Training modules for 3 months on skill development in food processing

Module No.	Module Title	Duration (Hrs)
01	Processing of Cereals	350
02	Processing of Pulses	350
03	Processing of Oilseeds & by-products	350
04	Processing of fruits and Vegetables	350
05	Manufacturing of Alcoholic Beverages	350
06	Technology of Manufacturing Bakery Products	350
07	Processing of Sugar and Cocoa Confectionary products	350
08	Processing and Preserving Milk & Milk Products	315
09	Meat and Poultry Products Technology	147
10	Processing of Fishes and their By-products	314
11	Processing and Value Addition of Plantation crops	350
12	Food Beverages Processing Technology	350
13	Slaughter House Practices and Processing of Meat	273
14	Manufacturing of Functional Foods and Nutraceuticals	361
15	Manufacturing of Traditional Foods and their Indigenization	336
16	Handling and Safe Storage of Food Grains	315
17	Processing of Sugarcane and Sugar	350
18	Wine making Technology	350
19	Packaging Technology of Fruits and Vegetables	350
20	Brewing Technology	350
21	Food Packaging & labeling	295
22	Food Safety & Microbial Analysis	320
23	Food Supply Chain management	350
24	Skill Development in Sensory Assessment Techniques	350
25	Operation & Maintenance of Food Processing Equipment	350
26	Instrumentation and Automation in Food Industry	315
27	Food Industry Business Management	315
28	Manufacturing of RTE, RTC and RTS Food Products	350
29	Performance Evaluation of Food Processing Machinery	350
30	Rice Milling Techniques	312
31	Manufacturing of Extruded Products	350
32	Processing of Spices & Condiments	315

MODULE – 01

1.	**Title of the Module**	:	**Processing of Cereals**
2.	**Sector**	:	Food Processing and Preservation
3.	**Code**	:	
4.	**Entry Qualification**	:	12th Standard
5.	**Minimum Age**	:	18 years
6.	**Terminal Competency**	:	After completion of the course the candidate will be able to: a) Operate & maintain many modern cereal processing equipment& machineries b) Make different processed food products with quality assurance
7.	**Duration (in Hrs)**	:	350 hours

8. Module Contents

S. No.	Theory	Practical	Contact Hours		
			T	**D**	**P**
1	Introduction to major & minor cereals of India – production, popular varieties of major cereals; Composition & Nutritional status of important cereals; Post harvest management of cereals and its importance & constraints – Cleaning, Grading, Transportation, Handling & Storage, general equipment for above operations; Importance of Equilibrium Moisture Content (EMC) of cereals;	Determination of physical properties of important cereals - paddy, rice, wheat, maize, sorghum and small millets. Determination of moisture and proximate composition of major cereals. Study of grain scalpers, cleaners and other handling equipment Study of storage structures and practices employed for storage of paddy, rice, wheat and maize.	5	5	25
		Total hours for this sub-module	**5**	**5**	**25**
2.	**Milling of Wheat:** Flour milling flow chart; Milling Machinery- different types of mills, *Chakki* and wheat roller mills; Major products and by-products of wheat milling – *atta, maida, rava, bran and germ*; Special flours for bakery; Durrum wheat products. Packaging and equipment used for wheat products	Identification and study of special characteristics of different groups of wheat; Flour milling of wheat in *chakki* and other mills and analyses of flour characteristics. Study of packages and equipment used for different wheat products. Visit to commercial wheat roller mill	10	10	50
		Total hours for this sub-module	10	10	50
3.	**Paddy Processing:** General terminologies in rice milling; Raw and	Rice milling studies with laboratory equipments – calculation of milling	10	10	50

	parboiled rice; Rice milling principles; Machinery for rice milling: Hullers &Modern rice milling machinery – grain scalpers / cleaners; types of dehuskers – rubber roll sheller, centrifugal sheller & under runner disc sheller; paddy cleaners, rice polishers, rice graders and colour sorter. Mini-Rice Mill; Parboiling - advantages, different techniques; Importance of grain dryers; BIS Grades of rice; Difference between *Indica* and *Japonica* varieties of rice – specialties and uses; Ageing of rice	yield, head yield and polish percent. Experiments on traditional and modern methods of parboiling. Drying study of paddy with dryers. Study of modern rice milling machinery and mini-rice mill. Operation and maintenance of rice milling machinery. Visit to modern rice mill			
		Total hours for this sub-module	10	10	50
4.	**Processing of Coarse Cereals -***Maize, Sorghum, Pearl Millet and Ragi:* Characteristics - nutritional composition; Milling of Maize – process flow chart, machinery and major and minor products; Domestic flour milling equipment used for pearling, grinding and flour sifting of sorghum, pearl millet and ragi; Popping of coarse millets – technique and equipment. *Minor Millets – Little, foxtail, kodo, proso and barnyard millets:* Nutritional superiority of minor millets, dehulling machinery	Analyses of proximate composition of coarse cereals. Pearling studies of sorghum, pearl millet and ragi. Popping of coarse grains Dehulling studies of minor millets Operation and maintenance of various coarse grains processing machinery. Malting of ragi and preparation of Weaning Food. Preparation of different millet based snacks Visit to cereal food processing industries	10	10	50
		Total hours for this sub-module	10	10	50
5.	**Baking and Confectionery** - Flour quality - Physical and chemical characteristics of flour; Flour improvers and enrichment; Fundamentals of Bread Making - functions of ingredients in bread making, unit operations, different Bread Making Methods – Variety of breads - Technology for baking Biscuits & Cakes	Determination of flour colour /Dullness by Flour Colour Grader Determination of gluten content in wheat Determination of Falling Number, Dough Raising Capacity Preparation of bread and its evaluation Determination of effect of ingredients – Yeast, Fat and Sugar Effect of additives on bread Preparation of Bakery Products - Buns, Rusk, etc. Baking of Biscuits - effect of ingredients Visit to bakery and biscuit and confectionery manufacturing industries	10	10	50
		Total hours for this sub-module	10	10	50
6.	**Extruded Products:** *Ready-to-cook* pasta and *Ready-to-eat* expanded products from cereals – formulation, preparation and equipment; Packaging of value added products – suitable packages	Preparation of *Ready-to-cook* pasta and *Ready-to-eat* expanded products from cereals Operation and maintenance of cold and hot extruders	**5**	**5**	**25**

	Total hours for this sub-module	**5**	**5**	**25**
Total Contact Hours Individually for Theory, Demonstration and Practical		50	50	250
Grand Total of Contact Hours		350		

T- Theory, D- Demonstration, P- Practical

9. Lists of Tools and Equipments for a Batch

S. No.	Description of equipment	Quantity
1	Porosity Apparatus	1
2	Protein Analyzer	1
3	Spectro-photometer	1
4	Solvent extraction apparatus	1
5	Texture Analyzer	1
6	Grain Cleaner / Grader	1
7	Wheat Milling unit	1
8	Grain Popping unit	1
9	Bakery Oven	1
10	Bread Slicer	1
11	Bakery utensils	5 set
12	Minor millet dehulling equipments	1 Sets
13	Hot air oven	1
14	Desiccators	2
15	Moisture Dishes	100
16	Lab model rice milling equipments	1 set
17	Rice sorter	1
18	Rice quality testing kit	1
19	Pasta machine	1
20	Hot extruder	1

10. Space Required for Conducting the Module (in square feet):

a. Theory Class Room : 20’ x 30’

b. Demonstration & Practical Class Room : 40’ x 60’

11. Power requirement : 10 kW

12. Qualifications of Instructor :

B.Sc. or M.Sc. in Food Science and Technology(or) B.Techin Food Engineering

Diploma in Food Science and Technology or Food Engineering with special training

13. Suggested Readings

Text Books

1) Chakraverty, A. (1995). *Post Harvest Technology of Cereals, Pulses and Oilseeds*. Oxford and IBH Publishing Co, Calcutta.

2) Samuel Matz (1992). *The Chemistry and Technology of Cereals as Food and Feed*. Chapman & Hall

3) Kent N.L. and A.D. Evans (1994). *Technology of Cereals*, 4th Edition, Elsevier Science (Pergaman) Pub., Oxford, UK,

4) Sahay, K.M. and K.K. Singh (1994). *Unit Operations of Agricultural Processing*. Vikas Publishing House Pvt. Ltd., New Delhi.

5) Salunkhe, D.K., Kadam, S.S. (1989). *Handbook of World Food Legumes: Chemistry, Processing and Utilization.* (3 vol. set), CRC Press, Florida.

6) Hamilton, R.J. and Bharti, A. Ed. 1980. Fats and Oils: Chemistry and Technology. Applied Science, London.

7) Blanshard J.M.V., Frazier, P.J. and Galliard, T. (1986). Chemistry and Physics of Baking. Royal Society of Chemistry, London.

8) Durbey, S.C. (1979). *Basic Baking: Science and Craft*. Gujarat Agricultural University, Anand Gujrat, India.

9) Pomeranz, Y. (1978). *Wheat: Chemistry and Technology*. American Assoc. of Cereal Chemists. St. Paul, Minnesota, USA.

10) Pomeranz, Y. (1987). *Modern Cereal Science and Technology*. VCH Pub., New York.

11) Wolf, I.A. (1983). *Handbook of Processing and Utilization in Agriculture*. (2 vol. set). CRC Press, Florida.

MODULE – 02

1.	**Title of the Module**	:	**Processing of Pulses**
2.	**Sector**	:	Food Processing and Preservation
3.	**Code**	:	
4.	**Entry Qualification**	:	12th Standard
5.	**Minimum Age**	:	18 years
6.	**Terminal Competency**	:	After completion of the course the candidate will be able to be: a) Production executive, Quality supervisor, Dal Mill operators / Maintenance assistant, Lab assistant
7.	**Duration (in Hrs)**	:	350 hours

8. Module Contents

S. No.	Theory	Practical	Contact Hours		
			T	**D**	**P**
1	Important pulses and production in India; Structure and composition, nutritive value, anti-nutritional factors; Definition of terms used in pulse processing; Pulse milling scenario - small, medium and large capacity mills; Adulteration in commercial dals	Determination of physical properties, moisture content and proximate analyses of different pulse grains Testing of quality of various commercial dals (in terms of physical and cooking parameters) and identification of adulterants	5	5	25
	Total hours for this sub-module		**5**	**5**	**25**
2.	Handling and storage of raw pulse grains; Different drying systems; Safe storage conditions; Control of pulse beetle in pulse storage – physical methods, fumigation	Drying of pulses by different methods to safe storage moisture content - Open yard drying, in-bin drying, tray drying, tunnel drying, fluidized bed drying, drying using LSU dryer Identification of pulse storage insects and training in use of insect control agents	5	5	25
	Total hours for this sub-module		**5**	**5**	**25**
3.	Pulse milling - traditional methods, wet and dry milling methods; Grading of raw pulses; Importance of pretreatments in dal milling; Different pretreatments employed in dal milling and their effect on dal quality	Grading of raw pulses – study of cleaning and grading machinery Study of pre-conditioning treatments of different pulses (red gram, green gram, black gram, Bengal gram and soybean). Traditional milling of pulses and	5	5	25

		domestic level processing. Milling yield calculations			
		Total hours for this sub-module	**5**	**5**	**25**
4. & 5.	Commercial methods of pulse processing – CFTRI, CIAE, Pantnagar, IIPR methods, etc Modern equipments for pulse processing – Mini dal mills, commercial dal mills	Study of machinery for cleaning and grading Dal milling : hands-on-training in different mini dal mills Study of modern dal mills - pulse scourer, dehusker, splitter and separator Visit to dal mills	10	10	50
		Total hours for this sub-module	**5**	**5**	**25**
6.	Value addition of common pulses- Steps involved in processing, machinery used for value addition – Quality of flour required for different products; Roasted anf fried products from pulses / dals; Quality assurance of the products; Malting of pulses for value added product processing; Canning of pulses	Germination of pulses for preparation of malted products Roasting and frying studies of pulses / dals Development of value added products from different pulses and with other combinations. Canning of fresh pulses Sensory evaluation of the developed products	5	5	25
		Total hours for this sub-module	**5**	**5**	**25**
7.	Raw material for papad production; Methods of preparation; Machineries involved, Hygiene and quality assurance; Packing and storage	Preparation of papad using commercial machinery, identification of faults and corrective steps in production process	5	5	25
		Total hours for this sub-module	**5**	**5**	**25**
8.	Techno-economic feasibility studies to establish a commercial dal mill. Site and equipment selection for establishment of commercial dal mill; Production management and marketing of dal and by-products; Cost analysis	Mini assignment for preparation of Bankable Project Document for Establishment of Dal Milling Unit. Training on marketing, customer relations.	5	5	25
		Total hours for this sub-module	**5**	**5**	**25**
9.	By-products from dal mills during processing of various pulses - their composition and nutritional value; Utilization of different by-products of individual pulse processing; Method of by-products processing – animal / poultry / fish feeds.	Utilization of by products (pulse powder and brokens produced during milling) alone or in combination with other ingredients to produce value added products. Quality analysis of the developed products	5	5	25
		Total hours for this sub-module	**5**	**5**	**25**
10.	Pulse incorporated extruded products, machinery; Introduction to packaging techniques for pulses / dals and their products; General	Preparation of extruded products with different combinations of pulses; Study of different types packaging films its characteristics,	5	5	25

	operation & maintenance of pulse processing equipments;	package labeling; Study of packaging equipments			
	Total hours for this sub-module		**5**	**5**	**25**
Total Contact Hours Individually for Theory, Demonstration and Practical			**50**	**50**	**250**
Grand Total of Contact Hours			**350**		

T- Theory, D- Demonstration, P- Practical

9. Lists of Tools and Equipments for a Batch

S. No.	Description of tools and machineries	Quantity
1	Flaking machine	1
2	Pitting machine	1
3	Mini Dal Milling Machines (different popular units)	1
4	Parboiler	1
5	Sieve shaker	1
6	Germinator	1
7	Scourer	1
8	Solar dryer/tunnel drier, fluidized bed dryer and LSU dryer	1 each
9	Extruder	1
10	Canning machineries, Seamer, Reformer, Sealing machine	1
11	Papad press	1
12	Insect traps for storage	1 set
13	Spiral separator	1
14	Gravity separator	1
15	Screen separator	1
16	Pulverizer & (animal) feed mixer	1
17		

10. Space Required for Conducting the Module (in square feet)

a. Theory Class Room : 20’ x 30’
b. Demonstration & Practical Class Room : 40’ x 60’

11. Power requirement : 10 kW

12. Qualifications of Instructor

B.Sc. or M.Sc. in Food Science and Technology (or) B.Tech in Food Engineering
Diploma in Food Science and Technology or Food Engineering with special training

13. Suggested Readings

Text Books

1) Chakraverty,A. 2000. Third Edition. *Post Harvest Technology Of Cereals, Pulses And Oilseeds*. Oxford & IBH Publishing & Co. Pvt. Ltd., New Delhi.

2) Sahay, K.M. and K.K. Singh. 1994. *Unit Operations In Agricultural Processing*, Vikas Publishing House Pvt. Ltd., New Delhi, p.340.

3) Henderson, S.M. and R.L.Perry. 1995. *Agricultural Process Engineering*, John Willey and Sons, New York. p.234.

4) Pande, P.H. 1994. Principles of agricultural processing, Kalyani Publishers, Ludhiana, p.278.

5) McCabe, W.L. and J.C.Smith. 2001. *Unit Operations In Chemical Engineering*. McGraw Hill Kogakusha Ltd., Tokyo. p.1028.

6) Mohsenin, N.N. 1986. *Physical Properties Of Plant And Animal Materials*, Gordon and Breach publishers, New York.p.1206.

7) Multon, J. L., A.M. Reimbert, D. Marsh and A.J. Eydt. 1989. *Preservation And Storage Of Grains, Seeds And Their Byproducts.* CBS Publishers and Distributors, Delhi.

MODULE – 03

1.	**Title of the Module**	:	**Processing of Oilseeds and their By-products**
2.	**Sector**	:	Food Processing and Preservation
3.	**Code**	:	
4.	**Entry Qualification**	:	12th Standard
5.	**Minimum Age**	:	18 years
6.	**Terminal Competency**	:	After completion of the course the candidate will be able to be: a) Production executive, Quality supervisor, Oil Mill operators / Maintenance assistant, Lab assistant
7.	**Duration (in Hrs)**	:	350 hours

8. Module Contents

S. No.	Theory	Practical	Contact Hours		
			T	**D**	**P**
1	Introduction to different oils & oilseeds; Oil content of different oilseeds; Physical and chemical properties of various oils and their domestic / industrial uses; Quality of oil – different standards; Rancidity of oils & its prevention; Aflatoxin in oil bearing materials	Determination of physical properties of different oilseeds Determination of moisture and oil contents of oilseeds Proximate analyses of different oil seeds Determination of specific gravity, colour, viscosity, etc. of oils Determination of acid, idodine and saponification values	5	5	25
	Total hours for this sub-module		**5**	**5**	**25**
2.	Handling and storage of oilseeds; Dehulling of oilseed; Size reduction and pretreatment of oilseeds for oil extraction; Mechanical oil expression - principles of operation of *ghani*, rotary, hydraulic press and screw expeller; Purification of oil – gravity settling, filter press;	Study of dehulling, size reduction and pretreatment equipment for oilseeds Mechanical expression of oil from laboratory model equipments Study of oil extraction in *ghani*, rotary, hydraulic press and screw expellers and calculation of extraction efficiency. Study of filter press; Maintenance of oil milling equipments	5	5	25
	Total hours for this sub-module		**5**	**5**	**25**
3.	Oil milling process in common oilseeds – groundnut, mustard, sesame, coconut, sunflower, safflower and cotton seed; Oil extraction process in palm oil;	Visit to different commercial oil milling establishments to study oil extraction in - *ghani*, rotary, hydraulic press and screw expellers and calculation of	5	5	25

	Extraction processes of virgin coconut oil.	extraction efficiency.			
		Total hours for this sub-module	**5**	**5**	**25**
4.	Solvent extraction process - steps involved, batch and continuous-continuous solvent extraction processes. Recovery of solvent from miscella; Removal and recovery of solvent from oil cake; Solvent extraction of oils from rice bran, soybean, etc	Laboratory oil extraction in soxhlet apparatus with different solvents Study of solvent extraction technique of edible oil in pilot scale unit Visit to commercial solvent extraction plant	5	5	25
		Total hours for this sub-module	**5**	**5**	**25**
5.	Refining of oil – objectives; Dewaxing and degumming processes; Types of refining - continuous acid refining- bleaching of oils - continuous bleaching process; Decolourising and deodorization processes.	Refining of different types of oil using convention methods Refining of oil in the pilot model oil refining unit, Visit to oil refining Unit	5	5	25
		Total hours for this sub-module	**5**	**5**	**25**
6.	Packaging and storage of edible oils - requirements; Types of packages – rigid and flexible packages, tin, glass, Polyethylene Teraphthalate (PET), Poly Vinyl Chloride and LDPE pouches; Chemical changes during storage of oil; Labeling of oil packages- statutory requirements	Study of tin filling and seaming of oils Study of auto form fill seal machines for pouch filling of oil Studies on storage of oil with different packaging materials Studies on chemical testing of stored oils	5	5	25
		Total hours for this sub-module	**5**	**5**	**25**
7.	Industrial applications of oils - quality regulations, FSSAI, ISI and Agmark standards; Manufacture of soap, candle, paints and varnishes;	Visit to Soap, candle, paints and varnishes manufacturing units	5	5	25
		Total hours for this sub-module	**5**	**5**	**25**
8.	Production of value added products; Hydrogenation of edible oils - manufacture of *vanaspati*; Production of peanut butter, margarine; Oil seeds as direct edible products	Preparation of value added products – peanut butter, fried / roasted seeds and sensory quality analysis; Visit to relevant food industries	5	5	25
		Total hours for this sub-module	**5**	**5**	**25**
9.	By-product utilization of oil extraction industry; Oil cake analysis; defating of oil meals / cakes; Oil meal/ cake as raw material for animal / poultry feed; Oil cake export	Visit to animal and poultry feed manufacture units	5	5	25
		Total hours for this sub-module	**5**	**5**	**25**
10.	Site and equipment selection for edible oil extraction plant;	Mini assignment for preparation of Bankable Project Document for	5	5	25

	Production management and marketing of edible oil and by-products; Cost analysis	Establishment of Oil Milling Unit			
		Total hours for this sub-module	**5**	**5**	**25**
Total Contact Hours Individually for Theory, Demonstration and Practical			**50**	**50**	**250**
		Grand Total of Contact Hours	**350**		

T- Theory, D- Demonstration, P- Practical

9. Lists of Tools and Equipments for a Batch

S. No.	Description of tools	Qty
1	Soxhlet apparatus	1
2	Ghani	1
3	Power Ghani	1
4	Rotary press	1
5	Hydraulic press	1
6	Screw press	1
7	Expellers	1
8	Filter press	1
9	Pilot model oil Solvent extraction plant	1
10	Pilot model oil Refining Unit	1
11	Centrifuge	1
12	Form fill sealing machine	1
13	Deep fat fryer	1
14	Moisture meter	1
15	Hot air oven	1
16	Oil analyses equipments for – colour, sp gravity, pH, turbidity, viscosity	1 set

10. Space Required for Conducting the Module (in square feet):

a. Theory Class Room : 20’ x 30’
b. Demonstration & Practical Class Room : 40’ x 60’

11. Power requirement : 10 kW

12. Qualifications of Instructor :
B.Sc. or M.Sc. in Food Science and Technology (or) B.Tech in Food Engineering
Diploma in Food Science and Technology or Food Engineering with special training

13. Suggested Readings

Text Books

1) Acharia, K.T. (1990). *Oil Seeds and Oil Milling in India*. Oxford and IBH publication, New Delhi.
2) Harry Lawson. (1997). *Food Oils and Fats, Technology, Utilization and Nutrition*. CBS Publishers and Distributors, New Delhi.
3) Hilditch, T. P. (1943). *Industrial Chemistry of the Fats and Waxes*, Baillier, Tindall and Cox, London.

4) Kirschenbauer, H.G. (1944). *Fats and Oils*, Reinhold Publishing Corporation, New York.

5) Panda, H. (2000). *Essential Oils – Hand Book*, National Institute of Industrial Research - ISBN, New Delhi.

6) Weiss, T.J. (1970). *Food Oils and Their Uses*. The AVI Publishing Company, Inc., Westport, Connecticut.

7) Willians, P. and Nand J. Devine. (1984). *The Chemistry and Technology of Edible Oils and Fats.* Pergamon Press, London.

MODULE – 04

1.	**Title of the Module**	:	**Processing of Fruits and Vegetable**
2.	**Sector**	:	Food Processing and Preservation
3.	**Code**	:	
4.	**Entry Qualification**	:	10th Standard
5.	**Minimum Age**	:	18 years
6.	**Terminal Competency**	:	After completion of the course the candidate will be able to: a) To develop proficiency skill in producing different processed fruits and vegetables food products b) Operating & maintenance of the modern Equipments & machineries c) Make different processed food products with quality assurance d) Process of Packaging, Storing & marketing
7.	**Duration (in Hrs)**	:	350 hours

8. Module Contents

S. No.	Theory	Practical	Contact Hours		
			T	D	P
1.	**Introduction to food preservation - importance and scope of fruit and vegetable preservation industry** Introduction on food processing and preservation - importance and scope of fruits and vegetables preservation industry – Principles and guidelines for location of fruit and vegetable processing unit	Introduction about the food processing industries, Various tools and equipments used in food processing industries			
	a.Introduction to food preservation	a.Tools used in fruit and vegetable processing industry	1	1	5
	b.Basic principles of food preservation	b.Equipments used in fruit and vegetable processing industry	1	1	5
	c.Importance and scope of fruit and vegetable processing industry	c.Visit to fruit processing industry	1	1	5
	d.Location for the fruit and vegetable processing industry	d. Visit to Canning centre	1	1	5
	e.Sanitary requirement of fruit and vegetable processing industry	e.Visit to cottage scale fruit processing industry	1	1	5

		Total hours for this sub-module	**5**	**5**	**25**
2.	**Fruits and vegetables preservation – Processing and preservation** Basic principles of food preservation Different methods of food Preservation and its importance – food spoilage and types – prevention of spoilage	Different methods of fruits and vegetables preservation – spoilage of fruits and vegetables products			
	a.Importance of fruits and vegetables preservation	a.Processing and preservation of fresh fruit juices	1	1	5
	b. Different methods of food preservation and its importance	b.Preparation of mixed fruit jam	2	2	10
	c.Spoilage of Fruit and vegetable products –causes and preventive measures	c. Preparation of jelly	1	1	5
	d.Causes of food spoilage and preventive measures	d. Defects in jam, jelly and marmalade preparation	1	1	5
	e. Defects in preparation of Fruit and vegetable products	e. Detection of spoilage – visual methods			
		Total hours for this sub-module	**5**	**5**	**25**
3.	**Preservation by use of high temperature** Pasteurization, sterilization, canning - History and steps involved,- types of cans and bottles - canning of acid and non acid foods- spoilage of canned foods	Process of canning – methods – canning of fruits and vegetables			
	a.Definition - different methods of high temperature - Pasteurization and sterilization - its importance	a.Canning of fruits – apple, orange and pineapple	1	1	5
	b. Canning - principles and advantages of canning and steps involved	b.Canning of vegetables – tomato, beans , etc.,	1	1	5
	c. Different types of cans and bottles – and its advantages and defects	c. Visit to aseptic unit	1	1	5
	d.Canning of fruits and vegetables – apple, orange and pineapple , tomato, beans	d. Canning of vegetables – cucumber, gerkin etc.,	1	1	5
	e.Mechanical defects in canning and spoilage of canned foods	e. Visit to Can reforming unit	1	1	5
		Total hours for this sub-module	**5**	**5**	**25**
4.	**Preservation by use of low temperature** Refrigeration - principles -	Refrigeration – cold storage unit – quality of refrigerated foods			

	Advantages - changes in the refrigerated food - common spoilage				
	a. Refrigeration - principles involved in refrigeration process	a.Storage of fruits under Refrigeration condition	1	1	5
	b.Advantages of refrigeration systems	b.Storage of vegetables under Refrigeration condition	1	1	5
	c. Factors affecting the quality of refrigerated products - common spoilage	c.Sensory evaluation of fruit products stored under room and refrigeration conditions	1	1	5
	d. Spoilage of the refrigerated foods	d.Visit to cold storage unit	1	1	5
	e. Maintenance of refrigerator and its importance		4	4	20
		Total hours for this sub-module			
5.	**Preservation by use of very low temperature** Freezing - difference between refrigeration and freezing - methods of freezing, steps involved in freezing - common food spoilage, types of freezing, - maintenance of freezers and refrigerators	Freezing and refrigeration process – quality analysis of the fruits and vegetables			
	a. Freezing and refrigeration – difference between refrigeration and freezing	a.Storage of fruits under Freezing	1	1	5
	b. Different types of freezing – advantages and disadvantages	b. Storage of vegetables under Freezing	1	1	5
	c. Methods of freezing - steps involved in freezing – quality parameters	c. Visit to cold storage unit	1	1	5
		Total hours for this sub-module	**3**	**3**	**15**
6.	**Preservation by Drying** Drying and dehydration - merits and demerits - factors affecting drying - blanching preparation of food for drying – osmotic dehydration- principles - Freeze drying – dehydrofreezing - advantages - mechanism of freeze drying and dehydrofreezing.	Drying and Dehydration of Fruits and Vegetables Drying and Dehydration of Fruits and Vegetables Repair and Maintenance of Machines Adequacy of Blanching of Fruits/Vegetables			
	a.Drying and dehydration – solar drying and mechanical drying - merits and demerits	a.Solar drying of fruits	2	2	10
	b.Preparation of Fruits/Vegetables for drying - factors affecting drying	b.Solar drying of vegetables	2	2	10

	c. Blanching of Fruits/Vegetables – methods - advantages	c.Mechanical dehydration of fruits	*1*	*1*	*5*
	d. Freeze drying – advantages - mechanism of freeze drying - dehydrofreezing and its advantages	d.Mechanical dehydration of vegetables	1	1	5
	e. Different types of drier – its merits and demerits	e.Blanching of Fruits/Vegetables for dehydration	1	1	5
		Total hours for this sub-module	**7**	**7**	**35**
7.	**Preservation by using sugar** Sugar concentration - principles of gel formation - preparation of jam, jelly, marmalades, preserve, candy, glazed, crystallized fruits - FSSAI – GMP – ISO standards - APEDA	Production of Fruit Jam, Jelly, Marmalade Fruit - FSSAI – GMP – ISO standards - APEDA			
	a.Sugar and its importance in food preservation - principles of gel formation	a.Preparation of guava jam	1	1	5
	b.Specifications – FSSAI and its importance and applications	b.Preparation of mixed fruit jam	1	1	5
	c.Jam – selection of fruits – methods of preparation	c.Preparation of guava jelly	1	1	5
	d.Jelly – quality of fruits – methods of pectin extraction	d.Preparation of jelly from citrus fruits	1	1	5
	e.Jelly strength – testing methods - methods of preparation – defects on jelly formation	e.Preparation of marmalade	1	1	5
	f.Marmalade – types of fruits used – preparation	f.Preparation of RTS from fresh fruits and clarified fruit juice	1	1	5
	g.Candy - glazed and crystallized fruits - Methods of preparation	g.Visit to Super market	1	1	5
	h. Preserves – quality parameters – process for preserves	h.Preparation of fruit Cheese, Preserve and Candies	1	1	5
		Total hours for this sub-module	**7**	**7**	**35**
8.	**Unfermented fruit beverages** Unfermented fruit beverages – preparation and preservation of unfermented fruit beverages – squash, RTS beverages , cordial, syrup, fruit juice concentrate	Preparation of unfermented beverages – methods – bottling – storage			
	a.Unfermented fruit beverages – selection of fruits for different fruit beverages	a.Preparation of RTS from fresh fruits and clarified fruit juice	1	1	5
	b.Specifications – FSSAI and its applications for fruit and vegetable products	b.Preparation of squash	1	1	5
	c.Squash and RTS beverages –	c.Preparation of cordial	1	1	5

	selection of fruits – methods of extraction of juice - method of pasteurization				
	d. Nectar,cordial - selection of fruits – method of pasteurization	d.Preparation of nector	1	1	5
	e. Crush and fruit juice concentrate – principles - method of pasteurization	e.Preparation of crush	1	1	5
		Total hours for this sub-module	**5**	**5**	**25**
9.	**Preservation by using chemicals** Chemical preservatives - definition, role of chemical preservatives in fruit and vegetable products - permitted preservatives - chemicals and enzymes used for clarification of fruit juices	Use of chemical preservative in fruit and vegetable products - limitations			
	a.Chemical preservatives – definition – types of preservatives food processing	a.Preparation of mixed fruit jam	1	1	5
	b.Chemical preservatives – role of preservatives in food processing - application in value added fruit and vegetable products	b.Preparation of pineapple squash	1	1	5
	c.Chemical preservatives – permissible limits – health hazards	c.Preparation of citrus marmalade	1	1	5
	d. Chemicals and enzymes used for clarification of fruit juices	d.Preparation of mango RTS beverages	1	1	5
	e. Chemical preservatives - types of action – control of microbial growth	e.Visit to tomato processing centre	1	1	5
		Total hours for this sub-module	**5**	**5**	**25**
10.	**Preservation by salts and acids** Pickling - types and principles involved of pickles – preservation of fruits and vegetables with salt and acids - sauce and ketchup - principles	Preparation of Pickles and Chutneys, Relishes and Sauces Production of Tomato Juice, Ketchup, Puree and Paste			
	a. Pickling –different types of pickles	a.Preparation of pickle with salt	1	1	5
	b. Principles of pickling process Pickling process – preservation with salt , vinegar and oil	b.Preparation of pickle with oil	1	1	5
	C. Problems in pickle making – causes of spoilage	c.Preparation of pickle with vinegar	1	1	5
	d. Sauce and ketchup - principles involved - packaging	d.Preparation of sauce and ketchup	1	1	5

	Total hours for this sub-module	4	4	20
Total Contact Hours Individually for Theory, Demonstration and Practical		**50**	**50**	**250**
	Grand Total of Contact Hours	**350**		

T- Theory, D- Demonstration, P- Practical

9. Lists of Tools and Equipments for a Batch

S. No.	Description	Quantity
1	Construction of Zero Energy Cool Chamber	1
2	Mini Solar Drier	1
3	Blanching unit	1
4	Pulper	1
5	Juicer	1
6	Refracto-meters	3
7	pH Meter	1
8	Penitrometer	1
9	Autoclave unit	1
10	Tray Drier	1
11	Vacuum Drier	1
12	Utensils	5 Sets
13	Canning unit	1
14	Package Testing equipments	1 set
15	Chromo-meter	1

10. Space Required for Conducting the Module (in square feet):

a. Theory Class Room : 600 sqft
b. Demonstration & Practical Class Room :2000 sqft

11. Power requirement **:** 3 phase connection
5 Kw

12. Qualifications of Instructor

B.Sc. or M.Sc. in Food Science and Technology (or)B.Tech in Food Engineering
Diploma in Food Science and Technology or Food Engineering with special training

13. Suggested Readings

Text Books

1. Subalakshmi, G and Udipi, S.A. Food processing and preservation. New Age International Publishers, New Delhi, 2001.
2. Srilakshmi, B. Food Science. New Age International Publishers, New Delhi, 2003.
3. Potter, N.N. and Hotchkiss J. H. Food Science. CBS publishers and distributors. 1996.
4. Srivastava, R.PO and Kumar, S. Fruit and vegetable preservation, International Book distribution Company, Lucknow, 1994.
5. MC.Williams, M and Paine, H. Modern Food preservation. Surjeet Publications, Delhi, 1984.
6. Cruess, W.V. . Commercial fruits and vegetable products, Anees Offset press, New Delhi, 1997.
7. Pandey. Post harvest technology of fruits and vegetable principles and practices, New Delhi, 1997.
8. R.K. Meena and Yadav. Horti marketing and post harvest management

9. Giridharkar Siddhappa G.S. and Tandon G.A. Post harvest technology of fruits and vegetable principles and practices

MODULE – 05

1.	**Title of the Module**	:	**Manufacturing of Alcholic Beverages**
2.	**Sector**	:	Food Processing and Preservation
3.	**Code**	:	
4.	**Entry Qualification**	:	Bachelor degree in life science
5.	**Minimum Age**	:	20 years
6.	**Terminal Competency**	:	After completion of the course the candidate will be able to: a) Have thorough knowledge on production and quality parameters of alcoholic beverage production b) Operate and maintain the equipments used for production and distillation of alcoholic beverages c) Understand the packaging principles and techniques d) Implement food quality and safety in process lines and products
7.	**Duration (in Hrs)**	:	350 hours

8. Module Contents

S. No.	**Theory**	**Practical**	**Contact Hours**		
			T	**D**	**P**
1	Introduction to Industrial microbiology – history -scope - concepts of industrial microbiology -Role of brewery science	Fermentor- structure – assembling – calibration			
	a. Definition, concepts and scope of industrial microbiology	a. Structure and cleaning of Fermentor	1	1	5
	b. Historical development of industrial microbiology	b. Assembling and final pre-sterilization check of Fermentor.	1	1	5
	Role of brewery science in food industry	c. Calibration of fermentor electrodes	1	1	5
		d. Fermentor filters preparation	1	1	5
		Total hours for this sub-module	**4**	**4**	**20**
2.	Basic concepts on isolation- Media composition- favourable atmospheric conditions- Importance of media sterilization	Broth- mixing-rheological studies-sterilization			
	a. Basic concepts on isolation and screening of industrial microbes.	a. Rheological studies of fermentation broth.	1	1	5
	b. Media composition, nutritional and favourable atmospheric conditions.	b. Mixings of fermentation broth.	1	1	5

	c. Importance of media sterilization - contamination.	c. Setting up fermentation console.	1	1	5
	d. Taxonomical studies on industrially important microbes.	d. Post sterilization procedures.	1	1	5
	e. Types of cultures- maintenance and importance.	e. Water loss studies in sterilization studies.	1	1	5
		Total hours for this sub-module	**5**	**5**	**25**
3.	Introduction to fermentation - Fermentor – structure – Dynamics of fermentation Metabolic pathways Direct and in-direct fermentation - Enzymes Effect Organisms used Medium and atmosphere.	Fermentation – inoculation-production – beer-monitoring fermentation			
	a. Introduction to fermentation-History of fermentation	a. Aseptic techniques in inoculation of fermentors.	1	1	5
	b. Fermentor – structure – functions and handling practices	b. Aseptic samplings from fermentors.	1	1	5
	c. Dynamics of fermentation – types of fermentation	c. Visit to a Fermentor manufacturing centre	1	1	5
	d. Aerobic and anaerobic fermentation.	d. Visit to a beer production factory	1	1	5
	e. Metabolic pathways of fermentation	e. Visit to a alcoholic beverage quality assessing laboratory	1	1	5
	f. Fermentation methods -Direct and in-direct fermentation	f. Production of beer	1	1	5
	g. Enzymes in alcoholic fermentation	g. Production of beer	1	1	5
	h. Effect of pH, temperature, water activity, freezing, ionic strength on enzyme activity	h. Monitoring of fermentation process and recording the changes	1	1	5
		Total hours for this sub-module	**8**	**8**	**40**
4.	Introduction to alcoholic beverages – types of alcoholic beverages – microbial fermentation Principles of fermentation – organism of commercial fermentation -types of alcoholic beverages - nutritional quality of different alcoholic beverages - Social Implications of alcoholic Beverages – trade on alcohol	Alcoholic beverage- production-quality assessment			
	a. Alcoholic beverages definition - types of alcoholic beverages	a. Visit to a wine production factory	1	1	5
	b. Raw materials used for alcoholic beverage production	b. Production of wine.	1	1	5
	c. Physiology and nutritional requirement for the microbes used in alcoholic beverage production.	c. Production of wine	1	1	5
	d. Organisms used for production of different alcoholic beverages.	d. Assessing the quality of wine	1	1	5

	e. Medium and atmosphere for the growth of organisms used for the production of alcoholic beverages	e. Assessing the quality of wine	1	1	5
	f. Alcoholic beverages –specific to of different regions	f. Visit to a fenny production factory	1	1	5
	g. Alcoholic beverages consumption with respect to social status	g. Production of fenny	1	1	5
		Total hours for this sub-module	**7**	**7**	**35**
5.	Suitability for malting -Principles - Physiological and enzymatic transformations –types –wine-beer-cider-ale –fenny-peri-sherry-production technologies.	Production of fermented and flavoured – alcoholic beverage-visit – monitoring process-trouble shooting			
	a. Suitability of different cereals for malting -Principles & technology for malting.	a. Production of sherry	1	1	5
	b. Physiological and enzymatic transformations caused by malting.	b. Monitoring of fermentation process and recording the changes	1	1	5
	c. Beer types -Brewing process and defects of beer	c. Monitoring of fermentation process and recording the changes.	1	1	5
	d. Problems during brewing	d. Assessing the quality of fenny.	1	1	5
	e. Cider Production technology	e. Monitoring the fermentation process	1	1	5
	f. Wine production technology – post fermentation treatments	f. Visit to a commercial distillery to study the processing of alcoholic beverage	1	1	5
	g. Sherry production technology	g. Visit to a Codex Alimentarius laboratory	1	1	5
	h. Traditional and spontaneous wine fermentation	h. Trouble shooting and diagnostics in fermentation (continuous clinical observations)	1	1	5
		Total hours for this sub-module	**8**	**8**	**40**
6.	Introduction todistillation – types of distilled alcoholic beverages – whisky - brandy-rum-gin-vodka-champagne-scotch– fermentation characters- production technologies.	Distilled alcoholic beverage- visit – production technologies			
	a. Brandy production technology	a. Visit to distilled alcoholic beverage production unit.	1	1	5
	b. Whiskey and vinegar production technology	b. Production of brandy.	1	1	5
	c. Vodka, gin and flavored spirits production technology	c. Production of brandy.	1	1	5
	d. Flavored alcohols - Port, Sherry, Madeira, Marsala, Co mmandaria wine and the aromatized wine Vermouth.	d. Production of whisky.	1	1	5

	Total hours for this sub-module		**4**	**4**	**20**
7.	Packaging – Definitions, functions, importance, properties and selection of packaging material. Casking, Kegging, Bottling and Canning	Packaging – alcoholic beverage – quality of packaging material			
	a. Introduction to packaging techniques- packaging materials	a. Visit to Indian Institute of packaging.	1	1	5
	b. Concepts on selection of suitable packaging- Casking, Kegging, Bottling and Canning	b. Casking, kegging, bottling and canning of beverage in glass	1	1	5
	c. Handling and storage of packed alcoholic beverages	c. Casking, kegging, bottling and canning of beverage in glass	1	1	5
	Shelf life of different packaging materials	d. Studying the quality of glass and can with respect to packaging of alcoholic beverage	1	1	5
	Total hours for this sub-module		**4**	**4**	**20**
8.	Sensory – chemical and bio-chemical –attributes contribute to consumer appreciation	Packaging and labeling-visit – vinegar production			
	a. Analysis of raw materials used for alcohol production- importance.	a. Study on the packaging and labeling of alcoholic beverages	1	1	5
	b. Sampling for physical analysis, chemical, biochemical analysis, germination test	b. Visit to FSSAI	1	1	5
	c. Quality evaluation of fermented and distilled alcoholic sensory.	c. Visit to a beer industry	1	1	5
	d. Quality evaluation of fermented and distilled alcoholic chemical	d. Vinegar production.	1	1	5
	Total hours for this sub-module		**4**	**4**	**20**
9.	Nutrition -Digestion and effects on the body - Usage in medicines - Impact of alcohol consumption	Medicinal use- alcohol –visit to			
	a. Nutrition -Digestion and effects on the body	a. Visit to a distillery unit to study the problems in large scale production	1	1	5
	b. Usage in medicines	b. Visit to a distillery unit to study the quality analysis.	1	1	5
	c. Impact of alcohol consumption on social stigma.	c. Visit to a pharma company to study the medicinal usage of alcohol	1	1	5
	Total hours for this sub-module		**3**	**3**	**15**
10.	Standards in national level-international level				
	a. National and international bodies governing the alcohol business	a. Visit to a distilled alcoholic beverage industry to study the marketing strategies	1	1	5
	b. Standards in national level	b. Visit to a distilled alcoholic beverage industry to study the national and international	1	1	5

		standards			
	c. Standards in international level	c. Visit to central excise office to study alcohol related laws	1	1	5
		Total hours for this sub-module	**3**	**3**	**15**
Total Contact Hours Individually for Theory, Demonstration and Practical			**50**	**50**	**250**
		Grand Total of Contact Hours	**350**		

T- Theory, D- Demonstration, P- Practical

9. Lists of Tools and Equipments for a Batch

S.No.	Description of equipments	Qty. (No.)
1.	Fermentor 5 litre capacity	1 for 5 students
2.	Laminar air flow chamber	2
3.	Auto clave	4
4.	Hot air oven	3
5.	Incubator	3
6.	Weighing balance	4
7.	Gas stove	2
8.	Fridge with freezer	2
9.	Working table with sink & without sink	1
10.	BOD incubator	2
11.	Storage racks	4
12.	pH meter	2
13.	Deep freezer	2
14.	Spectrophoto meter	2
15.	Shaker	2
16.	Centrifuge	4
17.	Walk in cooler	1
18.	Cell counter	5
19.	Water distillation unit	2
20.	Glass distillation unit	2

10. Space Required for Conducting the Module (in square feet):

a. Theory Class Room : 1000 square feet
b. Demonstration & Practical Class Room : 2000 square feet

11. Power requirement **:** 3 phase connection
30 KW

12. Qualifications of Instructor

B.Sc. or M.Sc. in Food Science and Technology (or) B.Tech in Food Engineering
Diploma in Food Science and Technology or Food Engineering with special training

13. Suggested Readings

1. Y. H. Hui, Lisbeth Meunier-Goddik, Jytte Josephsen, Wai-Kit Nip, Peggy S. Stanfield. 2004, Handbook of Food and Beverage Fermentation Technology.CRC Press
2. Bakker, Jokie / Clarke, Ronald J. 2011 Wine flavor chemistry. Wiley-VCH
3. Alan J. Buglass. 2011. Handbook of Alcoholic Beverages Technical, Analytical and Nutritional Aspects. Volume I and II A John Wiley and Sons, Ltd., Publication.

4. J Piggott . 2011. Alcoholic beverages: Sensory evaluation and consumer research. Wood Head Publishing.

MODULE - 06

1.	**Title of the Module**	:	**Technology of Manufacturing Bakery Products**
2.	**Sector**	:	Food Processing and Preservation
3.	**Code**	:	
4.	**Entry Qualification**	:	Minimum 12th Standard
5.	**Minimum Age**	:	18 years
6.	**Terminal Competency**	:	After completion of the course the candidate will be able to: a) Formulate and develop process techniques and product techniques in bakery b) Operate and maintain the equipment of the modern bakery c) Maintain good package and shelf life of the products d) Implement food quality and safety in process lines and products
7.	**Duration (in Hrs)**	:	350 hours

8. Module Contents

S. No.	Theory	Practical	Contact Hours		
			T	D	P
1.	Principle wheat producing countries and characteristics of wheat, Structure of wheat grain, Milling : A general descriptive survey of the various processes. Bakery – introduction – scope, present status and future prospectus	Raw material quality testing Temperature control for product development - Friction factor, mixing temperature, water temperature, weight of ice cubes - Calculate bakers percent, formula percent and conversion bakers to formula percent	1	1	5
	a. Flour : Refined, composition, nature of gluten and its functions in bread making and baking. Simple tests for flour quality, colour, gluten and water absorption. Blended flours and their suitability for use in different types of baked products. Flour improvers.	a. Anatomical features of wheat, physical properties and moisture content	1	1	5
	b. Enriched Bakery Products : Bakery goods with soya flour, ground-nut flour, whole wheat meal etc.	b. Diastatic activity and maltose value	1	1	5
	c. Yeast: baker's yeast, its production, its role in the fermentation of dough and	c. Damage starch content and amylase activity	1	1	5

	conditions favorable for its action. Effects of over-and under-fermentation and over-and under – proving of dough of bread and fermented goods.				
	d. Salt : The use and effects of salt in making bread. Raw materials required and quality parameters	d. Flour colour grade value and ash content Flour particle size distribution	1	1	5
	Total hours for this sub-module		**5**	**5**	**25**
2.	Bakery - introduction - baking principles - classification - role of ingredients in bakery products - chemistry and technology. Dough rheology - equipments used for quality evaluation.	Equipments used in bakery. . Quality assessment of raw ingredients used for bakery products.			
	a. Baking principles and classification of bakery products	a. Introduction of tools and equipments of bakery products.	1	1	5
	b. Role of ingredients in bakery products	c. Sieve analysis of the flour.	1	1	5
	d. Chemistry and technology of bakery products	e. Water absorption capacity and farinographic studies of the flour.	1	1	5
	f. Dough rheology	g. Determining the strength of the flour.	1	1	5
	h. Equipments used for quality evaluation	i. Analyzing the chemical constituents of different flour	1	1	5
	Total hours for this sub-module		**5**	**5**	**25**
3.	Bread - ingredients - additives and improvers - different types of bread - methods of bread preparation - bread spoilage and remedies - quality aspects of bread and standards.	Dough characteristics - determination of gluten - baking of bread - different mixing methods and types of breads, bun and bread rolls	1	1	5
	a. Role of ingredients, additives and improvers in bread making. Chemical leavening agents- baking powder, sodium bicarbonate, ammonium bicarbonate cream of tartar.	Determining the dough characteristics - Dough raising capacity - Pelshenke value	1	1	5
	b. Different method of preparation - Straigh dough method, normal straight dough, 70% sponge and dough, 100% sponge and dough, soaker and dough method, ferment method	a. Determining the gluten content, SDS-sedimentation volume test, Falling number test	1	1	5

	Different types of bread - Masala bread, French bread, Parsin bread, Oirrant loaf, Brown bread, Garlic bread, whole meal bread, Milk bread, etc.Rolls: Luncheaon rolls, Hot cross buns, bread basket, read sticks, crescent rolls, brioche, Vienna rolls etc.Sweet Dough : Sweet dough lean, sweet dough rich, chelsea buns, Baba au Rhum, Danish pastry, doughnuts (yeast), panetone. Unleavened breads- Nan, tortillas, Arabic bread, oda bread etc.Hot plate Good : Muffins crumpets.	b. Baking of bread, bun and bread rolls by different mixing methods.	1	1	5
	a. Bread spoilage and remedies Quality aspects of bread and its standards.	c. Determining the rheological properties–mixograph/ farinigraph/ extensograph/ viscoamylograph	1	1	5
	b. Machineries used in bread making.	d. Determining the microbial content	1	1	5
		Total hours for this sub-module	**5**	**5**	**25**
4.	Biscuits and cookies - role of ingredients - various types of biscuits - basic procedure in production.	Biscuits and cookies - different types			
	a. Role of ingredients in biscuits and cookies	a. Preparation of nankhatai	1	1	5
	b. Types of biscuits	e. Preparation of melting moments	1	1	5
	c. Basic procedure of biscuits and cookies	f. Preparation of golden cookies	1	1	5
	d. Characteristic features of ingredients of cookies	g. Preparation of tri colour cookies	1	1	5
	e. Quality assessment of raw ingredients used in cookies	h. Preparation of butter biscuit	1	1	5
		Total hours for this sub-module	**5**	**5**	**25**
5.	Cake-role of ingredients - flours, oils and fats, eggs, suger, dried fruits and nuts.- types of cakes - methods of mixing - preparation of fancy cakes and techniques - quality - cake faults and remedies.	Plain and fancy cakes - baking and quality analysis			
	a. Role of ingredients in sponge goods	a. Preparation of plain cake.	1	1	5
	a. Types of cakes	b. Preparation of flavoured cake	1	1	5
	b. Methods of preparation	c. Preparation of sponge cake	1	1	5
	c. Techniques and quality of fancy cakes	d. Preparation of pineapple upside down cake	1	1	5
	d. Cake faults and remedies	e. Preparation of plum cake.	1	1	5

	Total hours for this sub-module				
6.	Pastry - basic formulation - different types - flaky, puff and danish pastry- bakery products that combines flour and fat. Pie - types and methods.	Preparation of flaky pastries - types of pastry			
	a. Introduction to pastry preparation	a. different methods of preparations	2	2	10
	b. Types of pastries and preparation	b. Preparation of pizza base and filling for pizza.	1	1	5
	c. Preparation methods of danish pasties and the role of ingredients used.	c. Preparation of flaky pastry, puff pastry, danish pastries	1	1	5
	d. Cold and hot pastries	d. Preparation ofshortcrust pastry, filo pastry, choux pastry	1	1	5
		Total hours for this sub-module	**5**	**5**	**25**
7.	Standards, regulations and quality control for bakery products.	Standard requirements of atta, maida, fortified maida			
	Specifications for bakery ingredients BIS/FSSA standards for ingredients and products	Standard requirements for wheat flour – bread - biscuit industry	2	2	5
	Specifications for bakery products BIS/FSSA standards for ingredients and products	a. Alkaline water retention capacity, The falling number	1	1	5
	Morphology, types of baker's yeast, yeast freshness test gassing activity of yeast.	b. Significance of functional tests in relation to bread, biscuits	1	1	10
	Reproduction, physiology, quality tests of yeast	c. Significance of functional tests in relation to cakes	1	1	5
		Total hours for this sub-module	**5**	**5**	**25**
8.	Bakery decorations - classification - basic preparation techniques - Decoration of confectionery goods - tools and equipments	Decoration of baked and confectionery products - Icing and glazing	2	2	10
	a. Classification of bakery decorations	a. Processing of bakery decorative fondants	1	1	5
	b. Basic bakery decorations preparation techniques	b. Introduction to tools and equipments used in confectionery	1	1	5
	c. Tools and equipments used in confectionery	c. Icing techniques	1	1	5
	d. Decoration of confectionery goods	d. Glazing techniques	1	1	5
		Total hours for this sub-module	**5**	**5**	**25**
9.	Detail project report : Introduction, Market survey, Raw materials, Process of manufacture, plant & machinery, land & building, Project economics, Annexure of	HACCP plan, GMP for bakery			

	charts/financial aspects				
	Machineries required for bakery. Packaging requirements	Visit to bakery units.			
	Plan layout and requisites for establishing bakery Cost economic of the bakery products	Floor plan layout for a bakery unit			
	Packaging requirements	Suitable packaging materials for bakery products			
	Standards, regulations and quality control for bakery	Cost economics of bakery			
	Total hours for this sub-module		**5**	**5**	**25**
10.	Bakery hygiene and sanitation	Bakery products preparation			
	a. Cleaning and Sanitation in bakery	a. preparation of bread, Bun and bread rolls and quality evaluation	1	1	5
	b. General cleaning and sanitizing program Cleaning methods: Clean-out-of-Place Manual cleaning	b. preparation of bread, Bun and bread rolls and quality evaluation	2	2	10
	c. Properties of food soils Cleaning agents	c. preparation of cakes and quality evaluation	1	1	5
	d. Sanitizers: Physical and chemical Factors affecting effectiveness of sanitizer	d. Plain and fancy cakes - baking and quality analysis preparation of cakes and quality evaluation	1	1	5
	Total hours for this sub-module		**5**	**5**	**25**
Total Contact Hours Individually for Theory, Demonstration and Practical			**50**	**50**	**250**
Grand Total of Contact Hours			**350**		

T- Theory, D- Demonstration, P- Practical

9. Lists of Tools and Equipments for a Batch

S. No.	Description of tools	Qty. (No.)
1.	Bread knife	4
2.	Pallet knife	4
3.	Chopping knife	4
4.	Bread mould	20
5.	Soft brush	4
6.	Oven trays	20
7.	Cake mold	10
8.	Cookies cutter	10
9.	Piping bag and ss nozzle	4
10.	Steel and plastic scraper	5
11.	Pizza cutter	4

12.	Cake mould	10
13.	Scissors	2
14.	Chocolate and toffee moulds and dies	10
15.	Butter paper	10
16.	Wire whisk	3
17.	Ss spoon and fork	10
18.	Measuring jug	5 set
19.	Rolling pin SS or wood	5
20.	Lab apparels	25 sets

S.No.	Description of equipments	Qty. (No.)
1	Convention oven	1
2	Spiral kneader	1
3	Planetary mixer	1
4	Dough sheeter	1
5	Cookie depositor & wire cutting	1
6	Enrober	1
7	Bread slicer	1
8	Stove (Electric or Gas)	1
9	Fridge with freezer	1
10	Working table with sink & without sink	1
11	Balance	2
12	Storage racks	4

10. Space Required for Conducting the Module (in square feet):

a. Theory Class Room : 600 sq.ft.
b. Demonstration & Practical Class Room : 1500 sq.ft.

11. Power requirement

Total power requirement **:** 50 kW

12. Qualifications of Instructor

Diploma in Bakery Technology

B.Sc. or M.Sc in Food Science and Technology (or) B.Tech.in Food Engineering

Diploma in Food Science and Technology or Food Engineering with special training

13. Suggested Readings

Text Books

1) Amsterdam, 1985. Cakes and pastries, Time - life books.
2) Baker's Handbook on Practical Baking, (1994). US Wheat Associates, New Delhi.
3) Bernard, W. Minifie, (1997). Chocolate, cocoa and confectionery: CBS Publishers and Distributors, New Delhi.
4) Bernard, W.M. (1989). Chocolate, cocoa and confectionery, Science and Technology, 3rd Edn. AVI Book Published by Van Nostrand Rein hold, New York.
5) Dominic, W.S. Wong, (1996). Mechanism and theory in food chemistry, First Edition, CBS Publishers and Distributors, New Delhi.
6) E.B. Jackson, (1999). Sugar Confectionery Manufacture, Second edition, Aspen publishers Inc., Great Britain

7) Gordon Booth, R. (1997). Snack foods, CBS Publishers and Distributors, New Delhi.
8) Kent, N. L. and Evers, A. D. (1994). Technology of Cereals: Woodhead Publishing Limited, Cambridge.
9) Khetarpaul, N., Grewal, R., and Jood, S., (2005). Bakery Science and Cereal Technology, Daya Publishing House.
10) Matz, Samuel A, (2004). The Chemistry and Technology of Cereals as Food and Feed, (3rd Edition) CBS Publishers, New Delhi, first reprint.

MODULE – 07

1.	**Title of the Module**	:	**Processing of sugar and cocoa confectionery products**
2.	**Sector**	:	Food Processing and Preservation
3.	**Code**	:	
4.	**Entry Qualification**	:	Minimum 12th Standard
5.	**Minimum Age**	:	18 years
6.	**Terminal Competency**	:	After completion of the course the candidate will be able to: a. Formulate and develop process techniques and product techniques in confectionery b. Operate and maintain the equipments of the modern confectionery industries c. Maintain good package and shelf life of the products d. Implement food quality and safety in process lines and products
7.	**Duration (in Hrs)**	:	350 hours

8. Module Contents

S. No.	Theory	Practical	Contact Hours		
			T	**D**	**P**
1	History, traditional confectionery goods, types of confectionary, classification, Basic technical considerations, TS, TSS, pH, acidity, ERH, sugar, invert sugar, glucose syrup, RH, crystallization	a. Production of invert sugar	3		8
		b. Preparation of high boiled sweets			8
		c. Preparation of toffee			8
		d. Preparation of groundnut chikki			8
		Total hours for this sub-module	**3**	**-**	**32**
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. Confectionery - introduction - development - ingredients used in confectionery - sugars - types and role - thickening, gelling agents, binding agents and its application in confectionery - role of chemical	a. Preparation of decorative cake	7		8

	additives in confectionery				
		b. Preparation of traditional Indian confection			6
		c. Preparation of traditional Indian confection			6
		d. Preparation of Shrikhand wadi			8
		Total hours for this sub-module	**7**	**-**	**28**
3.	Whipping, release agent, thickeners, acidulents, milk and milk products, flavours, for confectionery, emulsifiers and other additives,	a. Preparation of milk chocolate	3		8
		b. Preparation of fruit toffee			8
		c. Preparation of flour confectionary			8
		d. Preparation of flour confectionary			8
		Total hours for this sub-module	**3**	**-**	**32**
4.	Cleaning and Sanitation in confectionery,General cleaning and sanitizing program Cleaning methods:CIP Clean-out-of-Place Manual cleaning Properties of food soils Cleaning agents Sanitizers: Physical and chemical, Factors affecting effectiveness of sanitizer	a. Preparation of milk cake			6
		b. Preparation of petha			6
		c. Preparation of fruit candy			8
		d. Preparation of Rasgulla			8
		Total hours for this sub-module	**7**	**-**	**28**
5.	Starch derivatives, colours used in confectionary. Production of glucose syrup, acid hydrolysis, enzyme hydrolysis	a. Type of Couverture			6
		b. Tempering the chocolate (Pre-crystallization)		8	2
		c.Preparation of caramel			8
		d. Preparation of Fondants			8
		Total hours for this sub-module	**3**	**8**	**24**
6.	Caramel: Definition, composition, factors affecting quality of caramel, caramel manufacture process, batch type, continuous types, checking of faults in caramel, Toffee, Candy, Chewing Gum and Bubble Gum	a. Machineries required confectionery.		8	

		b. Packaging requirements. Standards, regulations and quality control for confectionery products.		5	
		c. Floor plan lay out for a small scale confectionery unit. Cost economic of confectionery products.		8	
		d.Visit to coca processing industry		8	
	Total hours for this sub-module		**6**	**29**	**-**
7.	Cocoa processing: cocoa bean, processing, roasting, fermentation, production of cocoa butter cocoa powder, its quality	a. cocoa bean, processing, roasting, fermentation,			10
		b. fermentation of cocoa beans			8
		c. production of cocoa butter			8
		d. production of cocoa powder			8
	Total hours for this sub-module		**1**	**-**	**34**
8.	Chocolate processing : Ingredients, mixing, refining, conching, tempering, molding, cooling, coating, fat bloom	a. Preparation of chocolate			8
		b. Chocolate tempering			6
		c. Hand dipped chocolates			10
		d. Molded chocolates			10
	Total hours for this sub-module		**1**	**-**	**34**
9.	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	a. Preparation of Creams			4
		b. Preparation of Marshmelow and nougats			8
		c. Preparation of Chewing and bubble gums			10
		d. Preparation of Lolypops(High boiled sweets)			10
	Total hours for this sub-module		**3**	**-**	**32**
10.	Cocoa confectionery- primary and secondary processing of Cocoa-commercial manufacturing of chocolate and its uses in confectionery. Preparation of project report for confectionery Break even point	a. Hygiene and sanitation in cofectionary	3	6	

	assessments: Kinds of values, Chief techniques of costing, Break even ideas of costing				
		b. Chocolate standards		6	
		c. Preparation of project report			10
		d. Visit to chocolate industry			10
		Total hours for this sub-module	**3**	**12**	**20**
Total Contact Hours Individually for Theory, Demonstration and Practical			**37**	**49**	**264**
		Grand Total of Contact Hours	**350**		

T- Theory, D- Demonstration, P- Practical

9. Lists of Tools and Equipment for a Batch

S. No.	Description	Quantity
1.	Confectioners operate confectionery manufacturing and processing machinery such as boilers, baling presses, compressors, conveyor driven machinery, and storage silos, tanks and bins. They may also operate jar filling systems or wrapping machines. Confectioners may also operate industrial kitchen equipment such as ovens and cookers, deep fryers, steamers and mixers, as well as regular kitchen appliances such as microwaves and refrigerators. They may also operate laboratory equipment such as sonic and water baths, chemstations, stirrers and centrifuges. They are usually required to wear safety equipment.	-
2.	Weighing balance	1
3.	Spectrophotometer	1
4.	Steel containers	1
5.	Textrometer	1
6.	Chocolate and toffee moulds and dies	1

10. Space Required for Conducting the Module (in square feet):

a. Theory Class Room : 200 sqfeet
b. Demonstration & Practical Class Room : 300 sqfeet

11. Power requirement : 220 v 3 phase

12. Qualifications of Instructor

Diploma in Confectionery Technology or Food Science andTechnology
B.Sc. or M.Sc. in Food Science and Technology (or) B.Tech in Food Engineering
Diploma in Food Science and Technology or Food Engineering with special training

13. Suggested Readings

Text Books

1. Sugar Confectionery and Chocolate Manufacture, R. Less and E.B. Jackson.
2. Industrial Chocolate Manufactory and Use, S.T. Beekelt
3. Chocolate, Cocoa & Confectionery Sci and Tech., Bernared W. Minifie

4. Basic Baking, S.C. Dubey.
5. Chocolate, cocoa and confectionery: Bernard, W. Minifie, CBS Publishers and Distributors, New Delhi.
6. Chocolate, cocoa and confectionery, Science and Technology, Bernard, W.M. 3rd Edn. AVI Book Published by Van Nostrand Rein hold, New York.
7. Sugar Confectionery Manufacture, Second edition, E.B. Jackson, Aspen publishers Inc., Great Britain

MODULE – 08

1.	**Title of the Module**	:	**Processing and Preserving Milk and Milk Products**
2.	**Sector**	:	Food Processing and Perservation
3.	**Code**	:	
4.	**Entry Qualification**	:	Minimum 8th Standard
5.	**Minimum Age**	:	14 yrs
6.	**Terminal Competency**	:	After completion of this training the participant would be able to a) Access the quality of milk at their own b) Operation and maintenance of the various dairy milk and milk product machineries c) Processing of various milk and milk products. d) Aware about the quality and standards of milk products.
7.	**Duration (in Hrs)**	:	315 hours

8. Module Contents

S. No.	Theory	Practical	Contact Hours		
			T	**D**	**P**
1	Physico-chemical properties and compositon of milk and milk products	Chemical and microbiological analysis of milk and milk products.			
	a. Chemistry and microbiology of milk	a. Platform tests and Preparation of reagent	2	2	10
	b. Different types of liquid milk	b. Adulteration test	1	1	5
	c. Pricing of milk	c. Technique of fat, SNF, acidity of milk	1	1	5
	d. Collection/ reception of milk	d. Technique of MBRT	1	1	5
	Total hours for this sub-module		**5**	**5**	**25**
2.	Common dairy processes	Operation of common dairy equipments			
	a. Pasteurization of milk (batch & continuous)	a. Study and operate pasteurizer (LTLT, HTST)	1	1	10
	b. Separation, clarification and standardization of milk	b. Standardization calculation for fat & SNF Study and operate cream separator, Homogenizer	1	2	5
	c. Sterilization of milk	c.Study and operate batch sterilizer Preparation of sterilized flavour milk.	1	1	5
	d. Processing equipment knowledge for pasteurization, separation homogenization and sterilization	d. Trouble shooting and maintenance of the above equipments	2	1	5

	processes				
		Total hours for this sub-module	**5**	**5**	**25**
3.	Fermentation of milk and fermented indigenous dairy products	Production of different types of fermented milk products			
	a. Knowledge of batch fermentation, inoculum, inoculation Effect in time and temperature	a. Preparation of curd	2	1	5
	b. Process technology of curd	b. Preparation of Srikhand	1	1	5
	c.Process technology of Srikhand, lassi, buttermilk etc	c. Preparation of lassi, buttermilk etc.	1	1	5
	d. Chemical and microbilogical test of fermented milk products	d. Chemical and micro biological test of finished products	1	1	3
		Total hours for this sub-module	**5**	**4**	**18**
4.	Coagulated milk products	Production of different types of coagulated milk products			
	a. Basic knowledge and types of coagulation	a. Preparation of Chhana	1	1	5
	b. Process technology of Chhana	b. Preparation of paneer	1	1	5
	c. Process technology of Paneer	c. Preparation of local/common cheese	1	1	5
	d. Process technology of common cheese	d. Chhana based sweet preparation	1	1	5
	e. Process technology of chhana based sweet		1		
		Total hours for this sub-module	**5**	**4**	**20**
5.	Frozen milk products Safety and hygiene and management of dairy plant, CIP, various standards	Production of different types of frozen milk products Visit to a milk and milk products manufacturing plant			
	a. Knowledge of Frozen products Calculation/standardization of ice cream mix	a. Standardization of ice cream mix	1	1	5
	b. Process technology of ice- cream	b. Preparation of different type of ice-cream	1	2	10
	c. Process technology of Softy	c. Preparation of Sofety	1	1	5
	d. Process technology of Kulfi	d. Preparation of Kulfi	1	1	5
		Total hours for this sub-module	**4**	**5**	**25**
6.	Partially dehydrated milk products	Production of different types of partially dehydrated milk products			
	a. Chemical changes & composition of Partially dehydrated milk	a. Chemical analysis of different milk products	1	1	5
	b. Process technology of Khoa, kheer etc	b. Preparation of khoa, kheer etc.	1	2	10
	c. Process technology of khoa based sweet	c. Preparation of different khoa based sweet	1	2	10
		Total hours for this sub-module	**3**	**5**	**25**
7.	Condensed and dried milk	Condensed and dried milk			
	a. Process technology for manufacture of evaporated milk	a. Preparation/flow chart of evaporated milk and dried milk	1	1	5

	b. Process technology for manufacture of and dried milk	b. Visit to milk evaporated and drying plant	1	1	5
	c. Chemical composition of evaporated and dried milk.	c. Chemical & micro biological analysis of evaporated and dried milk	2	1	5
	Total hours for this sub-module		**4**	**3**	**15**
8.	Packaging of milk and milk products	Packaging of milk and milk products			
	a. Packaging materials characteristics, properties	a. Visualize different types of packaging materials and machine used in Dairy industry	1	1	2
	b. Packaging requirement for different milk and milk products	b. Operation of batch type packaging machine	1	1	5
	c. working principles of various type batch type filling machine	c. Operation of FFS type packaging machine	1	1	5
	d. working principles of FFS machine	d. Maintenance of packaging machine	1	1	5
	Total hours for this sub-module		**4**	**4**	**17**
9.	**Utility Section**	**Utility Section**			
	a. Principle of Refrigeration	a. Exposure in refrigeration plant	1	1	12
	b. Study of motor (seal, star-delta connection)	b. Electrical connection of Motor and its maintenance	1	1	10
	c. Study of Hot water generator/ LP boiler	c. Exposure in boiler section	1	1	5
	d. Study of ETP	d. Operational knowledge of ETP	1	1	5
	Total hours for this sub-module		**4**	**4**	**32**
10.	Food Safety, HACCP and Food Standards	Good Manufacturing Practices			
	a. Concept of safe food	a. HACCP Exercise for a fishery product	1	2	10
	b. Different standards for various fishery products. Food safety and standard Acts of India	b. GMP in fish processing	2	1	5
	c. HACCP (Hazard Analysis and Critical Control point)	c. How to know the different Govt./other subsidies in this field	1	1	5
	d. GMP (Good Manufacturing Practice)	d.Concept/Preparation of project report for financial support from different organization	1	1	5
	Total hours for this sub-module		**5**	**5**	**25**
Total Contact Hours Individually for Theory, Demonstration and Practical			**44**	**44**	**227**
Grand Total of Contact Hours			**315**		

T- Theory, D- Demonstration, P- Practical

9. Lists of Tools and Equipments for a Batch

S. No	Equipments	Quantity
1.	Cream Separator	1
2.	Gerber centrifuge	1
3.	Homogenizer	1

4.	Steam jacketed agitated vessel	1
5.	Plate heat exchanger	1
6.	Form-fill-seal machine	1
7.	Tetra pack packaging machine (optional)	1
8.	Scrapped surface heat exchanger (optional)	1
9.	Ice cream freezer, packaging machine	1
10.	Cup filling machine (optional)	1
11.	Softy machine	1
12.	Hot water generator	1
13.	Refrigeration unit	1
14.	Hydraulic press (*Paneer* press)	1
15.	Sterilizer/retort	1
15.	Incubator	1
16.	pH meter	1
17.	Titrator (optional)	1
18.	Digital moisture analyzer(optional)	1
19.	Refractometer	1
20.	Effluent treatment plant	10
21.	Hunter Lab Colorimeter(optional)	1
22.	Texture analyzer (optional)	1
23.	Steam boiler	1
24.	Chilling water unit	1
25.	Deep freezer	1
26.	Milk can	4
27.	Mechanical tool box	1 set
28.	Electrical tool box	1 set
29.	Lactometer	5
30.	Chemicals, glass ware	as per the requirement

10. Space Required for Conducting the Module (in square feet)

a. Theory Class Room : >500 sq. ft.

b. Demonstration & Practical Class Room : >1500 sq. ft.

11. Power requirement : Single phase / 3-phase electrical connection 20 KW

12. Qualifications of Instructor

Diploma in Dairy Technology

B.Sc. or M.Sc in Food Science and Technology (or) B.Tech in Food Engineering

Diploma in Food Science and Technology or Food Engineering with special training

13. Suggested Readings

Text Books

1) Aneja RP, Mathur BN, Chandan RC & Banerjee AK. 2002. *Technology of Indian Milk Products*. Dairy India Publication.
2) Burton H. 1998. *Ultra-high Temperature Processing of Milk and MilkProducts*. Elsevier.
3) De S.1980. *Outlines of Dairy Technology*. Oxford Univ. Press.

4) Gould GW. 1995. *New Methods of Food Preservation*. Blackie.
5) Smit G. 2003. *Dairy Processing – Improving Quality*. CRC- Woodhead Publication.
6) Walstra P, Geurts TJ, Noomen A, Jellema A & Van Boekel MAJS. 1999. *Dairy Technology – Principles of Milk Properties and Processes*. Marcel Dekker.
7) GhatakPK & Bandyopadhyay AK. 2007. *Practical Dairy Chemistry*. Kalyani Publishers. Ludhiana.

MODULE – 09

1.	**Title of the Module**	:	**Meat and Poultry Products Processing Technology**
2.	**Sector**	:	Meat and poultry
3.	**Code**	:	
4.	**Entry Qualification**	:	5th standard / literate
5.	**Minimum Age**	:	14 yrs
6.	**Terminal Competency**	:	On completion, the participant shall be able to a) Formulate and prepare meat and poultry products with understanding of b) underlying principles. c) Concept of maximum permissible level of ingredients and requirement to d) conform to legal standards and food safety. e) (c) Hygiene and sanitation practices during product preparation for food safety f) (d) Understand basics of quality aspects - proximate composition, g) microbiological quality and sensory evaluation.
7.	**Duration (in Hrs)**	:	147 hours

8. Module Contents

S. No.	Theory	Practical	Contact Hours		
			T	D	P
1	Layout and facilities required in a meat processing unit	Study of layout and facilities of a meat processing unit/lab			
	Equipment used for meat processing, hygienic design, parts, operation and maintenance	List of equipments, capacity, parts, and safety features and common brands			
	Proper use and maintenance of knives and equipments and occupational hazards in meat industry.	Potential occupational hazards and their prevention in meat processing			
	Ethics in meat processing	Visit to meat processing unit			
		Total hours for this sub-module	**4**	**8**	**20**
2.	Fundamentals of meat processing- A. raw materials and their storage (i) meat –red and white and (ii) fat	Sourcing raw materials and non-meat ingredients and assessing their quality, maximum permissible levels for each additive			
	(iii) Non-meat ingredients – binders, extenders, additives, preservatives, acidulants, fat replacers, casings, flavour	Preparation of model formulation, batch size calculation and costing			

	enhancers, etc.				
	Packaging methods- materials-basics	Identification of packaging materials and assessing thickness and other properties			
	Meat product formulation and least cost techniques	Least cost formulation of meat patty			
		Total hours for this sub-module	**4**	**8**	**20**
3.	Fundamentals of meat processing- B. Unit operations in meat processing- (i) Size reduction - mincing grinding, Bowl chopping, Emulsification, Flaking, Chunking	Preparation, yield estimation, manufacturing defects, if any, trouble shooting and sensory evaluation of following meat products (i)meat patties			
	(ii) Forming/moulding (iii) Tumbling/ massaging	(ii)Coarse and emulsion sausages			
	(iv) Battering and breading (v) Cooking	(iii)Meat rolls/loaves			
	(vi) Curing and Smoking	(iv) Bacon			
		Total hours for this sub-module	**4**	**8**	**20**
4.	(vii) Preservation-chilling and freezing	(v)Ham			
	(viii) Packaging	(vi) Chicken nuggets/ enrobed meat product			
	(ix) Drying etc.	(vii) Jerky			
		Total hours for this sub-module	**4**	**8**	**20**
5.	Meat quality evaluation- - sensory evaluation	Demonstration of microbiological quality evaluation			
	Meat quality evaluation- -microbiological quality	Demonstration of physico-chemical quality evaluation			
	Meat quality evaluation- -physico-chemical quality	Sensory evaluation of meat products			
	Meat quality evaluation- safety issues and maximum permissible level (MPL) concept	Demonstration of water quality analysis			
		Total hours for this sub-module	**4**	**8**	**20**
6.	Classification of meat and poultry products	(viii)Canned meat products			
	Principles involved in meat emulsion preparation and its stability	(ix)Restructured meat products			
	Principles of preparation of (a) Sausages-coarse and emulsion based	(x)Sectioned and formed meat products			
	(b) Patties	(xi)Intermediate moisture meat products			
		Total hours for this sub-module	**4**	**8**	**20**
7.	Principles of preparation of				
	(c) Roll				

	(d) Loaves	(xii) meat snack/ meat stick			
	(e) Fermented sausages	(xiii)Fermented sausages			
	(f) Ham and bacon				
	Total hours for this sub-module		**4**	**8**	**20**
8.	Principles of preparation of (g) Indigeneous meat products- shami kabab, Seekh kabab, Chicken tikkha,	Preparation, yield estimation, manufacturing defects, if any, trouble shooting and sensory evaluation of following meat products- (xiv)Indigeneous meat products - Shami kabab, seekh kabab,			
	(h) Chicken samosa, Butter chicken/ chicken curry, Roasted/ tandoor chicken	(xv) Chicken curry/ roasted chicken			
	(i) Canned products	(xvi)Chicken samosa;			
	(j) Restructured meat products	(xvii) Chicken tikka and Marinated chicken products			
	Total hours for this sub-module		**4**	**8**	**20**
9.	Principles of preparation of				
	(k) Sectioned and formed meat products	Visit to meat processing/ food processing unit in local area			
	(l) Meat snacks and jerky				
	(m) Intermediate moisture meat product				
	Total hours for this sub-module		**4**	**8**	**20**
10.	Packaging and labeling of meat products				
	Defects in product preparation and Trouble shooting	Visit to a meat retailing unit in the local area			
	Costing and pricing of products and their marketing				
	Legal standards- Food Safety and Standards Act 2006, Rules and Regulations, MFPO, Obtaining license for meat processing unit, BIS/ISO standards, Codex standards				
	Total hours for this sub-module		**4**	**8**	**20**
11.	Hygiene and sanitation practices and their importance	Preparation of chlorine based sanitizers for application			
	Good Manufacturing Practices(GMPs); Hazard Analysis and Critical Control Point(HACCP) system for food safety	Model HACCP plan for meat patty production process.			
	Total hours for this sub-module		**4**	**8**	**20**
Total Contact Hours Individually for Theory, Demonstration and Practical			**44**	**88**	**220**
Grand Total of Contact Hours			**352**		

T- Theory, D- Demonstration, P- Practical

9. Lists of Tools and Equipments for a Batch

S No	Description of tools	Qty
1.	Scientific meat processing facility with cold and hot potable water supply	01No.
2.	Refrigerators 400 lit.	2No.
3.	Deep freeze	2No.
4.	Stainless steel Working tables (7x4 approx.)	2No.
5.	Meat mincer/ grinder	1 No.
6.	Bowl chopper	1 No.
7.	Sausage stuffer	1 No.
8.	Deep fat fryer	1 No.
9.	Gas stove	1 No.
10.	Steam cooker	1 No.
11.	Meat forming machine/hazard operated patty mould	1 No.
12.	Ham moulds	2 No.
13.	Meat tumbler	1 No.
14.	Meat portioning machine	1 No.
15.	Rapid freezing unit	1 No.

10. Space Required for Conducting the Module (in square feet):

a. Theory Class Room :15' x 10'
b. Demonstration & Practical Class Room : 24' x 36'

11. Power requirement :3 phase electricity supply
5 KW

12. Qualifications of Instructor

Diploma in Meat Science and Technology
B.Sc. or M.Sc in Animal Science (or) Animal Husbandry and Dairying

13. Suggested Readings

Text Books

1) Pearson, A.M and T.A. Gillett. 1997. *Processed Meats. CBS Publishers & Distributors*, Third Edition, New Delhi.
2) Heinz G. and Hautzinger P. (2007). *Meat processing technology for small- to medium-scale producers.* RAP PUBLICATION 2007/20, FAO, Regional Office, Bangkok.
3) Barbut, S. (2010). *Poultry products processing: an industry guide*. CRC Press.
4) Sams, A. (Ed.). (2001). *Poultry meat processing*. CRC Press.

MODULE – 10

1.	**Title of the Module**	:	**Processing of Fishes and their By-products**
2.	**Sector**	:	Food Processing and Preservation
3.	**Code**	:	
4.	**Entry Qualification**	:	8th Standard
5.	**Minimum Age**	:	14 yrs
6.	**Terminal Competency**	:	After completion of this training the participant would be able to a) Acquire basic knowledge and skill on fish processing and preservation b) Demonstrate procedures involved in fish preservation and can prepare different types of processed fishery products
7.	**Duration (in Hrs)**	:	314 hours

8. Module Contents

S. No.	Theory	Practical	Contact Hours		
			T	D	P
1	Knowledge of fish handling on board and shore landing,	Identification of fishes and visit to fish handling site			
	a.Major Inland & Marine Fishery Resources	a. Identification of commercially important fin and Shell fishes.			
	b.Culture Fisheries Resources (Freshwater Aquaculture, Brackish water Aquaculture & Mericulture.	b. Visit to fish landing site			
	c.Fish Utilization and Consumption pattern	c. Visit to whole sale and retail fish market			
	d.Trend in fish trade and export	d. Visit to Ice-plant			
		Total hours for this sub-module	**5**	**4**	**12**
2.	Knowledge about Bio-chemical composition and Microbiology of Fin fish and Shell Fish	Sample collection procedures and laboratory methods for analysis of proximate composition			
	a. Proximate composition of fin and shell fish (moisture, protein and fat, mineral & vitamins)	a. Differentiating Fresh Fish vs spoiled fish			
	b. Basic know how of amino acid profile of fish protein & fatty acid composition of fish lipid, fish body oil, fish liver oil etc.	b.Analysis of proximate composition (moisture, protein and fat) in fish muscle in laboratory			
	c. Microbiological changes and rancidity.	c. Basic microbiology in fish spoilage			
	d. Knowledge of post-mortem changes, Physical changes, rigor mortis, autolytic changes	d. Post-mortem, rigor mortis and autolytic changes			

	Total hours for this sub-module		**5**	**4**	**25**
3.	Knowledge of hygiene , Handling, icing and Transportation of fish	Practice on personal hygiene, safety			
	a. Knowledge of Personnel hygiene, Plant hygiene and sanitation. Knowledge about cleaning procedure and cleaning detergents	a. Practice on Personnel hygiene and safety Knowledge of occupational health hazards related to the trade			
	b. Handling of fresh fish (on board & shore). Transportation of live fish to market.	b. Technique to transport live fish to markets.			
	c. Types of ice used in fish preservation and different icing methods.	c. Practicing different icing methods			
	d. Transportation methods used and its precautions (from landing centre to wholesale market to processing centers to retail markets)	d. Demonstration of different containers used in fish transportation.			
	Total hours for this sub-module		**5**	**4**	**20**
4.	Different methods of fish processing(smoking& fermentation)	Practicing the different methods of fish processing			
	a.Stunning, spiking, sorting, grading, washing of fish and water quality	a. Practicing Fish dressing and filleting (Beheading, scaling, gutting, making chunk, filleting)			
	b. Filleting procedures, types of fillets and splitting	b. Practicing Shrimp processing (Beheading, peeling & deveining)			
	c. Principles of fish smoking	c. Practicing smoking of fish			
	d.	d.			
	Total hours for this sub-module		**5**	**4**	**25**
5.	Knowledge of freezing and drying of fish	Development of freezed and dried fishery Products			
	a.Principles of fish freezing, freezing methods.	a. Practicing fish freezing			
	b. Different freezing equipments, cold storage	b. Visit to freezing plant (optional)			
	c. Changes in fish during freezing and cold storage	c. Practicing Sun/Solar drying of fish			
	d. Principles of drying (sun drying & mechanical drying)	d. Practicing Mechanical drying of fish			
	Total hours for this sub-module		**5**	**5**	**25**
6.	Knowledge about salt curing and canning of fish and pickling	Practicing salting and canning of fish			
	a. Principles of salting (dry salting & brining)	a. Practicing dry salting of fish			
	b. Principles of fish canning	b. Practicing brining of fish			
	c. Canning procedure	c. Practicing canning of fish			
	d. Different equipments used in canning	d. Visit to fish canning plant (optional)			
	Total hours for this sub-module		**5**	**4**	**25**

7.	Knowledge of value added Ready-to-eat and Ready-to-cook fishery Products	Development of Value added Ready-to-eat and Ready-to-cook fishery Products			
	a. Knowledge of Ready-to-eat, Ready-to-cook Fishery product	a. Practicing various RTE fishery Products -Fish cutlet, fish ball, fish wafer, fish and prawn pickle, fish nugget, breaded & battered fishery products, extruded fishery products etc.			
	b.Operational knowledge of Extruder				
	c. Methods for preparation of various RTE fishery products	b.Practicing various RTC fishery Products – Frozen retail fish in chunk & fillet, Head-less-peeled & deveined shrimp etc.			
	d. Methods for preparation of various RTC fishery products				
		Total hours for this sub-module	**5**	**5**	**25**
8.	Knowledge of handling and processing of miscellaneous products and fishery by-products	Practicing miscellaneous products and fishery by-products processing.			
	a.Handling and processing knowledge of shell fish, crustaceans, crab,sea cucumber, etc.	a. Preparation of different fish/ prawn pickles and traditional fish products.			
	b. Methods for preparation Fish meal, Body oil & liver oil extraction. Shark fin and fin rays,	b. Handling and processing of shell fish, crab,etc.			
	c. Knowledge of Fish Protein Concentrate (FPC), Fish Maws and isinglass,	c. Practicing various Fishery by-products (Fish Protein Concentrate, Fish Maws and isinglass,)			
	d. Processing knowledge of Chitin, chitosan, fish rose, see weeds etc.	d. Processing knowledge of Chitin and chitosan, fish rose, see weeds etc.			
		Total hours for this sub-module	**5**	**4**	**25**
9.	Food Safety, HACCP and Food Standards	Good Manufacturing Practices			
	a. Concept of safe food	a. HACCP Exercise for a fishery product			
	b. Different standards for various fishery products. Food safety and standard Acts of India	b. GMP in fish processing			
	c. HACCP (Hazard Analysis and Critical Control point)	c. How to know the different Govt./other subsidies in this field			
	d. GMP (Good Manufacturing Practice)	d.Concept/Preparation of project report for financial support from different organisation			

	Total hours for this sub-module	**5**	**4**	**20**
Total Contact Hours Individually for Theory, Demonstration and Practical		**50**	**42**	**222**
	Grand Total of Contact Hours	**314**		

T- Theory, D- Demonstration, P- Practical

9. Lists of Tools and Equipments for a Batch

S No	Description of tools	Qty
1.	Washing facility	5
2.	Refrigerators	10
3.	Knives for deboning	20
4.	Working tables	5
5.	Filleting knives	5
6.	Mechanical dryer	2
7.	Smoking unit	2
8.	Microwave oven	1
9.	Cold storage	1
10.	Plate freezer	1
11.	Canning equipments	1 set
12	Sharp knives	10
13	Disposal plastic bags	10
14	Electrical stunner (water bath stunner)	1
15	Gloves	20 sets
16	Caps	20 sets
17	Aprons	20 sets
18	Autoclave	1
19	Fish processing table	2 unit
20	Twin screw Extruder (optional)	01

10. Space Required for Conducting the Module (in square feet):

a. Theory Class Room : >500 sq. ft.

b. Demonstration & Practical Class Room : >1200 sq. ft.

11. Power requirement : Single phase domestic power/ 3-phase required for extruder (hence optional)

12. Qualifications of Instructor

Diploma in Fish Processing Technology

B.Sc. or M.Sc in Fisheries or Food Science and Technology

13. Suggested Readings

1) Balachandran .K.K. 2001 Post harvest Technology of fish and fish products. Daya publiching house, Delhi
2) Connel,J.J and Hardy,R. 1981. Trends in Fish Utilisation. Fishing New Books Oxford, London.
3) George Borgstrom. 1962 and 1965. Fish as food (Vol.I, II, III & IV), Academic press, Newyork.
4) Hall,G.M. 1997. Fish processing Technology. Blackie Academic and Professional, London
5) Gopakumar, k. 2002. Textbook of Fish processing Technology. ICAR publication, New Delhi.

MODULE – 11

1	**Title of the Module**	:	**Processing and Value Addition of Plantation Crops**
2	**Sector**	:	Plantation crops
3	**Code**	:	
4	**Entry Qualification**	:	12th Standard
5	**Minimum Age**	:	18 yrs
6	**Terminal Competency**	:	After completion of this training the participant will be able to: a) Jobs in Plantation crop processing industries, Production executive, Quality assurance executive, Machine operators, maintenance executives, Quality testing - lab assistant
7	**Duration (in Hrs)**	:	350 hours

8. Module Contents

S. No.	Theory	Practical	Contact Hours		
			T	**D**	**P**
1	a.Introduction to important plantation crops in India,	a.Introducing plantation crops to participants	1	1	5
	b. Production and processing details.	b. Maturity indices of various plantation crops	1	1	5
	c. Harvesting time, maturity indices and methods of harvesting	c. Methods of harvesting - demonstration of harvesting.	1	1	5
	d. Commercial importance of plantation crops	d. Introducing commercially important varieties of plantation crops	1		3
	e. Supply chain management-marketing.	e.Introducing various stake holders in supply chain of plantation crops	1		3
		Total hours for this sub-module	**5**	**3**	**21**
2.	a. Processing of tea, different forms of tea, unit operations involved in processing.	Production of tea from fresh tea leaves by different methods	2	2	5
	b. Value added products from tea-by products	a. Packaging materials/ methods	1	1	5
	c. Packaging and storage.	b. Quality testing of prepared tea samples- grades of tea	1	1	5
	d. Grading of tea- Quality analysis,	c. Sensory analysis/Tea tasting	1	1	5
	e. Recent trends in tea processing	d. Field visit to tea processing plant	1		8
		Total hours for this sub-module	**6**	**5**	**28**
3.	a. Processing coffee, different methods of production	a. Demonstration of unit operations in coffee processing	2	1	4
	b. unit operations involved in	b. Roasting of coffee and study the	1	1	5

	processing	physic-chemical changes during roasting.,			
	c.Value added products from coffee- by products	c. Grinding of coffee beans using different mills	1	1	4
	d. Packaging and storage.	d.Performance evaluation of coffee pulper cum washer	1	1	4
	e. Quality of coffee- recent trends	e. Field visit to coffee processing unit	1	1	8
		Total hours for this sub-module	**6**	**5**	**25**
4.	a.Introduction to Primary processing of cocoa and unit operations.	a. Cocoa harvesting- pod breaking	1	1	5
	b. Secondary processing of cocoa.	b. Cocoa Fermentation	1	1	5
	c. Machinery involved, Value added products from cocoa	c. Cocoa drying- methods	1	1	5
	d. Packaging and storage of cocoa products	d. Extraction of cocoa butter and Chocolate manufacturing	1	1	5
	e. Quality of cocoa and cocoa products	e. Quality analysis	1	1	5
		Total hours for this sub-module	**5**	**5**	**25**
5.	a. Production and processing of coconut. Methods of oil extraction- dry and wet methods.	a.Performance evaluation of coconut dehusker, coconut punch, splitter	2	1	5
	a. Value added products from coconut.	b. Oil extraction by different mechanisms and compare the quality and yield of coconut oil obtained by each method.	1	2	5
	b. By product utilization of coconut.	c. By products- coconut vinegar	1	1	5
	c. Recent developments in coconut processing machineries.	d. Quality evaluation of coconut products	1	1	5
	d. Quality of coconut products- packaging and storage of coconut products	e.Visit to coconut processing unit	1	1	8
		Total hours for this sub-module	**6**	**6**	**28**
6.	a. Introduction to Processing of Oil palm-, palm oil and palm kernel oil, uses	a.Performance evaluation of palm harvester	1	1	5
	b. Unit operations involved in oil palm processing	b. Extraction of palm oil	1	1	5
	c. By-products from oil palm industry	c. Extraction of palm kernel oil	1	1	5
	d. Purification, packaging and storage of oil palm products	d. Other by products viz kernel powder	1	1	5
	e. Quality evaluation of oil palm products	e. Quality analysis of palm products	1	1	5
		Total hours for this sub-module	**5**	**5**	**25**
7.	a.Processing of cashew – method of processing-	a. Different roasting methods for cashew (dry method, wet method or oil bath roasting and steam roasting)	1	1	5

	b. Unit operations involved in cashew processing	b. Demonstration of deshelling techniques	1	1	5
	c. Different products from cashew-cashew apples.	c. Packaging methods- vacuum packaging	1	1	5
	d. By-products during processing-CNSL- use of cashew apples	d.Demonstration of cashew apple products	1	1	5
	e.Grading, Packing of cashew and quality evaluation of products	e.Demonstration of different grades of cashew	1	1	5
	Total hours for this sub-module		**5**	**5**	**25**
8.	a. Introduction to processing of Rubber – maturity indices, latex formation, tapping,	a. Formation of rubber sheets from latex	1	1	5
	b. unit operations involved in producing different forms of rubber.	b. Different methods of drying	1	1	5
	c. Secondary products from rubber	c. Demonstration of different grades of rubber	1	1	5
	d.By product utilization	d. By- product production	1	1	5
	e.Grades of rubber- Quality requirements	e.Quality evaluation of rubber	1	1	5
	Total hours for this sub-module		**5**	**5**	**25**
9.	a.Production and Processing of arecanut- present scenario.	a. Demonstration of unit operation in arecanut processing.	1	1	5
	b. Value added products from arecanut- mature and green nuts.	b. Dehusking- drying	1	1	3
	b. Machineries involved in arecanut processing	c. Supari production	1	1	3
	c. Packaging and storage of arecanut products	d. By- products from arecanut	1	1	5
	d. Quality evaluation and by product utilization of arecanut.	e.Quality evaluation	1	1	5
	Total hours for this sub-module		**5**	**5**	**21**
10.	a.Food Safety and quality aspects related to products	a. FSSA regulations	1	1	5
	a. Pre requisite programmes to increase quality in plantation crop processing industries	b. Demonstration of PRP's related to plantation crop processing	1	1	3
	b. GMP in plantation processing for enhancing product quality	c. Demonstration of GMP's	1	1	3
	c. Application of HACCP in any one processing Industry	d. HACCP plan development for processing plant	1	1	8
	d. Entrepreneurships in Plantation crop processing sector	e. Viable project plan preparation	1	1	6
	Total hours for this sub-module		**5**	**5**	**25**
Total Contact Hours Individually for Theory, Demonstration and Practical			**53**	**49**	**248**
Grand Total of Contact Hours			**350**		

T- Theory, D- Demonstration, P- Practical

9. Lists of Tools and Equipments for a Batch

S.No.	Description of tools and machineries	Quantity
1.	Fluidized vibratory bed dryer	1
2.	Uruli roaster	1
3.	Coffee pulper cum washer	1
4.	CTC machine	1
5.	Vibratory type grader	1
6.	Rotary type grader	1
7.	Hammer mill	1
8.	Attrition mill	1
9.	Pin mill	1
10.	Ball mill	1
11.	Areca nut dehusker	1
12.	Cashew desheller	1
13.	Conching machine	1
14.	Tempering machine	1
15.	Coconut dehusker	1
16.	Tender coconut cutter	1
17.	Screw press oil extraction	1
18.	Plate and frame press	1
19.	Rubber – machineries a) Dispersion kneader b) Hot feed rubber extruder c) Rubber bale cutter d) Calender machines	1
20.	Hydraulic press	1

10. Space Required for Conducting the Module (in square feet):

a. Theory Class Room :One- 300 sq feet
b. Demonstration & Practical Class Room plants has to be utilized :One- 1000 sq ft. Existing labs/ workshops/ Pilot

11. Power requirement

Total power requirement **:** 50 kW

12. Qualifications of Instructor

Diploma in Plantation Crop Processing
B.Sc. or M.Sc. in Food Science and Technology (or) B.Tech in Food Engineering
Diploma in Food Science and Technology or Food Engineering with special training

13. Suggested Readings

Text Books

1) Pandey, P. H. 2002. Post Harvest Engineering of Horticultural Crops through Objectives. Saroj Prakasam, Allahabad.

2) Pruthi, J.S. 1998. Major Spices of India – Crop Management and Post Harvest Technology. Indian Council of Agricultural Research, Krishi Anusandhan Bhavan, Pusa, New Delhi. PP. 514.
3) ASTA, 1997. Official analytical methods of the American Spice Trade Association, Fourth Edition.
4) Purseglove, J.W., E.G.Brown, G.L.Green and S.R.J.Robbins. 1981. Cardamom – Chemistry. Spices, Vol. I, Tropical Agricultural Series, Longman, London, 1: 605.
5) Pruthi, J.S. 1980. Spices and Condiments: Chemistry, Microbiology and Technology. First Edition. Academic Press Inc., New York, USA. pp. 1-450. .
6) Pruthi, J.S. 2001. Minor Spices of India – Crop Management and Post Harvest Technology.
7) Indian Council of Agricultural Research, Krishi Anusandhan Bhavan, Pusa, New Delhi.PP. 782.
8) Sivetz, M, and Desrosier, N.W. 1979. Coffee Technology. AVI Publishing Co. Inc, Westport,Connecticut. First edition.
9) Handbook of Herbs and Spices : Volume 3 Vol. 3 by K. V. Peter (2006, Hardcover) : K. V. Peter (2006)
10) Spices: Vol.05. Horticulture Science Series By N.Mini Raj and K.V.Peter

Journals

1) Journal of spices and plantation crops
2) Indian J. Arecanut, Spices & Medicinal Plants
3) Journal of spices and aromatic crops

E- Reference

1) www.indianspices.com
2) www.coconutboard.gov.in
3) www.tide-india.org/projects/06diffusion-arecanut-processing.html
4) http://www.fao.org/docrep/v5030e/V5030E00.htm
5) http://www.sspindia.com/fruits-and-vegetable-equipment.html

MODULE – 12

1.	**Title of the Module**	:	**Food Beverages Processing Technology**
2.	**Sector**	:	Food Processing and Preservation
3.	**Code**	:	
4.	**Entry Qualification**	:	10^{th} standard
5.	**Minimum Age**	:	16 years
6.	**Terminal Competency**	:	After completion of the course the candidate will be able to: a) Operation and maintenance of the modern equipment and machinery used in food beverage industry. b) To make non-alcoholic beverages. c) Process of packaging and storage and maintaining the quality of products
7.	**Duration (in Hrs)**	:	350 hours

8. Module Contents

S. No.	**Theory**	**Practical**	**Contact Hours**		
			T	**D**	**P**
1	Beverage - definition: why we drink beverage ingredients-water, carbon" dioxide, sugar, flavours, colour, sweeteners, emulsifiers and stabilizers. Types of beverages and their importance; beverage industry in India; Manufacturing technology for juice based beverages; synthetic beverages; technology of still, carbonated, low-calorie and dry beverages; isotonic and sports drinks; role of various ingredients of soft drinks, carbonation of soft drinks.	Manufacturing of RTS and squash as per FSSAI and assessing the qualities of beverages.			
	a. Importance of beverage. Role of ingredients in beverages. Quality of ingredients	a. Assessing the chemical quality of beverages	2	1	6
	b. Manufacturing technology of juice based beverages	b. Processing of RTS and squash as per FSSAI	1	2	7
	c. Processing of low-calories and dry beverages	c. Processing of low calories beverage, processing of isotonic drinks, processing of sports drinks	1	1	6
	d. Processing of isotonic, sports drinks and carbonated drinks	d. E.coli in the water	1	1	6

	Total hours for this sub-module		**5**	**5**	**25**
2.	Specialty beverages based on tea, coffee, cocoa, spices, plant extracts, herbs, nuts, dairy and imitation dairy based beverages.	Preparation of beverages from coffee; preparation of iced and flavoured tea beverage. Extraction of flavours from spices			
	a. Processing of coffee, types and standards	a. Quality assessment of tea	1	1	5
	b. Processing of instant coffee and its significance.	b. Extraction of oleoresin from chillies	1	1	5
	c. Processing of tea and cocoa	c. Preparation of instant coffee powder	1	1	5
	d.Processing of spices and condiments	d. Utilization of condiments in culinary products	1	1	5
	e. Technology for production of cocoa	e. Quality assessment of coffee	1	1	5
	Total hours for this sub-module		**5**	**5**	**25**
3.	Alcoholic beverages – Nutritional content-types- organisms involved-preservation technology- beer-ale-wine whisky-medicinal use	Production of fermented beverages- Quality assessment.			
	a. Introduction – types of alcoholic beverages fermented –distilled – flavoured.	a. Production of fermented beverages- wine	1	1	5
	b. Nutritional content and medicinal uses	b. Production of fermented beverages- beer	1	1	5
	c. Processing and packaging of alcoholic beverages- fermented	c. Quality assessment of alcoholic beverage for iso-proponel content	1	1	5
	d. Processing and packaging of alcoholic beverages- distilled	d. Quality assessment of raw materials used for beer production-germination test	1	1	5
	e. Processing and packaging of alcoholic beverages- flavoured	e. Visit to a fermented beverages production unit	1	1	5
	Total hours for this sub-module		**5**	**5**	**25**
4.	Packaged drinking water-definition, types, manufacturing processes, quality evaluation and raw and processed water, methods of water treatment, BIS quality standards of bottled water; mineral water, natural spring water, flavoured water, carbonated water.	Processing of mineral water and test quality of packaged water			
	a. Water and its importance – Quality requirements of drinking water	a. Equipments used for mineral water plant	1	1	5
	b. softening technology of hard water and purification of water	b. Processing methodology of mineral water	1	1	5
	c. Methods of water treatment and assessing the quality	c. Test quality of packaged water	1	1	5
	d. Quality standards of bottled water, packaged drinking water and	d. Checking the quality of packaging materials used for	1	1	5

	mineral water	drinking water			
	e. Purifications of methods of water and its significants	e. Purification techniques	1	1	5
		Total hours for this sub-module	**5**	**5**	**25**
5.	Carbonated and non Carbonated beverages: Procedures carbonation equipments and machineries ingredients- preparation of Syrup packaging - containers and closures, Quality control, Filling inspection and quality controls-sanitation and hygiene in beverage industry-Quality of water used in beverages threshold limits of ingredients.	Carbonation equipments and machines, threshold limits of ingredients			
	a. Estimation of mineral content of water	a. Equipments used for carbonation.	1	1	5
	b. Microbiological safety of drinking water	b. Processing methodology of carbonation.	1	1	5
	c. Processing of carbonated water	c. Estimation of carbon dioxide in carbonated water.	1	1	5
	d. Processing of flavoured and carbonated water	d. Visit to drinking water supply system.	1	1	5
	e. Water treatment plant	e. Visit to carbonated beverage unit	1	1	5
		Total hours for this sub-module	**5**	**5**	**25**
6.	Strategy and philosophy of beverage industry. Characterization of natural food stuffs used by production of soft drinks.				
	a. Strategies of beverage industry	a. Visit to beverage industries	3	3	15
	b. Characterisation of natural food used in the production of beverage	b.Natural foods for processing of beverages	1	1	5
	c. HACCP in beverage industry	c. quality assessment of beverages	1	1	5
		Total hours for this sub-module	**5**	**5**	**25**
7.	Food additives used in beverages. Quality control in a beverage industry. Machineries used in different fruit juice extraction				
	a. Role of food additives in beverage	a. Estimation of preservative effect in beverage.	1	1	5
	b. Quality control- total quality management	b. Study on the changes in quality during storage.	1	1	5
	c. Machineries used in different fruit juice extraction	c. Operation of machineries in beverages	1	1	5
	d. Cleaning and operational procedures of machinaries used	d. Visit to beverage industry	2	1	5
		Total hours for this sub-module	**5**	**5**	**25**
8.	Types of beverages from grains, herbs and medicinal plants.	Studies on malting –chemical changes during malting-prepation			

	Manufacturing of malted beverages, herbal beverages and medicinal beverages.	of malted beverages			
	a. Types of beverages from grains	a. Malting techniques of millets	1	1	5
	b. Processing of beverages from herbs	b. Processing of herbal beverages	1	1	5
	c. Processing of beverages from medicinal plants	c. Processing of therapeutic beverages	1	1	5
	d. Equipments used in malting and extraction of extracts from herbs and medicinal plants.	d. Extraction of plant extracts using soxhlet apparatus	1	1	5
	e Chemical changes during malting and advantages of malting	e.Assessing the chemical constituents in the selected medicinal plants	1	1	5
	Total hours for this sub-module		**5**	**5**	**25**
9.	Biochemical processing occurring in the manufacturing of non-alcoholic beverages- Additives used to improve the sensory properties of beverages – Quality assessment of beverages.				
	a. Importance and scope of non alcoholic beverages	a. Processing of non alcoholic beverages.	1	1	5
	b. Manufacturing process of non-alcoholic beverage	b. Estimation of alcohol content in beverages	1	1	5
	c. Biochemical changes occurring in the production of non-alcoholic beverage	c.Use of additive in nonalcoholic beverages	1	1	5
	d. Types of food additives used in beverages	d. Quality evaluation of non alcoholic beverages-sensory	1	1	5
	e. Quality assessment of the beverages	e. Quality evaluation of non alcoholic beverages-chemical	1	1	5
	Total hours for this sub-module		**5**	**5**	**25**
10.	Demand and supply of food beverages in India and abroad - processing of beverages from exotic fruits and domestic fruits				
	a. Demand and supply of food beverages in India	a. processing of beverages from exotic fruits	1	1	5
	b. processing of beverages from domestic fruits	b. processing of beverages from domestic fruits	1	1	5
	c. processing of beverages from exotic fruits	c. processing of beverages from underutilized fruits	1	1	5
	d.Packaging and storage requirements of beverages	d. Packaging studies of beverages from exotic and domestic fruits	2	2	10
	Total hours for this sub-module		**5**	**5**	**25**
Total Contact Hours Individually for Theory, Demonstration and Practical			50	50	250
Grand Total of Contact Hours			**350**		

T- Theory, D- Demonstration, P- Practical

9. Lists of Tools and Equipments for a Batch

S. No.	Description	Quantity
1	Refractometer	5
2	Filter	1
3	Evaporator	1
4	Dryer	1
5	Measuring jar	Set 5
6	Stopwatch	5
7	Weighing balance	5
8	Stove	5
9	Gun thermometer	5
10	Juice extractor	1
11	Carbonator	1
12	Bottling and capping machine	1
13	Fermentor	1
14	Pasteurizer	

10. Space Required for Conducting the Module (in square feet)

a. Theory Class Room :600sqft
b. Demonstration & Practical Class Room :1600sqft

11. Power requirement : 3 phase electricity supply
5 Kw

12. Qualifications of Instructor

B.Sc. or M.Sc. in Food Science and Technology
Diploma in Food Science and Technology or Food Engineering with special training

13. Suggested Readings

Text Books

1) Carbonated Soft Drinks: Formulation and Manufacture by David P. Steen and Philip R. Ashurst
2) Handbook of alcoholic beverages by Alan J. Buglass
3) Handbook of water and waste water treatment plant operations by Frank R. Spellman

MODULE – 13

1.	**Title of the Module**	:	**Slaughter House Practices and Processing of Meat Products**
2.	**Sector**	:	Meat and poultry
3.	**Code**	:	
4.	**Entry Qualification**	:	Minimum 5th / 8th Standard
5.	**Minimum Age**	:	14 yrs
6.	**Terminal Competency**	:	After completion of this training the participant would be able to a) Understand the basic theories of slaughtering and hygienic practices in meat processing including the preservations and sanitation.
7.	**Duration (in Hrs)**	:	273 Contact hours

8. Module Contents

S. No.	Theory	Practical	Contact Hours		
			T	**D**	**P**
1.	Knowledge of Indian meat industry Knowledge on meat animal production Knowledge about status of abattoirs and meat processing plants in India	Cleanliness, sterilization and up keeping of tools			
		Total hours for this sub-module	**7**	**10**	**25**
2.	Knowledge about design, construction and management of abattoir Basic facilities required for abattoir	Practicing the methods of stunning			
		Total hours for this sub-module	**7**	**10**	**25**
3.	Knowledge about methods of animal slaughter Humane methods and ritual methods Knowledge of meat hygiene on ante mortem care and management of food animals, stunning, slaughter and dressing operations; Meat inspection procedures and judgment of carcass meat cuts	Bleeding by Halal method and Jhatka method			
		Total hours for this sub-module	**7**	**10**	**25**
4.	Knowledge of grading of carcass meat cuts- duties and functions of Veterinarians in wholesome meat production	Practicing the washing of carcass Practicing grading of carcass Practicing skinning out			
		Total hours for this sub-module	**7**	**10**	**25**

5.	Knowledge about post - slaughter physicochemical changes in meat and factors that influence them- Quality improvement methods Knowledge of adulteration of meat	Practicing the packaging operation			
		Total hours for this sub-module	**7**	**10**	**25**
6.	Knowledge of meat plant sanitation	Practice on personal hygiene, safety and occupational health hazards related to the trade			
		Total hours for this sub-module	**7**	**10**	**25**
7.	Knowledge of poultry products technology- Knowledge about pre-slaughter care and management. Knowledge of slaughtering techniques, inspection, preservation of poultry meat and products.	Field visit			
		Total hours for this sub-module	**7**	**10**	**25**
Total Contact Hours Individually for Theory, Demonstration and Practical			**49**	**70**	**175**
		Grand Total of Contact Hours	**294**		

T- Theory, D- Demonstration, P- Practical

9. Lists of Tools and Equipments for a Batch

S No	**Description of Tools & Equipments**	**Qty**
1.	Well equipped slaughter house	
2.	Stunning room with stunning equipments	
3.	Hot water tubs	10
4.	Feather collecting baskets	10
5.	Straight knives	20
6.	Washing facility for carcasses	5
7.	Refrigerators	10
8.	Packing materials	As needed
9.	Curved knives	20
10.	Portioning machine with circular saw	1
11.	Portioning machine with band saw	1
12.	Vacuum packaging machine	1
13.	Food grade plastic trays	50
14.	Bleeding cones -6 birds capacity	1
15.	Bleeding shackles	5
16.	Bleeding troughs	2
17.	Sharp knives	10
18.	Disposal plastic bags	10
19.	Electrical stunner (water bath stunner)	1
20.	Gloves	20 sets
21.	Caps	20 sets
22.	Aprons	20 sets

10. Space Required for Conducting the Module (in square feet):

a. Theory Class Room :15’ x 10’

b. Demonstration & Practical Class Room : 24’ x 36’

11. Power requirement :3 phase electricity supply

5 KW

12. Qualifications of Instructor

B.Sc. or M.Sc. in Food Science and Technology (or) B.Tech in Food Engineering Diploma in Food Science and Technology or Food Engineering with special training, Diploma in Meat Processing Technology

13. Suggested Readings

Text Books

1) Home slaughter of poultry – Arthur J. Maurer
2) Small scale poultry processing – FAO
3) Processing poultry byproducts in poultry slaughtering plants – Lortscher, L.L.

MODULE – 14

1.	**Title of the Module**	:	**Manufacturing of Functional Foods and Nutraceuticals**
2.	**Sector**	:	Food Processing and Preservation
3.	**Code**	:	
4.	**Entry Qualification**	:	Graduate with Science stream
5.	**Minimum Age**	:	20 years
6.	**Terminal Competency**	:	After completion of the course the candidate will be able to: a) Importance of functional foods and nutraceuticals in human diet b) Learn techniques to develop functional foods and nutraceuticals c) To assess the quality of functional food and nutraceuticals
7.	**Duration (in Hrs)**	:	361 hours

8. Module Contents

S. No.	**Theory**	**Practical**	**Contact Hours**		
			T	**D**	**P**
1	Introduction to Functional foods and Nutraceuticals. Role of functional foods and nutraceuticals for human health	Assessment of nutritional status through biochemical tests			
	a. Properties, structure and functions of various Nutraceuticals	a. Estimation of total phenols.			
	b. Functional Foods, ingredient selection for product development, Nutritional Genomics, packaging of developed products.	b. Qualitative test for phenolics and alkaloids using TLC.			
	c. Safety and shelf life studies of developed products	c. Estimation of ascorbic acid			
	d. Marketing of nutraceutical products	d. Determination of micronutrients in the developed products			
		Total hours for this sub-module	**6**	**6**	**25**
2.	Application of unit operations in the preservation of foods. Standard and specifications for different classes of foods	Estimation of proximate composition of foods			
	a. Definition, relation of Functional foods and Nutraceutical to foods and	a. Extraction and estimation of oil or crude fat content in oil seeds.			

	drugs				
	b. Applications of herbs to functional foods	b. Extraction of free amino acid in given sample			
	c. Concept of free radicals and antioxidants	c. Estimation of CHO and crude fiber substances from plant material			
	d. Nutritive and Non-nutritive food components with potential health effects. Effect of processing on Nutrients	d. Estimation of crude pectic substances from plant material			
		Total hours for this sub-module	**5**	**6**	**25**
3.	Types of Functional and neutraceutical foods and physical characteristics	Quality assurance of developed functional foods			
	a. Soy proteins and soy isoflavones in human health	a. Estimation of dietary fibre in foods			
	b. Role of nuts / flaxseeds in cardiovascular disease prevention	b. Finger millet product development			
	c. Functional foods from wheat, rice and millets and their health effects	c. ω-fatty acids in flaxseeds			
	d. Finger millet products and their health benefits	d. Calcium estimation in finger millet			
	e. Role of Dietary fibers in disease prevention				
		Total hours for this sub-module	**5**	**6**	**25**
4.	Properties, structure and functions of various Nutraceuticals. Factors affecting the properties	Quality assurance of developed neutraceutical foods			
	a. Glucosamine, Octacosanol, Lycopene, Carnitine, Melatonin and Ornithine alpha - ketoglutarate	a. Estimation of Curcumin/Lycopene			
	b. Use of proanthocyanidins, grape products, flaxseed oil as Nutraceuticals	b. Extraction and identification of Isoflavones by TLC			
	c. Sources and role of Isoprenoids, Isoflavones, Flavonoids, carotenoids, Tocotrienols, polyunsaturated fatty acids, sphingolipids, lecithin, choline. terpenoids	c. Estimation of piperine from Pepper by TLC			
	d. Vegetables, Cereals, milk and dairy products as Functional foods	d. Estimation of iron in finger millet by titrimetric method			
	e. Health effects of common beans, *Capsicum annum*, mustards, Ginseng, garlic, grape, citrus fruits, fish oils, and sea foods				
		Total hours for this sub-module	**5**	**6**	**25**
5.	Food as remedies				

	a. Nutraceuticals bridging the gap between food and drug	a. Estimation of Chlorophyll			
	b. Nutraceuticals in treatment for cognitive decline, Nutraceutical remedies for common disorders like Arthritis, Bronchitis, circulatory problems, hypoglycemia, Nephrological disorders, Liver disorders, Osteoporosis, Psoriasis and Ulcers etc	b. Detection and estimation of metals – Fe, Cu, Zn, Mg, Se.			
	c. Brief idea about some Nutraceutical rich supplements e. g. Bee pollen, Caffeine, Green tea, Lecithin, Mushroom extract, Chlorophyll, Kelp and *Spirulina* etc	c. Estimation of crude fat contents of foods by Soxhlet's method d. Estimation of starch fractions in cereals			
		Total hours for this sub-module	**5**	**6**	**25**
6.	Non-nutrients in foods	Determination of antinutritonal properties			
	a. Anti-nutritional Factors present in Foods	a. Estimation of total phenols			
	b. Types of inhibitors present in various foods and how they can be inactivated	b. Estimation of tannins, phytic acid			
	c. Role of processing on non nutrients	Estimation of Saponin			
		Total hours for this sub-module	**5**	**5**	**25**
7.	Probiotics as functional foods				
	a. General idea about role of Probiotics	d. Estimation of trypsin inhibitor activity e. Microbial analysis			
	b. Prebiotics as functional ingredients				
	c. Recent advances in techniques & feeding of substrates				
		Total hours for this sub-module	**5**	**5**	**25**
8.	Functional foods efficacy				
	a. Assessment of nutritional status and Recommended Daily Allowances	a. Preparation of review article on recommended daily allowances of minor nutrients			
	b. Requirement for Good clinical studies	b. Understanding of clinical work protocols			
	c. Knowledge on legal requirements for safety assessment				
		Total hours for this sub-module	**5**	**5**	**25**
9.	Industrial Scenario on functional foods and nutraceuticals. Nutraceutical Industry and Market Information				

	a. Nutraceuticals and the Future of Medical Science and Consumers' views on Nutraceuticals	a. Detection of food additives			
	b. New technologies in development of functional foods and Nutraceuticals	b. Extraction and estimation of total sugars from food products			
	c. Product testing, qualities and end use.	c. Estimation of total Nitrogen and protein of foods by Micro Kjeldahl methods.			
	d. Packaging strategies for Nutraceutical products				
	e. The food industry's role in promoting functional foods				
	Total hours for this sub-module		**5**	**5**	**25**
10.	Consumers evaluation, marketing strategies, Regulatory issues of functional foods				
	a. Knowledge on global regulations	a. Visit to Bazaars and prepare the review on claims			
	b. Labeling and claims on the products	b. Visit to Bazaars and evaluate the available foods			
	c. The role of marketing in the introduction of functional foods				
	Total hours for this sub-module		**5**	**5**	**25**
Total Contact Hours Individually for Theory, Demonstration and Practical			**51**	**60**	**250**
Grand Total of Contact Hours			**361**		

T- Theory, D- Demonstration, P- Practical

9. Lists of Tools and Equipments for a Batch

S. No.	Description	Quantity
1	UV Spectrophotometer	1
2	Kjeldhal Unit (Protein & Nitrogen)	1
3	Macro centrifuge 10,000 rpm	1
4	Digital pH meter	1
5	Micro Pipette100ml, 1000ml	1
6	Colorimeter	1
7	Thin layer chromatography kit (TLC Kit)	1
8	Refrigerator	1
9	Electronic Balance0.001g, 0.01g	1
10	Hot Water bath	1
11	ColdWater bath	1
12	Hot Air Oven	1
13	Hot Plate	1
14	Vortex Mixer	1
15	Muffle Furnace	1
16	Soxhlet Extraction apparatus	1

17.	Incubators	1
18.	Magnetic stirrer	1

S. No	Description of Glasswares	Capacity	Qty
1.	Oil flasks	--	12
2.	Oil Extraction set	--	1set
3.	Thimbles	--	12
4.	Standard flask	1 Lit	6
5.	Standard flask	500 ml	6
6.	Standard flask	250 ml	6
7.	Standard flask	100 ml	20
8.	Standard flask	50 ml	10
9.	Beaker	1000 ml	4
10.	Beaker	500 ml	6
11.	Beaker	250 ml	20
12.	Beaker	100 ml	20
14.	Boiling tubes	50 ml	25
15.	Test tubes	25ml	25
16.	Conical Flask	100 ml	25
17.	Measuring jar	10ml, 25ml, 50ml,100ml – each 6	4x6
18.	Measuring jar	250ml, 500ml, 1000lit – each 2	3x2
19.	Funnel	2.5 cm; 7.5 cm	Each 10
20.	Conical Flask	250 ml	10
21.	Petri Plates	--	25
23.	What man no 1 Filter paper	--	2 boxes
24.	Desiccators	--	2
25.	Burette	25ml	12
26.	Crucible	--	12
27.	Wash bottles	--	6
28.	Bunsen burners	--	2
29.	Digestion flasks	500 ml	12
30.	Distillation unit	-	2

S. No	Chemical Name	Quantity	No.	Grade
1.	Acetic acid	2.5L	1	LR
2.	Acetone	2.5L	1	LR
3.	Ammonia Solution	500ml	2	AR
4.	Ammonium Ferrous Sulphate	500g	1	LR
5.	Ammonium hepta Molybdate	100g	1	LR
6.	Ammonium Sulphate	500g	1	LR
7.	Anthrone	25g	1	LR
8.	Arsenous Oxide	100g	1	AR
9.	Barium chloride dehydrate	500g	1	LR
10.	Benzoic acid	500g	1	LR
11.	Bromcresol Green (pH Indicator)	5g	1	LR

12.	Calcium Hydroxide	500g	2	LR
13.	Cupric Sulphate	500g	5	LR
14.	Cupric Sulphate	500g	1	AR
15.	Cyclo Hexane	2.5L	3	LR
16.	Dextrose	500g	1	AR
17.	D-Glucose	500g	1	LR
18.	Di Potassium Hydrogen Ortho Phospate	500g	1	LR
19.	Dichloromethane	2.5L	6	LR
20.	Dichloromethane	2.5L	1	AR
21.	E.D.T.A di sodium salt	100g	1	LR
22.	EDTA	500g	1	LR
23.	Ferrous Sulphate	500g	1	LR
24.	HCl	2.5L	1	LR
25.	Hexane	2.5L	5	LR
26.	Iodine	100g	1	LR
27.	Iodine	500g	1	LR
28.	L-Ascorbic Acid	250g	1	LR
29.	Lead Nitrate	500g	1	LR
30.	Liquid Ammonia	500ml	1	LR
31.	Mercuric Oxide	100g	1	LR
32.	Methanol	2.5L	1	LR
33.	Methanol (HPTLC Grade)	2.5L	1	LR
34.	Nitric Acid	2.5L	1	LR
35.	Ortho Phosphoric Acid	500ml	1	LR
36.	Oxalic Acid	500g	1	LR
37.	Petroleum Ether	2.5L	1	LR
38.	Phenol	500ml	1	LR
39.	Potassium Dichromate	500g	1	LR
40.	Potassium Dihydrogen Phospate	500g	1	AR
41.	Potassium Hydroxide	500g	1	AR
42.	Potassium Metasulphate	500g	1	LR
43.	Potassium Sodium Tartarate	500g	1	AR
44.	Potassium Sulphate	500g	2	LR
45.	Sodium Acetate	500g	1	LR
46.	Sodium Meta bisulphate	500g	1	LR
47.	Sodium Nitrate	500g	1	LR
48.	Sodium Sulphate	500g	1	LR
49.	Solo Chrome Black	25g	1	LR
50.	Tris Hydrochloride	100g	1	GR

10. Space Required for Conducting the Module (in square feet)

a. Theory Class Room :

b. Demonstration & Practical Class Room :

11. Power requirement 220 v 3 phase

12. Qualifications of Instructor

B.Sc. or M.Sc. in Food Science and Technology (or) B.Tech in Food Engineering
Diploma in Food Science and Technology or Food Engineering with special training
Diploma in Food Science and Technology or Food Engineering with special training

13. Suggested Readings

Text Books / journal articles

1. Essentials of Functional Foods by M K Schmidl and T P Labuza, An Aspen Publications
2. Application of probiotics in processed foods,2002, J. processed food industry,K S Premavalli et.al
3. Functional foods – An overview,2002, J.Indian Food industry, K S Premavalli et.al
4. Finger Millet: A Valued Cereal by K S Premavalli.2012, Nova Publishers
5. Hand book of fermented functional foods by Edward R. Farnworth
6. Advances in preservation and processing technology of fruits and vegetables by Rajarathnam
7. Quality control for value addition in food processing by Devraj
8. Functional Foods and Neutraceuticals by Rotimi E. Aluko

MODULE – 15

1.	**Title of the Module**	:	**Manufacturing of Traditional Foods and their Indigenisation**
2.	**Sector**	:	Food Processing and Preservation
3.	**Code**	:	
4.	**Entry Qualification**	:	8th Standard
5.	**Minimum Age**	:	18 years
6.	**Terminal Competency**	:	After completion of the course the candidate will be able to: a) Operating & maintaining the equipments used for various unit operations involved for making food products b) To make indigenous food products c) Processing, packaging & storage of food products d) Maintaining the quality of food products
7.	**Duration (in Hrs)**	:	3 months (336 Contact hours)

8. Module Contents

Sl. No.	**Theory**	**Practical**	**Contact Hours**		
			T	**D**	**P**
1	Traditional foods and their importance Importance of primary, secondary, and tertiary processing. Concept of value addition, conversion of raw materials to consumer foods, Knowledge of importance of indigenous food products & their market value.	Regional variation in food products Study of various source required for production of indigenous food products, practicing hygiene and safety aspects in food preparation			
	a. Cereals, millet based foods	a. Cereal products preparation			
	b. Pulses, nuts based foods	b. Fruit products preparation			
	c. Fruits and Vegetable based foods	c. Spice products			
	d. Oilseeds based products				
	Total hours for this sub-module		**5**	**5**	**25**
2.	Knowledge of Traditional foods Knowledge of different industrially important indigenous food products in India, Knowledge of ingredients used for making these kind of products; Quality assurance of raw material, standards & grades	Quality evaluation of Ingredients involved for making these products.			
	a. Milk and milk products	a. Milk and milk products preparation			
	b. Meat, fish and other animal foods	b. Meat, fish and other animal products preparation			

	c. Sugar and Carbohydrate foods	c. Sugar and Carbohydrate foods products preparation			
	d. Spices and their products	d. Spices and their products preparation			
	Total hours for this sub-module		**5**	**5**	**25**
3.	Industrialisation of Indian foods Process & technology involved for production of indigenous food products, process parameters, key parameters which influence final product quality	Practice to make common indigenous food products			
	a. Primary processed foods	a. Survey on commercial availability of primary processed foods			
	b. Secondary processed foods	b. Survey on commercial availability of secondary processed foods			
	c. Machineries for primary foods	c. Listing the commonly used food processing machines			
	d. Food processing machineries				
	Total hours for this sub-module		**5**	**12***	**25**
4.	Raw materials, process and technology involved for production of indigenous food products, process parameters, key parameters which influence final product quality Knowledge of changes occurring in raw materials during initial stage to end products. Effect of addition of ingredients on final products	Practice to make common indigenous food products Observations of changes occurring in raw materials like starch gelatinization; baking, puffing, fermentation etc.			
	a. Cereals, pulses flours and products	a. Demonstration and preparation of various food products			
	b. Fats and oils				
	c. Spice powders				
	d. Pickles, value added products				
	Total hours for this sub-module		**5**	**5**	**25**
5.	Knowledge of machineries involve in such kind of products. Technology involved in processed foods	Practice to operate machines; how to operate, studies on parameters affecting the machine performance			
	a. Fruit products	Demonstration and preparation of various food products			
	b. Dehydrated products				
	c. Fried products				
	d. Ready to eat products				
	Total hours for this sub-module		**5**	**5**	**25**
6.	Knowledge of processing and changes occurring in raw materials during initial stage to end products. Effect of addition of ingredients on	Observation of changes occurring in raw materials such as starch gelatinization; baking, puffing, fermentation etc.			

	final products.	Measuring various product qualities of finished products; sensory analysis of final product, consumers acceptability evaluation			
	a. Heating	a. Cooking of cereal products			
	b. Chemicals treatment	b. Roasting of oilseeds			
	c. Fermentation	c. Baking of cookies			
		d. Fermentation of milk/vegetables			
	Total hours for this sub-module		**5**	**5**	**25**
7.	Knowledge of machineries involved in such kind of products. Trouble shooting, safety & maintenance operation involve in machineries; Knowledge of precautions taken, safety measures & safety hazard	Practice to operate machines; how to operate, changing parameters Learning practically these trouble shooting & maintenance operations; finding fault & quick actions for remedies			
	a. As in 4 and 5	a. Flour mill			
	b. Trouble shooting and measures	b. Roaster			
		c. Juice extractor			
		d. Dehydrator			
	Total hours for this sub-module		**5**	**12***	**25**
8.	Knowledge of product quality evaluation Method of techniques of proper packaging of finished products & proper storing in cooling & ambient places, Packaging of indigenous food products	Practice on packaging with sealing, storing & marketing. Marketing through agents, salesman and retailers etc. Measuring the product qualities			
	a. FSSAI, 2006	a. Raw material checking			
	b. Standards for raw materials	b.Sensory analysis of final product			
	c. Standards for processed foods	c. Food acceptance			
	d. Standards for ingredients				
	Total hours for this sub-module		**5**	**4**	**25**
9.	Maintaining records and filling up format for booking of various indigenous food products Method of techniques of proper packaging of finished products & proper storing in cooling & ambient places, Packaging of indigenous food products	Practice on packaging with sealing, storing & marketing. Marketing through agents, salesman and retailers etc. Practice on collection of orders and delivery of such kind of products			
	Total hours for this sub-module		**5**	**2**	**10**
10.	Maintaining records and filling up format for booking of various indigenous food products	Practice on collection of orders and delivery of such kind of products			
	Total hours for this sub-module		**1**	**5**	**20**
Total Contact Hours Individually for Theory, Demonstration and Practical			**46**	**60**	**230**
Grand Total of Contact Hours			**336**		

T- Theory, D- Demonstration, P- Practical

* Visit to Food Industry

9. Lists of Tools and Equipments for a Batch

Sl. No.	Description	Quantity
1	General requirements like vessels, balances, trays, water storage facilities, oil container, mould, boiling pan, cutting knife, table, different size containers etc. (To be shared)	04 for each tools
2	Other general requirements for Good manufacturing practices	15 sets each
3	Planetary mixer; 3 gear/ Food processor	02 No
4	Grinder, Sieve set boxes	02 No
5	Oven (Standard size with controlling feature)	02 No
6	Packaging machine	02 No
7	Moisture box	02 No
8	Work table marble top standard size	02 No
9	Storage rack standard size	05 No.
10	Moulds	02 No
11	Cutting knives	02 No
12	Dies; Sealing machine; Hot plate Induction stoves	02 No
13	Juice extractor	02No
14	Fermentor	02 No
15	Tool cabinet	02 No
16	First aid box	02 No
17	Discussion table	02 No
18	Weight Box	02 No
19	Other common facilities for training	As required

10. Space Required for Conducting the Module (in square feet):

a. Theory Class Room **:** 1000 square feet
b. Demonstration & Practical Class Room **:** 2000 square feet

11. Power requirement **:** 3 phase connection
5 KW

12. Qualifications of Instructor

Diploma in Catering Management
Diploma in Food Production
B.Sc. or M.Sc. in Food Science and Technology

13. Suggested Readings

Text Books /Journal

1) Tuber and root crops by M.S.Palaniswami & K. V. Peter
2) The New Cultures of Food by Adam Lindgreen & Martin K. Hingley
3) Foods of the Southwest Indian Nations by Lois Ellen Frank
4) Food and Culture by Pamela Goyan Kittler, Kathryn P. Sucher
5) Mint Money with Traditional Foods by B. R. Badekar
6) Convenience Foods for Defence Forces based on Traditional Indian Foods,2000,Defence Science Journal,K S Premavalli

MODULE - 16

1.	**Title of the Module**	:	**Handling and Safe Storage of Food Grains**
2.	**Sector**	:	Food grains
3.	**Code**	:	
4.	**Entry Qualification**	:	Minimum 12th Standard
5.	**Minimum Age**	:	16 yrs.
6.	**Terminal Competency**	:	After completion of this course the participant would be able to a) Identify the pests damage in grain storage b) Recommend IPM for pests in grain storage c) Make consultancy for Handling and Safe storage of food grain
7.	**Duration (in Hrs)**	:	315 hours

8. Module Contents

S. No.	Theory	Practical	Contact Hours		
			T	D	P
1.	Grain Storage - Ecosystem approach - Overview of grain storage issues - Losses resulting from poor storage	Visit to Grain Milling Facility and a Bulk Storage Godown (FCI)			
	a. Grain storage overview	a. Visit to FCI storage structures	3	-	8
	b. Handling and storage losses in India for grains	b. Discussion on losses in grain handling	2		3
		c. Visit to Private Traders' storages			8
	c. Monitoring the grain during storage	d. Understanding grain eco-system through visiting storage scenario in villages	5		8
	a. Safe storage practices	e. Discussion on Grain handling	5		3
		Total hours for this sub-module	**15**	**-**	**30**
2.	Grain drying, handling and milling	Visit to grain milling industries			
	a. Parboiling and processing of paddy	a. Visit to Modern Grain Mills industries	3	-	8
	b. Grain drying equipment and practices	b. Discussing the equipment for parboiling, drying and milling	3		9
	c. Grain milling equipment and practices	c. Visit to Wheat Flour Mills	4		8
		d. Discussing the milling equipment for wheat			10
		Total hours for this sub-module	**10**		**35**
3.	Stored product insect pests - cereals, pulses, oilseeds, milled products, spices, condiments, dried fruits and nuts	Stored product insects and pests			
	a. Identification of stored product	a. Grain sampling for insect infestation	3	5	5

	pests				
	b. Understanding the behavioural dynamics of life stages of insects and pests	b. Detecting insect presence through various techniques	3		5
	c. Appreciation of losses due to pests in grain trade.	c. Insect control measures	4		5
		d. Studying insect traps			5
		Total hours for this sub-module	**10**	**5**	**20**
4.	Storage microorganisms and storage mites - Grain and seed borne pathogens and their management	Identification of microorganisms in infected grain Evaluating different methods of control			
	a. Effect of storage mites, fungi and microorganisms on grain storage	a. Identifying storage mites and fungi	5	5	5
		b. Measures to control storage micro-organisms			5
		Total hours for this sub-module	**5**	**5**	**10**
5.	Biochemical changes in stored commodities due to pest infestation	Estimating the quality changes during different period of storage in infested/infected grain			
	a. Biochemical changes in food grains due to storage pests	a. Assessment of quality changes due to storage pests	4	5	5
	b. Effect of insect infestation or microbial infection on the nutritional changes during storage	b. Nutritional changes due to stored grain pests	3		5
	c. Aflatoxin content in grains due to microbial infection	c. Estimation of aflatoxin content in infected grain	3		5
		Total hours for this sub-module	**10**	**5**	**15**
6.	Physical and chemical methods of pest control	Effects of Temperature and Moisture on Pest Population			
	a. Importance of temperature and moisture	a. Understanding the dynamics of moisture movement within grain bulk	3	-	5
	b. Insect control by physical methods	b. Understanding the importance of grain temperature and its link to infestation	2		5
		Total hours for this sub-module	**5**	**-**	**10**
7.	Rodents and their management	Identification of rodents and burrows			
	a. Detection of rodent infestation - Physical methods of control	a. Control measures for rodent infestation	2		10
	b. Chemical methods of control	b. Food Safety Regulations related to rodent infestation	2		10
	c. Food safety laws and standards		1		
	Total hours for this sub-module		**5**	**-**	**20**
8.	Principles and methods of post harvest IPM	Evaluating different methods of insect control			
	a. Preventive and curative measures - Gadgets used in	a. Evaluating insect control strategies	3	5	10

	storage pest management Modified atmospheric storage for stored grain insect pest management -				
	b. Physical control measures for management of stored product pest management with special reference on techniques Botanicals for the management of pests of stored grains	b. Evaluating insect control strategies	2		10
	Total hours for this sub-module		**5**	**5**	**20**
9	Methods of detection of insect infestation in grains and estimation of losses	Detection of insect infestation by various methods			
	a. Staining method - Density or floatation method- Gelatinization method - Cracking floatation method	a. Insect detection by any two methods	2	5	10
	b. Aural/Ninhydrin colour reaction - Carbondioxide determination method - X-ray radiographic method	b. Insect detection by any two methods	3		10
	Total hours for this sub-module		**5**	**5**	**20**
10	Fumigation of grain storages	Fumigation with Aluminium phosphide and CO_2			
	a. Basics of Fumigation	a. Equipment and procedure required for fumigation	5	5	5
	b. Fumigants- alternative fumigants for grain protection- Aluminium phosphide - Methyl Bromide CO_2 fumigation	b. Fumigation of grain storages with Aluminum phosphide	5		10
		c. Fumigation of grain storages with carbon dioxide			10
	Total hours for this sub-module		**10**	**5**	**25**
Total Contact Hours Individually for Theory, Demonstration and Practical			**80**	**30**	**205**
Grand Total of Contact Hours			**315**		

T- Theory, D- Demonstration, P- Practical

9. Lists of Tools and Equipments for a Batch

S.No.	Description	Quantity
1.	Microscopes	1
2.	Weighing balance	1
3.	Moisture meter	1
4.	Hot air oven	1
5.	Environmental chamber	1
6.	Grains and flour for culturing	1
7.	Insect cage for culturing insects	1
8.	Plastic containers	1
9.	Sealing machine	1
10.	Racks	1

11.	Small metal bins	1
12.	Laminar flow chamber	1
13.	Glassware and chemicals	1
14.	Sample probes	1
15.	Fumigation accessories	1 set
16.	Gas sensors for CO_2 detection	1
17.	Glasswares and minimal lab wares	1
18.	Insect collection pumps and work table	1

10. Space Required for Conducting the Module (in square feet)

a. Theory Class Room : 600 sqft
b. Demonstration & Practical Class Room : 2000 sqft

11. Power requirement **:** 10 kW power

12. Qualifications of Instructor

B.Sc. or M.Sc. in Food Science and Technology
Diploma in Grain Science and Technology

13. Suggested Readings

Text Books

1) Cotton, Richard T. 2007. Insect Pests of Stored Grain and Grain Products.
2) Ghosh, S.K. 2003. Integrated Management of Stored Grain Pest.
3) Bhargava, M.C. & K.C.Kumawat. 2010. Pests of Stored Grains and Their Management
4) Bhadriraju Subramanyam and David W. Hagstrum. 2000. Alternatives to Pesticides in Stored-Product IPM
5) Bhadriraju Subramanyam.1995. Integrated Management of Insects in Stored Products
6) David W. Hagstrum and Bhadriraju Subramanyam. 2008. Fundamentals of Stored-Product Entomology
12) David W. Hagstrum and Bhadriraju Subramanyam.2006. Fundamentals of Stored Product Entomology
13) Marcel Dekker. 2002.Handbook of Food Toxicology
14) David Rees.2004. Insects of Stored Products
15) Jerry W. Heaps .2006. Insect Management for Food Storage and Processing, Second Edition

MODULE - 17

1.	Title of the Module	:	**Processing of Sugarcane and Sugar**
2.	Sector	:	Food Processing and Preservation
3.	Code	:	
4.	Entry Qualification	:	12th Standard
5.	Minimum Age	:	18 yrs
6.	Terminal Competency	:	After completion of the course the candidate will be able to: a) Operation & maintain the equipments used for various unit operations involve for Sugar production b) Process of packaging & storage c) Maintaining the quality of food products d) Byproduct utilization
7.	Duration (in Hrs)	:	350 hours

8. Module Contents

S. No.	Theory	Practical	Contact Hours		
			T	**D**	**P**
1.	Maturity of sugarcane, cutting and cleaning of sugar cane - Deterioration of cane after cutting, loading and unloading, cane carriers, cane kickers, revolving knives, crushers, shredders - Milling of sugar cane - Extraction of juice, composition, purification of juice.	a. Peeling of sugarcane, Extraction of juice from sugarcane crusher	10		
					10
		b. Milling efficiency			5
		c. Quality parameters- Composition			10
		d. Non-sugar constituents in sugar cane juice			
	Total hours for this sub-module		**10**	**-**	**25**
2.	Practice to product - good quality sugarcane juice to make sugar, jiggery, Purification steps, concentration of juice. Knowledge of importance on sugar processing & sugar production in food industry & its market value. Various possible products after sugarcane processing.	a. Juice Brix by brix hydrometers and by hand refractometers Pol and purity of juice	5		
					8
		b.Brix , Pol and purity of , massecuites and molasses.			6
		c. Pol% bagasses, moisture % bagasse, preparatory index.			8
		d. Pol% sugar , moisture % sugar, ash % sugar. Phosphate in juice , calcium oxide in juice, glucose ash ratio.			8
	Total hours for this sub-module		**5**	**-**	**30**

3.	Different steps involved for sugar production; operating parameters, necessity, change in raw materials after applying the operation, Clarifying and bleaching agents, Hot and cold imbibition. Peeling of sugarcane, Cane Carriers, rotating knives and fibrizers/shredder.	a. Purification of sugar cane juice,	9		
					10
		b. Bottling of sugarcane juice,			5
		c. bottling equipment,			3
		d. Study of vaccum filters and , centrifuge		8	
		Total hours for this sub-module	**9**	**8**	**18**
4.	Milling (Juice extraction): Extraction of juice from sugarcane, study of different type of cane peeler and cane crushers.Purification of sugar cane juice, Bottling of sugarcane juice, bottling equipment, leaf filter, centrifuge.	a.Extraction of juice and clarification	7		
					6
		b.Boiling of juice and clarification			8
		c.Making the molds			4
		d.Testing the quality of jaggary			10
		Total hours for this sub-module	**7**	**-**	**28**
5.	Knowledge of Machineries involve in Sugar production like Evaporators, Conveyor, Filter , materials handling equipments Clarification: Evaporation and heating: Crystallization: Centrifuging: Drying: sugar refining Grading and Bagging: Effluent treatment etc.	a. To determine the quality of molasses	3		7
					8
		b. To determine the Pol % and Moist % of the Filltercake			8
		c. Proximate composition of Press mud and Iolation of wax from pressmud. Determination of brix % bagasse			8
		d. Production of ethanol from molasses.			8
		Total hours for this sub-module	**3**	**-**	**32**
6.	Process of manufacture of jaggery unit operations involved; knowledge of different types jaggery, quality evaluation of jiggery. Utilization of Press mud and molasses	a. Demonstration of different unit operation involved in sugar production	5		
				10	
		b. Practice to operate these machineries; controlling parameters		6	
		c. Evaporators, filters and material handling, performance evaluation of evaporator		6	
		d.Crystallizers and centrifugal machines		8	
		Total hours for this sub-module	**5**	**30**	**-**
7.	Methods of techniques of proper packaging of sugar & Proper	Identification of faults & immediate action avoiding damage	5		

	storing of sugar, moisture control during storage, Knowledge of storage and packaging techniques and materials Quality control of Sugar & confectionary; Keeping and refining qualities of raw sugar; Chemical treatment to prevent deterioration	of equipments; maintenance &cleaning operation of evaporators and filter			
		a.maintenance & cleaning operation of crushers, evaporators,rotating vaccum filters, crystalizers, centrifgal machines, hoppers etc.			8
		b. Boiler water pH, and TDS			6
		c. Boiler water Hardness			6
		d.Waste disposal and effluent treatment.		10	
		Total hours for this sub-module	**5**	**10**	**20**
8.	Knowledge of precaution taken & safety hazards Safety measure, trouble shooting operation involve & handling of equipments Practice on grading, packaging, sealing; storing & marketing of sugar. Quality evaluation of sugar; Learning of sugar refining By product utilization of sugar Industries like bagasse, Press mud molasses; ethyl alcohol production.	a. Grading, of sugar	7	2	6
		b. Packaging and sealing of sugar		2	6
		c. Determination of purity of phosphoric acid by Sodium hydroxide method			6
		d. Determination of CaO content in lime by using pattern and Redder indicator			6
		Total hours for this sub-module	**7**	**4**	**24**
9.	Maintaining various records; Good receive note, weight chart, quality control chart etc. Cleaning and Sanitation in sugar industry - Cleaning and sanitizing program Cleaning methods: CIP, Clean-out-of-Place - Manual cleaning**,** Properties of food soilsCleaning agents - Sanitizers: Physical and chemical, Factors affecting effectiveness of sanitizer	a. Crystal size, Purity of sugar.	6		
					8
		b. Sulphur Di Oxide content in sugar			8
		c. Sugar dryers		8	
		d. Elivators		5	
		Total hours for this sub-module	**6**	**13**	**16**
10.	Grading and marketing of sugar and jaggery. Use of baggase as fuel; Drying of baggase, fuel value of baggase. Practice on collection of order of sugar, maintaining records	a. Drying of baggase	5		8
		b. Fuel value of baggase			8
		c. Practice on collection of order of sugar, maintaining records			8
		d. Practice on collection of order of sugar, maintaining records			6
		Total hours for this sub-module	**5**	**-**	**30**
Total Contact Hours Individually for Theory, Demonstration and Practical			**62**	**65**	**223**
		Grand Total of Contact Hours	**350**		

T-Theory, D-Demonstration, P-Practical

9. Lists of Tools and Equipments for a Batch

S. No.	Description	Quantity
1.	General requirements like vessels, balances, trays, water storage facilities, oil container, mould, boiling pan, cutting knife, table, different size containers etc. (To be shared)	04 for each tools
2.	Other general requirements for Good manufacturing practices	15 sets each
3.	Sugarcane crusher	02 No
4.	Load carrying machine	02 No
5.	Juice collection tank	02 No
6.	Pumping machine	02 No
7.	Evaporators	02 No
8.	Materials handling devices for carrying different materials	02 No
9.	Clarification unit	05 No.
10.	Refining unit	01 No
11.	Conveyor	02 No
12.	Packaging unit	02 No
13.	Tool cabinet	02 No
14.	First aid box	02 No
15.	Discussion table	02 No
16.	Weight Box	02 No
17.	Polarimeter	-
18.	Spectrophotometer	-
19.	Hydrometers	-
20.	Other common facilities for training	As required

10. Space Required for Conducting the Module (in square feet)

a. Theory Class Room : 600 sqft
b. Demonstration & Practical Class Room : 2000 sqft

11. Power requirement : 10 kW power

12. Qualifications of Instructor :

B.Sc. or M.Sc. in Food Science and Technology (or) B.Tech in Food Engineering
Diploma in Food Science and Technology or Food Engineering with special training
Diploma in Food Science and Technology or Food Engineering with special training

13. Suggested Readings

Text Books

1. The complete book on sugarcane processing and byproducts of Molasses by H-Panda- Asia Pacific Business Press Inc.
2. Sugar Confectionery Manufacture – E.B. Jackson – A champan and Hall Food Science Book – An Aspen Publication (1999).
3. System of Technical Control For Cane Sugar Factories In India - 2005 by N.C. Verma.
4. Hand Book of Sugar Technology by R.B.L. Mathur.
5. Hand Book of Cane Sugar Engineering by E. Hugot.
6. Text Book of Qualitative Analysis by Vogel.

7. Cane Sugar Factory Control by Banerji.
8. Hand of book of cane sugar – Meade & Chen
9. Introduction to cane sugar technology – Jenkins G. H.
10. Unit operation in cane sugar production – John H. Payne
11. Manufacture of sugar from sugarcane – C. C. M. Perk
12. Efficient Management for sugar factories – Mangal Singh
13. Cane sugar manufacture in India – D. P. Kulkarni

MODULE – 18

1.	**Title of the Module**	:	**Wine makingTechnology**
2.	**Sector**	:	Food Processing and Preservation
3.	**Code**	:	
4.	**Entry Qualification**	:	12th Standard
5.	**Minimum Age**	:	18 yrs.
6.	**Terminal Competency**	:	After completion of the course the candidate will be able to: a) Trained man power to work in winery b) Marketing wines
7.	**Duration (in Hrs)**	:	350 hours

8. Module Contents

S. No.	Theory	Practical	Contact Hours		
			T	**D**	**P**
1	Alcoholic beverages:Distilled and undistilled Present national and international grape scenario, Varieties of wine grapes and its improvement : commercial classification of grapes, indigenous germplasm; varietal situation; description of varieties suitable for wine making, need for varietal improvement; objective of improvement; methods of improvement Quality improvement: components of quality, quality of wine grapes, means to improve the quality	Study of different grape varaties	7		
		a. Physical parameters of grapes			4
		b. pH,Acidity and TSS of grapes			8
		c. Volatile acidity, free SO2,			8
		d. Harvestng and crushing of grapes			8
	Total hours for this sub-module		**7**	**-**	**28**
2.	Harvesting and post-harvest management: maturity index, changes in the wine grapes during maturation, ripening, grading	a.Estimation of reducing & total sugar by copper reduction technique.	3		
	a. Fermentation process development, scale of up process.				8
	b. Contamination of wine during	b.Preparation of mother culture			8

	processing and effect of contaminants on quality of wine.	and starter culture for wine production Preparation of red and white wine.			
	c.Methods of sensory evaluation	c. Wine clarification : Removal of protein from wine by hydrolysis, precipitation and adsorption method.			8
		d. Preparation of Fortified Wines			8
		Total hours for this sub-module	**3**	**-**	**32**
3.	Biochemistry of alcoholic fermentation during wine production, sugar degradation pathway, alcoholic fermentation, regulation of sugar utilizing metabolic pathway, pastures effect and Crabtree effect of glycerol, metabolic factors in yeast that control the formation of acetic acid etc.	a. Alcohol, Ethanol, Acetaldehyde content of wine by titrametric method.	3		
					8
		b.Wine yeast			8
		c. Technology of production of still and sparkling wines		8	
		d.Nutritional and health benefits of grapes and wines			8
		Total hours for this sub-module	**3**	**8**	**24**
4.	Biochemical changes due to commercial yeast strains: adaptation of yeast in fermentation media, addition of sulfur dioxide and effect of pH during crushing, nutrient balance during fermentation etc.	a.Protein stability test / Heat stability test of wine Estmation of phenols	5		
					10
		b. Stuck fermentation: causes and solutions		6	
		c. Exploitation of other fruits for wine making			6
		d. Modalities in sensory evaluation of wine			8
		Total hours for this sub-module	**5**	**6**	**24**
5.	Monitoring and controlling of fermentation parameters of wine: monitoring and viability and cell number of yeast during must preparation, controlling microbial growth during wine production, effect of pH, temperature, CO2, amount of sugar consumed. Wine machineries: Destemer, Crusher, Pneumatic/ hydraulic press, Screw pumps, Fermentation tanks with cooling jackets/ cooling system, Filters, Vaccumized bottling plants, Wine cold	a. Additives in Wine making	9		
					8
		b. Pneumatic Press		6	
		c. Destemer Crusher		6	
		d. Filters		6	

	stabilization tanks, Water softening plant, Oak wood vats and barrels for maturation of wine, certification wine machineries etc.				
	Total hours for this sub-module		**9**	**18**	**8**
6.	Production technology of wine, different types of grape wines, still and sparkling wines production of wine from fruits other than the grapes, Application of colors and additives in grape wine productions etc.	a. Study of Fermenters	3		
					10
		b. Cold Stabilizer			8
		c. Chilling Plant and Heat exchanger		8	
		d. Water treatment plants		6	
	Total hours for this sub-module		**3**	**14**	**18**
7.	Packaging technology, labeling & storage of wines, Economic feasibility studies of wine productions, wine marketing etc.	a. Fining equipments (Filtration)	3		
				8	
		b. Bottling, Corking, labeling, foiling and Packing unit			8
		c. Equipment used in sparkling winemaking		8	
		d. White wine production and recommended varieties.			8
	Total hours for this sub-module		**3**	**16**	**16**
8.	wine spoilage Sensory evaluation of wine. New concept of wine production: organic, biodynamic wine etc Flavor development and maturation of wine, types of flavoring compounds etc. Biotechnology in Viti culture, Wine as a functional food, Factors affecting during storage or aging of wine.	a. Red wine production and recommended varieties.	3		
					8
		b.Marketing and Standards of Wine		8	
		c. Production of wines other than grapes.			8
		d. Techniques of testing wine:- Selection of glass, serving temperature, Design of room for wine testing			8
	Total hours for this sub-module		**3**	**16**	**16**
9.	Cleaning and Sanitation in Winery General cleaning and sanitizing program Cleaning methods:CIP, Clean-out-of-Place Manual cleaning Properties of food soils Cleaning agents Sanitizers: Physical and chemical Factors affecting effectiveness of sanitizer Studies on factors affecting quality of wine Wine standards, Rules and	a.Wine spoilage	5		
				8	
		b. Sensory evaluation and score card:- Rose worthly score card, Devis score card and sparkling wine score card.			8
		c. Visit to vinyard			8
		d. Tartarate and bitartarate stability test / cold stability test			6

	regulations, wine additivves				
	Total hours for this sub-module		**5**	**8**	**22**
10.	Project report Introduction, Market survey, Raw materials, Process of manufacture, plant & machinery, land & building, Project economics, Annexures of charts/financial aspects	a.Determination of acetaldehyde / phenol content of wine.	7		
					8
		b. Adulteration of wine.			8
		c. Cleaning and Sanitizing agents			8
		d. Visit to the winery			4
	Total hours for this sub-module		**7**	**-**	**28**
Total Contact Hours Individually for Theory, Demonstration and Practical			**48**	**86**	**216**
Grand Total of Contact Hours			**350**		

T- Theory, D- Demonstration, P- Practical

9. Lists of Tools and Equipments for a Batch

S. No.	Description	Quantity
1	Pneumatic press,	1
2	Chilling plant, bottling unit,	1
3	Autoclave,	1
4	Hot air oven,	1
5	Incubator,BOD Incubator,	1
6	Deep freezer,	1
7	Refrigerator,	2
8	Laminar air flow bench,	1
9	Vortexmixer/shaker,	1
10	Hot plate,	1
11	Water bath shaker incubator,	1
12	PH meter,	10
13	Colorimeter,	2
14	Compound microscopes (5),	1
15	Steel distillation plant,	1
16	Orbital incubator Shaker,	1
17	Analytical weighing balance,	1
18	Paper chromatographic cabinet,	1
19	TLC assembly,	1
20	Homogenizer,	1
21	Magnetic stirrer,	1
22	UV-Visible spectrophotometer,	1
23	Fabricated S.S. Fermenter (50 L),	1
24	Flame Photometer,	1
25	Sonicator Crusher,Pycnometer,	1
26	Hydrometer,	1
27	Refractometer,	5
28	Refrigerator	1
29	Centrifuge	1

10. Space Required for Conducting the Module (in square feet):

a. Theory Class Room : 600 sq.ft.
b. Demonstration & Practical Class Room : 1500 sq.ft.

11. Power requirement

Total power requirement : 50 kW

12. Qualifications of Instructor :

B.Sc. or M.Sc. in Food Science and Technology (or) B.Tech in Food Engineering
Diploma in Food Science and Technology or Food Engineering with special training
Diploma in Alcohol Fermentation

13. Suggested Readings

Text Books

1. The Grape, Improvement, Production and Post harvest management by K.L. Chadha
2. Fruits: Tropical & subtropical by T.K. Bose
3. General Viticulture by A.J. Winkler
4. Viticulture in Tropics by K.L. Chadha
5. Principles and practice of winemaking, by. Boltan R.B Chapman and Hall.
6. Wine Microbiology Science and Technology. Glaudio Delfins and Formica J. V.
7. The art and science of Wine. James Halliday and Hough Johnson.Mitchell Beazley International Ltd. Landon.
8. Prescott S.C. and Dunn C.G. (1983) Industrial Microbiology, Reed, G. (Ed.) AVI
9. Tech Books.
10. Technology and Biochemistry of Wine Vol. I and II Jan Farkas, Gorden and Breach science publishers.
11. Microbial Technology Vol. I and II by Peppler and Perlman.
12. Advances in Biotechnology Vol. I and II by Murray Moo-Young.
13. Wine analysis and production by Bruce W. Zoecklein Kenneth C. Fugelsang, Barry Gump, Fred. Nury, CBS Publication, Delhi.
14. Wine analysis and Production by Bruice W. Zecke.
15. Principle and Practices of Wine making by Roger B. Boulton.
16. Winery utilities by David R. Storm.
17. Wine Microbiology by Kenneth C. Fugelsang
18. Application of Sensory Evaluation in Wine Making by Susan E. Duncan
19. Principles of sensory evaluation of foods by M.S. Amerine, Academic press, New York
20. Handbook of analysis and quality control for fruit and vegetable products by S. Ranganna, Tata McGraw Hill Pub. Co. Ltd. New Delhi.
21. Food Safety and Standards Act, 2006 by P. K. Das

MODULE – 19

1.	**Title of the Module**	:	**Packaging Technology of Fruits and Vegetables**
2.	**Sector**	:	Food Processing and Preservation
3.	**Code**	:	
4.	**Entry Qualification**	:	12th Standard
5.	**Minimum Age**	:	18 yrs.
6.	**Terminal Competency**	:	After completion of the course the candidate will be able to: a) Become an entrepreneur b) Marketing professional in supply chain c) Packhouse provider d) Technical empolyee in packhouse
7.	**Duration (in Hrs)**	:	350 hours

8. Module Contents

S. No.	Theory	Practical	Contact Hours		
			T	**D**	**P**
1	Harvest indices of fruits and vegetables, Morphology, structure and composition of fruit and vegetable - Physical, textural characteristics, harvesting, grading, packing, storage and ripening techniques; industrial and export potential,	a. Harvest indices of fruits	7		
	a. Harvesting and precooling,				8
	b. Loading and unloading	b. Morphology, structure and composition of fruit and vegetable			8
	c. Transportation	c. Physical qualities of fruits and vegetables,			6
	d. Reception area.Sorting and Grading Lines	d. textural characteristics, and chemical composition			6
		Total hours for this sub-module	**7**	**-**	**28**
2.	Methods of maturity determinations maturity indices for selected fruits and vegetables Agri. Export Zones (AEZ) and industrial supports. packaging house operations, commodity pre-treatments-chemicals, wax coating, pre-	a.Harvesting of important fruits and vegetables,	7		3
				6	
		b.Precooling of fruits,		6	
		c. Loading and transportation of fruits and vetables,			8
		d. Sorting and grading of fruits and vetables			8

	packaging and irradiation; packaging of vegetables, post harvest, diseases and prevention from infestation, principles of transport				
		Total hours for this sub-module	**7**	**12**	**16**
3.	Harvesting of important fruits and vegetables, precooling of fruits, loading, transportation, losses during transport, unloading Determination of RQ Storage practices : Controlled atmospheric, Bead atmosphere, hypobaric storage, cool store, zero energy cool chamber, Short, and Long term humidity controlled storage chambers,	a.Quality standards for table grapes, mango, pomegranate, tomato etc.	7		
				6	
		b.Quality standards for table pomegranate, tomato etc.		6	
		c. losses during transport, unloading			8
		d. Determination of RQ			8
		Total hours for this sub-module	**7**	**12**	**16**
4.	Commodity pretreatments - chemicals, wax coating, prepackaging, Physiological post harvest diseases, chilling injury and diseaseHandling and packaging of fruits and vegetables - Post Harvest handling system for citrus, mango, banana, pomegranate, tomato, papaya and carrot packaging house operations	a. Studies on wax coating on apples, papaya, citrus, mango, aonla	5		
	a. Handling equipments: Hand Trolleys, Crates, Crate Washing system, Pallets to stack carets, Fork lifts, Hydraulic Pallet jack				8
		b.MAP			8
		c. Visit to CAP unit			10
		d.Cold storage			4
		Total hours for this sub-module	**5**	**-**	**30**
5.	Studies on use of chemicals for ripening and enhancing shelf life of fruits and vegetables Food regulations and standards Role of APEDA , AGMARK standards, Global GAP	a. Studies on use of chemicals for ripening and enhancing shelf life of fruits and vegetables	7		
					8
		b. Studies on packaging of fruits and vegetables			10
		c. Studies on physiological disorders - chilling injury of banana and custard apple			5
		d. Studies on physiological disorders - chilling injury of fruits			5
		Total hours for this sub-module	**7**	**-**	**28**
6.	Storage disorders. Physical, physiological and chemical control of post - harvest deterioration of fruits, vegetables and its significance during storage	Studies on regulations of ripening of banana, mango, papaya	3		
		a. Transit Cold Store		8	
		b. HACCP plan		8	
		c. Frozen sorage		8	

	and transport. Fruit ripening- chemical changes, regulations, methods	d. passive and active Smart and intelligent,		8	
		Total hours for this sub-module	**3**	**32**	**-**
7.	Packaging Passive and active, Smart and intelligent packaging,	Studies on various storage systems and structures	3		
	a. Ethylene and oxygen Scavengers	a. Ethylene and oxygen Scavengers			8
	b. Wax coating,	b. Wax coating,			8
	c.surface sterilization of vegetables/fruits	c.surface sterilization of vegetables/fruits			8
	d. Vapour Heat Treatment	d. Visit to Vapour Heat Treatment plant		8	
		Total hours for this sub-module	**3**	**8**	**24**
8.	Detail project report : Introduction, Market survey, Raw materials, Process of manufacture, plant & machinery, land & building, Project economics, Annexures of charts/financial aspects	a.Handling equipments: Hand Trolleys	3		
				8	
		b.Handling equipments: tray lifters/cranes		8	
		c.Logistics		8	
		8.Waste disposal		8	
		Total hours for this sub-module	**3**	**32**	**-**
9.	Food regulations and standards Cleaning and Sanitation in pack houseGeneral cleaning and sanitizing program Cleaning methods:CIP, Clean-out-of-Place Manual cleaning Properties of food soils Cleaning agents Sanitizers: Physical and chemical Factors affecting effectiveness of sanitizer	a. Detection of contaminants	5		
					10
		a. Role of APEDA ,		6	
		b. AGMARK standards,		6	
		c. Global GAP		6	2
		Total hours for this sub-module	**5**	**18**	**12**
10.	Project report Introduction, Market survey, Raw materials, Process of manufacture, plant & machinery, land & building, Project economics, Annexures of charts/financial aspects	a. Visit to commercial packaging house – grape/mango/ pomegranate/banana	3		
				8	
		b. Visit to commercial storage structures - onion, garlic, potato		8	
		c.Isolation of *E.coli*			8
		d. Preparation of project report			8
		Total hours for this sub-module	**3**	**16**	**16**
Total Contact Hours Individually for Theory, Demonstration and Practical			**50**	**130**	**170**
		Grand Total of Contact Hours	**350**		

T- Theory, D- Demonstration, P- Practical

9. Lists of Tools and Equipments for a Batch

S. No.	Description	Quantity
1	Weighing balance	2
2	Texturometer	1
3	Colour grader	1
4	Refractometer	5
5	Spectrophotometer	2
6	Sterilization Unit: A spray unit is provided along with a 200 litres water tank. Safe chemicals can be dissolve and sprayed for. It extends shelf life.	1
7	Inspection Table: To remove the rotten fruits/ vegetables manually.	5
8	Grading Unit: To grade of all round vegetables/fruits from 25 mm to 150 mm in four categories of different sizes.	1
9	Weighing Unit: A platform type digital weighing scale of 100 kg capacity is provided for weighing of finished goods.	5
10	Polythene Sealer: Electric operated sealer is provide for packing of fruits/ vegetables in polythene packets.	2
11	Plastic Ghamela: 5 pieces to collect the graded vegetable/ fruits.Packaging	1
12	Ripening chambers	1
13	CAP	1
14	Refrigerated van	1
15	Ripening chamber	1

10. Space Required for Conducting the Module (in square feet):
    a. Theory Class Room : 600 sq.ft.
    b. Demonstration & Practical Class Room : 1500 sq.ft.

11. Power requirement

Total power requirement : 50 kW

12. Qualifications of Instructor

B.Sc. or M.Sc. in Food Science and Technology (or) B.Tech in Food Engineering
Diploma in Food Science and Technology or Food Engineering with special training

13. Suggested Readings

Text Books

1 Post Harvest Physiology, Handling and Utilization of Tropical and Subtropical Fruits and Vegetable — Er. B. Pantastico

2 Post Harvest: An Introduction to the Physiology and Handling of Fruits and Vegetables.E.G. Hall. — R.B. Wills, M.B. Mc Glasson, D. Graham, T.L. Lee and

Post Harvest Technology of Fruits and — L.R. Verma, and V.K. Joshi.

Vegetables- Vol. I

3 Hi-tech Horticulture D.K. Singh.
4 Biochemistry of Foods Eskin, Henderson and Townsend
5 Fruit and Vegetable Technology Duckworth.

MODULE – 20

1.	**Title of the Module**	:	**Brewing Technology**
2.	**Sector**	:	Food Processing and Preservation
3.	**Code**	:	
4.	**Entry Qualification**	:	12th Standard
5.	**Minimum Age**	:	18 yrs.
6.	**Terminal Competency**	:	After completion of the course the candidate will be able to: a) Trained man power to work in brewery b) In malt industry c) Marketing of beer
7.	**Duration (in Hrs)**	:	350 hours

8. Module Contents

S. No.	Theory	Practical	Contact Hours		
			T	**D**	**P**
1	Alcoholic beverages:Distilled and undistilled Introduction, Types of Barley, preparation of barley malt History of brewing, Malts, Mash tun adjucts and brewing liquour.	a. Preparation of barley malt	7		
					8
		b. Studies on physical quality of malt			8
		c. Chemical analysis of malt			6
		d. Preparation of mother culture and starter cultures for beer production.			6
		Total hours for this sub-module	**7**	**-**	**28**
2.	Milling, mashing and wort separation systems. The hop-boil and copper adjucts, wort clarification, cooling and aeration.	a.Preparation of malt powder	3		
					8
		b.Preparation of mash and mashing			8
		c. Seperation of mash			8
		d. Wort boiling			8
		Total hours for this sub-module	**3**	**-**	**32**
3.	Fermentation process development, scale of up process. Contamination of beer during processing and effect of contaminants on quality of beer.	a. Wort seperation	3		
					8
		b.Fermentation			8
		c. clarification of beer			8
		d. Aging of beer			8
		Total hours for this sub-module	**3**	**-**	**32**
4.	Monitoring and controlling of	a.Sensory evaluation of Beer.	3		

	fermentation parameters of beer				8
		b. Stuck Fermentation: Causes and Solutions in brewery			8
		c.Removal of protein from beer by hydrolysis, precipitation and adsorption method.			8
		d.Major problems in Beer production. Defects in Beer			8
	Total hours for this sub-module		**3**	**-**	**32**
5.	Brewery equipments	a. Studies on factors affecting quality of beer.	3		
					8
		b. Fermentors		4	6
		c. **Oak Wood Barrels and its Effect on Flavour of beer**			6
		d. Design of Brewery equipments		8	
	Total hours for this sub-module		**3**	**12**	**20**
6.	Types of beers, aging of beers Contamination of beer during processing and effect of contaminants on quality of beer. Water treatment plants	a. Contamination of beer during processing and effect of contaminants on quality of beer.	3		
					8
		b. Cold Stabilizer			8
		c. Chilling Plant and Heat exchanger		8	
		d. Water treatment plants		8	
	Total hours for this sub-module		**3**	**16**	**16**
7.	Hops: composition, acids, chemistry of brewing.	a. Fining equipments (Filtration)	3		
				8	
		b. Bottling, Corking, labeling, foiling and Packing unit		8	
		c. Nutritional and Health Benefits of beer			8
		d. Analysis of lagar beer			8
	Total hours for this sub-module		**3**	**16**	**16**
8.	Packaging technology, labeling, storage of beers and marketing of beer etc.	Hops: chemistry	3		
		a. Analysis of hops for acids			8
		b.Brewers yeast: Morphology			8
		c. Physiology of brewers yeast			8
		d. Marketing and Standards of beer		8	
	Total hours for this sub-module		**3**	**8**	**24**
9.	***Cleaning and Sanitation in brewery***	a. Tartarate and bitartarate stability test / cold stability test	3		
					8
		b. Determination of acetaldehyde / phenol content of beer			8

	General cleaning and sanitizing program Cleaning methods:CIP, Clean-out-of-Place Manual cleaning Properties of food soils Cleaning agents Sanitizers: Physical and chemical, Factors affecting effectiveness of sanitizer International rules and standards for beers				
		c. Spoilage of beer			8
		d. Adulteration of beer			8
	Total hours for this sub-module		**3**	**-**	**32**
10.	Project report Introduction, Market survey, Raw materials, Process of manufacture, plant & machinery, land & building, Project economics, Annexures of charts/financial aspects	a.Cleaning and Sanitizing agents	3		
					8
		b. Beer bottle washing			8
		c. Corking of beer and pressure of CO2			8
		d. Visit to the brewery			8
	Total hours for this sub-module		**3**	**-**	**32**
Total Contact Hours Individually for Theory, Demonstration and Practical			**34**	**52**	**264**
Grand Total of Contact Hours			**350**		

T- Theory, D- Demonstration, P- Practical

9. Lists of Tools and Equipments for a Batch

S. No.	Description	Quantity
1	Grinders	2
2	Chilling plant, bottling unit,	1
3	Autoclave,	1
4	Hot air oven,	1
5	Incubator,BOD Incubator,	1
6	Deep freezer,	1
7	Refrigerator,	2
8	Laminar air flow bench,	1
9	Vortex mixer/shaker,	5
10	Hot plate,	1
11	Water bath shaker incubator,	1
12	PH meter,	10
13	Colorimeter,	1
14	Compound microscopes (5),	1
15	Steel distillation plant,	1
17	Analytical weighing balance,	1
18	Paper chromatographic cabinet,	1
19	TLC assembly,	1

20	Homogenizer,	1
21	Magnetic stirrer,	1
22	UV-Visible spectrophotometer,	1
23	Fabricated S.S. Fermenter (50 L),	1
26	Hydrometer,	2
27	Refractometer,	5
29	Centrifuge	1

10. Space Required for Conducting the Module (in square feet):

a. Theory Class Room : 500 sq. ft.
b. Demonstration & Practical Class Room : 1600 sq.ft.

11. Power requirement **:** 220 v 3 phase

12. Qualifications of Instructor : BSc (Food Science & Technology)
M.Sc. (Packaging Technology)

11. Power requirement

12. Qualifications of Instructor

B.Sc. or M.Sc. in Food Science and Technology (or) B.Tech or M.Tech in Food Engineering
Diploma in Brewing Technology or Fermentation Technology

13. Suggested Readings

Text Books

1. Brewing Science and Practice by Briggs, Boulton, Brookes and Stevens 2004, Woodhead Publishing Limited, USA.
2. Food Biotechnology edited by Kalidas Shetty, Gopinadhan Paliyath, Anthony Pometto and Robert E. Levin, Taylor & Francis Group 2006.
3. Biotechnology by B. D. Singh, Kalyani publication, 2000.
4. Fermentation a practical approach by McNeil and L M Harvey, published in the
5. Practical Approach Series, Indian publication, 2007.
6. Microbial Technology Vol. I and II by Peppler and Perlman.

MODULE -21

1	**Title of the Module**	:	**Food Packaging and Labeling**
2	**Sector**	:	Food Processing
3	**Code**	:	
4	**Entry Qualification**	:	Minimum 12th Standard
5	**Minimum Age**	:	17 yrs.
6	**Terminal Competency**	:	After completion of this training the participant would be able to a) To familiar the students with the operation and maintenance of modern as well as traditional packaging methods b) To train the students to determine the appropriate packaging requirement for a food material c) To familiar the students with the various food standards, laws and regulations while trading a food material
7	**Duration (in Hrs)**	:	295 hours

8. Module Contents

S. No.	Theory	Practical	Contact Hours		
			T	**D**	**P**
1	Definitions, objectives and functions of packaging and packaging materials - types of packaging materials: paper: glass, methods of bottle making; metals: tinplate containers, tinning process, components of tinplate, types of cans, aluminum containers, lacquers; plastics: types of plastic films, laminated plastic materials	Testing of packaging materials for quality assurance like determination of thickness, GSM, grease resistance, bursting strength, tearing resistance, WVTR, puncture resistance			
	Total hours for this sub-module		**8**	**15**	**25**
2.	Properties of packaging materials such as tensile strength, bursting strength, tearing resistance, puncture resistance, impact strength, tear strength, methods of testing and evaluation; barrier properties of packaging materials; theory of permeability, factors affecting permeability, permeability coefficient, gas transmission rate and its measurement, water vapor	Familiarization of types of packaging material, Measurement of tin coating weight by Clarke's method Visit to a package manufacturing plant			

	transmission rate and its measurement				
	Total hours for this sub-module		**8**	**15**	**25**
3.	Packaging equipment and machinery - vacuum machine; gas packaging machine; seal and shrink packaging machine; form and fill sealing machine; aseptic packaging systems; bottling machine; carton making machine	Vacuum packaging and determination of storage life Testing the compression strength of the boxes			
	Total hours for this sub-module		**8**	**15**	**25**
4.	Food packaging systems- different forms of packaging such as rigid, semirigid and flexible forms, retortable pouches - packaging system for dehydrated foods, frozen foods, dairy products, fresh fruits and vegetables, meat, fish, poultry, sea foods, vanaspati ghee & basamati rice	Packaging of food material in seal and shrink packaging machine and study its shelf life, Testing of strength of glass containers by thermal shock test, Testing of strength of filled pouches by drop tester			
	Total hours for this sub-module		**8**	**15**	**25**
5.	Standard packages - package laws and regulation – general guidelines on giving declarations - SWMA, PFA rules, Ingredients, FPO rules, MFPO rules, Agmark rules	Packaging of powder foods and estimation of shelf-life Visit to a food packaging plant			
	Total hours for this sub-module		**8**	**15**	**25**
6.	**Food Packaging and Labelling** Labeling requirements for packed food and food products as per FSSA 2006, SWMA and nutritional labeling requirements.	Visit to food package manufacturing industries			
	Total hours for this sub-module		**10**	**20**	**25**
Total Contact Hours Individually for Theory, Demonstration and Practical			**50**	**95**	**150**
Grand Total of Contact Hours			**295**		

T- Theory, D- Demonstration, P- Practical

9. Lists of Tools and Equipments for a Batch

S. No.	Description	Qty
1.	Vacuum packaging machine	1
2.	Texture Analyzer	1
3.	Form & fill sealing machine	1
4.	Gas packaging machine	1
5.	Seal & shrink packaging machine	1
6.	Fruit & vegetable packaging (bag) machine	1

7.	Bottle filling machine	1
8.	Carton making machine	1
9.	Cup filling machine	1
10.	Ghee packaging machine	1
11.	Drop Tester	1
12.	Crush Tester	1
13.	Shear Tester	1
14.	Slip Friction Tester	1
15.	Thickness Tester	1
16.	Cobb Tester	1
17.	Vibration Tester	1
18.	Water vapor permeability tester	1
19.	Mechanical tool box	1 set
20.	Electrical tool box	1 set
21.	Chemicals, glass ware, packaging materials	as per the requirement

10. Space Required for Conducting the Module (in square feet):

a. Theory Class Room : 500 sq. ft.
b. Demonstration & Practical Class Room : 1600 sq.ft.

11. Power requirement **:** 3 phase connection

12. Qualifications of Instructor

B.Sc. or M.Sc. in Food Science and Technology (or) B.Tech in Food Engineering
Diploma in Food Science and Technology or Food Engineering with special training
Diploma in Packaging Technology

13. Suggested Readings

Text Books

1) Coles R, McDowell D & Kirwan M.J. 2003. *Food Packaging Technology*. Oxford Blackwell.
2) Crosby NT. 1981. *Food Packaging Materials*. Applied Science Publication.
3) Gordon L Robertson. 2006. *Food Packaging: Principles and Practice*. 2nd Ed. CRC Press.
4) Mahadeviah M & Gowramma RV. 1996. *Food Packaging Materials*. Tata McGraw Hill.
5) Raija A. 2006. *Novel Food Packaging*. Woodland Publication Co.
6) Sacharow S & Grittin RC. 1980. *Principles of Food Packaging*. AVI Publication.
7) *Modern packaging technology*, EIRI Board of Consultants and Engineers.

MODULE – 22

1.	**Title of the Module**	:	**Food Safety and Microbial Analysis**
2.	**Sector**	:	Food processing industries and R & D units
3.	**Code**	:	
4.	**Entry Qualification**	:	Minimum graduate with Science (Biology /Medical) stream
5.	**Minimum Age**	:	20 yrs
6.	**Terminal Competency**	:	After completion of the course the candidate will be able to: a) Understand the beneficial uses of micro-organisms in the food industry b) Utilize laboratory techniques to identify micro-organisms in foods; c) Understand the role and significance of microbial inactivation, adaptation and environmental factors (i.e. pH, temperature etc.) on the growth and response of micro-organisms in food industries ; d) Identify the important pathogens and spoilage Microorganisms in foods and the conditions under which they grow; e) Identify the conditions including sanitation practices, under which the important pathogens and spoilage micro-organisms are commonly inactivated, killed or made harmless in food processing
7.	**Duration (in Hrs)**	:	320 hours

8. Module Contents

S.No.	**Theory**	**Practical**	**Contact Hours**		
			T	**D**	**P**
1	Importance of Food microbiology in food industry. Occurrence of Microorganisms and Sources of Microorganisms in food. Identification of microorganisms by direct methods like Morphology, Arrangements of bacterial cells, Structure and Chemical composition and indirect method like detection of degradative enzymes as proteases, lipases, amylases, and cellulases. Differentiation of bacteria, fungi and actinimycetes occurring in food.	Good laboratory practices, cleanliness, sanitation and safety measures to be adopted in a food microbiology lab.			
	a. Importance of Food microbiology in food industry. Occurrence of microorganisms and their role	a. Glassware handling and usage, washing, identification and care of equipments, lab facilities	3	2	3

	b. Sources of Micro-organisms in food	b. Selection and storage of chemicals, media ingredients, sanitation and hygiene practices for rooms, articles, personnel	3	2	3
	c. Major Characteristics of micro-organisms	c. Cleaning of work surface, hands, needles, loops; Disposal methods for used articles, hazard prevention	3	2	3
	d. Morphology, Structure and nomenclature of micro-organisms	d. Protocols: preparation of solutions required for media, cotton plug making for tubes, flasks, pipettes.	3	2	3
		Total hours for this sub-module	**12**	**8**	**12**
2.	Nature of food spoilage by microorganisms (bacteria, fungi, and virus), enzymes, pets and rodents.	Influence of various intrinsic and extrinsic parameters on the microbial activity during food storage.			
	a. Food spoilage & different types of food contaminations	a. Various types of media and their preparation in lab Sterilization of media – Steam sterilization, intermittent steaming, dry hot air, filter sterilization.	3	2	3
	b. Spoilage caused by microbes (bacteria, fungi, and viruses), enzymes	b. Sampling and, Cultivation of micro-organisms: Serial dilution techniques, Membrane filtration	3	2	3
	c. Spoilage of foods, caused by pets and rodents	c. Enumeration and identification of coliforms from water using MPN technique.	3	2	3
	d. Contamination and spoilage of: Cereals and pulses	d. Examination of spoilage in foods.	3	2	3
		Total hours for this sub-module	**12**	**8**	**12**
3.	Contamination and spoilage of: Cereals and pulses; sugar and sugar products; Sourses of microbial spoilage in vegetables and fruits and detection; Microbial spoilage of flesh foods; eggs; milk and milk products.	Handling of bacteria, yeasts and fungi and pure culture techniques, aerobic and anaerobic systems, broth inoculation, agar tube inoculation			
	a. Food contamination and Toxin production : Contamination and spoilage of sugar and sugar products	a. Handling of bacteria, yeasts and fungi and pure culture techniques broth inoculation, agar tube inoculation	3	2	3
	b. Contamination and spoilage of vegetables and fruits	b. Handling of bacteria under aerobic and anaerobic systems	3	2	3
	c. Microbial contamination and spoilage	c. Detection of *E. Coli, Yersinia,*	3	2	3

	of flesh foods/ meat & eggs	*Staphylococci, & Salmonella* from food samples			
	d. Microbial contamination and spoilage of milk and milk products.	d. Detection of *Campylobacter, Bacillus cereus, Cl. botulinum* from food samples	3	2	3
		Total hours for this sub-module	**12**	**8**	**12**
4.	Techniques of preservation in food processing industries - canning, controlled atmosphere, cold storage and drying Water activity, intrinsic and extrinsic parameters influencing storage of processed food.	Identification and examination of spoiled canned food Rapid analysis for testing the quality of milk. Detection of *Staphylococci, yersinia, campylobacter, B.cereus, Cl.botulinum & Salmonella* from food samples in selective and differential media.			
	a. Physical conditions required for growth of food microbes	a. Visual examination of microbial growth, description of colony morphology, turbidity measure by colorimetry.	3	2	3
	b. Microbial Examination of common food items	b. Preparation of smears, use of monochrome staining, gram stain, acid fast stain,	3	2	3
	c. Maintenance and preservation of pure cultures	c. Microscopic examination : Bright field and UV fluorescent microscopy	3	2	3
	d. Normal Growth Cycle (growth curve) of bacteria, growth phases, synchronous growth and continuous culture	d. Magnification, use of stage micrometer and ocular disc for determining the size of microorganisms	3	2	3
		Total hours for this sub-module	**12**	**8**	**12**
5.	Types of microbial spoilages and detection in in the canned food-flat and flipper,Spoilage of processed meat, fish, milk and milk products	Sampling and, Cultivation of micro-organisms: Serial dilution techniques, Membrane filtration Enumeration and identification of coliforms from water using MPN technique.			
	a. Pure cultures and cultural characteristics	a. Staining techniques and handling of microscopes	3	2	3
	b. Mixed cultures; selective methods	b. Preparation of smears, use of monochrome staining, gram stain, acid fast stain	3	2	3
	c. Methods isolating pure cultures	c. Techniques for Spore stain and capsule stain	3	2	3
	d. Maintenance and preservation of pure	d. Techniques for flagella stain, and	3	2	3

	cultures	fluorescent staining			
		Total hours for this sub-module	**12**	**8**	**12**
6.	Microbial Examination of Food: Pure cultures and cultural characteristics – Mixed cultures; selective methods – Methods isolating pure cultures – Maintenance and preservation of pure cultures.Physical conditions required for growth – Temperature, Gaseous requirement, pH, miscellaneous physical requirement. Light microscopy and staining techniques for identifying microorganisms-simple and differential staining techniques.	Influence of various intrinsic and extrinsic parameters on the microbial activity during food storage. Identification and examination of spoiled canned food Rapid analysis for testing the quality of milk. Detection of *Staphylococci, yersinia, campylobacter, B.cereus, Cl.botulinum & Salmonella* from food samples in selective and differential media.			
	a. Beneficial activities of microbes in foods	a. Microbial fermentation	3	2	3
	b. Probiotics : their use in Food Microbiology	b. Wine fermentation microbes	3	2	3
	c. Role of microorganisms in pickled products	c. Probiotic fermentation and food production	3	2	3
	d. Role of microorganisms in jams	d. Industrially important food enzyme production	3	2	3
		Total hours for this sub-module	**12**	**8**	**12**
7.	Cultural media-liquid, solid and semisolid media. Simple media, selective media, enrichment media and differential media and their use	Visual examination of growth, description of colony morphology, turbidity measure by colorimetry.			
	a. Microorganisms used in food fermentations	a. Examination of microorganisms from floors, equipments, plants, machineries	3	2	3
	b. Fermented food and beverage production – wine & beer	b. Examination and identification of first and second stage of cell morphology	3	2	3
	c. Microbiology of traditional fermented foods - *Idli, Dosa*,	c. Use of disinfectants, phenol coefficients	3	2	3
	d. Microbiology of curd and yogurt	d. Tests for establishing sensitivity to chemicals, antibiotics, chemo-therapeutics, and minimal inhibitory concentrations.	3	2	3

		Total hours for this sub-module	**12**	**8**	**12**
8.	Food safety: definition, food safety issues, factors affecting food safety, importance of safe foods. Food additives and contaminants: various kinds of additives- food colour. Preservatives, artificial sweetners, toxins, adulterants and pesticide residues	Staining techniques Preparation of smears, use of monochrome staining, gram stain, acid fast stain, spore stain, capsule stain, flagella stain, fluorescent stain, staining, card and handling of microscopes.			
	a. **Introduction to food safety**: definition, food safety issues	a. Techniques used in **Food quality analysis**	3	2	3
	b. Factors affecting food safety, importance of safe foods.	b. Determination of food pathogens in processed foods	3	2	3
	c. **Food additives and contaminants**: various kinds of additives- food colours	c. Aflatoxin detection by TLC	3	2	3
	d. Preservatives, artificial sweetners, toxins, adulterants and pesticide residues	d. Aflatoxin detection by TLC	3	2	3
		Total hours for this sub-module	**12**	**8**	**12**
9.	**Sanitation** in food processing plant, Sanitizers- detergents, disinfectants. **Food quality evaluation-** sensory, physical, chemical and microbiological tests.	**Microscopic examination** Bright field; UV fluorescent microscopy, magnification, use of stage micrometer and ocular disc for determining size of microorganisms.			
	a. **Sanitation** in food processing plant	a. Determination of Synthetic color in foods	3	2	3
	b. Sanitizers- detergents, disinfectants	b. Determination of Food Preservatives -I	3	2	3
	c. **Food quality evaluation**	c. Determination of Food Preservatives -II	3	2	3
	d. Sensory, physical, chemical and microbial tests for evaluation of food quality	d. Determination of artificial sweetners by UV Spectro-photometric method	3	2	3
		Total hours for this sub-module	**12**	**8**	**12**
10.	**Food safety standards-** regulatory agencies- Bureau of Indian Standards (BIS), AGMARK, ISO. Concepts of GMP, HACCP.	**Food quality analysis** Determination of food pathogens in processed foods			
	a. **Food safety standards-** regulatory agencies- Bureau of Indian Standards (BIS)	a. Detection of common food adulterants in raw / unprocessed foods - I	3	2	3
	b. Food Safety Standards : AGMARK	b. Detection of common food adulterants in raw / unprocessed foods - II	3	2	3
	c. ISO Certification	c. Detection of common adulterants	3	2	3

		in processed foods - I			
	d. Concepts of GMP, HACCP	d. Detection of common adulterants in processed foods - II	3	2	3
		Total hours for this sub-module	**12**	**8**	**12**
Total Contact Hours Individually for Theory, Demonstration and Practical			**120**	**80**	**120**
Grand Total of Contact Hours			**320**		

T- Theory, D- Demonstration, P- Practical

9. Lists of Tools and Equipments for a Batch

S.No	Experiment	Name of the Instrument	Qnty.
1.	Sterilization techniques and equipments, Preparation of culture media	Auto clave Horizontal	1
2.			
3.	Isolation of microorganisms & Enumeration	Incubators	1
4.	Examination of anaerobic microorganisms in food	Anaerobic jar	1
5.	Detection of Biological oxygen demand for the microorganisms	BOD incubator	1
6.	Preservation of foods at low temperature and for storage of microbial cultures	Refrigerator	1
7.	Distilled water for experiments	Water Distillation System	1
8.	Burning laboratory harmful waste, converts to ash, discarding purpose.	Electrical Incinerator	1
9.	Food preservation with chemicals and at low temperature	Deep freezer	1
10.	Moisture studies for food samples,	Desiccators	1
11.	Enumeration of microorganisms in food by aerobic plate count method, Enumeration of yeast and molds in foods by direct plating technique	Micro Pipettes 1ml fixed 1ml variable 10 ml	2 2 2
12.	Sample preparation, filtration for isolation and purification of microorganisms	Membrane filtration unit	1
13.	Preparation of culture media.	pH /EC /TDS meter	1
14.	Sterilization techniques and equipments.	Hot Air Oven	1
15.	Microbiological works	Vertical Laminar Flow Chamber	Each 1 No
16.	Reagent preparation, Serial dilution etc	Vortex mixture	2 Nos
17.	Reagent preparation, Sample preparation, Serial dilution, etc	Magnetic stirrer with hot plate	1
18.	Sterilization techniques and equipments.	Sonicator	1
19.	Media preparation and other experiments	water bath	1
20.	Estimation of toxin production in foods by molds, Rapid detection of food borne pathogens	TLC Set	1
21.	Washing of glassware washing and other utensils	Dish washer	1
22.	Isolation of microorganisms & Enumeration.	colony counter	2
23.	Drying of Food products and microorganisms Encapsulation of probiotic bacteria	Freeze Dryer	1
24.	Microbial growth determination	UV Spectrophotometer	1

25.	Enumeration of microorganisms in food by aerobic plate count method	Air sampler	1
26.	Microscopic examination of microorganisms	Dark field and phase contrast Digital Microscope	1
27.	Bacterial cell count	Haemocytometer	1
28.	Microbial growth determination	Shaking Incubator	1
29.	Microbial growth determination	Fermentor	1
30.	Media preparation	pH meter	1
31.	Extraction	centrifuge	1
32.	Sampling	Heating mantle	1
33.	Weighing of food samples	Electronic balances	2
34.	safety precautions	Fire extinguisher	1
35.	medical safety precautions	Eye washer	1
36.	Microbiological work	Bunsen burner	2
37.	Microbiological work	Spirit lamp	2
38.	Temperature recording	Thermometer	2
39.	Microbiological work	Plate spreader	2
40.	Microbiological work	Auto Loop sterilizer	1
41.	Microbiological work	Inoculating loop	5
42.	Nutrient agar medium, nutrient broth, Potassium dihydrogen phosphate, Peptone, Sodium chloride Potassium dichromate , Conc. Sulphuric acid . Sterile sampling bags, Agar , Plate count agar ,Yeast and mold agar , Potato dextrose agar ,Chlortetracycline hydrochloride, Tartaric acid , Lauryl tryptose broth , Brilliant green bile broth , EC medium , Levines Eosin methylene blue agar , Tryptone ,MRVP test reagent , Koser Citrate medium .p-dimethyl aminobenzaldehyde (for Kovacs reagent), Baird-Parker agar , Trypticase soy broth , Sodium pyruvate , Brain heart infusion broth , Coagulase plasma,Toluidine blue ,SS agar, MSA agar, EMB agar, Macconkey agar, MRS agar, MRS broth, Sodium Hydroxide, Hydrochloric acid, buffer tablets	Chemicals	-
43.	Autoclavable petridishes, culture tubes, beakers, conical flasks, measuring cylinders, absorbent & Nonabsorbent cotton, Autoclavable Test tubes, Autoclavable screw cap tubes, Burette borosilicate , Burette stands , Measuring cylinders graduated, Universal bottles, McCartney bottles, Funnels glass, Buchner flasks, Beakers, Conical flasks , Volumetric flasks, Milk dilution bottles with screw caps, glass Pipettes, Glass bottles with polypropylene (autoclavable) screw caps, Durham tubes and Brushes for bottle washing.	Glassware's	-
44.	Test tube stand, petri plate holders,pH paper, Aluminium foil, autoclavable micro tips, Enamel trays	Plastic wares	-

10. Space Required for Conducting the Module (in square feet)

a. Theory Class Room : 40' X 30'

b. Demonstration & Practical Class Room : 50'x40'

11. Power requirement : 3 phase power connection

5 KW

12. Qualifications of Instructor

B.Sc. or M.Sc. in Agricultural or General Microbiology

Diploma in Food Microbiology or Food Safety

13. Suggested Readings

Text Books

1) Food Microbiology – Adams
2) Food Microbiology by W. C. Frazier & D.C. Westhoffs, IV th edn., TMH (1993).
3) An Introduction of Microbiology _ P. Tauro
4) Food Microbiology – James M. H Jay
5) Food Hygiene, microbiology & HACCP – 3rd edition – S.J. Forsythe & P.R. Hayes
6) Developments in Food Microbiology, R. Davis. Appl.Sci.Publ, London 2004
7) Fermented Food Biotechnology H. A. Modi Aavishkar Publisher, Jaipur 2011
8) Graham, H.D. 1980: The safety of foods, AVI publishing company Inc. Westport.
9) Shapton DA (1994). Principles and practices of safe processing of foods. Butterworth Publication, London.
10) Winton AL (1999) Techniques of food analysis, Allied Science Publications New Delhi.
11) Pomeranze Y (2004). Food analysis - Theory and Practice CBS Publications, New Delhi.
12) Jacob MB (1999). The chemical analysis of foods and food products. CBS Publ. New Delhi
13) Guide to Improve Food Hygiene - Gaston and Tiffney
14) Practical Food Microbiology & Technology - Harry H. Weiser, Mountney, J. and Gord, W.W.
15) Food Poisoning and Food Hygiene - Betty C. Hobbs
16) Principles of Food Sanitation - Marriott and Norman, G.
17) Hygiene and Sanitation in Food Industry - S. Roday
18) FundamentalFood Microbiology. (4th Edition). Bibek Ray, Arun Bhljnia; CRC Press.
19) Modern Food Microbiology. (6th Edition). James M. Jay.
20) Manual of Methods of Analysis of Foods**.** Food Safety and Standards Authority of India. Ministry of Health, Govt. of India
21) Basic Food Microbiology. John E. Rushing, P.A. Curtis, A.M. Fraser*, D.P. Green,. D.H. Pilkington, D.R. Ward and L.G. Turner.

MODULE – 23

1	**Title of the Module**	:	**Food Supply Chain Management**
2	**Sector**	:	Food Processing
3	**Code**	:	
4	**Entry Qualification**	:	12th Standard
5	**Minimum Age**	:	18 yrs.
6	**Terminal Competency**	:	After completion of this training the participant will be able to a) Become an entrepreneur b) Marketing professional in food business c) Logistics provider d) Food Trading
7	**Duration (in Hrs)**	:	3 months (350 contact hours)

8. Module Contents

S. No.	Theory	Practical	Contact Hours		
			T	D	P
1	Supply chain, logistics, Evolution of logistics concept, Logistical mission and strategic Issues, Logistics in India, Imporatance of logistics management, Stratigic logistics planning process, Operational objectives, Components of logistics management, Functions of logistics management, Intigrated logistics system, Agribusiness Environment & Policy - Agricultural Production Management - Business Ethics & Global Business Environment Sources of cereals and legumes, fruits aand vegetables, milk and milk products, meat and meat products, marine products in India, its importance in national economy. Supply chain business opportunities, Market, Assessment, Technical Analysis, and Financial Analysis, Forecasting, Facilities and Aggregate Planning. Food Processing Unit Operations -1	Stratigic logistics planning process, Functions of logistics management, Intigrated logistics system,	5		
	a. Introduction	a. Elements of the supply chain		6	

	Business logistics The supply chain Importance of Logistics/Supply Chain (SC) Costs analysis Logistics customer service Supply and distribution lines lengthening with greater complexity Quick customized response Logistics Food supply chain management from farm to fork, Elements of the supply chain, Transport and storage, Social and environmental concerns associated with the food supply chain				
	b.	b. Life Cycle Assessment Studies of Food Products			12
	c.	c.Detection of micrbial spoilage of food			8
	d.	d. Sensory evaluation of food			4
		Total hours for this sub-module	**5**	**6**	**24**
2.	Post Harvest Food Management - Supply Chain Management The major cold chain technologies Dry ice, Gel packs, Eutectic plates, Liquid nitrogen, Quilts, Reefers Refrigerated Containers Managerial Economics		3		
	a.	a.The Cold Chain		2	
	b. Fresh Food and Supply Chain Management Challenges	b. The major cold chain technologies: Dry ice,			10
	c. Life Cycle Assessment Studies of Food Products	c. Gel packs,			10
	d. Retail logistics: changes and challenges Retail logistics and supply chain Transformation The Cold Chain and its Logistics, From a geographical perspective, the cold chain has the following impacts: The major cold chain technologies Dry ice, Gel packs, Eutectic plates, Liquid nitrogen, Quilts, Reefers	d. Eutectic plates,			10

	Refrigerated Containers Value Chain, Global Value Chain				
		Total hours for this sub-module	**3**	**2**	**30**
3.	Principles of Logistics: Production and sale of food products at globale level, and the life cycle of the product is short. The right and wrong of logistics are influencing the success or failure of corporate management. Learning CSF(critical success factor) of Logistics through the study of successful food industry. Quantitative Management Analysis		2		
	a.	a.Liquid nitrogen,			10
	b.	b.Quilts, Reefers			10
	c.	c.Refrigerated Containers			10
	d.	d.Study of retail logistics		3	
		Total hours for this sub-module	**2**	**3**	**30**
4.	Food safety The risk management, internationally agreed definition, framework and process of risk management. Risk analysis, risk assessment, risk management and risk communication. Food Safety and Standards - Agricultural Marketing - Production and Operations Management Commodity Markets and Futures Trading - Retail Management - Management Concepts - Business Communication	Food Processing Unit Operations- 2	5		
	a.	a.Safety in the supply chain: Biological hazards			
	b.	b. Isolation of *Salmonell*			10
	c.	c. Isolation of *S. aureus*			10
	d.	d.Study of physical hazards			10
		Total hours for this sub-module	**5**	**-**	**30**
5.	Organizational Behavior - Human Resource Management - Financial Management of Agribusiness Managerial Accounting and Control		5		
	a.	a. Study of different packages			8

	b.	b. Properties of packaging material: physical			8
	c.	c. Properties of packaging material: chemical			8
	d.	d.Visit to packaging industry		6	
		Total hours for this sub-module	**5**	**6**	**24**
6.	Function of a package, packaging materials, their structural qualities and performance including moisture and gas transmission, interaction of food and the packaging material, methods of package testing, performance evaluation and design of packaging systems for plant and animals products. Food packaging and law, shelf life testing, modern and traditional packaging material, physical and chemical properties, production, storage and recycling of packaging materials, regulation and equipment analysis of various existing packaging system and standards.Smart and intelligent packaging. Micro Finance for Agribusiness - Rural Marketing	Food Processing Unit Operations- 3	5		
	a.	a.Special packaging methods : vacuum,			8
	b.	b. Special packaging methods : gas			8
	c.	c. Special packaging methods : shrink packaging			6
	d.	d.MAP			8
		Total hours for this sub-module	**5**	**-**	**30**
7.	Economic Environment and Business Laws - Agribusiness Cooperative Management	Research Methodology for Management	4		
	a.	a.Preparation of project report			10
	b.	b.Management of finance			5
	c.	c.Study of present hadling practices			8
	d.	d.Visit to mandi			8
		Total hours for this sub-module	**4**	**-**	**31**
8.	Traceability system: In order to nurture a diverse viewpoint capable of understanding and analyzing traceability, Recalls	Information Technology and Systems for Management	3		
	a.	a.Barcodes		8	
	b.	b.RFID		8	
	c.	c.Recalls		8	
	d.	d.Visit to logistic/supply chain		8	

		Total hours for this sub-module	**3**	**32**	**-**
9.	Quality Management in Agribusiness - Agribusiness and Society International food Legislation & StandardsConcepts and trends in food legislation. International and federal standards: Codex alimentarious, ISO series, food safety in USA. Legislation in Europe: EU, Enforcers of Food Laws Approval Process for Food Additives Nutritional Labeling. Distribution 1. Purpose of Quality Control : Raw Material Safety, Product Value, Accident Prevention QC Issues in Food System : Raw Material Sourcing, Manufacturer, Distributer, Retailer. Safety/Quality/Price required by consumers : Consumer Needs The practices of QC in wholesalers The practices of QC in retailers	Approach to and Current State of Food Safety Assurance: The Age of Food Shortage and the Age of Food Glut Deregulation: Advances in Distribution and Food Safety due to Deregulation Future of Indian Agriculture: Basic Food, Agriculture and Farming Community Planning, and the Transition to Agribusiness	7		
	a.	a. Global food supply chain		6	
	b.	b. Supply Chain Risk		6	
	c.	c. HACCP,GAP		8	
	d.	d. Current State of Food Safety Assurance		8	
		Total hours for this sub-module	**7**	**28**	**-**
10.	Contract Farming - International Agricultural Trade Project report Introduction, Market survey, Raw materials, Process of manufacture, plant & machinery, land & building, Project economics, Annexures of charts/financial aspects Food Trade Barrier Basis, trends and composition of India's Foreign trade. Analysis of Exim policy. Institutes for promotion of Indian agricultural/horticultural trade and export inspection agencies. Export documentation, Procedures etc. Role of Institute like	E-trading	**9**		

	Export/Imporkt Bank and ECGC (Export Credit Guarantee Corporation). Food Regulation in an open economy, Trade related regulations, Global food Regulatory Framework, food safety, Regulating Quality, Emerging Food Regulation. safety/ risk management, CSR (Corporate Social Responsibility)、risk communication, etc. in food supply chain. ***Cleaning and Sanitation in supply chain***				
	a.	a. Visit and study of the level of "Food Safety Administration" in Wholesalers and Retailers of Food		6	
	b.	b.Visit to contract and cluster farm		6	
	c.	c.Preparation of project report		6	
	d.	d. Visit to fruit exopting unit		8	
		Total hours for this sub-module	**9**	**26**	**-**
Total Contact Hours Individually for Theory, Demonstration and Practical			**48**	**103**	**199**
		Grand Total of Contact Hours	**350**		

T- Theory, D- Demonstration, P- Practical

9. Lists of Tools and Equipments for a Batch

S.No.	Particulars	Quantity
1.	Computer with internet and Software packages	10

10. Space Required for Conducting the Module (in square feet):

a. Theory Class Room : 500 sq. ft.
b. Demonstration & Practical Class Room : 1600 sq.ft.

11. Power requirement **:** 3 phase connection
5 kw

12. Qualifications of Instructor

BBA or MBA with specialization in Supply Chain Management
Diploma in Supply Chain Management

13. Suggested Readings

Text Books

1. Food Supply Chain Management: Economic, Social and Environmental Perspectives (Pullman, M. and Z. Wu, 2011: Routledge ISBN-10: 0415885884)
2. Food Supply Chain Management Eds by Michael A. Bourlakis and Paul W. H. Weightman, Published by Wiley-Blackwell. Amazon.com INC.
3. Food Supply Chain Management**Edited by:** Jane F. Eastham, Liz Sharples and Stephen D. Ball byElsevier Ltd.
4. Food Safety for the 21st Century: Managing HACCP and Food Safety throughout the Global Supply Chain byCarol Wallace, William Sperber, Sara E. Mortimore. Wiley, John & Sons,
5. Textbook of Logistics and Supply Chain Management by D.K. Agrawal Macmillan Publishers India Limited.

MODULE – 24

1	**Title of the Module**	:	**Skill Development in Sensory Assessment Techniques**
2	**Sector**	:	Food processing industries and R & D units
3	**Code**	:	
4	**Entry Qualification**	:	Graduate with Science stream
5	**Minimum Age**	:	230 yrs
6	**Terminal Competency**	:	After completion of the course the candidate will be able to: a) Develop proficiency skills in basic knowledge of sensorial testing of food and beverages b) Design and conducting the sensorial testing of food and beverages c) Data analysis of the response of the panelist d) Drawing conclusions of the sensorial testing
7	**Duration (in Hrs)**	:	350 hours

8. Module Contents

Sl. No.	**Theory**	**Practical**	**Contact Hours**		
			T	**D**	**P**
1	Basics of sensory science a. Pre-requisits for sensory analysis b. Definition of sensory analysis c. Knowledge on sensory vs organoleptic evaluation	Understanding the basics of sensory test	5	5	25
2.	Sensory characteristics of food Factors influencing the sensory evaluation a. Taste b. Odour c. Texture d. Flavour	Understanding the characteristics and factors affecting sensory evaluation	5	5	25
3.	Taste: an important sensory attribute a. Classification of basic taste b. Classification of foods based on taste c. Taste quality in food systems d. Food taste acceptance	Evaluation of taste of several products	5	5	25
4.	Programme of a course for panel finalization a. Theoretical concept of sensory test programme such as set of	Study the types of sensory evaluation for recognizing the four basic taste	5	5	25

	sensory test and panelist b. Types of sensory tests and its application with example c. Types of sensory panelist and basis of their uses in various sensory evaluation				
5.	Concept of sensory laboratory a. Strategic requirement for sensory laboratory b. Factors affecting its application for certain sensory test c. Components of the sensory laboratory	Understanding the sensory evaluation laboratory	5	5	25
6.	Threshold tests for four basic tastes a. Threshold types b. Determination of threshold concentration c. Factors affecting the results of threshold tests	a. Tests with sucrose concentration series b. Tests with sodium chloride concentration series c. Tests with pure water concentration series	5	5	25
7.	a.Concept of developing questionnaire: b.Basics of the statistical tests required for sensory data analysis, namely, ANOVA, t-test etc. in reference to min. number of judges or panelist required for conducting a certain test, procedure adopted and way to analyze data	Understanding the concept of sensory evaluation, data collection and analysis	5	5	25
8.	Sensory analysis a. Selection of sensory type b. Selection of evaluation panelist or judges for the selected sensory test c. Requirements of the sensory laboratory d. Preparing samples and conduct of test	Understanding the preparation for a sensory evaluation and conduct of test	5	5	25
9.	Concept of the Difference test a. Developing questionnaire for the selected test b. Selecting judges and analyzing their response	Understanding the preparation for a sensory evaluation and conduct of test	**5**	**5**	**25**
10.	Concept of the tests a. Developing questionnaire for the selected test b. Selecting judges and analyzing their response	Conducting sensory test to characterize the nature of difference using ranking test	5	5	25
Total Contact Hours Individually for Theory, Demonstration and Practical			**50**	**50**	**250**
		Grand Total of Contact Hours	**350**		

T- Theory, D- Demonstration, P- Practical

9. Lists of Tools and Equipments for a Batch

S. No.	Description	Quantity
1	Sensory laboratory with one sample preparation and master chamber and min. 20 panel chambers	1
2	Raw materials as per the laboratory test	1
3	Lab materials – glasswares	-
4	Kitchen equipments and materials	
5	Testing materials	
6	Tasting beakers	
7	Foods for testing	
8	Computer with statistical software	
9	Odorants, essential oils	

10. Space Required for Conducting the Module (in square feet):

a. Theory Class Room : 500 sq. ft.
b. Demonstration & Practical Class Room : 1600 sq.ft.

11. Power requirement **:** 3 phase connection 5Kw

12. Qualifications of Instructor

Diploma in Sensory Technology or Food Science and Processing or Food Technology
B.Sc. or M.Sc. in Food Science and Technology (or) B.Tech in Food Engineering
Diploma in Food Science and Technology or Food Engineering with special training

13. Suggested Readings

Text Books

1) Sensory science- Principles and Applications in Food Evaluation by V.K. Joshi published by Agrotech Publishing Academy, Udaipur 2006.
2) Sensory Evaluation: A Practical Handbook, by Sarah Kemp, Tracey Hollowood, Joanne Hort published by Wiley-Blackwell, UK, 2009
3) Sensory Evaluation of food: Theory and Practice. Gisela Jellinek, VCH Publications

MODULE - 26

1	**Title of the Module**	:	**Operation and Maintenance of Food Processing Equipment**
2	**Sector**	:	Food Processing and Preservation
3	**Code**	:	
4	**Entry Qualification**	:	ITI or Diploma
5	**Minimum Age**	:	20 yrs
6	**Terminal Competency**	:	After completion of the course the students will understand the basic knowledge on working principle and maintenance of food processing equipments
7	**Duration (in Hrs)**	:	350 hours

8. Module Contents

S. No.	Theory	Practical	Contact Hours		
			T	**D**	**P**
1	Pumps – Types - Selection - Specification - Industrial application - Centrifugal pump - Head developed by pump- Cavitations - Special effect pumps - Positive displacement pump - Compressors & Blowers	Performance evaluation of centrifugal and positive displacement pumps			
	a. Introduction and types of pumps	a. Evaluation of centrifugal pumps	3	5	3
	b. Compressors and blowers	b. Evaluation of plunger pumps	2		3
		c. Evaluation of gear pumps			3
		d. Maintenance of pumps			5
		e. Evaluation of compressor			3
		f. Evaluation of blower			3
		g. Maintenance of compressors and blowers			5
	Total hours for this sub-module		**5**	**5**	**25**
2.	Size Reduction, crushing & grinding -Laws of crushing - close circuit & open circuit - Dry & wet, free & choke grinding - Jaw crusher - Roll crusher - Hammer mill - Ball mill	Energy calculation in ball mill, attrition mill, roll crusher and Jaw			
	a. Theory of size reduction	a. Evaluation of ball mill	2	5	5
	b. Introduction of different types of mills	b. Evaluation of attrition mill	3		5
		c. Evaluation of ball mill			5
		d. Evaluation of ball mill			5
		e. Operation and maintenance of different mills			5

	Total hours for this sub-module		**5**	**5**	**25**
3.	Size enlargement operation Granulation - Flocculation-extrusion	Performance evaluation of cold extruder and extruder			
	a. Theory of granulation, flocculation	a. Practice with extruders	3	5	10
	b. Theory of extrusion	b. Operation and maintenance tips	2		15
	Total hours for this sub-module		**5**	**5**	**25**
4.	Mechanical Separation Operations Sampling - Screening - Elutriation - Froth Flotation - Jigging - Heavy media separation	Performance evaluation of mechanical separator (Spiral, indented, gravity)			
	a. Theory of Mechanical Separation equipment	a. Evaluation of spiral separator	5	5	5
		b. Evaluation of indented cylinder separator			5
		c. Evaluation of specific gravity separators			5
		d. Evaluation of air screen cleaners			5
		e. Maintenance of mechanical separators			5
	Total hours for this sub-module		**5**	**5**	**25**
5.	Particulate Separating Equipment Cyclone Separator-Bag Filter-Electrostatic Precipitator-Electromagnetic Separator	Performance evaluation of cyclone separator, bag filter			
	a. Basic principles of particle separation equipment	a. Evaluation of cyclone separator	3	5	5
	b. Applications of separation equipment	b. Evaluation of bag filter	2		5
		c. Evaluation electrostatic precipitator			5
		d. Maintenance and trouble shooting of particle separators			10
	Total hours for this sub-module		**5**	**5**	**25**
6.	Filtration and Washing, Constant Rate and Constant Pressure Filtration, Batch and Continuous Filtration equipment - Filter Aids-Simple problems	Performance evaluation of reverse osmosis, plate filter and centrifuge			
	a. Theory, principles and applications of filtering equipment	a. Practical on reverse osmosis	5	5	5
		b. Practical on plate filter			5
		c. Practical on centrifuge			5
		d. Design, maintenance and trouble shooting of filteration equipment			10
	Total hours for this sub-module		**5**	**5**	**25**
7.	Mixing & mixing equipment-Types of impellers used in stirred tank —	Performance evaluation of ribbon blender and kneader			

	Study of power consumption of mixers —Construction and working of stirred tank mixer & sigma mixer				
	a. Theory of mixing and mixing equipment	a. Evaluation of ribbon blender	5	5	5
		b. Evaluation of dough mixer			5
		c. Evaluation of planetary mixer			5
		d. Evaluation of cake mixer			5
		e. Repair and maintenance of mixers			5
	Total hours for this sub-module		**5**	**5**	**25**
8.	Different types of Conveyor Equipment- Belt Conveyor-Apron Conveyor-Bucket Elevator-Screw Conveyor- Pneumatic Conveyor	Performance evaluation of screw conveyor and bucket elevator			
	a. Construction and working principle of different types of conveyors	a. Operation and evaluation of belt conveyors	3	5	5
	b. Theory and application of apron conveyors	b. Operation and evaluation of screw conveyors	2		5
		c. Operation and evaluation of bucket elevators			5
		d. Operation and evaluation of apron conveyors			5
		e. Maintenance of conveyors			5
	Total hours for this sub-module		**5**	**5**	**25**
9.	Storage & Handling of Solids- Silos and Bins.	Evaluation of different insect traps			
	a. Basics of storage	a. Design practice of storage systems	3	5	5
	b. Bins, Silos and accessories	b. Selection of accessories of bins and silos	2		5
		c. Operation and maintenance of silos and bins			5
		d. Evaluation of insect traps			5
		e. Monitoring of solids in storage			5
	Total hours for this sub-module		**5**	**5**	**25**
10.	Dryers and Drying Equipment	Practice with dryers			
	a. Basic theory of drying	a. Evaluation of grain dryers	3	5	5
	b. Introduction to drying equipment	b. Evaluation of dryers for food processing – Tray dryer	2		5
		c. Evaluation of Drum dryers			5
		d. Evaluation of Vacuum dryers			5
		e. Evaluation of speciality dryers			5
	Total hours for this sub-module		**5**	**5**	**25**
Total Contact Hours Individually for Theory, Demonstration and Practical			**50**	**50**	**250**
Grand Total of Contact Hours			**350**		

T- Theory, D- Demonstration, P- Practical

9. Lists of Tools and Equipment for a Batch

S. No.	Description	Quantity
1	Centrifugal pump	2
2	Models of positive displacement pump	1
3	Ball mill	1
4	Attrition mill	1
5	Hammer mill	1
6	Cold extruder	1
7	Extrusion unit	1
8	Gravity separator	1
9	Cyclone separator	1
10	Bag filter	1
11	Spiral separator	1
12	Reverse osmosis equipment	1
13	Ribbon blender	1
14	Kneader	1
15	Screw conveyor	1
16	Bucket elevator	1
17	Insect traps	1 set
18	Roll crusher	1
19	Jaw crusher	1
20	Centrifuge separator	1
21	Drum dryer	1
22	Tray dryer	1
23	Vacuum dryer	1
24	Speciality dryer	1

10. Space Required for Conducting the Module (in square feet):

a. Theory Class Room : 600 sq.ft.
b. Demonstration & Practical Class Room : 1500 sq.ft.

11. Power requirement

Total power requirement **:** 50 kW

12. Qualifications of Instructor

BE or ME in Mechanical Engineering with background in Electrical Engineering
Diploma in Mechanical Engineering

13. Suggested Readings

Text Books

1) Unit operations of Chemical Engineering, 4th ed. / McCabe and Smith / McGraw-Hill Book Co. Ltd., New York and Kogakusha Co. Ltd., Tokyo
2) Introduction to Chemical Engineering / Badger & Banchero / McGraw-Hill Book Co. Ltd., New York and Kogakusha Co. Ltd., Tokyo
3) Introduction to Chemical Engineering / Ghosal, Sanyal and Dutta / Tata McGraw Hill, New Delhi
4) Chemical Engineering, Vol. 2 & 5 / Coulson & Richardson / Pergamon Press, Oxford
5) Principles of Unit Operations, 2nd ed. / Foust & others / John Wiley & Sons Inc., London

MODULE – 27

1.	**Title of the Module**	:	**Instrumentation and Automation in Food Industry**
2.	**Sector**	:	Food Processing and Preservation
3.	**Code**	:	
4.	**Entry Qualification**	:	Minimum graduate with Science stream preferably with mathematics
5.	**Minimum Age**	:	20 years
6.	**Terminal Competency**	:	After completion of the course the candidate will be able to: a) Develop proficiency in of instrumentation required in food industry. b) Monitor sensors and control systems with the food processing machines c) Suggest future expansion and modification to the existing instrumentation d) Manage crisis situations arising due to instrumentation failure
7.	**Duration (in Hrs)**	:	315 hours

8. Module Contents

S. No.	Theory	Practical	Contact Hours		
			T	**D**	**P**
1	Basics of electronics				
	a. Current laws, voltage laws and theorems	a. Familiarising with bread board- Resistor colour codes- Oscilloscope- Meters	3		5
	b. Resistance, Inductance and capacitance	b. Building simple circuits with RLC	3		5
	c. Network theorems	c. Checking network theorems	3		5
	d. Transformer basics	d. Transformer characteristics	3		5
		Total hours for this sub-module	**12**		**20**
2.	Diodes				
	a. Semi conductor basics	a. Understanding semi conductors	3		5
	b. PN Junction Diode	b. Diode chjaracteristics	3		5
	c. Diode as rectifiers	c. Building power supplies using rectifiers	3		5
	d. Zenor diodes	d. Bridge circuits	3		5
		Total hours for this sub-module	**12**		**20**
3.	Transistors				
	a. Bipolar junction transistors	a. Understanding transistors	3		5

	b. Transistor characteristics	b.Drawing Transistor characteristics	3		5
	c. Transistor as amplifier	c. Amplifier circuits	3		5
	d. Transistor as switch	d. Switching circuits	3		5
	Total hours for this sub-module		**12**		**20**
4.	Operational Amplifiers				
	a. Introduction- Impedance advantage of Op-Amps	a. Characteristics of inverting and non inverting op-amps	3		5
	b. Inverting and Non inverting amplifiers	b. Building Op-Amp summation and difference	3		5
	c. Difference, Summing, Differentiation and Integration functions of Op-Amp	c. Building Op-Amp circuits for integration and differentiation	3		5
	d. Op-Amp circuits for signal generation and signal processing	d. Building feed back circuits for signal generation and processing	3		5
	Total hours for this sub-module		**12**		**20**
5.	Oscillators and Filters				
	a. Transistor oscillators	a. Practice with different types of oscillator circuits	3		20
	b. Wien Bridge oscillators		3		
	c. RC phase shift oscillators		3		
	d. LC oscillators-Hartley and Colpitts type		3		
	Total hours for this sub-module		**12**		**20**
6.	Digital Electronics				
	a. Integrated circuits	a. Timer circuits with IC 555	3		5
	b. Logic Gates	b. Understanding different logic gates	3		5
	c. Advances in digital electronics	c. Building circuits with ICs	3		5
	d. Microprocessors	d. Tutorial with 8085 microprocessors	3		5
	Total hours for this sub-module		**12**		**20**
7.	Instrumentation				
	Static and dynamic characteristics of an instruments	a. Measurement of process variables	3		5
	b. Introduction to sensors and sensing elements for temperature, pressure, flow, level, speed, force, torque, pH, colour, opacity, viscosity, etc	b. Calibration and its importance	3		5
	c. Transducer	c. Working with transducers and associated circuitry	3		5
	d. Signal conditioning	d. Signal conditioning circuits	3		5
	Total hours for this sub-module		**12**		**20**
8.	Control Systems				
	a. Introduction to control system and controller	a. Practice with designing control circuits	3		20
	b. Types of control system, advantages and disadvantages		3		

	c. Comparison between on-off, PD and PID controllers		3		
	d. Selecting suitable control circuits with feed backs		3		
	Total hours for this sub-module		**12**		**20**
9.	Data logging				
	a. Datalogging basics	a. Data logger, microprocessor based data loggers and PLC operation	3		20
	b. Interface between data logger and sensors		3		
	c. Microprocessor and control circuits		3		
	d. PLC and its working		3		
	Total hours for this sub-module		**12**		**20**
10.	Automation				
	a. Introducing automation in food industry	a. Visit to corporate industries and study the features of HMI/SCADA systems	3		20
	b. HMI/SCADA systems for automation- Advantages of real time data of high precision		4		
	Total hours for this sub-module		**7**		**20**
Total Contact Hours Individually for Theory, Demonstration and Practical			**115**		**200**
Grand Total of Contact Hours			**315**		

T- Theory, D- Demonstration, P- Practical

9. Lists of Tools and Equipments for a Batch

S. No.	Description	Quantity
1	Working tables	5
2	Multi-meters	4
3	Power supply (const. current, const. voltage, variable voltage both for ac and dc	2 unit each
4	Diode	8
5	Training PCB	2sets
6	SCR application demonstration kit	2sets
7	OpAmp IC # 744 demonstration kit	2sets
8	IC #555 demonstration kit	2 sets
9	Logical gates demonstration kits (with all gates)	2 sets
10	Thermocouple/RTD/pressure/level/flow sensors use and calibration	2 sets
11	Data logger with compatibles item 10 sensors	1 set

10. Space Required for Conducting the Module (in square feet)

a. Theory Class Room : 600
b. Demonstration & Practical Class Room : 2000

11. Power requirement : 5 kW power.

12. Qualifications of Instructor :

BE or ME in Electronics and Instrumentation Engineering
Diploma in Electronics and Instrumentation Engineering

13. Suggested Readings

Text Books

1) Salivahanan, S. N. Suresh Kumar and A. Vallavaraj. 2006. Electronic devices and circuits. Tata McGraw-Hill Publishing Co. Ltd. New Delhi
2) Ernest O Doebelin, 1990. Measurement Systems – Application and Design. McGraw-Hill Publishing Co. London
3) Gupta B.R. 1999. Electronics and instrumentation. Second Ed. Wheeler Publishing, New Dehli
4) Singh, S.K. 2005. Industrial Instrumentation. 2nd Ed. Tata McGraw-Hill Publishing Co. Ltd. New Delhi

MODULE - 28

1.	**Title of the Module**	:	**Food Industry Business Management**
2.	**Sector**	:	Food Processing and Preservation
3.	**Code**	:	
4.	**Entry Qualification**	:	Minimum Bachelors Degree
5.	**Minimum Age**	:	20 yrs
6.	**Terminal Competency**	:	After completion of the course the candidate will be able to: a) Become an Entrepreneur b) Work as Marketing executive for Food Industry c) Work as Consultant for food Industry business d) Retail Store Executive e) Purchase Executive f) Warehouse Executive g) Logistics Executive
7.	**Duration (in Hrs)**	:	315 hours

8. Module Contents

S. No.	**Theory**	**Practical**	**Contact Hours**		
			T	**D**	**P**
1	Business Planning				
	a. Planning and its importance	a. Planning and its importance	3	-	5
	b. Decision making process	b. Decision making process	3		5
	c. Strategic and operational plans	c. Strategic and operational plans	3		5
	d. Planning tools (Budgets, Schedules, and Policies)	d. Planning tools (Budgets, Schedules, and Policies)	3		5
	Total hours for this sub-module		**12**		**20**
2.	Business Organzation				
	a. Basic ownership forms	a. Basic ownership forms	3	-	5
	b. Types of organization structures	b. Types of organization structures	3		5
	c. Management structures	c. Management structures	3		5
	d. Legal aspects of starting a business	d. Legal aspects of starting a business	3		5
	Total hours for this sub-module		**12**	**-**	**20**
3.	Business Leadership				
	a. Effective leadership qualities	a. Effective leadership qualities	3		10
	b. Leadership styles	b. Leadership styles	3		5
	c. Goal setting, advancement,	c. Motivating individual	3		10

	cross training, empowerment and self training	employees			
	Total hours for this sub-module		**9**	**-**	**25**
4.	Controlling Functions of Management				
	a. Mission, Vission, Goal and Objective	a. Mission, Vission, Goal and Objective	3		5
	b. Evaluation and pursuing alternatives	b. Evaluation and pursuing alternatives	3		5
	c. Opeartions management	c. TQM, Lean, Just in time, etc.,	3		5
	Total hours for this sub-module		**9**	**-**	**15**
5.	Finance				
	a. Basic finance terms	a. Assets, Liabilities, Owner's equity, Revenue, Expenses	3		5
	b. Statements	b. Income, Balance sheet and Cash flow statements	3		5
	c. Managerial decision making based on financial statements	c. Ratio and Break even analysis	3		5
	d. Finance for starting and operating business	d. Pesronal funds, bank loans, venture capital funds etc.	3		5
	Total hours for this sub-module		**12**		**20**
6.	Economics				
	a. Basic economic terms	a. Recession, depression, GDP, Inflation etc.,	3	-	5
	b. Economic systems	b. Capitalist, socialist and mixed economies	3		5
	c. Globalization and business	c. Effects of globalization on doing business	3		5
	d. Supply and demand	d. Supply and demand	3		5
	e. Types of competition	e. Monopoly, Oligopoly and Perfect competition	3		5
	Total hours for this sub-module		**15**		**25**
7.	Marketing				
	a. Marketing basics	a. Four P's of marketing mix	3	-	5
	b. Product development	b. Elements of product development	3		5
	c. Pricing	c. Pricing strategy	3		5
	d. Distribution channels	d. Understanding distribution channels	3		5
	e. Types of promotion	e. Understanding different types of promotion	3		5
	Total hours for this sub-module		**15**		**25**
8.	Human Resource Management				
	a. Management theories	a. X,Y, Z theory and Herzberg's theory, Maslow's theory	3		5
	b. Management responsibilities	b. Recruiting, hiring, training, appraising, and firing employees	3		5
	c. Employment arrangements	c. Teams, Work schedules, Job sharing etc.,	3		5
	d. Compensation and benefits	d. Wages, salaries and insurance	3		5

	Total hours for this sub-module		**12**		**20**
9.	Ethics and social responsibility				
	a. Ethics code	a. Ethics code- case studies	3	-	10
	b. Corporate social responsibility	b. Corporate social responsibility- Case studies	3		10
	Total hours for this sub-module		**6**		**20**
10.	Legal Aspects of Business				
	a. Labour legislations	a. Understanding labour legislations	3	-	5
	b. FSSAI regulations	b. License, Registration etc.,	3		10
	c. Export regulations	c. BIS, Agmark, Codex Alimentarius standards	2		10
	Total hours for this sub-module		**8**		**25**
Total Contact Hours Individually for Theory, Demonstration and Practical			100		215
Grand Total of Contact Hours			**315**		

T- Theory, D- Demonstration, P- Practical

9. Lists of Tools and Equipments for a Batch

S. No.	Description	Quantity
1	Computers and work stations depending on the number of trainees per batch	-

10. Space Required for Conducting the Module (in square feet)

a. Theory Class Room : 600
b. Demonstration & Practical Class Room : -

11. Power requirement : -

12. Qualifications of Instructor

BBA or MBA in Business Management

13. Suggested Readings

Text Books

1) Prasad, L.M. 2005, 'Principles and Practices of Management', Sultan Chand and Sona Educational Publishers, New Delhi.
2) Richard, B. Chase, Nicholas, J., Acquilano and F. Robert Jacobs, 2007, 'Production and Operations Management – Manufacturing and service, Tata Mc Graw Hill Publishing company Limited, New Delhi
3) Philip Kotler, Marketing Management, Pearson Education, India, 2003.
4) Kohls, R.L., and J.N. Uhl, 1998. Marketing of Agricultural Products, 8th Ed. New Yord: Macmillan
5) Rhodes, V.J., and J.L. Dauve. 1998. The Agricultural Marketing System. 5th ed. Scottsdale, Ariz.: Hathaway
6) Shephered S. Geoffrey and Gene A. Futrell, Marketing Farm Products, (Iowa: State University Press), 1982

7) Sunil Chopra, Peter Meindl (2004). Supply Chain Management: Strategy, Planning, and Operation, Prentice Hall, 2nd ed.

E-References

1) www.management.teacher.com
2) www.management.about.com
3) www.bized.co.uk
4) http://managementhelp.org/
5) www.entrepreneurship.org
6) www.fma.org
7) http://www.ifmr.ac.in

MODULE – 29

1.	**Title of the Module**	:	**Manufacturing of RTE, RTC and RTS Food Products**
2.	**Sector**	:	Food processing and preservation
3.	**Code**	:	
4.	**Entry Qualification**	:	10^{th} Standards
5.	**Minimum Age**	:	14 yrs
6.	**Terminal Competency**	:	After completion of the course the candidate will be able to: a) Operating & maintain the equipments used for various unit operation involve for making any food products b) To make RTE, RTS & RTC food products c) Process of packaging & storage d) Maintaining the quality of food products
7.	**Duration (in Hrs)**	:	350 hours

8. Module Contents

S. No.	**Theory**	**Practical**	**Contact Hours**		
			T	**D**	**P**
1	Concept of value addition. Conversion of raw material to consumer foods. Knowledge of importance of RTE, RTC and RTS food products. Ready-to-Cook, market value of RTE, RTC and RTS food products	Demonstration of various source required for production of Ready-to-Eat, Ready-to-Cook and Ready-to-Serve (RTE, RTC and RTS) food products			
	Total hours for this sub-module		**5**	**5**	**25**
2.	Knowledge of different industrially important RTE, RTC & RTS food products, Knowledge of ingredients use for making these kind of products; Quality assurance of raw material, standards and grades	Quality evaluation of Ingredients involve for making these products, knowing grades & classification			
	Total hours for this sub-module		**5**	**5**	**25**
3.	Process & technology involve for production of RTE, RTC and RTS food products, process parameters, key parameters which influence final product quality	Practice to make common RTE, RTC and RTS food products			
	Total hours for this sub-module		**5**	**5**	**25**

4.	Knowledge of changes occurs in raw materials during initial stage to end products. Effect of addition of ingredients on final products	Changes occurs during processing in raw materials like gelatinization, denaturization, bronwing reaction etc.			
	Total hours for this sub-module		**5**	**5**	**25**
5.	Knowledge of machineries involve in such kind of products like extruder, pasta making machine, bakers, mixer, molding machine etc.	Practice to operate these machines; how to operate, changing parameters;			
	Total hours for this sub-module		**5**	**5**	**25**
6.	Knowledge of product quality evaluation; standards for national & international markets; Sensory evaluation of final products	Quality evaluation of finished products – rheological, textural and sensory analysis			
	Total hours for this sub-module		**5**	**5**	**25**
7.	Trouble shooting, safety & maintenance operation involve in machineries; Knowledge of precaution taken & safety hazard; Environmental concern & Pollution measure	Learning practically these trouble shooting & maintenance operations; finding fault & quick action for remedies			
	Total hours for this sub-module		**5**	**5**	**25**
8.	Method of techniques of proper packaging of finished products & proper storing in cooling & ambient places, Packaging of RTE , RTC & RTS food products	Practice on packaging with sealing, storing and marketing. Marketing through agents, salesman and retailers etc.			
	Total hours for this sub-module		**5**	**5**	**25**
9**.**	Dehydration and retort processing techniques for the development of RTE and RTC products	Dehydration and osmodehydration of foods, Retort processing of breakfast, meals and snack foods			
	Total hours for this sub-module		**5**	**5**	**25**
10.	Maintaining records and filling up format for booking of various RTE, RTC & RTS food products	Practice on collection of orders and delivery of such kind of products			
	Total hours for this sub-module		**5**	**5**	**25**
Total Contact Hours Individually for Theory, Demonstration and Practical			**50**	**50**	**250**
Grand Total of Contact Hours			**350**		

T- Theory, D- Demonstration, P- Practical

9. Lists of Tools and Equipments for a Batch

S. No.	Description	Quantity
1.	General requirements like vessels, balances, trays, water storage facilities, oil container, mould, boiling pan, cutting knife, table, different size containers etc. (To be shared) (cooker, baby boiler – one unit)	04 for each tools
2.	Other general requirements for Good manufacturing practices	15 sets each
3.	Planetary mixer; 3 gear/ Food processor	02 No
4.	Grinder, Sieve set boxes	02 No
5.	Oven (Standard size with controlling feature)	02 No
6.	Packaging machine	02 No
7.	Moist box	02 No
8.	Work table marble top standard size	02 No
9.	Storage rack standard size	05 No.
10.	Moulds	02 No
11.	Cutting knives	02 No
12.	Dies; Sealing machine; Hot plate Induction stoves	02 No
13.	Tool cabinet	02 No
14.	First aid box	02 No
15.	Discussion table	02 No
16.	Weight Box	02 No
17.	Other common facilities for training	As required

10. Space Required for Conducting the Module (in square feet):

a. Theory Class Room **:** 1000 square feet
b. Demonstration & Practical Class Room **:** 2000 square feet

11. Power requirement **:** 3 phase connection
2 KW

12. Qualifications of Instructor

B.Sc. or M.Sc. in Food Science and Technology (or) B.Tech in Food Engineering
Diploma in Food Science and Technology or Food Engineering with special training
Diploma in Food Science and Technology or Food Engineering

13. Suggested Readings

Text Books

1) Fast R.B & Cardwell E.F. Breakfast cereals and how they are made (2000) American Association of Cereal Chemists. St. Paul Minnesota
2) Harper J.M. Extrusion of Foods. Vol. 1 & 2 (1991) CRC Press, Inc.) Boca Raton, Aorida

MODULE – 30

1.	**Title of the Module**	:	**Performance Evaluation of Food Processing Machinery**
2.	**Sector**	:	Food Processing
3.	**Code**	:	
4.	**Entry Qualification**	:	Minimum ITI/Diploma
5.	**Minimum Age**	:	20 yrs
6.	**Terminal Competency**	:	After completion of the course the candidate will be able to: a) Understand the basics of food processing machinery b) Evaluate the performance of the machinery c) Repair and maintenance of the machinery
7.	**Duration (in Hrs)**	:	350 hours

8. Module Contents

S. No.	Theory	Practical	Contact Hours		
			T	**D**	**P**
1	Basic knowledge in manufacturing practices - Carpentry, Fitting, Welding, Smithy, Drilling, Shaping, Turning, Milling, Boring	Basic manufacturing practices - Carpentry, Fitting, Welding, Smithy, Drilling, Shaping, Turning, Milling, Boring			
		Total hours for this sub-module	**4**	**4**	**20**
2.	Basic knowledge in maize, wheat and paddy processing, Evaluation of rice processing machinery - parboiling, cleaners, graders, rubber roll sheller, paddy separator, polishers, and stitching machinery	Evaluation of rice processing machinery – parboiling plant, cleaners, rubber roll sheller, paddy separator, polishers, graders, stitching machinery, repairs and maintenance			
		Total hours for this sub-module	**8**	**8**	**40**
3.	Basic knowledge in types of pulses, Evaluation of pulse processing machinery - cleaners, graders, dehusker, splitter, Gota machine, polishers	Evaluation of pulse processing machinery – cleaners, graders, conditioner, dehusker, splitter, Gota machine, polishers, repairs and maintenance			
		Total hours for this sub-module	**5**	**5**	**25**
4.	Basic knowledge in major and minor millets - Evaluation of millet processing machinery - cleaners, dehusker, polishers, popping machines	Evaluation of millet processing machinery – cleaners, dehusker, polishers, popping machine, repairs and maintenance			
		Total hours for this sub-module	**7**	**7**	**35**

5.	Basic knowledge in nuts and oil seeds - Evaluation of oil seeds processing machinery - cleaners, graders, rotary, expeller, filter	Evaluation of oil seeds processing machinery – cleaners, graders, rotary, expeller, filter, Repairs and maintenance			
	Total hours for this sub-module		**4**	**4**	**20**
6.	Basic knowledge in spices and condiments - size reduction - Evaluation of size reduction machinery - ball mill, burr mill, hammer mill, pin mill, roller mill - and colloidal mill	Evaluation of fruit processing machinery – graders, deseeding machine, pulper, homogenizer, evaporator, cooler, retort, repairs and maintenance			
	Total hours for this sub-module		**8**	**8**	**40**
7.	Basic knowledge in fruit types, processing, uses, Evaluation of fruit processing machinery - graders, deseeding machine, pulper, homogenizer, evaporator, cooler, retort, repairs and maintenance	Evaluation of fruit processing machinery - graders, deseeding machine, pulper, homogenizer, evaporator, cooler, retort, repairs and maintenance			
	Total hours for this sub-module		**4**	**4**	**20**
8.	Basic knowledge in milk and milk processing - Evaluation of milk processing machinery - pasteurizer, sterilizer, cream separator	Evaluation of milk processing machinery - pasteurizer, sterilizer, cream separator			
	Total hours for this sub-module		**4**	**4**	**20**
9.	Basic knowledge on different types of extruders and dryers for processing of food crops	Evaluation of dryers for solid, semi solid and liquid food and extruders for RTE and RTC food products.			
	Total hours for this sub-module		**3**	**3**	**15**
10.	Basic knowledge in packaging machinery for solid, semi solid and liquid products, form fill packaging	Evaluation, repairs andmaintenance of Packaging machinery			
	Total hours for this sub-module		**3**	**3**	**15**
Total Contact Hours Individually for Theory, Demonstration and Practical			**50**	**50**	**250**
Grand Total of Contact Hours			**350**		

T- Theory, D- Demonstration, P- Practical

9. Lists of Tools and Equipments for a Batch

S.No.	Description	Quantity
1.	Carpentry tools	4 sets
2.	Fitting tools	4 sets
3.	Welding – arc welding	2 sets
4.	Welding – gas welding	2 sets

5.	Smithy tools	4 sets
6.	Lathe	1
7.	Drilling machine	1
8.	Shaper	1
9.	Parboiling set up with dryer	1
10.	Paddy cleaner	1
11.	Rubber roll sheller	1
12.	Paddy separator	1
13.	Rice polisher – abrasive	1
14.	Rice polisher – friction	1
15.	Rice grader	1
16.	Bag Stitching machine	1
17.	Weighing scale	1
18.	Pulse cleaner	1
19.	Pulse grader	1
20.	Pulse conditioning set up	1
21.	Pulse dehusker	1
22.	Gota separator	1
23.	Millets cleaner with different sieves	1
24.	Millets dehusker and polisher	1
25.	Popping machine	1
26.	Rotary	1
27.	Oil expeller	1
28.	Filter press	1
29.	Ball mill	1
30.	Burr mill,	1
31.	Hammer mill,	1
32.	Pin mill	1
33.	Fruit grader	1
34.	Pulper	1
35.	Deseeding machine	1
36.	Homogenizer	1
37.	Double jacket kettle	1
38.	Retort	1
39.	Bottle filling machine	1
40.	Bottle sealing machine	1
41.	Retort packing machine	1
42.	Pasteurizer	1
43.	Sterilizer	1
44.	Cream separator	1
45.	Hand Gloves	10 sets
46.	Cutting pliers	5 sets
47.	Screw drivers	5 sets
48.	Open end spanners	5 sets
49.	Ring spanners	5 sets
50.	Wrenches	5 sets
51.	Hand drilling machine	1
52.	Work tables	5
53.	Storage rack for keeping tools	1

10. Space Required for Conducting the Module (in square feet):

a. Theory Class Room : 500 sq. ft.
b. Demonstration & Practical Class Room : 1600 sq.ft.

11. Power requirement **:** 3 phase connection
2 KW

12. Qualifications of Instructor

BE or ME in Mechanical or Agricultural Engineering
Diploma in Mechanical Engineering

13. Suggested Readings

Text Books

1) Hajra Chowdry, S.K. 1986. Elements of workshop technology, Asian Book, New Delhi.
2) Sahay, K.M. and Singh, K.K. 2007. Unit operations in Agricultural Processing, Vikas Publishing House, New Delhi
3) Chakravarthy, A. Post harvest technology of cereals, pulses and oilseeds, 1988 Oxford & IBH Publishing Company.
4) Earle, R.L. 1985. Unit operations in food processing. Pergamon Press. Oxford. U.K.

MODULE – 31

1.	**Title of the Module**	:	**Rice Milling Techniques**
2.	**Sector**	:	Grain Processing
3.	**Code**	:	
4.	**Entry Qualification**	:	Minimum 8^{th} / 10^{th} Standard
5.	**Minimum Age**	:	14 yrs
6.	**Terminal Competency**	:	After completion of this training the participant will have: a) Knowledge in the various rice processing operations b) Overall knowledge in various machineries available in different sections of Rice Processing Industry. c) To assess the quality of Paddy/rice and various by-products d) Operate the Rice milling machinery
7.	**Duration (in Hrs)**	:	312 hours

8. Module Contents

S. No.	Theory	Practical	Contact Hours		
			T	**D**	**P**
1	Rice Processing - importance of process Paddy - History of rice processing - Different types of rice available in world and Indian market - Requirement of space for different capacity of mills.	Different types of rice in Indian market. Visualization of different rice samples produced in the market and discussion.			
		Total hours for this sub-module	**12**	**12**	**40**
2.	Importance of knowledge on rice milling techniques - Traditional methods of rice processing and modern concepts of rice processing	Traditional method of rice processing. Conventional methods of rice processing Single steam parboiling Double steam parboiling Modern methods of rice processing Hot soaking - Improved hot soaking method			
		Total hours for this sub-module	**12**	**12**	**40**
3.	Traditional rice processing machinery - Huller machines - Modified huller machines - Semi modern rice mill and machinery	Traditional method of rice processing using Huller machine Milling of raw paddy in semi modern rice mill Milling of parboiled paddy in semi modern rice mill.			
		Total hours for this sub-module	**12**	**12**	**40**

4.	Modern Rice Mills and Rice machinery Precleaners - Destoners - Different type of Huller / Sheller machines - Different Paddy Separators Different Polishers - Broken separator - Silky polisher - Destoner - Colour sortersi - Bagging unit	Laboratory milling study Calculation of milling yield Milling of raw paddy in modern rice mill Milling of parboiled paddy in modern rice mill			
		Total hours for this sub-module	**12**	**12**	**40**
5.	Parboiling vessels and machinery used in parboiling section – Boiler - Parboiling vessel – Dryer - Drying method	Parboiling of paddy at mill level Mild parboiled rice Parboiling of paddy at mill level Fully parboiled rice Assessment of drying time and drying at mill yard. Assessment of drying time and drying in dryer			
		Total hours for this sub-module	**12**	**12**	**40**
6.	Assessment of Paddy/ Rice Quality	Assessment of physical parameters, Assessment of paddy for FAQ standard, Assessment of rice for FAQ standard, Assessment of Rice cooking quality, Assessment of Rice cooking quality			
		Total hours for this sub-module	**12**	**12**	**40**
7.	Storage and packaging of Paddy/Rice, Prevention of high moisture paddy	Storage of paddy/Rice Prevention of high moisture paddy Gelatinization properties			
		Total hours for this sub-module	**12**	**12**	**40**
8.	Potential traditional processing techniques and By-product utilization	Preparation of ethnic food products, puffing, flaking, parching and roasting. By product utilization. Estimation of moisture and oil content in rice bran			
		Total hours for this sub-module	**12**	**12**	**40**
9.	Value added products from rice – traditional foods, extruded products, health drinks, convenient food products	Preparation ready to eat and ready to cook extruder products and drinks, bakery products			
		Total hours for this sub-module	**12**	**12**	**40**
10.	Maintenance of Rice Milling Machines and Safety measures	Problem shooting areas in rice mill, Safety measures and visit to industries			
		Total hours for this sub-module	**12**	**12**	**40**
Total Contact Hours Individually for Theory, Demonstration and Practical			**60**	**60**	**200**
		Grand Total of Contact Hours	**312**		

T- Theory, D- Demonstration, P- Practical

9. Lists of Tools and Equipments for a Batch

S.No.	Description of Tools	Quantity
1.	Hand winnower – Plastic	4
2.	Cloth (For cloth bags)	4 meters
3.	Nylon bags	4 meters
4.	Trays	4
5.	Spoons	8
6.	Lab chappals	16
7.	Mini - Lab Sheller	2
8.	Mini - Lab polisher	2
9.	Lab broken separator	1
10.	Lens	2
11.	Crack detector	1
12.	L,B measurement wooden board	4
13.	Dial caliper	2
14.	Paddy – Soaking vessels – Plastic	4
15.	Parboiling coffee filter like vessels (upto 2Kg cap.) with lid (SS)	2
16.	Vessel – for saturation test –(SS)	2
17.	Cooking vessels – for gruel loss (dia.~ 1feet, with provision for placing six 250 ml. beakers simultaneously) (SS).	2
18.	Rice cooking vessel (Suitable to place a stand of 15 test tubes simultaneously) (SS).	2
19.	Vessel for elongation test (SS) (Boiling and cooling)	2 + 2
20.	Fabrication of wire meshes (Gruel loss test and Elongation test)	24 Nos.
21.	Fabrication of stands to hold wire meshes (Gruel loss test and Elongation test)	4
22.	Wire gauge – to hold samples, and sample holding containers (SS)	20
23.	Hawkins pressure cooker 1 Lit.	1 No.
25.	Hawkins pressure cooker 2 Lit.	1 No.
26.	Stainless steel plates	2 nos
27.	Moisture box	25 nos.
28.	Heat sealing machine	1
29.	Single burner stove	2
30.	Induction stove	1
31.	Instructor chair and table	1
32.	Dual desk	10
33.	Work table for grain testing and quality tests	2
34.	Stools	16
35.	Discussion table	1
36.	Tool cabinet	1
37.	Trainees locker with space for 16 members	1
38.	First aid box	1
39.	Book shelf	1
40.	Storage rack – mesh cupboard	1

S.No.	Description of Equipments	Quantity
1.	Weighing balance (Cap. 200g and 5 Kg) – each two	2+2
2.	Moisture meter	4
3.	Oven	1
4.	Lab Sheller	1
5.	Lab polisher	1
6.	Oil extractor	1
7.	Sand bath	2
8.	Vortex mixer	2
9.	DigitalTemperature probes - 1meter, 30 cm, 60 cm length	Each 2
10.	Sieve sets	1 set
11.	Hot water bath with temperature control	2
12.	Cold water bath.	1

S.No.	Description of Glasswares and Chemicals	Quantity
1.	Flat bottom oil flasks	18
2.	Oil Extraction set (condenser and extractor)	1set each
3.	Thimbles	18
4.	Standard flask 1 Lit	4
5.	Standard flask 500 ml	4
6.	Standard flask 250 ml	4
7.	Standard flask 100 ml	20
8.	Standard flask 50 ml	10
9.	Beaker 1000 ml	4
10.	Beaker 500 ml	4
11.	Beaker 250 ml	20
12.	Beaker 100 ml	20
13.	Cooking Test tubes (50ml – graduated for each ml) (flat bottom)	25
14.	Boiling tubes – round bottom (50 ml)	25
15.	Test tubes 25 ml (round bottom without rim)	25
16.	Conical Flask (100 ml)	25
17.	Measuring jar 10ml, 25ml, 50ml,100ml – each 10	4x10
18.	Measuring jar 250ml, 500ml, 1000lit – each 2	3x2
19.	Funnel Ø 2.5 cm; Funnel Ø 7.5 cm	Each 20
20.	Conical Flask (250 ml)	10
21.	Petri Plates – Inner 9.5 cm	25
22.	Petri Plates - Inner 13 cm	10
23.	What man no 1 Filter paper	6 boxes
24.	Desiccators	2
25.	Burette: 25ml	4
26.	Crucible	10
27.	Wash bottles	4
28.	Bunsen burners	4
29.	Gas stove (Single burner)	2
30.	Induction stove	1
	List of Chemicals	

1.	Sodium Hydroxide
2.	Sodium Chloride
3.	Potassium hydroxide
4.	Xanthene
5.	HCL, H_2SO_4 ,and other chemicals as per need.

10. Space Required for Conducting the Module (in square feet):

a. Theory Class Room **:** 1000 square feet
b. Demonstration & Practical Class Room **:** 2000 square feet

11. Power requirement **:** 3 phase connection
5 KW

12. Qualifications of Instructor

Diploma in Milling Technology
B.Tech or M.Tech in Food Science and Technology

MODULE – 32

1.	**Title of the Module**	:	**Manufacturing of Extruded Products**
2.	**Sector**	:	Food Processing
3.	**Code**	:	
4.	**Entry Qualification**	:	Minimum 12th Standard/ ITI
5.	**Minimum Age**	:	17 yrs.
6.	**Terminal Competency**	:	After completion of this course the participant would be able to: a) Work on single/twin screw extruder b) Study about Extrusion cooking, preconditioning of raw material, types of extruders and operating parameters c) Different types of extruded products and their processing.
7.	**Duration (in Hrs)**	:	350 hours

8. Module Contents

S. No.	Theory	Practical	Contact Hours		
			T	D	P
1.	Extrusion - Definition - Introduction to extruders and their principles - Extruders in the food industry - History and uses of extruders in the food industry.	Extruder operation Study of extruder process Study on expanded and formed products			
		Total hours for this sub-module	**5**	**5**	**25**
2.	Process characteristics of the twin screw extruder - feeding, screw design, screw speed, screw configurations, die design Ingredients used in extrusion cooking - Pre-conditioning of raw materials used in extrusion process, Pre-conditioning operations and benefits of pre-conditioning - Rheological properties of cereals during extrusion	Study on utilization of different cereals in development of extruded product			
		Total hours for this sub-module	**5**	**5**	**25**
3.	Structure of cereal grains -Wheat - Endosperm, Bran layer, germ, pericarp, seed coat, aleurone layer. Corn hull, germ, endosperm, tip cap. Rice - hull, germ, aleurone layer. Barley -sorghum - pearl millet	Processing of Cereal based and Breakfast cereal products - I			

	Total hours for this sub-module		**5**	**5**	**25**
4.	Selection of extruder - Introduction and terminology - Function and advantages of extruder technology - General design features - Single-screw extruder - Twin-screw extruder Single- vs. twin-screw extruder	Processing of Cereal based and Breakfast cereal products - II			
	Total hours for this sub-module		**5**	**5**	**25**
5.	Key control points in meeting product requirements	Characterization of extruded products Physical and nutritional quality of extruded products			
	Total hours for this sub-module		**5**	**5**	**25**
6.	Effect of extrusion on nutritional quality - Introduction - Macronutrients - Vitamins - Minerals - Non-nutrient healthful components of foods	Study of factors affecting extrusion cooking - moisture content, diameter, temperature, pressure, screw speed, time			
	Total hours for this sub-module		**5**	**5**	**25**
7.	Specific Extruded products - Expanded, Puffed, Formed, Pasta, macroni - Snack foods of dairy origin - Meat based snack foods	Development of pasta products Nutritional factors affecting the quality of product			
	Total hours for this sub-module		**5**	**5**	**25**
8.	Breakfast cereals - Introduction, The range of products, Key process issues of the product range, Main unit operations and technologies. Snack foods - Introduction, Formed dough products - potato, Half-product or pellet snacks, Directly expanded snacks, Co-extruded snacks. Baby foods - Introduction, Traditional batch processing, Extrusion system for baby foods, Market for baby foods	Packaging of cereal products Packaging equipments			
	Total hours for this sub-module		**5**	**5**	**25**
9.	Macroni-method of manufacture, Noodles, Types of noodles, raw materials. Pasta technology - raw materials, process and equipment, different shapes and styles - packaging technology	Trouble shooting in extrusion process			

	Total hours for this sub-module		**5**	**5**	**25**
10.	Quality control for extruded products and FSSAI standard	Extruded products manufacturing industry visit			
	Total hours for this sub-module		**5**	**5**	**25**
Total Contact Hours Individually for Theory, Demonstration and Practical			**50**	**50**	**250**
Grand Total of Contact Hours			**350**		

T- Theory, D- Demonstration, P- Practical

9. Lists of Tools and Equipments for a Batch

S.No.	Description of tools & equipments	Quantity
1	Hand operated moisture meter	2
2	Weighing Balance	5
3	Measuring glass	5 sets
4	Different types of Dies	Assorted
5	Segmented/non segmented screws	Assorted
6	Apron	50
7	Hand gloves	50
8	Cap	50
9	Single / twin screw Extruder	1
10	Ribbon blender	2
11	Cooling conveyor	1
12	Post extrusion dryer	2
13	Pneumatic conveyor	1
14	Flaking machine	1
15	Drum coater	1
16	Water bath	1
17	Moisture meter	1
18	Tray drier	1
19	Hammer mill	1
20	Vernier caliper 15 cm 0.01 mm LC	5
21	Screw gauge/micrometer 0.001 mm LC	1
22	Centrifuge	1
23	Texture analyser	1
24	Kjeldahl digestion and distillation apparatus	1
25	SS containers for collection and storage of materials	-
26	Packing machine	1

10. Space Required for Conducting the Module (in square feet):

a. Theory Class Room **:** 1000 square feet
b. Demonstration & Practical Class Room **:** 2000 square feet

11. Power requirement **:** 3 phase connection
5 KW

12. Qualifications of Instructor

B.Sc. or M.Sc. in Food Science and Technology
Diploma in Food Science and Technology

13. Suggested Readings

Text Books

1) Richardson P. *Thermal Technologies in Food Processing.* Wood head Publishers, Cambridge
2) Guy R. *Extrusion Cooking, Technologies and Applications.* Wood head Publishing Limited, Abington, Cambridge.
3) Fast R.B. and Caldwell E.F. *Breakfast Cereals and How they are made.*(2000) American Association of Cereal Chemists., St. Paul, Minnesota.
4) Frame N.D. *The Technology of Extrusion Cooking*. (1994) Blackie Academic & Professional, New York.
5) Harper J.M. *Extrusion of Foods.* Vol. 1&2 (1991) CRC Press, Inc; Boca Raton, Florida.
6) O'Connor C. *Extrusion Technology for the Food Industry.* (1987) Elsevier Applied Science, New York

MODULE – 33

1.	**Title of the Module**	:	**Processing of Spices & Condiments**
2.	**Sector**	:	Spice processing
3.	**Code**	:	
4.	**Entry Qualification**	:	Minimum 8th Standard
5.	**Minimum Age**	:	14 yrs
6.	**Terminal Competency**	:	After completion of this training the participant will be able to: a) Jobs in spices & plantation crop processing industries, Production executive, Quality assurance executive, Machine operators, maintenance executives, Quality testing – lab assistant
7.	**Duration (in Hrs)**	:	315 hours

8. Module Contents

S. No.	Theory	Practical	Contact Hours		
			T	D	P
1.	Spices, Condiments - Definition, production, importance, classification of spices.	Identifying important spices, condiments. Classification based on the morphology (seed spice, flower/buds, bulbs, stem /bark, leaves)			
	a. Spice processing scenario in India.	a. Major classification			
	b. Harvesting time and methods of harvest for individual spices	b. Minor classification			
	c. Major and Minor spices (anise seed, basil, bay leaves, capsicum spice, caraway seed, cardamom, celery seed, cinnamon and cassia, cloves, coriander, cumin, dill seed, dill weed, fennel seed, fenugreek)	c. Ensuring the maturity indices of Spice and condiment			
	d. Major and Minor spices (ginger, mace, nutmeg, marjoram, mustard seed, oregano, parsley, pepper - white and black, rosemary, rosemary,	d. Chemical composition of spices and condiments			

	saffron, sage, savory, tarragon, thyme, turmeric)				
	Total hours for this sub-module		**5**	**5**	**25**
2.	Spice processing	Procurement and pre-processing of spices.			
	a. Pre-processing of spices and condiments	a. Spice cleaning			
	b. Importance of post harvest management.	b. Spice reconditioning			
	c. Major losses occurring during post harvest period.	c. Spice grinding			
	d. Methods to minimize the losses	d. Post processing treatment			
	Total hours for this sub-module		**5**	**5**	**25**
3.	Processing of individual spices	Unit operations involved in processing of Seasoning Blends			
	a. Performance evaluation of inclined belt separator, spiral separator, vibratory type grader, rotary type grader.	a. Celery Salt, Garlic Salt, Onion salt			
	b. Performance evaluation of white pepper peeler cum washer, pepper threshers, abrasive type white pepper polisher, pepper cleaner cum grader,	b. Chilly powder, curry powder			
	c. Performance evaluation of turmeric boiler, turmeric polisher	c. Curry powder, pickling spice, poultry seasoning,			
	d. Performance evaluation of chilli seed extractor, cardamom garbling machinery	d. Pumpkin pie spices, apple pie spices and oriental five spice blend			
	Total hours for this sub-module		**5**	**5**	**25**
4.	Drying of spices	Drying characteristics of spices			
	a. Different types of dryers used in spice drying	a. Drying of spices in thin layer dryers, rotary dryer.			
	b. Working principle and operation	c. Drying of spices in cabinet dryer			
	d. Quality comparison with traditional methods	e. Drying of spices in fluidized bed dryer			
	f. Drying characteristics of spices in dryers	g. Drying of spices in spouted bed dryer			
	Total hours for this sub-module		**5**	**5**	**25**
5.	Suitable spice grinders and Grinding of all spices	Working with different machinery for spice grinding			
	a. Principle, method of spice grinding	a. Hammer mill			

	b. Machinery used for spice grinding	b. Pin mill			
	c. Energy involved in grinding	c. Attrition mill			
	d. Recent developments in spice grinding	d. Ball mill			
	Total hours for this sub-module		**5**	**5**	**25**
6.	Unit operations involved in processing other Seasoning	Different types of Seasonings and its formulation			
	a. Overview of the industry	a. Meat seasoning			
	b. Overview of formulating	b. Snack seasoning			
	c. Specific product formulations	c. Sauces and gravies			
	d. Spices and seasoning trends for the new millennium	d. New flavor trends, ethnic flavours			
	Total hours for this sub-module		**5**	**5**	**25**
7.	Spice extractives	Different extraction techniques			
	a. Spice volatile oils	a. Extraction of essential oils			
	b. Spice Oleoresins	b. Extraction of oleoresin			
	c. Use of spice extractives	c. Method of extraction			
	d. Replacement of spices with oils & oleoresins	d. Spice alternative products (oil/oleoresins)			
	Total hours for this sub-module		**5**	**5**	**25**
8.	Quality issues dealing with spices	Quality analysis of spices and value added products from spices			
	a. Quality analysis of spices and their derivatives	a. Estimation of volatile oil			
	b. Sampling and sample preparation	b. Estimation of starch			
	c. Spice-Specific tests	c. Estimation of total ash and acid insoluble ash			
	d. Recommended levels for individual components in each product	d. Estimation of moisture			
	Total hours for this sub-module		**5**	**5**	**25**
9.	Quality standards and specification for spices and its products				
	Naturally occurring toxicants	Microbiological methods			
	Antioxidant action of spice compounds	Estimation of crude fibre			
	Health benefits of spice compounds				
	Antimicrobial action of spices				
	Total hours for this sub-module		**5**	**5**	**25**
10.	Spices packaging and storage recommendation for marketing	Packaging requirements and Safe storage requirements for whole spices and blends			
	a. Seasoning blend duplication	a. Packaging - Spice blends / seasonings			
	b. Background information for	b. Packaging - Whole spice			

	seasoning formulation				
	c. Seasoning blends	c. Safe storage - whole spices & seasoning blends			
	Total hours for this sub-module		**5**	**5**	**25**
Total Contact Hours Individually for Theory, Demonstration and Practical			**45**	**45**	**225**
Grand Total of Contact Hours			**315**		

T- Theory, D- Demonstration, P- Practical

9. Lists of Tools and Equipments for a Batch

S.No.	Description	Quantity
2.	Pepper thresher	1
3.	Inclined belt separator	1
4.	Spiral separator	1
5.	Vibratory type grader	1
6.	Rotary type grader	1
7.	White pepper peeler cum washer	1
8.	Abrasive type white pepper polisher	1
9.	Turmeric boiler	1
10.	Turmeric polisher	1
11.	Cardamom garbler	1
12.	Pepper cleaner cum grader	1
13.	Chilli seed extractor	1
14.	Tray Dryer	1
15.	Fluidized bed dryer	1
16.	Rotary dryer	1
17.	Spouted bed dryer	1
18.	Hammer mill	1
19.	Attrition mill	1
20.	Pin mill	1
21.	Ball mill	1
22.	Vacuum Packaging	1
23.	Gunny bag Stitching machine	1
24.	Soxhlet apparatus	1
25.	Ginger Polisher	1

10. Space Required for Conducting the Module (in square feet):

a. Theory Class Room : 500 sq. ft.
b. Demonstration & Practical Class Room : 1600 sq.ft.

11. Power requirement **:** 3 phase connection
5 KW

12. Qualifications of Instructor

B.Sc. or M.Sc. in Food Science and Technology
Diploma in Food Science and Technology

13. Suggested Readings

Text Books

1) Pandey, P. H. 2002. Post Harvest Engineering of Horticultural Crops through Objectives. Saroj Prakasam, Allahabad.
2) Pruthi, J.S. 1998. Major Spices of India - Crop Management and Post Harvest Technology. Indian Council of Agricultural Research, Krishi Anusandhan Bhavan, Pusa, New Delhi. PP. 514.
3) ASTA, 1997. Official analytical methods of the American Spice Trade Association, Fourth Edition.
4) Purseglove, J.W., E.G.Brown, G.L.Green and S.R.J.Robbins. 1981. Cardamom – Chemistry. Spices, Vol. I, Tropical Agricultural Series, Longman, London, 1: 605.
5) Pruthi, J.S. 1980. Spices and Condiments: Chemistry, Microbiology and Technology. First Edition. Academic Press Inc., New York, USA. pp. 1-450. .
6) Pruthi, J.S. 2001. Minor Spices of India – Crop Management and Post Harvest Technology.
7) Indian Council of Agricultural Research, Krishi Anusandhan Bhavan, Pusa, New Delhi.PP. 782.
8) Sivetz, M, and Desrosier, N.W. 1979. Coffee Technology. AVI Publishing Co. Inc, Westport,Connecticut. First edition.
9) Handbook of Herbs and Spices : Volume 3 Vol. 3 by K. V. Peter (2006, Hardcover) : K. V. Peter (2006)
10) Spices: Vol.05. Horticulture Science Series By N.Mini Raj and K.V.Peter

Journals

1) Journal of spices and plantation crops
2) Indian J. Arecanut, Spices & Medicinal Plants
3) Journal of spices and aromatic crops
4) Spice India

E- Reference

1) www.indianspices.com
2) www.coconutboard.gov.in
3) www.tide-india.org/projects/06diffusion-arecanut-processing.html
4) http://www.fao.org/docrep/v5030e/V5030E00.htm
5) http://www.sspindia.com/fruits-and-vegetable-equipment.html