food quality	5
	<b>Total</b>	<b>24</b>

## Practicals

No. of Units	Topics	No. of Experiments
1	Demonstration of various machineries used in processing	1
2	Demonstration of effect of blanching on quality of foods	1
3	Preservation of food by heat treatment- canning Canning of fruits and vegetables	1
4	Preservation of food by high concentration of sugar i.e. preparation of jam	1
5	Preservation of food by using salt- Pickle	1
6	Preservation of food by using acidulants i.e. pickling by acid, vinegar or acetic acid	1
7	Preservation of food by using chemicals	1
8	Preservation of bread, cake using mold inhibitors	1
9	Preservation of coconut shreds using humectants	1
10	Drying of pineapple slices, apple slices in cabinet drier	1

11	Demonstration on drying of green leafy vegetables	1
12	Drying of Mango/other pulp	1
13	Drying of semisolid foods using roller dryers	1
14	Drying of foods using freeze-drying process	1
15	Demonstration of preserving foods under cold v/s freezing process	1
16	Processing foods using fermentation technique i.e. preparation of sauerkraut	1
	<b>Total</b>	<b>16</b>

### REFERENCE BOOKS

- |   |  |
|---|--|
| 1 Technology of Food Preservation             | N.W. Desroiser and N.W. Desrosier              |
| 2 Introduction to Food Science and Technology | G.P. Stewart and M.A. Amerine.                 |
| 3 Food Processing Operations Vol. III         | M.A. Joslyn and J.J. Heild.                    |
| 4 Preservation of Fruits and Vegetables       | Giridhari Lal, G.S. Siddappa, and G.L. Tondon. |

## FST-112      **FOOD PRODUCTION TRENDS    2 (2+0)** **AND PROGRAMMES**

### Theory

No. of Units	Topics	No. of Lectures
1	Food demand and supply – Qualitative and quantitative requirements	2
2	Expected technological advances to meet the needs	2
3	Future priorities in food production needs –status of food industry in India and abroad	2
4	Magnitude and inter dependence of food production and processing agencies.	2
5	Food availability, production trends – factors of production – types of foods like processed semi processed, ready to eat foods, fast foods	3
6	Food characteristics nutritional significance of major food groups	2
7	Present trends of consumption, further requirements	2

8	Consumers change of aptitude in food products consumption	3
9	New food products developed programmes aimed for making more food availability to increasing population and their prospects – merits and drawbacks, prospects for future growth in India	2
10	National and international trends and programmes in food handling, processing and marketing	2
11	Potentials and prospects of developing food industry in India	2
12	Food losses –factors affecting – programmes and strategies to eliminate the losses and meet the required demand	2
13	Global demand for food	2
14	World food day – importance and action plans	2
	<b>Total</b>	<b>30</b>

## REFERENCE BOOKS

- Food Science III edn. N. N. Potter. AVI Publishing Co Inc West post, USA
- Canned Foods Thermal Processing and Microbiology AC Herson and A.D. Null and-J A Churchill Ltd. London
- Agricultural Administration in India K. Vijayaraghavan
- Modern Techniques of Raising field crops Chidra Singh, Oxford & IBH Pub.Co.
- Agriculture Research Systems and Management in the 21<sup>st</sup> Century KV Raman, M.M. Anwer and R.B. Gaddagimath, NAARAM Alumni Association National Academy of Agril. Research Management, Rajendranagar, Hyderabad.
- Food Processing Industries B.M. Desai, V.K. Gupta, N.V. Namboodri. Oxford & IBH Publishing Company, Pvt. Ltd., 66 Janpath, New Delhi.

## FST-122 POST HARVEST MANAGEMENT OF FRUITS AND VEGETABLES 3 (2+1)

### Theory

No. of Units	Topics	No. of Lectures
1	Post harvest technology of fruits and vegetables: An over view concept and science, importance loss reduction, role in export, economy and employment generation	3
2	Morphology, structure and composition of fruit and vegetable - Physical, textural characteristics, structure and composition	3
3	Maturity standards - Importance, methods of maturity determinations maturity indices for selected fruits and vegetables	3

4	Harvesting of important fruits and vegetables	3
5	Fruit ripening- chemical changes, regulations, methods	3
6	Storage practices : Controlled atmospheric, Bead atmosphere, hypobaric storage, cool store, zero energy cool chamber	4
7	Commodity pretreatments - chemicals, wax coating, prepackaging	3
8	Physiological post harvest diseases, chilling injury and disease	2
9	Handling and packaging of fruits and vegetables - Post Harvest handling system for citrus, mango, banana, pomegranate, tomato, papaya and carrot packaging house operations	3
10	Principles of transport and commercial transport operations	2
<b>Total</b>		<b>29</b>

### Practicals

No. of Units	Topics	No. of Experiments
1	Studies on morphological features of some selected fruits and vegetables	1
2	Studies on maturity indices	1
3	Studies on harvesting of fruits and vegetables	1
4	Determination of RQ	1
5	Studies on precooling and storage of fruits and vegetables	1
6	Studies on wax coating on apples, papaya, citrus, mango, aonla	2
7	Studies on use of chemicals for ripening and enhancing shelf life of fruits and vegetables	2
8	Studies on regulations of ripening of banana, mango, papaya	1
9	Studies on various storage systems and structures	1
10	Studies on prepackaging of fruits	1
11	Studies on prepackaging of vegetables	1
12	Studies on physiological disorders - chilling injury of banana and custard apple	1
13	Visit to commercial packaging house – grape/mango/pomegranate/banana	1
14	Visit to commercial storage structures - onion, garlic, potato	1
<b>Total</b>		<b>16</b>

### REFERENCE BOOKS

Post Harvest Physiology, Handling and Utilization of Tropical and Subtropical

Er. B. Pantastico



Fruits and Vegetable  
Post Harvest: An Introduction to the  
Physiology and Handling of Fruits and  
Vegetables.

R.B. Wills, M.B. Mc Glasson,  
D. Graham, T.L. Lee and  
E.G. Hall.

Post Harvest Technology of Fruits and  
Vegetables- Vol. I  
Hi-tech Horticulture  
Biochemistry of Foods  
Fruit and Vegetable Technology

L.R. Verma, and V.K. Joshi.  
  
D.K. Singh.  
Eskin, Henderson and Townsend  
Duckworth.

### **FST-123 CEREAL PROCESSING**

**3 (2+1)**

#### **Theory**

<b>No. of Units</b>	<b>Topics</b>	<b>No. of Lectures</b>
1	Present status and future prospects of cereals (Rice, Wheat, Corn, Sorghum, Rye) Morphology of Rice : Physical properties: Density, Bulk density, Angle of repose, - hardness, asperity, porosity, stack of milling and moisture on physical properties Chemical composition: Distribution of nutrients and Aroma of rice.	4
	Drying of paddy : general principles and methods of drying, cracking phenomenon - prevention. Methods of drying, batch type, continuous type driers	4

2	Parboiling of rice : Milling of rice : i) Conventional Milling ii) Modern milling iii) Advantages and disadvantages of milling machineries. iv) By products of rice milling Aging of rice : Enrichment: Need of Enrichment, Methods of enrichment, enrichment levels, fortification of amino acids. - Processed Foods from rice: Breakfast cereals, flakes, puffing, canning and instant rice	5  5
	Corn : Morphology, Physico-chemical properties, Corn milling, Milling fractions and modified starches Barley : Morphology, Physico-chemical properties and processing (Malting)	5
4	Sorghum : Morphology, Physico-chemical properties, Milling, Malting, Pearling and industrial utilization	4
5	Millets – Oat / Rye : Importance of Millet, composition, processing of millets for food uses	5
	<b>Total</b>	<b>32</b>

### Practicals

No. of Units	Topics	No. of Experiments
1	Morphological characteristics of cereals	1
2	Physical properties of cereals	1
3	Chemical properties of cereals	1
4	Determination of colour of cereals	1
5	Parboiling of paddy	1
6	Cooking quality of rice	1
7	Milling of rice	2
8	Conditioning of wheat	1
9	Production of sorghum flakes	1
10	Production of popcorns	1
11	Preparation of sorghum malt	2
12	Determination of gelatinization temp. by amylograph	1
13	Extraction of oil from rice bran	1
14	Visit to cereal processing unit	1
	<b>Total</b>	<b>16</b>

### REFERENCE BOOKS

- |  |                                    |
|--|------------------------------------|
| 1 Technology of Cereals                                    | Kent.                              |
| 2 Post Harvest Technology of Cereals, Pulses and Oil seeds | A. Chakrawarthy                    |
| 3 Modern Cereal Sci and Technology                         | Y. Pomeranz                        |
| 4 Utilization of Rice                                      | Luh.                               |
| 5 Post Harvest Bio Technology of Cereals                   | D.K. Salunkhe                      |
| 6 Hand Book of Cereal Science and Technology               | Editors O.R. Fennema, Markus Karel |

**FST-235    LEGUME AND OILSEED TECHNOLOGY    3 (2+1)**

**Theory**

<b>No. of Units</b>	<b>Topics</b>	<b>No. of Lectures</b>
1	Present status and future prospectus of legumes and oil seeds morphology of legume and oilseeds	3
2	Classification and types of legumes and pulses. Chemical composition and nutritional value. Antinutritional factors, their chemistry, methods of removal of antinutritional factors	4
3	Processing of legumes of home scale, cottage scale and commercial methods of dehulling. Modern techniques in dehulling. Processing of red gram,. bengal gram, green gram, black gram.	4
4	Dal milling – principles, methods, equipments and effect on quality. Principle products, dry and wet milling of pulses, fermented products of legumes	2
5	Soaking – principles, methods of soaking - sprouting, puffing, roasting and parboiling of legumes, physical and bio-chemical changes during these processes	4
6	Cooking quality of dhal – methods, factors affecting quality of dhal and cooking of dhal. quick cooking dhal, instant dhal.	2
7	Introduction, present and future prospects of oil seeds, chemical composition and characters of oil seed and oils, antinutritional factors, elimination methods	3
8	Post harvest technology of oil seeds, handling drying, storage, grading, pretreatments, cleaning, dehulling, size reduction and flaking	2
9	Oil extraction: traditional methods, ghani, power ghanis, expellers –principle of expeller, structure design of expeller.	2
10	Solvent extraction process : principle, pretreatment - breaking, cracking, flaking. extraction principle, factors affecting the extraction process. Desolventization	2
11	Refining of oils – degumming, neutralization, bleaching, filtration, deodorization, their principles and process controls.	2
12	New technologies in oil seed processing, utilization of oil seed meals of different food uses. high protein product like protein concentrate and isolates	3
	<b>Total</b>	<b>33</b>

**Practicals**

<b>No. of Units</b>	<b>Topics</b>	<b>No. of Experiments</b>
1	Physical properties of legumes and oil seeds	1

2	Estimation of protein	1
3	Estimation of fat	1
4	Methods and principles of dehulling application oil application red earth slurry.	1
5	Dal milling process.	2
6	Antinutritional factors, methods of elimination.	2
7	Soaking studies.	2
8	Sprouting of legumes.	1
9	Cooking quality of dal	1
10	Fermented product of legumes- dosa, idli, wada, dhokala, etc.	2
11	Extraction of oil by expeller press	1
12	Production of protein rich product.	1
13	Visit to dal mill and oil extraction plant.	1
	<b>Total</b>	<b>17</b>

## REFERENCE BOOKS

Post Harvest Biotechnology of Legumes	D.K. Salunkhe <i>et al.</i>
Post Harvest Biotechnology of Oil Seed	D.K. Salunkhe <i>et al.</i>
Processed Protein Food Stuff	A.M. Alschule
The Chemistry and Technology of Edible Oils and Fat	A.E. Baily
Post Harvest Technology of Cereals, Pulses and Oil seeds	Chakraborty
Oil Seed Processing Technology	B.D. Shukla

## FST-236 MEAT, POULTRY AND FISH TECHNOLOGY

3 (2+1)

### Theory

No. of Units	Topics	No. of Lectures
1	Sources and developments of meat and poultry industries and importance in national economy	2
2	Muscle structure, chemical composition and physico-chemical properties of meat muscle Abattoir design and layout	3
3	Pre-slaughter transport and care and antimortem inspection	2
4	Slaughtering of animals and poultry, post-mortem inspection and grading of meat	3
5	Factors affecting post-mortem changes, properties and shelf life of meat	3

6	Egg structure: Composition, quality characteristics, processing and preservation of eggs	3
7	Processing and preservation of meat- mechanical deboning, aging or chilling, freezing, pickling, curing, cooking and smoking of meat.	3
8	Meat tenderization –Principles and methods	2
9	Meat emulsions	2
10	Technology of manufacture of meat and poultry products	3
11	Meat plant sanitation and safety	1
12	By-products utilization of abattoir	3
13	Fish-Classification, composition, quality characteristics and preservation.	2
	<b>Total</b>	<b>32</b>

### Practicals

No. of Units	Topics	No. of Experiments
1	Pre-slaughter operations of meat animals and poultry birds	1
2	Slaughtering and dressing of meat animals	2
3	Study of post-mortem changes	1
4	Meat cutting and handling	1
5	Evaluation of meat quality	2
6	Preservation of meat by different methods and preparation of meat and poultry products	3
7	Evaluation of quality and grading of eggs	2
8	Preservation of shell eggs	2
9	Studies on by-products utilization	1
10	Anatomy and preservation of fish	2
	<b>Total</b>	<b>17</b>

### REFERENCE BOOKS

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 F.

**FST-237    WHEAT MILLING AND BAKING  
TECHNOLOGY**

**3 (2+1)**

**Theory**

<b>No. of Units</b>	<b>Topics</b>	<b>No. of Lectures</b>
1	Wheat – importance, production varieties	1
2	Types of wheat, grading and quality of wheat	2
3	Structure of wheat, chemical constituents, their distribution	3-4
4	Physico-chemical and Rheological properties	4-5
5	Enzymes in wheat, damage wheat	6
6	Conditioning of wheat – principles and methods of conditioning	7-8
7	Milling of wheat – Roller flour milling process Break rolls, reduction rolls, The design and operation	9-12

	Wheat milling process	
8	Products of wheat milling industry Flour grades, Supplementation, Fortification	13-15
9	Flour additives, flour improvers, Bleaching, Oxidizing agents	16-18
10	Bakery products, role of bakery ingredients (major and minor), from hard wheat: bread processes of bread making using straight and sponge, dough methods role of each ingredient, quality control Testing of raw material testing of final product Bread faults, staleness, ropyness	19-25
11	Baked Products from soft wheat: cookies, crackers, biscuits, cakes: types, ingredients, process, causes, remedy	26-27
12	Other bakery products: using very hard wheat. pizza, pastry and its types. Macaroni products: Including spaghetti, noodles, vermicelli-process. Nutritional improvement of bakery products	28-29
13	Setting of bakery unit, bakery norms, specifications for raw materials Packaging, marketing of products, project report on bakery	30-32
	<b>Total</b>	<b>32</b>

### Practical

No. of Units	Topics	No. of Experiments
1	Classification of wheat based on physico-chemical properties	1
2	Conditioning of wheat	1
3	Milling of wheat	1
4	Quality Testing of flour. - Falling number and $\alpha$ - amylase activity. - Sedimentation value. - Pelshenke value. - Rheological Tests. Farinograph. Mixograph Extensiograph. Alveograph.	4-8
5	Manufacture of bread, types, faults, remedies, shelf life bread, quality of bread	9-12
6	Test Baking: biscuits, cookies, crackers, buns: Types and quality	13-14
7	Other baked products- pastry, pizza	15
	Visit to wheat milling industry, visit to bakery	16

### REFERENCE BOOKS

Bakery Science and Cereal Technology  
Technology of Cereals  
Bread  
Flour Milling Process

Khetarpaul.  
Kent.  
Spensor.  
Scott.

**FST-238**

**CONFECTIONERY TECHNOLOGY**

**2 (1+1)**

**Theory**

<b>No. of Units</b>	<b>Topics</b>	<b>No. of Lectures</b>
1	History, traditional confectionery goods, types of confectionary, classification Basic technical considerations, TS, TSS, pH, acidity, ERH, sugar, invert sugar, glucose syrup, RH, crystallization	2
2	Raw materials Sugar, sugar qualities, physical, chemical, optical properties. sugar grinding, dextrose, fructose, lactose, caramel, maltose, honey, sorbitol, xylitol, iso malt, soy maltose, polydextrose, lactitol, maltitol.	2
3	whipping, release agent, thickeners, acidulents, milk and milk products, flavours, for confectionery, emulsifiers and other additives,	2
4	starch derivatives, colours used in confectionary. Production of	1



	glucose syrup, acid hydrolysis, enzyme hydrolysis	
5	Cocoa processing: cocoa bean, processing, roasting, fermentation, production of cocoa butter cocoa powder, its quality	1
6	Chocolate processing : Ingredients, mixing, refining, conching, tempering, molding, cooling, coating, fat bloom	2
9	<b>Mid term examination</b>	
10-11	High boiled sweets: Introduction, composition, properties of high boiled sweets, preparation of high boiled sweets, traditional, batch and continuous method of preparation. different types of higher boiled sweets, recipes	2
11-12	Caramel: Definition, composition, factors affecting quality of caramel, caramel manufacture process, batch type, continuous types, checking of faults in caramel	2
13	Toffee: Definition, composition, types of toffee ingredient and their role. batch and continuous method of toffee	1
14-15	Fondant: Fudge/Creamy: ingredients, methods, productivity Lozenges: definition recipe, method of manufacture, compositions, factors affecting quality, industrial production, checklist of faults	2
16-17	Tablets: Definitions, recipe, composition, wet granulation, slugging, manufacture of tablet, and checklist of tablet faults marshmallow and nougat: Definition, composition, recipe, and method of manufacture of nougat	2
18-19	Panning: Process, types of panning, soft and hard panning. quality of confectionery, standards and regulations, packaging requirements of confectionery, economics and marketing of confectionary goods.	1

### Practicals

1	Production of invert sugar	1
2	Preparation of high boiled sweets	1
3	Preparation of toffee	1
4	Preparation of groundnut chikki	1
5	Preparation of decorative cake	1
6	Preparation of chocolate	1
7	Preparation of traditional Indian confection	1
8	Preparation of Shrikhand wadi	1
9	Preparation of milk chocolate	1
10	Preparation of fruit toffee	1
11	Preparation of flour confectionary	1
12	Preparation of flour confectionary	1
13	Preparation of milk cake	1
14	Preparation of petha	1
15	Preparation of fruit candy	1
16	Preparation of Rasgulla	1
17	Visit to confectionary industry	1
	<b>Total</b>	<b>17</b>

### REFERENCE BOOKS

Sugar Confectionery and Chocolate Manufacture  
 Industrial Chocolate Manufactory and Use  
 Chocolate, Cocoa & Confectionery Sci and Tech.  
 Basic Baking

R. Less and E.B. Jackson.  
 S.T. Beekelt  
 Bernared W. Minifie  
 S.C. Dubey.

## **FST-249 FRUIT AND VEGETABLE PROCESSING 3 (2+1)**

### **Theory**

<b>No. of Units</b>	<b>Topics</b>	<b>No. of Lectures</b>
1	Production and processing scenario of fruits and vegetables in India and World	1
2	Scope of fruit and vegetable preservation industry in India. present status, constraints and prospects	2
3	Overview of principles and preservation methods of fruits and vegetables	3
	Commercial processing technology of following fruits and vegetables	
4	Mango: pulp, RTS, squash, canned pulp. toffee amchur, pickle, powder, bar	2
5	Banana: wafers, puree, powder, banana fig	1

6	Papaya: jam, candy, RTS, nectar, squash, papain.	1
7	Pomegranate: juice, squash, syrup, anardana, dalimb manuka, anargoli.	2
8	Guava: jelly, cheese, juice, canned guava, squash, toffee	1
9	Grape: raisin, juice, wine	1
10	Fig : pulp, dried fig, toffee, powder, bar	1
11	Citrus fruits: jelly, marmalade, RTS, squash, candy	1
12	Aonla ; preserve, jam, candy, juice, squash, powder, dried shreds, chavanprash, pickle, chutney, sauce, sweets.	2
13	Tamarind: pulp, powder, toffee, bar, RTS, slab	2
14	Jamun : jelly, RTS, syrup, wine, flakes, bar, powder	1
15	Wood apple: jelly, marmalade	1
16	Tomato: ketchup, sauce, puree, soup, chutney, pickle	2
17	Ginger: preserve, candy, dried ,ginger pickle, RTS, syrup.	1
18	Onion: dried onion, powder	1
19	Garlic : dried garlic, powder,	1
20	Potato : wafer, starch, papad	1
21	Carrot: preserve, candy, pickle, jam	1
22	Cauliflower and Cabbage: dried cauliflower and cabbage, sauerkraut, pickle	1
23	Leafy vegetables; dried leafy vegetables (spinach, fenugreek, coriander leaves, curry leaves)	1
24	Bitter gourd: pickle, dried bitter gourd	1
	<b>Total</b>	<b>32</b>

## Practicals

No. of Units	Topics	No. of Experiments
1	Canning of mango/guava/papaya	1
2	Preparation of fruit jam: apple/mango/guava/papaya/aonla/strawberry	1
3	Preparation of fruit jelly : wood apple/ sweet orange/mandarin/guava/ tamarind.	1
4	Preparation of fruit marmalade:	1
5	Preparation of fruit preserve and candy	1
6	Preparation of fruit RTS	1
7	Preparation of fruit squash	1
8	Preparation of fruit syrup	1
9	Preparation of grape raisin, dried fig and banana fig.	1
10	Preparation of anardana and dalimb manuka	1
11	Preparation of fruit cheese.	1

12	Preparation of pickle, mixed pickle	1
13	Preparation of dried ginger	1
14	Preparation of amchur	1
15	Preparation of dried onion and garlic	1
16	Preparation of banana and potato wafers	1
17	Preparation of dehydrated leafy vegetable	1
	<b>Total</b>	<b>17</b>

## REFERENCE BOOKS

Fruit and Vegetable Preservation Principles and Practices	Srivastava R.P. and Sanjeev Kumar
Post Harvest Technology of Fruits and Vegetables : Handling, Processing, Fermentation and Waste Management vol. I and II	Verma L. R. and Joshi V.K.
Hi Tech Horticulture	Singh D.K.
Preservation of Fruits and Vegetables	Khader
Fruit and Vegetable Preservation	Bhutani R.C.
Principles of Fruit Preservation	Morris, Thomas Norman,.
Preservation of fruits and vegetables	Giridharilal, G.S. Siddappa and G.L. Tandon.

## FST-2410 FOOD QUALITY 2(1+1)

### Theory

No. of Units	Topics	No. of Lectures
1	Food quality, its role in industry definition of quality, quality control, factors affecting quality control	1
2	Quality attributes, dominant attributes, hidden attributes	1
3	Colour-role of colour in quality spectra, different types of colour measuring instruments	1
4	Viscosity- types of fluids, different viscometers to measure viscosity	1
5	Consistency- Methods used to measure consistency of product Difference between viscosity and consistency	1
6	Size and shape- Its role, method to find shape and size of food and food products	1

7	Defects: classification, genetic- physiological defects- structural, off color, character, Entomological defects: holes, scars, lesions, off coloring, curled leaves, Pathological defects Mechanical defects, Extraneous or foreign material defects. Measurement of defects: Improving visibility by dilution, white background, color differences, standardization of conditions, reference standards, counts and measures, isolation of defects by floatation, elution, electronic sorting, Internal defects	2
8	Texture- Classification, definition and role of firmness, yielding quality, juiciness, chewiness, fibrousness, grittiness, mealiness, stickiness,, measurement of texture/ kinesthetic characteristics.- by compression, mechanical thumb, puncture tester, succulometer, shearing by tenderometer, texturometer, maturometer, fibro meter, moisture content, by barbender moisture tester, alcohol insoluble solids, color, consistency & sound measurement for kinesthetics	2
9	Flavour- definition and its role in food quality, Taste, classification, taste qualities, relative intensity, reaction time, effect of disease, temperature, and taste medium on taste, basic tastes, interaction of tastes Odour- definition, classification, neutral - mechanisms, olfactory abnormalities, odor testing, techniques, thresholds, odor intensities	2
10	Visual, auditory, other senses, vision, audition, oral perception other than taste	2
11	Factors influencing sensory measurements: Attitudinal factors, motivation psychological errors in Judgment, relation between stimulus and perception adaptation. Correlation of sensory and instrumental analysis.	2
12	Quality Measurements: Laboratory measurement: types of tests, panel selection and testing environment, serving procedures, instruction to judges, different tests, directional difference tests, classification of difference tests, two-sample tests, three sample tests, multisample tests, comparison of procedures, ranking, scoring, hedonic scaling, dilution procedures, descriptive sensory analysis, contour method, other procedures. Consumer measurement: Factors influencing acceptance and preference, objectives of consumer preference studies, information obtained from consumer study, factors influencing results from consumer surveys, methods of approach, development of the questionnaire, types of questionnaires, serving procedures. Comparison of laboratory panels with consumer panels, limitations of consumer survey	2
13	Quality of raw materials: Physical, Chemical and microbial quality. Quality of products during processing & after processing color, taste, texture, flavour, appearance.	1
14	Factors influencing the Food qualities: Soil, field practices, harvesting practices, procedures, packaging, transportation, storage,	2

	conditions, processing conditions, packaging and storage conditions of finished products.	
15	Recording and reporting of quality.	1
	<b>Total</b>	<b>22</b>

### Practicals

No. of Units	Topics	No. of Experiments
1	Sensory evaluation of product	1
2	Quality evaluation of raw materials.	1
3	Quality evaluation of product for size, shape.	1
4	Determination of viscosity of food products.	1
5	Determination of texture	2
6	Sensory evaluation of product for taste	1
7	Market testing of products.	2
8	Evaluation of food standards.	1
9	Determination of color by using lovibond tintometer	2
10	Visit to food factory to know sensory evaluation problems.	2
11	Consumer study for food quality.	1
12	Visit to fruit and Vegetable market for quality assessment.	1
	<b>Total</b>	<b>16</b>

### REFERENCE BOOKS

Principles of Sensory Evaluation of Food	Maynard A –Amerine, Rose Marie Pangborn, Edward B. Roessler.
Quality Control for Food Industry	Krammer & Twigg.
Quality Control in Food Industry	S.N. Herschdogrfer.
Advances in Food Research	Academic Press. Vol I.

## FST-2411 PROCESSING OF MILK AND MILK PRODUCTS

2 (1+1)

### Theory

No. of Units	Topics	No. of Lectures
1	Milk – Definition, composition of milk from different species, colostrum.	2
2	Physico – Chemical properties of milk.	2
3	Nutritive value of milk and milk products.	2
4	Effect of heat on milk.	2
5	Processing of milk- pasteurization by L T H T and HTST and UHT – filtration, UF and RO, clarification, cream separation, homogenization and heat processing.	2
6	Classification of milk products.	2

7	Manufacture of butter and butter oil (Ghee)	2
8	Fermented milks	2
9	Preparation of yoghurt and cheese.	2
10	Ice-cream – Method of manufacture.	2
11	Manufacture of indigenous milk products – ghee, khoa, chhanna, paneer, dahi and shrikand.	2
12	Indian milk confectionary – Khoa and Chhanna based sweets.	2
13	By products of dairy Industry and their utilization.	2
14	Packaging and storage of milk and milk products – Defects – Standards.	2
	<b>Total</b>	<b>28</b>

### Practicals

No. of Units	Topics	No. of Experiments
1	Sampling and analysis of milk – physico chemical properties and composition, DMC and NYC reduction tests, presence of adulterants and preservatives.	2
2	Standardization of milk for markets	1
3	Clarification and separation of milk	1
4	Heat processing of milk – Pasteurization	1
5	Preparation of butter and ghee	2
6	Ice-cream preparation	2
7	Preparation of dahi, shrikhand, lassi etc	2
8	Preparation of khoa and khoa based sweets	2
9	Preparation of channa, paneer and chana based sweets	2
10	Visit to Dairy plant	1
	<b>Total</b>	<b>16</b>

### REFERENCE BOOKS

- |  |  |
|--|--|
| 1 Outlines of dairy Technology                   | Sukumar- De , Oxford University Press, New Delhi.                                |
| 2 The Fluid Milk Industry                        | J.L.Henderson. 3 <sup>rd</sup> edition AVI Publishing Co. West port, Conn. USA.  |
| 3 Principles of Dairy Processing                 | J.N.Warner, Wiley Eastern Ltd, New Delhi.  |
| 4 Indian Dairy Products                          | K.S.Rangappa and K L Acharya Asia Publishing house, Bombay.                      |
| 5 Judging of Dairy Products                      | J.A.Nelson and Trout, The Olsen publishing Co. Milwaukee, Wisconsin, USA.        |
| 6 Milk processing and Dairy Products Industries, | EIRI Board of consultants & Engineers Engineers India Research Institute, Delhi. |
| 7 Technology of Milk Processing                  | Q. A. Khan & Padmanabhan   |

## FST-2412 SPICE AND FLAVOR TECHNOLOGY

3 (2+1)

### Theory

No. of Units	Topics	No. of Lectures
1	Production and processing scenario of spice, flavour & plantation crops and its scope	2
2	Major Spices: (1) Post Harvest Technology composition, processed products of following spices (2) Ginger (3) Chill (4) Turmeric (5) Onion and garlic (6) Pepper (7) Cardamom (8) Cashew nut, coco nut.	2
3-8	Minor spices, herbs and leafy vegetables: processing and utilization, All spice, Annie seed, sweet Basil, Caraway seed, Cassia, Cinnamon, Clove, Coriander, cumin, Dill seed Fern seed nutmeg mint marjoram, Rose merry, saffron, sage	5
9	<b>Mid term examination</b>	
10-11	Savory, Thyme, Ajowan, Curry leaves, Asafoetida	3
12	Tea, Coffee, Cocoa: Processing quality control	2
13	Vanilla and annatto-processing	2
14	Spice oil and oleoresins	2
15	Chemistry and physiology of taste, flavouring compounds in foods	3
16	Separation, purification and identification of natural flavouring materials	3
17	Synthetic flavouring agents and their stability	2
18	Flavours of soft drinks, Baking and confectionery industry	2
19	Standards specification of spices and flavours	2
20	Packaging of spices and spice products	2
	<b>Total</b>	<b>32</b>

### Practical

No. of Units	Topics	No. of Experiments
1	Identification and characterization of flavouring compounds of spices	1
2	Oil determination	1
3	Extraction of oil from clove, pepper, cardamom-chili	1
4	Extraction of oleoresins-Turmeric, ginger, pepper, clove	2
5	Piperine estimation in pepper oleoresin	1
6	Steam distillation of spices	2
7	Determination of curcumin content in turmeric	1
8	Chemical analysis of spices moisture, Volatile oil, specific gravity, refractive index, acid value	1
9	<b>Mid term examination</b>	
10	Study of standard specification of spices	1



11	Packaging study of spices	1
12	Preparation of curry powder	1
13	Preparation of Indian Masala for different foods	2
14	Visit to spice industry	1
	<b>Total</b>	<b>16</b>

### REFERENCE BOOKS

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

## FST-3513 FOOD INDUSTRIAL BYPRODUCT AND WASTE UTILIZATION 2 (1+1)

### Theory

No. of Units	Topics	No. of Lectures
1	Industrial byproducts and waste.	2
2	Potentials and prospects of developing by-products industry in India.	2
3	Agricultural waste and agro based industrial waste management.	2
4	By products of cereals.	2
5	By products of legumes.	2
6	By products of oil seeds.	2
7	By products of dairy.	2
8	By products of fruit and vegetables processing industries.	3
9	By products of meat, poultry and eggs.	2
10	By products of fish processing units.	2
11	By products of plantation crops and spices.	3
12	Uses of byproducts of agro based industries in various sector.	2
13	Byproducts of fermentation industries.	2
14	By products of sugar and bakery industries.	2
	<b>Total</b>	<b>30</b>

### Practical

<b>No. of Units</b>	<b>Topics</b>	<b>No. of Experiments</b>
1	Extraction of banana fiber.	1
2	Extraction of leaf proteins.	2
3	Alcohol production from molasses.	3
4	Utilization of crop residues for the production of cellulose.	2
5	Use of mango kernels for starch manufacture.	3
6	Isolation and purification of pectin from organic waste.	2
7	Extraction of volatile oils from organic waste.	2
	<b>Total</b>	<b>15</b>

### REFERENCE BOOKS

- |                                  |             |
|----------------------------------|-------------|
| 1 Food from Waste                | Warvan      |
| 2 Food Protein Sources           | Pirie       |
| 3 Technology of Fish Utilization | Ed. Kreuyer |

## FST-3514 CARBONATED BEVERAGE TECHNOLOGY 2(1+1)

### Theory

<b>No. of Units</b>	<b>Topics</b>	<b>No. of Lectures</b>
1	History and types of soft drinks	1
2	Water treatment and quality	1
3	Specification for beverage water	1
4	Alkalinity reduction ,filtration of water,water softening.	1
5	Sweeteners used in soft drink and their properties ,non nutritive sweetners	1
6	Natural colorants used in soft drinks	1
7	Synthetic colorants used in soft drink	1
8	Acidulants used in soft drink	1
9	Mid term examination	
10	Clouding agents for soft drink	1

11	Flavouring agents used in soft drink	1
12	Carbon dioxide and carbonation for soft drink	1
13	Equipments and machineries used in soft drink	1
14	Packaging aspects in soft drink	1
15	Quality control in soft drink –Chemical and sensory	1
16	Quality control in soft drink –Microbiological quality	1

### Practical

No. of Units	Topics	No. of Experiments
1	Physical properties of water	1
2	Determination of Hardness of water	1
3	Determination of density of caramel	1
4	Determination of viscosity of caramel	1
5	Determination of colours in soft drinks by wool technique	1
6	Determination of saccharine in beverages	1
7	Determination of benzoic acid in beverages	1
8	Determination of sulphur dioxide in beverages	1
9	Mid term	
10	Determination of caffeine in cola type of beverages	1
11	Determination of brix value, gas content, PH and acidity of beverages	1
12	Microbial total plate count of water and beverages	1
13	Microbial analysis of water for E – coli	1
14	Visit to carbonation Unit	1
15	Visit to water treatment plant	1
16	Visit to the drinking water/mineral water plant+-	

### REFERENCE BOOKS

- 1 Preservation of Fruit and Vegetable Products - Giridharilal, Siddappa G.S. and Tondon G.D.
- 2 Fruit and Vegetable Juices - Tressler D.K., Joslyn M.A. and Marsh G.C. AVI publishing company New York.
- 3 Food Engineering Operations - Brennan, Buttler, Crowell and Lilly

## FST-3615 PRODUCT DEVELOPMENT AND FORMULATION 2 (1+1)

### Theory

No. of Units	Topics	No. of Lectures
1	Need, importance and objectives of formulation for new product	1

	development.	
2	Ideas, business philosophy and strategy of new product	1
3	Formulation based on sources availability and cost competitiveness for concept developments of new products	2
4	Standardization of various formulation and product design	2
5	Adaptable technology and sustainable technology for standardized formulation for process development	1
6	Process control parameters and scale-up, production trials for new product development at lab and pilot scale	2
7	Quality assessment of new developed products	2
8	Market testing and marketing plan	1
9	Costing and economic evaluation of developed products	2
10	Commercialization / product launch for marketing	2
	<b>Total</b>	<b>16</b>

### Practical

No. of Units	Topics	No. of Experiments
1	Market survey of existing various products	1
2	Formulation of new products based on corporate decision /needbased	
	Protein-energy rich	1
	Low calorie (fat replacer)	1
	Low sodium content	1
	Glycemic index based	1
	Cholestrolemic index based	1
	Phyto-chemical based	1
3	Product development based on above formulation depending on local sources/ technology	2
4	Quality assessment	2
5	New product development for	
	Infant / weaning foods	1
	Geriatric	1
	Physiological status	1
	Athletes	1

	<b>Total</b>	<b>15</b>
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## REFERENCE BOOKS

1 New Food Product Design and Development

Sensory and Consumer Research in Food  
Product Design and Development

Beckley, Blackwell Publishing  
Oxford UK

Moskowitz, Blackwell  
Publishing Oxford UK

## FST-3616 SPECIALITY FOOD

**3 (2+1)**

### Theory

No. of Units	Topics	No. of Lectures
1	Need and scope of specialty foods	3
2	Speciality food based on ease in preparation for cost health benefits Functional foods Convenience food Health care and medical benefits Nutritional status Low cost foods	3
3	Speciality foods based on sources <ul style="list-style-type: none"> <li>• Cereals and millets</li> <li>• Legumes and pulses</li> <li>• Fruits and vegetables</li> <li>• Animal food sources</li> <li>• By product based</li> <li>• Non conventional foods</li> </ul>	4
4	Speciality foods based on process <ul style="list-style-type: none"> <li>• Innovative process technology</li> <li>• Food additives basis</li> <li>• Bioactive components</li> <li>• Novel nutraceuticals products</li> <li>• Packaging techniques</li> <li>• Adaptable technology basis</li> <li>• Fast and PET foods 3</li> </ul>	3
5	Speciality food based on genetics Genetically modified foods Transgenic foods Biotechnological aspects of detoxification	3
6	Proprietary foods	3
7	Supplementary foods	3
8	Therapeutic foods	3

	Modification of diets in disorders, feeding purposes Disease oriented of different organs ex: digestive tract, liver, cardiovascular system, kidney, metabolic disorders, allergy, endocrine disorders	
9	Specific consumer oriented foods <ul style="list-style-type: none"> <li>• Defence persons</li> <li>• Space / astronaut</li> <li>• High altitude mountain climbers</li> <li>• Disaster situation – crises, care, maintenance</li> </ul>	4
10	Speciality foods based on growing condition - organic, inorganic farming	3
	<b>Total</b>	<b>32</b>

### Practical

No. of Units	Topics	No. of Experiments
1	Preparation of speciality foods based on	
	i) Functionality	1
	ii) Convenience	1
	iii) Low cost	1
	iv) Nutritional purpose	1
2	Preparation of speciality food using locally available food crops, fruit and vegetables few products	2
3	Assessment of byproduct for preparation of value added speciality food	2
4	Isolation of phytochemical/ bioreactive agent of plant sources and their utilisation in proprietary foods	2
5	Preparation of speciality food as per requirement of	
	i) Location	1
	ii) Nature of work	1
	iii) Status of worker	1
6	Evolution of food cultivated under organic farming conditions	2
	<b>Total</b>	<b>15</b>

### REFERENCE BOOKS

1 Food Science	Potter
2 Processed Protein Food Stuffs	Alchule
3 Food and Nutrition	M Swaminathan
4 Therapeutic Diets	NIN
5 Supplementary Foods	NIN

## FST- 3617 EXTRUSION TECHNOLOGY 2 (1+1)

### Theory

<b>No. of Units</b>	<b>Topics</b>	<b>No. of Lectures</b>
1	Food proteins Types, sources, availability, need, properties etc. food problems, role, means for increasing food supply	4
2	Amino acid fortification of foods i.e. break fast cereals, infant foods, bread, baked products.	4
3	Legumes and oilseed foods Isolate, concentrate, and substitute to milk, variation in composition and nutritive value.	4
4	Meat Analogue, commercial development, nutritional aspect, marketing aspect	4
5	New protein foods, tofu, miso, texturized vegetable protein, hydrolyzed vegetable protein, formulation and quality control	4
6	Extrusion Technology Importance, principles of extrusion cooking, methods of extrusion cooking	4
7	Extruders- Types of extruders, single screw, twin screw, their applications, effects of dependent and independent variables on the product quality.	4
8	Extruded products- Raw materials, process of manufacture, properties, quality, evaluation, packaging requirement, marketing	4
	<b>Total</b>	<b>32</b>

### Practicals

<b>No. of Units</b>	<b>Topics</b>	<b>No. of Experiments</b>
1	Physicochemical properties of proteins, protein rich products, weaning foods, beverages	4
2	Texturized products, protein rich bakery products	4
3	Type of food extruders, preparation of extruded products	4
4	Factors affecting extrusion cooking, moisture content, diameter, temperature, pressure, screw speed, time, quality evaluation of these products	4
	<b>Total</b>	<b>16</b>

### REFERENCE BOOKS

1. New protein foods, vol.I,II, A.L. Altschul.
2. Extruded foods Matza.

## **FST-3618 QUALITY ASSURANCE AND CERTIFICATION (1+1)**

### **Theory**

<b>No. of Units</b>	<b>Topics</b>	<b>No. of Lectures</b>
1	Quality inspection, quality control, quality management and quality assurance	1
2	Total quality management <ul style="list-style-type: none"><li>• Good manufacturing practices</li><li>• Good agricultural practices</li><li>• Good laboratory practices</li></ul> Quality management systems (QMS)	4
3	Quality Circles, SQC., ISO System	2
4	HACCP, principles, implementation	3
5	Plan documentation, types of records	2
6	Auditing, surveillance Audit, mock audit, third party quality certifying audit, Auditors and Lead auditors.	2
7	Certification, certification procedures, certifying bodies, accrediting bodies, international bodies.	2
	<b>Total</b>	<b>16</b>

### **Practicals**

<b>No. of Units</b>	<b>Topics</b>	<b>No. of Experiments</b>
1	Quality assurance procedures	1
2	TQM, GMP, GAP documentation.	2
3	Preparation of quality policy & documentation (quality Manuals)	1
4	Preparation of laboratory manuals.	1
5	Application of HACCP to products.	2
6	Preparation of documentation and records.	1
7	Auditing- surveillance, mock audit.	2
8	Visit to units implementing GMP, GAP	2
9	Visit to units with ISO systems	2
10	Visit to units with HACCP certification.	2
	<b>Total</b>	<b>16</b>

### **REFERENCE BOOKS**



1 Preharvest and Post Harvest Food Safety	Beier, Blackwell Publishing Oxford UK
2 Guide to Food Laws and Regulations	Curties, Blackwell Publishing Oxford UK
3 Technology of Food Preservation	Desrosier and Desrosier
4 HACCP	Mortimore, Blackwell Publishing Oxford UK

Other courses of 7 credits approved by IV<sup>th</sup> Dean Committee are as follows

Sr. No.	Course title	Course credits
1	Principles of Economics	2 (2+0)
2	IT Application in Food Industry	2 (1+1)
3	Processing of Spices and Plantation Crops	3 (2+1)

1. Physical education : 01credit (Non credit course)  
2. Mathematics (Deficiency courses) : 04 credit (Non credit courses)

## DEPARTMENT OF FOOD CHEMISTRY AND NUTRITION

Sr. No.	Course No.	Course Title	Credits	Semester
1.	FCN-111	Bio-chemistry	3 (2+1)	I
2.	FCN- 112	Food Chemistry – I	3 (2+1)	I
3.	FCN- 123	Food Chemistry – II	3 (2+1)	II
4.	FCN-124	Human Nutrition	3 (2+1)	II
5.	FCN- 235	Techniques In Food Analysis	3 (1+2)	III
6.	FCN- 246	Food Additives	3 (2+1)	IV
7.	FCN-247	Environmental Science	3 2+1)	IV
		<b>Total credits</b>	<b>21</b>	

**DEPT. OF FOOD CHEMISTRY AND NUTRITION**

**FCN-111    BIOCHEMISTRY**

**3(2+1)**

**Theory**

<b>No. of Units</b>	<b>Topics</b>	<b>No. of Lectures</b>
1	Biochemistry & it's scope	1
2	Cellular Biochemistry Cell-structure – plant and animal, composition and function of cell organelle	1
3	Carbohydrates Occurrence ,Classification & Structures Physicochemical and Metabolic functions	2 2

	Metabolism – Glycolysis, TCA cycle, HMP pathway, ETC, oxidative phosphorylation and gluconeogenesis.	3
4	Proteins Occurrence, Classification & Structures Physicochemical & Metabolic functions Metabolism- Transamination, deamination and decarboxylation, amino acids- classification, structure biosynthesis of amino acids.	2 2 3
5	Lipids Occurrence, Classification & Structure Physicochemical and metabolic functions Metabolism- degradation of fats, $\beta$ - oxidation, fatty acids, classification and biosynthesis.	2 2 3
6	Nucleic Acids classification, structure & biosynthesis of nucleic acid,- Metabolism RNA and DNA metabolism.	4
7	Vitamins- Sources and classification, Chemistry and Metabolic functions, deficiency syndromes	4
8	Enzymes : Chemical Nature and nomenclature Classification, sources and properties Mechanism of action, coenzyme and prosthetic groups	3 2 2
	<b>Total</b>	<b>38</b>

### Practicals

No. of Units	Topics	No. of Experiments
1	Safety measures in the laboratory	1
2	Preparation of various solutions and buffers	2
3	Qualitative & quantitative determination of carbohydrates	3
4	Qualitative & quantitative determination of Amino acids	3
5	Qualitative & quantitative determination of Proteins	3
6	Qualitative & quantitative determination of Lipids	3
7	Qualitative & quantitative determination of vitamins – B1, B2, Vitamin-A	2
8	Isolation of enzymes from various sources	2
9		1
	<b>Total</b>	<b>20</b>

## REFERENCE BOOKS

1	Outlines of Biochemistry	Cohn & Stumpf
2	Text Book of Biochemistry	West & Todd
3	An Introduction to Practical Biochemistry	Plummer D.T.
	Osner Hawk's Practical Physiological Chemistry	Hawk.
5	Principles of Biochemistry	Lehninger
6	Principles of Biochemistry	Voet
7	Practical Biochemistry	Thamiah

## FCN- 112 FOOD CHEMISTRY – I 3 (2+1)

### Theory

No. of Units	Topics	No. of Lectures
1	Nature Scope and development of food chemistry, role of food chemist.	2
2	Moisture in foods Role and type of water in foods. Functional properties of water, role of water in food spoilage. Water activity and sorption isotherm iv) Molecular mobility and foods stability	4
3	Dispersed systems of foods Physicochemical aspects of food dispersion system a) Sol b) gel c) foam d) emulations	4

	Rheology of diphasic systems	
4	<p>Carbohydrates</p> <p>Functional characteristics of different carbohydrates ( sugars- water relationship, sweetness).</p> <p>Maillard reaction, caramelization, methods to control non enzymatic reactions.</p> <p>Modification of carbohydrates- unmodified and modified starches, modified celluloses</p> <p>Dietary fibres NDF, ADF, Cellulose, hemicellulose, pectin and carbohydrates digestibility – sugars and starch and their energy values.</p> <p>Functional properties of polysaccharides, natural vegetable gums, carbohydrate composition of various natural foods.</p>	5
5	<p>Proteins in foods</p> <p>Physicochemical properties- ionic properties, protein denaturation, gelation and hydrolysis.</p> <p>Protein content and composition in various foods- cereal grains, legumes and oilseed proteins, proteins of meat, milk, egg and fish.</p> <p>Functional properties of proteins in foods – water and oil binding, foaming, gelation, emulsification.</p> <p>Effects of processing on functional properties of proteins-heat processing alkali treatments, chilling, freezing, dehydration and radiations.</p> <p>Unconventional sources of proteins- SCP fish protein concentrates, leaf proteins.</p>	5
6	<p>Lipids in foods</p> <p>Role and use of lipids /fat, occurrence, fat group classification,</p> <p>Physicochemical aspects of fatty acids in natural foods, hydrolysis, reversion, polymorphism and its application.</p> <p>Chemical aspects of lipolysis, auto oxidation, antioxidants,</p> <p>Technology of fat and oil processing</p> <p>a) Refining</p> <p>b) Hydrogenations</p> <p>c) Inter esterification</p> <p>d) Safety use of oils and fats in food formulation</p>	6
7	<p>Enzymes in food industry</p> <p>Carbohydrases ( Amylases, cellulases, pectinases, hemicellulases)</p> <p>Proteases Lipases and oxidases in food processing.</p>	4
	Total	30

## Practicals

No. of Units	Topics	No. of Experiments
1	Determination of moisture content of foods using different methods.	2
2	Studies of absorption isotherms of different foods.	2
3	Swelling and solubility characteristics of starches	2
4	Rheological properties of diphasic systems	2
5	Determination of crude proteins by microkjaldhal method	2
6	Determination of essential amino acids i.e. Lysine, tryptophan, methionine etc.	2
7	Isolation of egg and milk protein	2
8	Preparation of protein isolate and concentrate of plant proteins	2
9	Determination of acid value, saponification value and iodine number of fat/ oil	2
10	Assay of amylases, papain and lipases.	3
	<b>Total</b>	<b>21</b>

## REFERENCE BOOKS

- 1 Food Chemistry- Vol-I Fennema O.R.
- 2 Food Chemistry Mayer L.H.

## FCN- 123 FOOD CHEMISTRY - II 3 (2+1)

### Theory

No. of Units	Topics	No. of Lectures
1	Chemistry of food flavour Philosophy and definitions of flavour Flavourmatics / flavouring compounds Sensory assessment of flavour Technology for flavour retention	3
2	Food additives and Technology General attributes Buffer systems/ salts / Acids Chelating agents and sequestrants Antioxidants Antimicrobial agents Non-nutritive and low calorie sweeteners Stabilizer and thickeners	4

	Fat replacers Texturizers and improvers	
3	Pigments in animal and plants kingdoms Heme pigments Chlorophyll Carotenoids Phenolic and flavonoids Betalins Effect of processing on pigment behavior Technology for retention of natural colours of food stuffs	7
4	Food colorants Regulatory aspects – Natural and synthetic permitted food colours. Properties of certified dyes Use of regulatory dyes Colour losses during thermal processing	3
5	Vitamins and minerals Dietary sources requirements Allowances Enrichment Restorations Fortifications Losses of vitamins and minerals Optimization and retention of vitamins and minerals	4
6	Food toxicology Inherent toxicants – antinutritional factors their occurrence, effects and methods of elimination or inactivation- protease inhibitions, lectins, lathyrogens, phytates and flatulence factors Terms in toxicology Safety evaluation using traditional and modern approach Food Contaminants Pesticidal residues – permitted limits Toxicology and public health	4
7	Enzymes in foods – Role of endogenous enzymes in maturation and ripening Enzymatic browning- mechanism, methods of regulation or control.	2
	<b>Total</b>	<b>27</b>

### Practical

No. of Units	Topics	No. of Lectures
1	Preparation of mineral solution by using ash and tri acid	2

	method (dry and wet oxidations)	
2	Estimation of calcium	1
3	Determination of phosphorus	1
4	Determination of iron	1
5	Estimation of magnesium	1
6	Estimation of tannins and phytic acid from food	2
7	Determination of vit. A (Total carotenoids)	1
8	Determination of ascorbic acid by dye method	1
9	Determination of niacin and pyridoxine	2
10	Determination of food colors	1
11	Assessment of hydrocolloids as food additives	1
12	Assessment of various pectinases from fruits and vegetables	2
	<b>Total</b>	<b>16</b>

### REFERENCE BOOKS

- 1 Food Chemistry-Vol.I
- 2 Food Chemistry

Fennema O.R.  
Mayer L.H.

## FCN-124 HUMAN NUTRITION 3 (2+1)

### Theory

No. of Units	Topics	No. of Lectures
1	Concepts and content of nutrition Nutrition agencies Nutrition of community Nutritional policies and their implementation Metabolic function of nutrients	3
2	Water and energy balance Water intake and losses Basal metabolism- BMR Body surface area and factors affecting BMR	3
3	Formulation of diets Classification of balanced diet Preparation of balanced diet for various groups Diets and disorders	5



4	Recommended dietary allowances For various age group According physiological status Athletic and sports man Geriatric persons	5
5	Malnutrition Type of Malnutrition Multi-factorial causes Epidemiology of under nutrition and over nutrition Nutrition infection and immunity Nutrition education	5
6	Assessment of nutritional status Diet surveys Anthropometry Clinical examination Biochemical assessment Additional medical information	4
7	In-born error of metabolism Blood constituents Nutrients Hormones and enzymes Miscellaneous disorders	4
8	Food fad and faddism	1
9	Potentially toxic substance in human food	1
	<b>Total</b>	<b>31</b>

### Practicals

No. of Units	Topics	No. of Experiments
1	Role of various national and international agencies in field of human nutrition	1
2	Calculation of BMR and body surface area	2
3	Preparation of balance diets, evaluation of energy value and techno economical feasibility	3
4	Anthropometric measurements	2
5	Techniques in animal feeding experiments	2
6	Biochemical analysis of urine and blood	2
7	Nutritional survey	2
8	Determination of energy value Bomb Calorimeter On basis of composition	2
9	Computation of Energy requirements On the basis of Physical activity ACU unit	2
	<b>Total</b>	<b>18</b>

### REFERENCE BOOKS

- |  |                |
|--|----------------|
| 1 Community Nutrition                                  | Mc Laren       |
| 2 ICMR Publications                                    |                |
| 3 Food and Nutrition                                   | M. Swaminathan |
| 4 Assessment of nutritional<br>Status of the community | D.B. Jelliffe  |

### FCN- 235 TECHNIQUES IN FOOD ANALYSIS 3 (1+2)

#### Theory

No. of Units	Topics	No. of Lectures
1	Nature and concepts of food analysis Rules and regulations of food analysis Safety in laboratory Sampling techniques	3
	Principles and methodology involved in analytical techniques PH Meter and use of ion selective electrodes Spectroscopy a. Ultra violet visible, florescence b. Infrared spectro c. Atomic absorption and emission d. Mass spectroscopy i) Nuclear magnetic resonance and electron spin resonance ii) Chromatography Adsorption Column Partition Gel-filtration Affinity Ion-exchange Size-exclusion method Gas liquid High performance liquid chromatography Separation techniques a. Dialysis b. Electrophoresis i) Paper ii) SDS gel electrophoresis iii) Immuno electrophoresis c. Sedimentation, ultra filtration, ultracentrifugation d. Iso-electric focusing e. Isotopic techniques f. Manometric techniques.	15
3	Principles and methodology involved in analysis of foods. Rheological analysis Textural profile	2
4	Immuno assay techniques in food analysis Isotopic and Non-isotopic immuno assay Enzyme-immuno assay	2
5	Evaluation of analytical data Accuracy and precision	3

	Statistical significance Co-relations regression Computers for data analysis and result interpretation	
6	Sensory analysis of food Objective method ii) Subjective method	3
	<b>Total</b>	<b>28</b>

### Practicals

No. of Units	Topics	No. of Experiments
1	Analysis of heavy metal using atomic absorption spectrophotometer	1
2	Estimation of phytic acid using spectrophotometer	1
3	Separation of amino acids by two-dimensional paper chromatography	2
4	The identification of sugars in fruit juice using TLC	1
5	Separation of proteins by Ion-exchange chromatography	1
6	Molecular weight determination using sephadox-gel	2
7	Identification of amino acids by paper electrophoresis	1
8	Gel-electrophoresis for analytic techniques	2
9	Quantitative determination of sugars and fatty acid profile by GLC	2
10	Quantitative make-up of water and fat soluble vitamins using HPLC	2
	<b>Total</b>	<b>15</b>

### REFERENCE BOOKS

- |   |                                 |
|---|---------------------------------|
| 1 Food Analysis Theory and Practice   | Pomeranz & Meloan               |
| 2 Methods in Food Analysis  | Maynard                         |
| 3 Food Biochemistry   | Eskin, Henderson and Twonsend.  |
| 4 Post Harvest Physiology, Handling and Utilization of Tropical and Co-west port cohn.    | Pantastico, AVI Publishing      |
| 5 Subtropical Fruits and Vegetables.  | R.B. Wills, W.B.Mc Glasson,     |
| 6 Post harvest : An Introduction to the Physiology and Handling of Fruits and Vegetables. | D.Graham T.H. Lee and E.G. Hall |
| 7 Introduction to practical Biochemistry  | Plumer.                         |

**FCN- 246    FOOD ADDITIVES    3 (2+1)****Theory**

<b>No. of Units</b>	<b>Topics</b>	<b>No. of Lectures</b>
1	Intentional and unintentional food additives their toxicology and safety evaluation	2
2	Naturally occurring food additives	3
3	Food colour (natural and artificial)	3
4	Pigments their importance and utilization as food colour	3
5	Taste and flavour inducer, potentiater	3
6	Food preservatives and their chemical action	3
7	Role mode of action salt, chelating agents stabilizers and thickeners, polyhydric alcohol, anticaking agent, firming and colouring agent, flour bleaching agent, antioxidants, non-nutritional sweetness and antimicrobial agents	3
	<b>Total</b>	<b>21</b>

**Practicals**

<b>No. of Units.</b>	<b>Topics</b>	<b>No. of Experiments</b>
1	Evaluation of GRAS aspect of food additives	2
2	Identification of food colour by TLC	2
3	Isolation and identification of naturally occurring food pigments by paper and TLC	2
4	Spectrophotometric method of total chlorophyll (A&B)	2
5	Determination of diacetyl content of Butter	2
6	Role mode of action of chelating agent in fruit juice	2
7	Role and mode of action of stabilizer and thickener in frozen dairy products. (Ice-cream)	2
8	Role and mode of clarifying agent in fruit juices	1
9	Role and mode of antioxidant in frozen fish	1
10	Role of leavening agent in baked food product.	1
	<b>Total</b>	<b>17</b>

**REFERENCE BOOKS**

- |                         |              |
|-------------------------|--------------|
| 1 Food Chemistry- Vol-I | Fennema O.R. |
| 2 Food Chemistry        | Mayer L.H.   |

**Theory**

<b>No. of Units</b>	<b>Topics</b>	<b>No. of Lectures</b>
1	Environmental science: An introduction	2
2	Ecosystem: kinds, structure, characteristics, functioning	2
3	Biochemical cycles	1
4	Natural resources and their managements	2
5	Environmental pollution.	2
6	Air pollution	2
7	Water pollution	2
8	Solid waste pollution	2
9	Noise pollution	1
10	Soil pollution	2
11	Radio active pollution	1
12	Food processing industry waste and its management	2
13	Management of urban waste water	1
14	Recycling of organic waste	2
15	Recycling of factory effluent	2
16	Control of environmental pollution through law	2
17	Composting of biological waste	2
18	Sewage, uses of water disposal effluent treatment, microbial examination	
	<b>Total</b>	<b>32</b>

**Practicals**

<b>No. of Units</b>	<b>Topics</b>	<b>No. of Experiments</b>
1	Environment and its analysis	1
2	Water quality parameters	1
3	Collection of sample for pollution study	1
4	Determination of pH/ acidity/alkalinity from sample	2
5	Estimation of dissolved oxygen	1
6	Estimation of BOD	2
7	Estimation of COD	1
8	Estimation of nitrates	1
9	Estimation of phosphates	1
10	Estimation of pollutant elements	1
11	Estimation of heavy/ toxic elements	1
12	Estimation of lead / mercury	1
13	Visit to industrial sewage disposal unit	1
	<b>Total</b>	<b>15</b>

**REFERENCE BOOKS**

Environmental Biology

Fundamentals of Environmental Science

Dr. K.C. Agrawal.

G.S. Dhaliwal and G.S. Sanghai

## DEPARTMENT OF FOOD AND INDUSTRIAL MICROBIOLOGY

<b>Sr. No.</b>	<b>Course No.</b>	<b>Course Title</b>	<b>Credits</b>	<b>Semester</b>
1.	FIM-111	Fundamentals of Microbiology	3 (2+1)	I
2.	FIM-122	Food Microbiology	3 (2+1)	II
3.	FIM-233	Fermentation and Industrial Microbiology	3 (2+1)	III
4.	FIM-244	Food Safety and Microbial Standards	3 (2+1)	IV
5.	FIM-355	Food Bio-technology	3 (2+1)	V
6.	FIM -366	Food Hygiene and Sanitation	3 (2+1)	VI
		<b>Total credits</b>	<b>18 (12+6)</b>	

## DEPARTMENT OF FOOD AND INDUSTRIAL MICROBIOLOGY

### FIM-111 Fundamentals of Microbiology 3 (2+1)

#### Theory

No. of Units	Topics	No. of Lectures
1	Evolution and scope of Microbiology	2
2	General morphological, cultural characteristics and reproduction of bacteria, yeasts, molds, actinomycetes, algae, protozoa, and rickettsia	5
3	Nutrient transport phenomenon and physiology of microorganisms	4
4	Genetic recombination, transduction, transformation and bacterial conjugation, mutation and mutagenesis	4
5	Growth curve: Physical and chemical factors influencing growth and destruction of microorganisms (including thermal death time, Z, F and D values)	4
6	Viruses: Structure and replication with particular reference to food borne viruses.	4
7	Control of Microorganisms by physical and chemical agents, antibiotics and other chemotherapeutic agents	4
8	Preservation of microbial cultures	3
	<b>Total</b>	<b>30</b>

#### Practicals

No. of Units	Topics	No. of Experiments
1	Microscopy	1
2	Micrometry	1
3	Cleaning and sterilization of glassware	1
4	Preparation of nutrient agar media and techniques of inoculation	1
5	Staining methods (monochrome staining, negative staining, capsule-staining, flagella staining and endospore staining)	2
6	Pure culture techniques (streak plate/pour plate)	2
7	Introduction to identification procedures (morphology and cultural characteristics)	2
8	Growth characteristics of bacteria: Determination of microbial numbers, direct plate count, generation time	2
9	Factors influencing growth: $P_H$ , temperature, growth curves for bacteria	1
10	Methods of microbial culture preservation for bacteria and yeasts.	1
11	Anaerobic culture methods	1
	<b>Total</b>	<b>15</b>

## REFERENCE BOOKS

- |  |   |
|--|---|
| 1 Fundamentals of Microbiology               | Martin Frobisher, Sc.D.                                   |
| 2 Text Book of Microbiology                  | Bob A. Freeman  |
| 3 Microbiology, a Text Book                  | Prof. Kamal, A.K. Shrivastava and G.P. Rao                |
| 4 Microbiology                               | M.J. Pelczar Jr., E.C.S. Chan and N.R. Krieg.             |
| 5 Biology of Microorganisms                  | T.D. Brock  |
| 6 General Microbiology                       | Singh B. D., Nallari P., Kavikishore P. B and Singh R. P. |
| 7 Microbiology Fundamentals and Applications | Purohit S. S.   |
| 8 Microbiology                               | Prescott, Harley and Klein                                |
| 9 Practical Microbiology                     | G. Sirockin and S. Callimore                              |
| 10 Microbes in Action.                       |   |
| A laboratory manual of microbiology          | H.E. Salley , Jr & A.T. Van Denmak                        |

## FIM-122 FOOD MICROBIOLOGY 3 (2+1)

### Theory

No. of Units	Topics	No. of Lectures
1	Microbial spoilage of foods	2
2	Chemical changes caused by microorganisms	1
3	Principles of food preservation	1
4	Control of microorganisms by use of low and high temperature	4
5	Asepsis, water activity , drying, preservatives, radiation and pressure for control of microorganisms	4
6	Microbiology of milk and milk products Sources of contamination, spoilage and prevention	2
7	Microbiology of fruits and vegetables Sources of contamination, spoilage and prevention	2
8	Microbiology of cereal and cereal products. Sources of contamination, spoilage and prevention	2
9	Microbiology of meat and meat products. Sources of contamination, spoilage and prevention	2
10	Microbiology of fish and other sea foods Sources of contamination, spoilage and prevention	2
11	Microbiology of poultry and eggs Sources of contamination, spoilage and prevention	2
12	Microbiology of sugar and sugar products Sources of contamination, spoilage and prevention	2
13	Microbiology of salts and spices Sources of contamination, spoilage and prevention	2
14	Microbiology of canned foods Sources of contamination, spoilage and prevention	2
	<b>Total</b>	<b>30</b>



## Practicals

No. of Units	Topics	No. of Experiments
1	Isolation of molds from foods	2
2	Microbial examination of cereal and cereal products Identification, isolation and confirmation of <i>R. nigricans</i>	2
3	Microbial examination of vegetable and fruits Identification, isolation and confirmation of <i>R. nigricans/Erwinia carotovora</i>	2
4	Microbial examination of meat and meat products Identification, isolation and confirmation of <i>Coliform</i> bacteria/ <i>P.fluorescens</i>	2
5	Microbial examination of fish and other sea foods Identification, isolation and confirmation of <i>Proteus</i>	2
6	Microbial examination of Eggs and poultry Identification, isolation and confirmation of <i>Pseudomonas fluorescens</i>	2
7	Microbial examination of milk and milk products Identification, isolation and confirmation of <i>S.thermophilus</i>	1
8	Microbial examination of sugar, salts and spices Identification, isolation and confirmation of <i>L.messenteroides/L.dextranicum</i>	1
9	Thermal Death Time determination	1
	<b>Total</b>	<b>15</b>

## REFERENCE BOOKS

- |                                      |   |
|--------------------------------------|---|
| 1 Food Microbiology                  | W.C. Frazier and D.C. Westhoff                            |
| 2 Modern Food Microbiology           | James M. Jay.   |
| 3 Basic Food Microbiology            | G.J. Banwart.   |
| 4 Applied Microbiology               | Singh B. D., Nallari P., Kavikishore P. B and Singh R. P. |
| 5 Food Microbiology (vol. I & II)    | Adams M.R. and Moss M.O.                                  |
| 6 Food Microbiology and Lab Practice | Bell  |

**FIM-233 FERMENTATION AND INDUSTRIAL MICROBIOLOGY 3 (2+1)**

**Theory**

<b>No. of Units</b>	<b>Topics</b>	<b>No. of Lectures</b>
1	Microbes as friends, primary and secondary metabolites, screening and isolation of microorganisms, the organizations involved microbiological work	1
2	Industrially important secondary metabolites, organic acids, antibiotics, probiotics, compounds of therapeutic and medicinal value	6
3	Bacteriocins, nisin, biocolours, carotenoids, B-carotene, lycopane, ang kak, production of microbial enzymes, down stream processing of enzymes and application of microbial enzymes in food and allied industries	6
4	Production and purification of microbial polysaccharides, and their applications production of important amino acids, vitamins and bioinsecticides	5
5	Plant cell cultures and metabolites, production of SCP, fermented dairy products, bakers yeast	3
6	Fermented foods and alcoholic beverages, microbial standards	3
7	Industrial fermentors and accessories. (instrumentation)	2
8	Economic feasibility studies of few products, advances in strain improvements for high yields of metabolites, blue green algae	2
9	Mushrooms – production, preservation and quality	2
	<b>Total</b>	<b>30</b>

**Practicals**

<b>No. of Units</b>	<b>Topics</b>	<b>No. of Experiments</b>
1	Standardization of physical factors for higher yields of citric acid	2
2	Production and assay of antibiotics – Penicillin/tetracycline	2
3	Production and assay of $\beta$ -carotene	1
4	Production of ang kak (Red rice) and estimation of colouring compounds	1
5	Production, purification and assay of fungal analyses / proteases	2
6	Production of xanthan / pullulan	1
7	Production and assay of amino acids	1
8	Production and assay of nisin from lactic acid bacteria	1
9	Single cell protein (SCP) production	1
10	Mushroom production	1
11	Preparation of food based fermented product like miso/Idli/Dhokla	2
	<b>Total</b>	<b>15</b>

## REFERENCE BOOKS

- |   |                             |
|---|-----------------------------|
| 1 Microbial Technology Vol-I                  | H.J. Peppler and D. Perlman |
| 2 Microbial Technology Vol-II                 | H.J. Peppler and D. Perlman |
| 3 Industrial Microbiology 4 <sup>th</sup> Ed. | Prescott and Dunns          |

## FIM-244 FOOD SAFETY AND MICROBIAL STANDARDS 3 (2+1)

### Theory

No. of Units	Topics	No. of Lectures
1	Hazards in food chain physical, chemical, biological	6
2	Toxins in food, naturally occurring, bacterial and fungal	4
3	Intrinsic toxins produced during processing and storage	3
4	Metals as toxins – sources, contamination, toxicity and elimination	3
5	Pesticide residues as toxin i) Chlorinated ii) Non – chlorinated.	3
6	Permitted and non permitted food additives as and when amended	4
7	Microbial standards of fresh and processed foods.	3
8	Risk assessment and management during food preparation.	4
	<b>Total</b>	<b>30</b>

### Practicals

No. of Units	Topics	No. of Experiments
1	Estimation of <i>Salmonella</i> / <i>Shigella</i> / <i>Stachyphylococcus</i> from food samples.	2
2	Estimation of fungal toxins from food samples. (Different types of foods)	2
3	Heavy metal detection (lead)	2
4	Isolation and identification of <i>Listeria</i> and <i>E. Coli</i>	2
5	HACCP for food industries by taking few models	2
6	Study of national and international microbial quality standards	2
7	Visit to export oriented food processing industry	2
8	Microbial and chemical analysis of water	2
	<b>Total</b>	<b>15</b>

### REFERENCE BOOK

- |                                |                                |
|--------------------------------|--------------------------------|
| 1 Food Hygiene and Sanitation  | S. Roday                       |
| 2 Food Microbiology            | W.C. Frazier and D.C. Westhoff |
| 3 Food Chemistry (New Edition) | Owin R. Fenema                 |
| 4 Handbook of Food Toxicology  | S.S. Deshpande                 |
| 5 Food Microbiology            | M.R. Adams and M.O. Moss       |
| 6 Food Additives Toxicology    | J.A. Maga and A.T. Tu          |
| 7 Safety of Foods (II Edition) | H.D. Graham                    |

**FIM-355 FOOD BIO-TECHNOLOGY 3 (2+1)****Theory**

<b>No. of Units</b>	<b>Topics</b>	<b>No. of Lectures</b>
1	Prospectus of Bio-Technology	2
2	Molecular genetics i.e. fundamentals of molecular biology with special reference to chemistry and biology and DNA. (Primary secondary and tertiary) structures	3
3	Biological role of DNA in cell metabolism	2
4	Genetic recombination mechanisms and technique used for improvement in microbial strains	2
5	Applications of genetic control mechanism in industrial fermentation process, (Induction, manipulation and recombination)	2
6	Recombinant-DNA technology (plasmids and cloning)	2
7	Cell and tissue culture	2
8	Continuous cultures	2
9	Secondary metabolites synthesis	2
10	Expression of foreign genes. promoter (Enzyme), biomass production by using various micro organisms	3
11	Application of Biotechnology in food (Food industries), pharmaceuticals and agriculture	3
12	Bio-gas plant	2
13	Bio technology approach for the exploitation of food and industrially important microorganisms	3
<b>Total</b>		<b>30</b>

**Practicals**

<b>No. of Units</b>	<b>Topics</b>	<b>No. of Experiments</b>
1	Study of auxotroph	1
2	Micro propagation through tissue culture	1
3	Strain improvement through U.V. mutation for lactose utilization	2
4	Chemical mutagenesis using chemical mutagens (Ethidium bromide)	2
5	Determination of survival curves using physical and chemical mutagens	2
6	Isolation and analysis of chromosomal / genomic DNA from <i>E.coli</i> and <i>Bacillus cereus</i>	2
7	Separation of protoplast using cellulytic enzymes	2
8	Introduction of ELISA / Southern blot / DNA finger printing etc	1
9	Agarose gel electrophoresis of plasmid DNA	1
10	Pesticide degradation by pseudomonas spp	1
<b>Total</b>		<b>15</b>

**REFERENCE BOOKS**

1 Advances in Biotechnology Vol.1

Murayy Moo-Young

	(Scientific and Engineering principles)	C.W. Gambell and C.Vezina
2	Advances in Biotechnology Vol-II (Fuels, chemicals, foods and waste treatments)	Murayy Moo-Young C.W. Gambell and C.Vezina
3	Advances in Biotechnology Vol-III (Fermentation Products)	Murray Moo-Young
4	VIIth International Biotechnology Symposium (Feb 19-25 1984) held at New Delhi-Part-I	
5	VIIth International Biotechnology Symposium (Feb. 19-25 1984) Held at New Delhi Part-II.	
6	Microbial Technology-Vol-I (Microbial Process)	Peppler and Perlman
7	Microbial Technology-Vol-I I (Fermentation Technology)	Peppler and Perlman

### **FIM-366 FOOD HYGIENE AND SANITATION 3 (2+1)**

#### **Theory**

<b>No. of Units</b>	<b>Topics</b>	<b>No. of Lectures</b>
1	Principles of Food Hygiene, hygiene in urban and rural areas with respect to food preparations.	2
2	Food handling habits and personal hygiene	2
3	Sources of water and impurities in water, hardness of water.	2

4	Water supply systems and water purification, chlorination	2
5	Types of Soil (Food residues on equipment surfaces) and its properties.	2
6	Cleaning procedures, types of cleaning agents and their properties.	2
7	Acid and alkaline cleaners.	2
8	Types of sanitizing agents and their properties.	2
<b>9</b>	<b>Mid Semester Examination</b>	
10	Chlorine, iodine and their compounds as sanitizers, Quaternary ammonium compounds, phenolic compounds as sanitizers. Advantages and disadvantages of these sanitizers.	2
11	Physical sanitizing agents example Hot water, Steam and UV light.	2
12	Sanitation facilities and procedures in food plant operations. CIP system.	2
13	Cleaning premises and surroundings. Common Pests in food services rodents, insects, birds, house flies, cockroaches, ants and their control.	2
14	Sanitation regulations, phytosanitary requirements.	2
15	Hygiene and sanitation of preparation, storage and retail shops.	2
16	Plant and equipments design, requirements for ease in maintenance of hygiene and sanitation	2
17	Study of food sanitation check lists.	2
	Total	32

### Practicals

No. of Units	Experiments	No. of Experiments
1	Microbial quality of air	1
2	Microbial load of palm/ fingers, nose secretions of workers TPC/ <i>E.Coli</i> / <i>Vibrio</i> - continue.	2
3	Microbial load of palm/ fingers, nose secretions of workers TPC/ <i>E.Coli</i> / <i>Vibrio</i> - continue.	3
4	Microbial quality of eating utensils- continue	4
5	Microbial quality of eating utensils	5
6	Visit to water purification plant	6
7	Determination of micro-organisms as sanitary indicator ropiness/ moldiness of bread - continue	7
8	Determination of micro-organisms as sanitary indicator ropiness/ moldiness of bread	8
<b>9</b>	<b>Mid Semester Examination</b>	
10	Testing of sanitizers, disinfectants for antimicrobial activity- continue	9
11	Testing of sanitizers, disinfectants for antimicrobial activity	10
12	Study of phenol coefficients of sanitizers- continue	11
13	Study of phenol coefficients of sanitizers	12
14	Visit to District public health laboratory and preparation of visit	13

	report	
15	Investigation of organisms involved in infections, diseases vibrio typhoid.	14
16	Visit to restaurants/ local food industries and preparation of visit report on prevailing conditions of hygiene	15
17	Methods of pest control in food industries rodents / cockroaches	16

### REFERENCE BOOK

- |   |   |
|---|---|
| 1 Guide to improving Food Hygiene                           | - Ed Gaston & Tiffney   |
| 2 Practical Food Microbiology and                           | - Harry H. Weiser, J. Mountney and W.W. Gord Technology (2 <sup>nd</sup> edition) |
| 3 Food Poisoning and Food Hygiene (3 <sup>rd</sup> Edition) | - Betty C. Hobbs  |
| 4 Principles of Food Sanitation                             | - Marriott. Norman G.   |
| 5 Hygiene in food manufacturing and Handling                | - Barry Graham- Rack and Raymond Bmsted   |

## DEPARTMENT OF FOOD ENGINEERING

Sr. No.	Course No.	Course Title	Credits	Semester
1	FE-111	Engineering Drawing	1 (0+1)	I
2	FE-112	Fluid Mechanics and Hydraulics	2 (1+1)	I
3	FE-123	Energy Generation and Conservation	3 (2+1)	II



4	FE-124	Heat and Mass Transfer	2 (1+1)	II
5	FE-235	Food Processing Equipments-I	3 (2+1)	III
6	FE-236	Food Packaging	3 (2+1)	III
7	FE-247	Food Processing Equipments-II	3 (2+1)	IV
8	FE-358	Refrigeration Engineering and Cold Chain	3 (2+1)	V
9	FE-359	Bio-Chemical Engineering	3(2+1)	V
10	FE-3510	Instrumentation and Process control	3 (2+1)	V
11	FE-3611	Food Plant Design and Layout	3 (1+2)	VI
		<b>Total Credits</b>	<b>29 (17+12)</b>	

## DEPARTMENT OF FOOD ENGINEERING

### FE-111 ENGINEERING DRAWING 1 (0+1)

#### Practicals

No. of Units	Topics	No. of Experiments
1	Drawing of lines, lettering and dimensioning, types of lines	2
2	Types of lettering, types of dimensioning	2
3	Drawing of scales Plain scale and diagonal scale	1
4	Drawing of screw threads Types of threads	2
5	Screw fastening Types of nuts, types of bolts and stud	1
6	Drawing of rivets and riveted joints, forms of rivet heads, types of riveted joints, failure of riveted joints	2
7	Drawing of welded joints Forms of welds, location and dimensions of welds	1
8	Drawing of keys, types of keys	2
9	Drawing of shaft couplings Rigid couplings and flexible couplings	1
10	Drawing of shaft bearings Journal bearings and pivot bearings	2
	<b>Total</b>	<b>16</b>

#### REFERENCE BOOKS

- |                                |            |
|--------------------------------|------------|
| Elementary Engineering drawing | N.D. Bhatt |
| 2 Machine drawing              | N.D. Bhatt |

**FE-112 FLUID MECHANICS AND HYDRAULICS 2 (1+1)****Theory**

<b>No. of Units</b>	<b>Topics</b>	<b>No. of Lectures</b>
1	Properties of fluids	2
2	Static pressure of liquids : Hydraulic pressure, absolute and gauge pressure, pressure head of a liquid. Pressure on vertical rectangular surfaces. Compressible and non compressible fluids. Surface tension	2
3	Pressure measuring devices: Simple, differential, micro, inclined manometer, mechanical gauges,	2
4	Floating bodies : Archimede's principle, stability of floating bodies. Equilibrium of floating bodies	2
5	Fluid flow : Classification, steady, uniform and non-uniform, laminar and turbulent, Bernoulli's theorem and its applications	2
6	Flow through pipes: Loss of head	1
7	Flow through orifices, discharge losses. Time for emptying a tank. Venturi meter, pitot tube, Rota meter. Water level point gauge, hook gauge. Reynold's number	2
8	Pumps : Classification, reciprocating, centrifugal pump. Pressure variation, work efficiency. Types of chambers, selection and sizing	2
	<b>Total</b>	<b>15</b>

**Practicals**

<b>No. of Units</b>	<b>Topics</b>	<b>No. of Experiments</b>
1	Study of different tools and fittings	1
2	To plot flow rate versus pressure drop with U-tube manometer	2
3	Verification of Bernoulli's theorem	2
4	Determination of discharge co-efficient for venturi, Orifice, V-Notch	2
5	Verification of emptying time formula for a tank	1
6	Determination of critical Reynold's number by Reynold' apparatus	2
7	Study of reciprocating, centrifugal and gear pump	2
8	Calibration of Rotameter	2
9	Study of different types of valves	1
	<b>Total</b>	<b>15</b>

**REFERENCE BOOKS**

- |   |                 |   |
|---|-----------------|---|
| 1 | Fluid Mechanics | V.L. Streeter (1983), McGraw Hill, New York             |
| 2 | Fluid Mechanics | R.S. Khurmi (1994), Sultan Chand Publishers, Delhi.     |
| 3 | Hydraulics      | Jagdish Lal (1987), Metropolitan Publishers, New Delhi. |

**FE-123 ENERGY GENERATION  
AND CONSERVATION**

**3 (2+1)**

**Theory**

<b>No. of Units</b>	<b>Topics</b>	<b>No. of Lectures</b>
1	Units and dimensions, Basic concepts : systems, processes, cycles, energy, The Zeroth Law of Thermodynamics	3
2	Ideal gases : Equation of state, Compression and expansion of gases	2
3	The first Law of Thermodynamics : Internal energy, enthalpy	2
4	Renewable energy sources like solar, wind and biogas and their utilization in food processing	3
5	Related equipment and machineries to renewable energy sources	2
6	Fuels : Chemical properties, air for combustion, Calorific value and its determination, Burners, firing of fuels	3
7	Properties of steam : Wet, dry saturated, superheated steam, Use of steam tables	2
8	Steam generators : Fire tube boilers, Water tube boilers	2
9	Boiler mountings and Boiler accessories	2
10	Measurement of Height of boiler chimney	2
11	Condensers	2
12	Layout of pipe-line and expansion joints	2
13	Boiler trial : Codes, Indian Boiler Regulation acts. Air Compressors : Reciprocating, Single and two stage air compressors	3
	<b>Total</b>	<b>30</b>

**Practicals**

<b>No. of Units</b>	<b>Topics</b>	<b>No. of Experiments</b>
1	Application of thermodynamics in engineering problems	2
2	Determination of dryness fraction of steam	2
3	To study the boiler installed in Model Plant, Water softening plant, Babcock and Wilcox boiler, Electrode boiler, Boiler mounting and steam-line layout and steam traps	6
4	Visit to sugar mill or rice mill plant with steam utilization	3
5	Study of solar water heater and biogas plants and appliances	2
	<b>Total</b>	<b>15</b>

**REFERENCE BOOKS**

1 Engineering Thermodynamics

C.P. Gupta & Rajendra Prakash  
(1991), Nemi Chand and Sons, Roorkee

2	Elements of Heat Engines	N.C. Pandya & C.S. Shah. (1990) Charotar Publishing House, Anand
3	Indian Boiler Regulation Codes. (1991)	
4	Dairy Plant Engg. and Management	Tufail Ahmed (1996), Kitab Mahal New Delhi
5	Thermal Engineering	Mathur and Mehta

## FE-124 HEAT AND MASS TRANSFER 2 (1+1)

### Theory

No. of Units	Topics	No. of Lectures
1	Basic heat transfer process, thermal conductivity, Overall heat transfer co-efficient, physical properties related to heat transfer	2
2	One-dimensional steady state conduction : Theory of heat conduction, Fourier's law, Derivation of Fourier's equation in Cartesian co-ordinates, Heat flow through slab, cylinder and sphere with non-uniform thermal conductivity	2
3	Heat transfer through composite walls and insulated pipelines	1
4	Steady-state heat conduction with heat dissipation to environment :Introduction to extended surfaces (FINS) of uniform area of cross-section. Equation of temperature distribution with different boundary conditions. Introduction to unsteadystate heat conduction	1
5	Convection : Forced and free convection, use of dimensional analysis for correlating variables affecting convection heat transfer, Concept of Nusselt number. Prandtl number, Reynolds number,	2
6	Radiation : emissivity, absorptivity, transmissivity, Radiation through black and grey surfaces, determination of shape factors	2
7	Heat Exchangers : General discussion, fouling factors, jacketed kettles, LMTD, parallel and counter flow heat exchangers, Shell and tube and plate heat exchangers,	2
8	Application of different types of heat exchangers in dairy and food industry	1
9	Mass transfer : Fick's law of diffusion, steady state diffusion of gases and liquids through solids, isothermal evaporation of water into air, mass transfer coefficient, applications in Dairy and Food industry	2
	<b>Total</b>	<b>15</b>

### Practicals

No. of Units	Topics	No. of Experiments
1	To study various types of heat exchangers used in Dairy & Food Industry	2
2	Preparation and calibration of thermocouples	2
3	Determination of thermal conductivity : milk, solid dairy & food products.	2
4	Determination of overall heat transfer co-efficient of : Shell and tube, plate heat exchangers Jacketted kettle used in Dairy & Food Industry	3
5	Studies on heat transfer through extended surfaces.	2
6	Studies on temperature distribution and heat transfer in HTST pasteurizer	2
7	Design problems on heat exchangers	2
	<b>Total</b>	<b>15</b>

### REFERENCE BOOKS

- |   |                                  |  |
|---|----------------------------------|--|
| 1 | A course in Heat & Mass Transfer | S. Domkundwar, (1993), Danpat Rai and Sons, New Delhi                  |
| 2 | Heat Transfer                    | C.P. Gupta (1964), Prentice hall of India, New Delhi                   |
| 3 | Principles of Heat Transfer      | F. Kretith, and M.S. Bohn, (1986), Harper and Row Publishers, New York |

## FE-235 FOOD PROCESSING EQUIPMENTS – I 3 (2+1)

### Theory

No. of Units	Topics	No. of Lectures
1	Material handling : Material handling machines and conveyors	2
2	Pretreatment unit operations : Cleaning, Dehulling and Dehusking, Sorting & Grading	2
3	Peeling and Forming	2
4	Size reduction and separation	2
5	Agitation and Mixing	2
6	-do-	2
7	Engineering properties of Food materials: Its significance in equipment design, processing and handling of food products	2
8	Hygienic design of Food processing equipment. Sanitary requirement, Sanitary pipes and fittings	2
9	Rheology and texture of food materials: Concept of rheology, elastic, plastic and viscous behaviour, methods of texture evaluation, subjective	3

	and objective measurements	
10	Methods of texture evaluation, subjective and objective measurements	2
11	Evaporation : Principles of evaporation, types and selection of evaporators, mass and energy balance. Design of single and multiple effect evaporators, recompression heat and mass recovery and vacuum creating devices.	3
12	Drying : Principles of drying, drying rate kinetics, Classification, mass and energy balance. Different types of dryers and components - roller, spray, tray, fluidized bed etc	3
13	Thermal processing: Blanching, Pasturization and Sterilization - principles, different methods and equipments. Processing in containers, process time, T-evaluation, Design of batch and continuous sterilization	3
	<b>Total</b>	<b>30</b>

### Practicals

No. of Units	Topics	No. of Experiments
1.	Study of Instron and its working	2
2	Studies on the sorting and grading of food materials	2
3	Determine flow parameters of Newtonian, non newtonian food products by : Capillary tube viscometer, Hakke's viscometer, Rotational viscometer and Falling Ball viscometer	3
4	Study of evaporator, dryer, sterilizer	2
5	Design problems on evaporators	2
6	Design problems on Dryers	2
7	Numerical problem on Thermo bacteriology (D, Z, & F)	2
	<b>Total</b>	<b>15</b>

### REFERENCE BOOKS

- |   |                                    |
|---|------------------------------------|
| 1 Unit operations of chemical Engineering | Mc Cabe Smith & Harriott           |
| 2 Food Engineering operation              | Brennan, Butters, Cowell and Lilly |
| 3 Process Heat Transfer                   | Kern                               |

**FE-236**

**FOOD PACKAGING**

**3 (2+1)**

### Theory

No. of Units	Topics	No. of Lectures
1	Introduction to subject, Packaging situations in World, India, need of	5

	packaging, plastic consumption/use in World, India etc. Package requirements, package functions, Hazards acting on package during transportation, Storage and atmospheric package, labeling laws	
2	Package Materials: classification packages, paper as package material its manufacture, types, advantages corrugated and paper board boxes etc. Glass as package material, Manufacture, Advantages, disadvantages. Metal as package material-manufacture, Advantages, disadvantages, Aluminum as package material,. Its advantages and disadvantages, plastic as package material classification of polymers, properties of each plastics, uses of each plastics, chemistry of each plastic such as polyethylene, Polypropylene, polystyrene, polycarbonate, PVC, PVDC, Cellulose acetate, Nylon etc.	10
3	Lamination Coating and Aseptic packaging Lamination, need of lamination, types, properties, advantages & disadvantages of each type Coating on paper & films, types of coatings. Need of coating, methods of coatings. Aseptic packaging-Need, Advantaged, process, comparison of conventional & aseptic packaging, system of aseptic packaging and materials used in aseptic packaging. Machineries used in Packing foods	5
4	Packaging of Specific Foods Packaging of specific foods with its properties, Like bread, Biscuits, Coffee, Milk powder, egg powder, carbonated beverages. Snack foods etc.	5
5	Mechanical and functional tests on Package Various mechanical and functional testes perform in laboratories on package boxes and package materials	5
<b>Total</b>		<b>30</b>

### Practicals

No. of Units	Topics	No. of Experiments
1	Classification of various packages based on material and rigidity	1
2	Measurement of thickness of paper, paper boards	1
3	Measurement of water absorption of paper, paper boards	1
4	Measurement of bursting strength of paper of paper boards	1
5	Measurement Tear resistance of papers	1
6	Measurement of puncture resistance of paper and paperboard	2
7	Measurement of tensile strength of paper of paper boards	1
8	Determination of gas transmission rate of package films	1
9	Determination of WVTR of films	2
10	Determination of coating on package materials	1
11	Identification of plastic films	1



12	Prepackaging practices followed for packing fruits and vegetables	2
	<b>Total</b>	<b>15</b>

#### **REFERENCE BOOKS**

Handbook of Package Engineering	Joseph F. Hanlon
Fundamentals of Packaging	F.A. Paine
Food Packaging	Sacharow and Griffin
Principles of Food Packaging	R. Heiss
Flexible Packaging of Foods	A.L. Brody
Food Packaging and Preservation	M. Mathouthi

## FE-247 FOOD PROCESSING EQUIPMENTS- II 3 (2+1)

### Theory

No. of Units	Topics	No. of Lectures
1	Mechanical separations : Centrifugation : liquid-liquid centrifugation, liquid- solid centrifugation, clarifiers, de sludging and decanting machines	3
2	Filtration : Principles involved in filtration. Pressure and vacuum filtration	3
3	Expression : batch and continuous type	3
4	Baking, Roasting and Frying equipment	3
5	Extraction and Leaching, Crystallization and Distillation : Basic principles involved	3
6	Membrane processes : Ultra filtration, Reverse osmosis	3
7	Electro dialysis, Pre-evaporation and micro filtration	3
8	Microwave and Dielectric & Infrared heating : Physical parameters. Heat transfer phenomenon. Equipment and application	3
9	Irradiation - Principle and its equipments	3
10	Blending and pulverization equipments	3
	<b>Total</b>	<b>30</b>

### Practicals

No. of Units	Topics	No. of Experiments
1	Lab demonstration on state of water	2
2	Demonstration of equilibrium sorption isotherms	2
3	Study of centrifugal separators	2
4	Study of ultra filtration equipments	2
5	Study of microwave oven, infrared moisture meter and universal moisture meter	2
6	Visit to Bakery Plant	1
7	Study of size reduction machineries	2
8	Study of size reduction machineries	2
	<b>Total</b>	<b>15</b>

### REFERENCE BOOKS

- |                                    |                                    |
|------------------------------------|------------------------------------|
| 1 Food Engineering operation       | Brennan, Butters, Cowell and Lilly |
| 2 Introduction to Food Engineering | Heldman D.R. and Singh R.P.        |
| 3 Fundamentals of Food Engineering | Charm S.E.                         |

**FE-358 REFRIGERATION ENGINEERING 3 (2+1)**  
**AND COLD CHAIN**

**Theory**

<b>No. of Units</b>	<b>Topics</b>	<b>No. of Lectures</b>
1	Definition of refrigeration and air conditioning, necessity of refrigeration and air conditioning. History of refrigeration	3
2	Refrigerants, definition, classification, nomenclature, methane and ethane series. Desirable properties of refrigerants- physical, chemical, safety, thermodynamic and economical. Azeotropes	4
3	Components of vapour compression refrigeration system, evaporator, compressor, condenser and expansion valve	4

4	Ice manufacture, principles of ice production, different systems Treatment of water for making ice, Brines, Freezing tanks, ice cans, air agitation, quality of ice	4
5	Applications of refrigeration in different food products – fruit and vegetable products, meat products, fish, poultry products, dairy products etc	4
6	Food Freezing: Freezing systems: indirect contact systems, plate freezers, air blast freezers, and freezers for liquid foods. Direct contact systems, air blast immersion, frozen food properties, density, thermal conductivity enthalpy, apparent specific heat and thermal diffusivity, freezing time, factors influencing freezing time, freezing rate, thawing time	6
7	Frozen food storage: Quality changes in foods during frozen storage	5
<b>Total</b>		<b>30</b>

### Practicals

No. of Units	Topics	No. of Experiments
1	Standard refrigeration symbols	1
2	To study vapour compression refrigeration system	1
3	Solving problems on cooling load calculations / Refrigeration load	3
4	To study the properties and performance characteristics of some commonly used refrigerants	2
5	To study the components of the refrigeration system	3
6	Freezing of foods by different methods	3
7	Determination of freezing time of a food material	2
<b>Total</b>		<b>15</b>

### REFERENCE BOOKS

Refrigeration and air-conditioning	Manohar Prasad
Introduction to Food Engineering	R. P. Singh and D. R. Heldman
A course in Refrigeration and air conditioning	S.C. Arora and S. Domkundwar

### FE-359 BIOCHEMICAL ENGINEERING 3 (2+1)

#### Theory

No. of Units	Topics	No. of Lectures
1	Biochemical Engineering and their scope: Definition, necessity, value engineering, good manufacturing practices. Standard operating procedures, good laboratory practices	2

2	History of Biochemical Engineering: Theory of scientists Pfizer, Alexander Fleming Salman Waksman. Instrumentation and their control, physical and chemical parameters.	1
3	Role of biochemical engineering in development of modern fermentor: Scale up, management of cellular process, design, operation and their problems	3
4	Basis for biochemical engineering in fermentation industry: Unit operation, unit process, process design, chemical reaction kinetics, process variables, biochemical properties, process control	3
5	Kinetics of microbial growth and death: Definition, fermentation kinetics rate of cell synthesis, product formation and effect of environment. Types of kinetics, Batch and continuous type, control measures	2
6	Simple enzyme kinetics: Simple kinetics model for enzyme substrate interaction. Derive the equation of Michaelis Menton, for reaction rate, product formation, calculation of $K_m$ and $V_{max}$ values	3
7	Complex enzyme kinetics: Oxidation – reduction form of enzymes, observed apparent rate constant, factors affecting the inhibition, competitive, non competitive inhibition, substrate interaction	3
8	Kinetics pattern of various fermentations: Classification of kinetics pattern, as per different scientists, simple, simultaneous, consecutive, stepwise, complex reactions and their examples	3
9	Media and air sterilization: Definition, thermal death time, media heat sterilization, advantages of continuous sterilization.	2
10	Aeration and agitation	3
11	Product recovery of different process: Mass transfer resistance, extraction, leaching, drying and evaporation, sorption and storage, permeability law	2
12	Product formation for value added products using bioconversions techniques Production of single cell protein, alcohol, raw material for required for product formation, production of antibiotics, economic process, utilization of damaged grain through bioconversion, present mode of utilization and their nutritional value	3
	<b>Total</b>	<b>30</b>

### Practicals

No. of Units	Topics	No. of Experiments
1	Instrumentation and their control in fermentation industry -physical parameter	2
2	Instrumentation and their control in fermentation industry – chemical parameter, metabolic parameters and biosensors in food industry	2
3	To study the different parts of 30 lit. laboratory and 1 lakh lit. capacity fermentors	1
4	Comparative study of one lakh liter laboratory fermentor	1
5	To study the thermal stability of peroxidase enzyme in potato	1

6	To assess the amylase activity from given food sample	1
7	To measure the microbial growth after (fermentation thermal death time)	1
8	To study the mass transfer of solution by dialysis process	1
9	To study the time temperature relationship for destruction of microorganisms	1
10	To study the ethyl alcohol production through bioconversion	2
11	To study the vitamin production through bioconversion	1
12	Visit to Distillery Plant	1
	<b>Total</b>	<b>15</b>

## REFERENCE BOOKS

Biochemical Engineering

Shuichi Alba, Arthur E. Humphrey and Nancy F. Millis

Biochemical Engineering Fundamentals Bailer J.E. and Ollis D.F.

## FE-3510 INSTRUMENTATION AND PROCESS CONTROL 3 (2+1)

### Theory

No. of Units	Topics	No. of Lectures
1	Introduction, definition, recorders and monitors, panel boards	3
2	General characteristics of instruments, static and dynamic characteristics	4
3	Temperature and temp. scales, various types of thermometers - mercury-in-glass, bimetallic, pressure-spring thermometers, thermocouples, resistance thermometers and pyrometers	5

4	Pressure and pressure scales, manometers, pressure elements differential pressure	4
5	Liquid level measurement, different methods of liquid level measurement	4
6	Flow measurement, kinds of flow, rate of flow, total flow differential pressure meters, variable area meters	4
7	Transmission, pneumatic and electrical	3
8	Control elements, control actions, pneumatic and electrical control systems	3
	<b>Total</b>	<b>30</b>

### Practicals

No. of Units	Topics	No. of Experiments
1	To study instrumentation symbols	1
2	Measurement of temperature by different thermometers.	1
3	Measurement of pressure by 'U' tube manometer, (inclined tube manometer)	2
4	Measurement of liquid level in the tank with the help of Bob and tape	2
5	Determination of relative humidity by wet and dry bulb thermometer	2
6	Measurement of velocity of fluid by using venturimeter/orifice meter/pilot tube	2
7.	Measurement of RPM of an electric motor by Tachometer	2
8	Measurement of wind velocity by anemometer	1
9	Measurement of intensity of sun shine by sunshine recorders	2
	<b>Total</b>	<b>15</b>

### REFERENCE BOOKS

- |   |                            |
|---|----------------------------|
| 1 Instrumentation                           | F.W. Kirk and N.R. Rimboi. |
| 2 Industrial instrumentation fundamentals   | Austin E. Fjribance        |
| 3 Process instruments and controls Handbook | Considine                  |

## FE-3611 FOOD PLANT DESIGN AND LAYOUT 3 (1+2)

### Theory

No. of Units	Topics	No. of Lectures
1	Overall design of an enterprise : Plant design, sales planning for plant design	1
2	Strength of material – engineering materials, material science, use of various metals, including plastic, glass, etc in food industry, selection and specification – material design, concepts and manufacturing of various equipments and machineries for food processing plant	2
3	Plant Location, levels of Plant location. Location of layout : location factors, plant site selection. Location theory and models, industrial buildings and grounds	2
4	Classification of Dairy and Food Plants, farm level collection and chilling centre, space requirement	1
5	Preparation of a Plant Layout : Plant Layout problem, importance, objectives, classical types of layouts.	2
6	Evaluation of Plant Layout. Advantages of good layout. Organizing for Plant Layout, Data forms	1
7	Common Problems in Plant Layout and Process scheduling	1
8	Siting of Process sections, Equipment selection and capacity determination	2
9	Arrangement of process, and service equipment. Estimation of Services and Utilities	1
10	Office layout, line balancing, Flexibility. Practical Layouts	1
11	Maintenance of Food Plant Building, Illumination and ventilation, Cleaning and sanitization, painting and colour coding, Fly and insect control	1
	<b>Total</b>	<b>15</b>

### Practicals

No. of Units	Topics	No. of Experiments
1	Preparation of project report	3
2	Preparation of feasibility report	2
3	Layout of Food storage wares and godowns	2
4	Layout and design of cold storage	3
5	Layout of preprocessing house	2
6	Layout of Milk and Milk product plants	3
7	Bakery and related product plant	3
8	Fruits processing plants	3
9	Vegetable processing plants	2



10	Layout of multi-product and composite food Plants	3
11	Waste treatment and management of food plant	3
12	Visit to Fruit and Vegetables processing plant	1
	<b>Total</b>	<b>30</b>

## REFERENCE BOOKS

Milk Plant Layout  
Plant Layout and Design  
Engineering for Dairy and  
Food Products

H.S. Hall (1963). FAO Pub., Rome  
James M.Moore (1962), Mac Millan, New York  
A.W. Faral (1980). Rebert E., Kriger  
Pub Co., New York

## DEPARTMENT OF FOOD TRADE AND BUSINESS MANAGEMENT

<b>Sr. No.</b>	<b>Course No.</b>	<b>Course Title</b>	<b>Credits</b>	<b>Semester</b>
1	FTBM-351	Co-operation, marketing And finance	3 (2+1)	V
2	FTBM-352	Business Management And International Trade	2(2+0)	V
3	FTBM-363	Entrepreneurship Development and Communication Skill	2 (1+1)	VI
4	FTBM-364	Food laws and regulations	3(2+1)	VI
5	FT-375	Seminar	1(0+1)	VII
		<b>Total Credits</b>	<b>11 (7+4)</b>	

**FTBM-351 CO-OPERATION, MARKETING AND FINANCE 3 (2+1)****Theory**

<b>No. of Units</b>	<b>Topics</b>	<b>No. of Lectures</b>
1	Co-operation – Philosophy and principles. History of Indian Co-operative movement	2
2	Co-operative credit structures in regional level and their study and single window systems	2
3	Marketing – importance in economic development. Classification of Markets, Marketing functions and Market functionaries	2
4	Marketable and Marketed surplus, Marketing costs, margins and price spread, problems in marketing of agricultural commodities – perishables, grains, oilseeds and processed foods	2
5	Remedial measures for problems in agricultural marketing	1
6	Agricultural marketing institutions, Regulated markets and Co-operative marketing societies	3
7	MARKFED, NAFED, Ware Housing Corporation and Food Corporation of India	2
8	Nature of agricultural product prices, Agricultural price policy and need for price stabilization	2
9	Methods of fixation of MSP for agricultural commodities	2
10	Commission on agricultural costs and prices	2
11	Finance – nature and scope, Credit – meaning, definition and classification	2
12	Credit analysis and repayment plans and History of financing agriculture in India	2
13	Commercial banks – Nationalization of Commercial banks, Lead Bank scheme and Regional Rural Banks	2
14	Scale of finance, Higher financing agencies – RBI, NABARD, AFC, ADB, World Bank	2
15	Insurance and credit guarantee corporation of India and Crop Insurance	2
16	Contract farming – strategy and scope	2
	<b>Total</b>	<b>32</b>

## Practicals

No. of Units	Topics	No. of Experiments
1	Study of a regulated market	1
2	Study of a vegetable market	1
3	Study of a fruit market	1
4	Study of a cattle market	1
5	Computation of market costs, margins and price spread	1
6	Study of Andhra Pradesh State Warehousing Corporation	1
7	Study of Central Warehousing Corporation	1
8	Study of Food Corporation of India	1
9	Study of MARKFED	1
10	Study of functioning of a commercial bank	1
11	Study of a regional rural bank	1
12	Study of food processing enterprise	1
13	Formulation of project reports for financing food Industry	1
14	Working out repayment plans	1
15	Study of Primary Agricultural Credit Society	1
16	Study of Farmers' Service Society.	1
<b>Total</b>		<b>16</b>

## REFERENCE BOOKS

1 Co-operation in India

2 Indian Food Grain Marketing

3 Agricultural Marketing in India

4 Farm Finance for Development

Mamoria C B and Saxena R D

Kitab Mahal, Allahabad

Moore John R John S S and Khasro A M

Prentice Hall of India, New Delhi

Acharya S S and Agarwal N L

Oxford & IBH Publishing Co., New Delhi

Muni Raj R

**FTBM-352 BUSINESS MANAGEMENT AND INTERNATIONAL TRADE 2 (2+0)**

**Theory**

No. of Units	Topics	No. of Lectures
1	Business Management: introduction, theories and functions Food industry management: 1. Purchase management and production management 2. Financial management and marketing management –retail management 3. Human resource development and personnel management Sectors in food industry and scale of operations in India	12
2	International trade: Basics, Classical theory, Theory of absolute advantage, Theory of comparative advantage, Modern theory, Free trade – protection, methods of protection quotas, bounties, exchange control, devaluation, Commercial treaties, terms of trade balance of payments, exim policy, foreign exchange, mechanics of foreign exchange, GATT and WTO. World Trade Agreements Related With Food Business Export Trends And Prospects Of Food Products In India	10
3	World Consumption of Food Patterns and Types of Food Consumption across the Globe <ul style="list-style-type: none"> <li>Developed Nations</li> <li>Developing Nations</li> <li>Under Developed Nations</li> </ul> Ethnic Food Habits of Different Regions	6
4	Govt. institutions related to international food trade APEDA, Tea Board, Spice Board, MFPI, etc	6
5	Management of export import organization Registration, documentation, export import logistics	4
6	Case Studies	4
	Total	42

**REFERENCE BOOKS**

- 1 Principles of Agri business Mangement
- 2 Agricultural Marketing in India
- 3 Marketing in the International Environment
- 4 GATT implications of Denkel proposals

D. David and S. Erickson  
Mc Graw Hill Book Co. New York  
Acharya SS and Agarwal NL  
Oxford and IBM Publishers, New Delhi.  
Cundiff Higler , P H I New Delhi .  
G. S. Batra & Narinder Kumar  
Azmol publications Pvt. Ltd., - New Delhi

5 Market Management

Philip Kotler

Prentice Hall of India, New Delhi.

6 Marketing Management

Dr. P.K. Shrivastava

**FTBM-363 ENTREPRENEURSHIP DEVELOPMENT 2(1+1)**  
**AND COMMUNICATION SKILL**

**Theory**

No. of Units	Topics	No. of Lectures
1	Entrepreneur – Meaning, Definition, Characteristics & Role demands of Entrepreneur, Identifying Potential Entrepreneurs	
2	Entrepreneurship Development- Concept of Entrepreneurship, process of Entrepreneurship Development, Motivation & Entrepreneurship Development, Importance of Planning, Monitoring & follow-up, Managing competition, Entrepreneurship Development Programmes	
3	Characteristics of Indian Food Processing Industries and Export	
4	SWOT analysis, Generation, Incubation and commercialization of ideas and innovations	
5	Entrepreneurial behaviour- Concept, dimensions, factors affecting Entrepreneurial behavior	
6	Govt. schemes & Incentives for promotion of Entrepreneurship. Govt. policy on small & medium enterprises	
7	Market survey, Formulation of project & financial analysis of project	
8	Communication- Meaning & process of communication	
9	Advertisements- Meaning, types, Forms, functions	
10	Writing skill- Business letter, letter of enquiry, Quotation, Order & tenders, Complaints letters	
	<b>Total</b>	

**Practicals**

No. of Units	Topics	No. of Experiments
1	Conducting market survey to know the demands for different products	
2	Preparing advertisement for popularization of products & news writing	
3	Preparing project proposal	
4	Individual & group presentation, features of oral presentation	
5	Evaluation of presentation- Evaluation sheet, other strategies to be consider for evaluating a presentation	
6	Dyadic communication- face to face conversation, telephonic conversation, rate of speech, clarity of voice, speaking & listening politeness telephone etiquettes	
7	Meetings- Purpose, procedure, participation, chairmanship, physical arrangement, recording & writing of minutes of meeting	
	<b>Total</b>	<b>15</b>

**REFERENCE BOOKS**

1 Hand Book for New Entrepreneurs

Bhatt, EDI faculty,

	Entrepreneurship Development Institute of India, , Ahmedabad.
2 Entrepreneurship and Venture Management	Chifford M and Back M B Mc Graw Hill Book Co., New York
3 Entrepreneurship	G.Babu Rao, TTTI (SR) Hyderabad – 29
4 Organizational Behavior	Fred Luthomi (1989) Tata MC Graw Hill publishers, New Delhi.
5 Fundamental of Business organization and Management	Y.K. Bhushan(1987) Sultan Chand & Co. New Delhi.

### **FTBM-364 FOOD LAWS AND REGULATIONS 3 (2+1)**

#### **Theory**

<b>No. of Units</b>	<b>Topics</b>	<b>No. of Lectures</b>
1	Introduction to subject, Need of enforcing the laws and various types of laws.	4
2	Mandatory food laws Food safety and standards act 2006- Food safety and standard authority of India, food advisory committee, scientific panels and scientific committees, state food safety authority, standards for food articles, food recall procedures, tribunal, offences and penalties, general principles to be followed in administration of act, general provisions as to articles of food, special responsibility as to safety of food	6
3	Prevention of Food Adulteration Act (1954) Definition, object of act, central committee for food standards; public analysis, food inspector, duties of Food inspectors, Report of Public analyst, sealing, fastening and dispatch of samples and powers of court	6
4	Other Mandatory acts The Standards of Weights and Measure Act (1976), The Packaged Commodity Rules (1977), Essential Commodities Act (1955), Consumer Protection Act (1986), The Environment Protection Act (1986) and the Environment Protection Rules (1989), Insecticide Act (1968), The Export (Quality Control and Inspection) Act (1963), The Atomic Energy Act (1962), Control of Irradiation of Food Rules (1991)	6
5	Food Product Orders The Fruit Products Order (1955), The Milk and Milk Products Order (1992), The Meat Food Products Order (1973), The Vegetable Oil Products (Control) Order (1947), The Edible Oils Packaging (Regulation) Order (1998), The Solvent Extracted Oil, De oiled Meal, and Edible Flour (Control) Order (1967), The Infant Milk Substitutes, Feeding Bottles and Infant Foods (Regulation of Production, Supply and Distribution) Act (1992)	6
6	Optional food standards -Scope of these standards, their need, procedure to obtain that standard, The Bureau of Indian Standards Act (1986), The Agricultural Produce (Grading and Marketing) Act (1937) -	2

	AGMARK	
7	Codex Standards -Scope of codex standards, codex standards for cereals, pulses, fruit & vegetables, Meat & Poultry products, Recommended international code of hygiene for various products	2
	<b>Total</b>	<b>32</b>

### Practicals

No. of Units	Topics	No. of Experiments
1	Examination of Cereals and pulses from warehouse and market shop in relation to PFA and BIS specifications	2
2	Examination of Ghee for various standards of MMPO and BIS	1
3	Examination of honey for PFA and BIS standards.	2
4	Examination of spices for Agmark and BIS standards.	1
5	Examination of milk and milk products for BIS and milk product order- standards (MMPO)	2
6	Examination of fruit Jam of two to three different companies for FPO specifications	1
7	Examination of squash of two to three different industries for FPO specifications.	1
8	Examination of ketchup of two to three different Companies for FPO specifications	1
9	Visit to BIS Laboratory	1
10	Visit to Agmark laboratory	1
11	Visit to quality control laboratory and Food processing industry	2
	<b>Total</b>	<b>15</b>

### REFERENCE BOOKS

- |   |  |
|---|--|
| 1 Hand Book on Food Safety and Standards Act, 2006. | P.K.Das,<br>Universal Law Publishers, New Delhi. |
| 2 The Prevention of Food Adulteration Act.          | Professional Book Publishers, New Delhi.         |
| 3 Quality Control in Food Industry Vol. 1           | S.M. Herschdoerfer                               |

### FT-365

### SEMINAR

**1(0+1)**

The topics of the seminar will be proposed by the faculty under the chairmanship of Associate Dean and Principal ( Food Technology). The students will be given freedom to choose the topics based on their merit/ CGPA. The marks distribution for it as given below.

- |                            |    |
|----------------------------|----|
| 1 Script of the seminar    | 10 |
| 2 Use of audio visual aids | 10 |



3	Mode of presentation	20
4	Clarification of queries raised in discussion	10
Total		50

## AL-111 MATHEMATICS

**2 (2+0)**

### Theory

No. of Units	Topics	No. of Lectures
1	Determinants: Definition of second order and third order determinants, minors and cofactors of a determinant, expansion of determinant, elementary properties of determinant (statement only).	2
2	Logarithm: Introduction and definition, laws of logarithm with proof, change of base, numerical problems.	2
3	Function: Definition of function, types of functions viz, algebraic, logarithmic, trigonometric, inverse and exponential (illustration only)	2
4	Limits: Definition of limits, theorems and standard limits (statement only), numerical problems.	3
5	Differentiation: Definition of derivative, derivatives of constant functions, power functions and trigonometric functions, derivatives of $\log x$ , $a^x$ , $e^x$ (without proof), rules of differentiation (statement only), maxima and minima.	5
6	Ordinary differential equations of first order and second order: Definition, order and degree, formation of differential equation, general and particular solution of differential equation, solution of differential equation by the method of variable separable, exact differential equation, linear differential equation of the type $dy/dx + Py = Q$ , where P and Q are functions of X, linear differential equation with constant coefficient.	8
7	Integral calculus: Integration as the inverse of differentiation, definition of integral of a function, indefinite integral or antiderivatives, integral of some standard functions (without proof), rules of integration (statement only), definition of definite integral as the limit of sum illustrated with the help of simple examples.	4
8	Linear programming problems involving two variables only: Introduction of concepts, mathematical formulation of linear programming problems, graphical method of solution for problems in two variables.	6
<b>Total</b>		<b>32</b>

### REFERENCE BOOKS:

Higher Engineering Mathematics: B.S. Grewal  
Higher Algebra: Hall and Knight  
Differential Calculus: Shanti Narayan  
Integral Calculus: Shanti Narayan

## AL-121 ELEMENTARY STATISTICS

**2 (1+1)**

### Theory

No. of Units	Topics	No. of Lectures
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1	Introduction: Definition, introduction and scope of statistics in various fields.	1
2	Data condensation and graphical methods: Raw data, attributes, variables, discrete and continuous variables, construction of frequency distribution and cumulative frequency, graphical representation of frequency distribution: Histogram, frequency polygon, frequency curves and ogive curves.	2
3	Measures of central tendency: Concept of central tendency, Arithmetic mean, median, mode, geometric mean, harmonic mean (Definition, formulae, merits and demerits).	2
4	Measures of dispersion: Concept of dispersion and measures of dispersion, range, mean deviation, standard deviation, coefficient of variation, variance (definition, and formulae).	2
5	Correlation: Concept of correlation, positive and negative correlation, methods of studying correlation, scatter diagram method, karl pearson's coefficient of correlation (covariance method), Rank correlation method.	2
6	Linear regression analysis: Introduction, lines of regression, derivation of line of regression of Y on X, line of regression of X on Y, coefficient of regression.	2
7	Theory of probability: Classical definition, Axiomatic approach to probability, theorems of probability.	2
8	Discrete probability distribution: Definition of discrete random variable, Binomial distribution: Definition, mean and variance of binomial distribution, application of binomial distribution. Poisson distribution: Definition, mean and variance of Poisson distribution, application of Poisson distribution.	3
	<b>Total</b>	<b>16</b>

### Practicals

No. of Units	Topics	No. of Experiments
1	Frequency distribution of data	1
2	Graphical representation of data	1
3	Measures of central tendency	1
4	Measures of dispersion	2
5	Coefficient of variation	2
6	Coefficient of correlation	2
7	Rank correlation	1
8	Linear regression	2
9	Fitting a binomial distribution	2
10	Fitting of poisson distribution	2
	Total	16

### REFERENCE BOOKS:

Fundamental of statistics: S.C. Gupta  
Statistical methods: S.P. Gupta

Running and warming up: Exercise for good posture and physical fitness and the exercise for Agility, Strength, Coordination, Endurance and Speed.

Yoga : Any five asnas

Athletics : a) Running : 100,200,400, 800 mts. B) Jumping : Long Jump, High Jump c) Throwing: Shot-put, Disc Throw Participant should participate at least in one event Athletics group.

4. Skill development in any one of the following game: a) Out-door: Volley ball, Basket ball, Football,

Cricket, Kaabaddi, Kho-kho B) Indoor : Table tennis, Badminton, Wrestling, best –

Physique

5. Dand Baithkas : Skipping, Hoping and Gym. Exercises.

6. Recreation Game : Any one in spite of above syllabus the following points should also be considered for

daily

as per schedule 1) Attendance 2) Uniform 3) Dressing 4) participation in Inter-collegiate and

Inter-University

tournaments.

Uniform: Track\_suit, Canvas and socks