DEPARTMENT OF TECHNOLOGY,
SHIVAJI UNIVERSITY KOLHAPUR
THIRD YEAR B.TECH
Scheme of Teaching and Examination: Semester- V (Food Technology)

Subject Code	Subject	Teaching Scheme with Credits (Hours / Week)				Examination Scheme (Marks)					
						Theory			Practical		
		L	T	P	Credits	Scheme	Max. marks	Min. Passing	Scheme	Max. marks	Min. Passing
FT311	Food Packaging	04	-	-	04	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
FT312	Fruits and Vegetables Processing Technology	04	-	-	04	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
FT313	Dairy Technology	04	-	-	04	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
FT314	Food Process Engineering-II	04	-	-	04	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
FT315	Process Instrumentation, Dynamics and control	03	-	-	03	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
FT311L	Food Packaging Laboratory	-	-	02	01	-	-	-	IOE	50	20
FT312L	Fruits& Vegetables Processing Technology Laboratory	-	-	02	01	-	-	-	EPE	50	20
FT313L	Dairy Technology Laboratory	-	-	02	01	-	-	-	EOE	50	20
FT314L	Food Process Engineering-II Laboratory	-	-	02	01	-	-	-	IOE	50	20
FT315L	Process Instrumentation, Dynamics and control Laboratory	-	-	02	01	-	-	-	IOE	50	20
FT316	Internship I	-	-	-	01				IOE	50	20
	Total	**19**	**-**	**10**	**25**	-	**500**	-	-	**300**	-

Audit Course III											
LS311	Introduction to Foreign Language	**02**	-	-	-	Institute Level	-	-	-	-	-

Total contact hours per week: **29+2=31**

Note: Tutorials and Practicals to be conducted in batches with batch strength not exceeding 15 students.

CIE:	Continuous Internal Evaluation	SEE:	Semester End Examination
IPE:	Internal Practical Evaluation	EPE:	External Practical Examination
IOE:	Internal Oral Evaluation	EOE:	External Oral Examination

Internship I which is part of Semester V, evaluation will be the activity after the SEE of semester IV. It is mandatory for all the students to undergo the same and report to the institute for the semester V along with the completion certificate by the concerned organization. The students have to submit a hard as well as soft copy of the activity report to the institute.

DEPARTMENT OF TECHNOLOGY,
SHIVAJI UNIVERSITY KOLHAPUR
THIRD YEAR B.TECH
Scheme of Teaching and Examination: Semester- VI (Food Technology)

Subject Code	Subject	Teaching Scheme with Credits (Hours / Week)				Examination Scheme (Marks)					
						Theory			Practical		
		L	T	P	Credits	Scheme	Max. marks	Min. Passing	Scheme	Max. marks	Min. Passing
FT321	Sugar and Confectionery Technology	04	-	-	04	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
FT322	Technology of Cereals and Bakery Products	04	-	-	04	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
FT323	Biochemical Engineering	04	-	-	04	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
FT324	Process Equipment Design and Drawing	04	-	-	04	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
FT325	Industrial Economics and Management	04	-	-	04	CIE	50	20	-	-	-
						SEE	50	20	-	-	-
FT321L	Sugar and Confectionery Technology Laboratory	-	-	02	01	-	-	-	EPE	50	20
FT322L	Technology of Cereals and Bakery Products Laboratory	-	-	02	01	-	-	-	EOE	50	20
FT323L	Biochemical Engineering Laboratory	-	-	02	01	-	-	-	IOE	50	20
FT324L	Process Equipment Design and Drawing Laboratory	-	-	02	01	-	-	-	IOE	50	20
FT325L	Mini Project	-	-	02	01	-	-	-	IOE	50	20
									EOE	50	20
	Total	**20**	**-**	**10**	**25**	-	**500**	-	-	**300**	-

Audit Course IV											
RM321	Research Methodology	02	-	-	Institute Level	-	-	-	-	-	-

Total contact hours per week: **30+2=32**

Note: Tutorials and Practicals to be conducted in batches with batch strength not exceeding 15 students

CIE: Continuous Internal Evaluation
IPE: Internal Practical Evaluation
IOE: Internal Oral Evaluation
SEE: Semester End Examination
EPE: External Practical Examination
EOE: External Oral Examination

Internship II which is part of Semester VII evaluation will be the activity after the SEE of semester VI. It is mandatory for all the students to undergo the same and report to the institute for the semester VII along with the completion certificate by the concerned organization. The students have to submit a hard as well as soft copy of the activity report to the institute.

Class and Semester	:	**T. Y. B. Tech (Food Technology) Part III Semester-V**						
Course Title	:	**FOOD PACKAGING**				*Course Code*:	:	**FT 311**
Teaching Scheme (Hours)	:	**Lectures 4 hours/weeks=4 x 13 weeks= 52 hours minimum** **Tutorial= 0 hour/week** **Practical= 02 hours/week**				*Total Credits*	:	**04+01=05**
Evaluation Scheme (Marks)	:	**CIE = 50** **SEE = 50**	**IPE= NIL** **IOE= 50** **EPE= NIL**	: : :	**Grand Total= 150**	*Evaluation Scheme (Marks)*	:	**CIE = 50** **SEE = 50**
Revision:	:					*Month*	:	**June 2018**

Pre-requisites	**:**	The students should have knowledge of Food Preservation, Food Engg. I &II, Food Chemistry and Food Microbiology
Type of Course	**:**	Theory
Course Domain	**:**	Core
Skills Imbibed	**:**	List Skills based on the Bloom's Taxonomy decide whether it come under Cognitive, Affective domain , Psychomotor domain
Course Assessment Methods: 1. Continuous Internal Evaluation: Unit Test I & Unit Test II, Home assignments 2. Semester End Examination		

Course Objectives:

1. To impart comprehensive overview of the scientific and technical aspects of food packaging
2. To instill knowledge on packaging machinery, systems, testing and regulations of packaging
3. To gain knowledge on the different types of materials and media used for packaging foods
4. To gain knowledge on hazards and toxicity associated with packaging materials and laws, regulations and the monitoring agencies involved food safety, labeling of foods
5. To gain knowledge on methods of packaging, shelf life and food factors affecting packaging

Course Outcomes:

1. Students will able to understand the various properties of food packaging materials.
2. Student will learn to confirm packaging laws and regulations meeting standards.
3. Student will able to describe the properties of food packages, conversion technologies, processing and packaging technologies and user requirements including safety, convenience and environmental issues.
4. Students will learn to select suitable packaging material for specific foods.
5. Student will describe the technology involved in the production, shaping and printing of various packaging materials and package
6. Students will able to utilize the correct packaging materials use for different food products manufacture in Food Industry.

UNIT I Introduction to Food Packaging Package requirements, package functions, Hazards acting on package during transportation, Storage and atmospheric package, labeling laws Mechanical and functional tests on Package :Various mechanical and functional testes perform in laboratories on package boxes and package materials	**Hours** **6**
UNIT II Package Materials Classification packages, paper as package material its manufacture, types, advantages corrugated and paper board boxes etc. Glass as package material, Manufacture, Advantages, disadvantages. Metal as package material-manufacture, Advantages, disadvantages, Aluminum as package material, Its advantages and disadvantages, plastic as package material classification of polymers, properties of each plastics, uses of each plastics, chemistry of each plastic such as polyethylene, Polypropylene, polystyrene, polycarbonate, PVC, PVDC, Cellulose acetate, Nylon etc.	**8**
UNIT III Lamination and Coating on paper and films Lamination, need of lamination, types, properties, advantages and disadvantages of each type. Types of coatings. Need of coating, methods of coatings.	**8**
UNIT IV Aseptic packaging Need, Advantaged, process, comparison of conventional and aseptic packaging, system of aseptic packaging and materials used in aseptic packaging, Machineries used in Packing foods	**6**
UNIT V Packaging of Specific Foods Packaging of specific foods with its properties like bread, biscuits, coffee, milk powder, egg powder, carbonated beverages, Snack foods etc.	**6** **6**
UNIT VI Novel Food Packaging Packaging of Space food, Retort able pouches, Controlled and Modified atmosphere Packaging, Active packaging, Edible Packages etc	

Text Books	**:**	

1. Food Packaging Technology, 2003, Coles. Richard et al, Blackwell Publishing, Oxford

2. Food Packaging 'Principles and Practice' Second Edn., 2005, G.L. Robertson

3. Food Packaging Science and Technology, Dong Sun Lee, 2008

Reference Books	:	

1. Saroka, W 2002, Fundamentals of Packaging Technology, 3rd edition, Institute of Packaging Professionals, Herndon, Virginia.

2. Twede, D 2005, Cartons, Crates and Corrugated Board: Handbook of Pap*er and Wood Packaging Technology*, DEStech Publications

3. Kirwan, M J *et al*. (Ed) 2003, *Food Packaging Technology*, CRS Press

4.Modern food packaging, Indian Institute of Packaging, 1998

5. Novel Food Packaging Techniques, Ahvenainen .

6. Food packaging and preservation by M. Malthlouthi, 1994

Class and Semester	:	**T. Y. B. Tech (Food Technology) Part III Semester-V**					
Course Title	:	**Fruits and Vegetables Processing Technology**			*Course Code*:	:	**FT 312**
Teaching Scheme (Hours)	:	**Lectures 4 hours/weeks=4 x 13 weeks= 52hours minimum** **Tutorial= 0 hour/week** **Practical= 02 hours/week**			*Total Credits*	:	**04+01=05**
Evaluation Scheme (Marks)	:	**CIE = 50** **SEE = 50**	**IPE= NIL** **IOE= NIL** **EPE= 50**	: : :	**Grand Total= 150**	*Evaluation Scheme (Marks)*	:	**CIE = 50** **SEE = 50**
Revision:	:					*Month*	:	**June 2018**

Pre-requisites	**:**	Knowledge of Principles of Food Preservation, Food Chemistry, Food Biochemistry, Food Additives and Contaminants, Food Process Engineering I subjects etc.
Type of Course	**:**	Theory
Course Domain	**:**	Core
Skills Imbibed	**:**	List Skills based on the Bloom's Taxonomy decide whether it come under Cognitive, Affective domain , Psychomotor domain
Course Assessment Methods: 1. Continuous Internal Evaluation: Unit Test I & Unit Test II, Home assignments 2. Semester End Examination		

Course Objectives:

1. To demonstrate an understanding of the biochemistry and physiology of harvested fruits and vegetables
2. To describe the basic steps involved in the production of processed fruits and vegetables
3. To describe the Principles and practices employed to maintain the quality of fruits and vegetables
4. To gain a sound knowledge about the processing and preservation technologies of fruits and vegetables
5. To solve Indian farmers (Fruits and Vegetables) problems
6. To improve Indian agricultural economy

Course Outcomes:

1. Students will able to preserve the fruits and vegetables and make their products to make available them in off season.
2. Student will able to provide solution for spoilage of fruit and vegetables while handling and storage.
3. Students will able to learn storage of fruits and vegetables in perfect consumable condition for a longer time without change in its nutritional value.
4. Students will learn to extend the shelf life of the fruits and vegetable products with use of various preservation techniques.
5. Students will learn to prepare value added products from the fruits and vegetables so that farmers will get more income
6. Students will learn to develop ability for formulation of products, and will learn to solve agriculture and engineering problems.

	Hours
UNIT I Introduction to Fruits and Vegetables Current status of production and processing of fruits and vegetables. Post-harvest physiology, handling, losses and conservation of Fruits and Vegetables.	**8**
UNIT II Structure and Composition Structural, compositional and nutritional aspects of fruits and vegetables.	**8**
UNIT III Canning Canning, Materials for canning, different machineries in cannery plant, defects in canning and plant layout of ideal canning unit. Aseptic packaging.	**8**
UNIT IV Processing Technology of fruits Technology of Jams, Jellies marmalade, Glazed fruits, Crystallized fruits, fruits candy, and fruit preserve.	**10**
UNIT V Processing Technology of vegetables Tomato Products: sauces, ketchups, puree, pastes, chutneys and pickles, dehydrated fruits and vegetables: powders	**10**
UNIT VI Technology of beverages Juices and pulps, RTS, concentrates, squashes, cordials, nectars, carbonated beverages.	**8**

Text Books	**:**	1. Tressler D.K. & Joslyn M.A. "Fruits and vegetables juice processing technology" edited by AVI publishing Co. Westport, Connecticut .1971 2. Wills, Lee, Graham, Mc Glasson & Hall "Post-Harvest Physiology & Handling of Fruits and Vegetables. 1996
Reference Books	**:**	1. Girdharilal and Sidappa G.S. "Preservation of fruits & vegetables", CAR. New Delhi. 2. Tressler D.K. & Joslyn M.A. "Fruits & vegetables juice processing technology" edited by AVI publishing Co. Westport, Connecticut 1971 3.Wills, Lee, Graham,McGlasson & Hall "Post-Harvest Physiology &

		Handling of Fruits & Vegetables" AVI Publication 4. Shrivastava and Kunal. "Fruit and Vegetable Preservation"

Class & Semester	:	**T. Y. B. Tech (Food Technology), Part III, Semester V**				
Course Title	:	**Dairy Technology**		*Course Code*:	:	**FT313**
Teaching Scheme (Hours)	:	**Lectures 4 hours/weeks=4 x 13 weeks= 52 hours minimum** **Tutorial= 0 hour/week** **Practical= 02 hours/week**		*Total Credits*	:	**04+01=05**
Evaluation Scheme (Marks)	:	**CIE = 50** **SEE = 50**	**IPE=NIL** **IOE= NIL** **EOE= 50** : : : **Grand Total=150**	*Evaluation Scheme (Marks)*	:	**CIE = 50** **SEE = 50**
Revision:	:	**Third**		*Month*	:	**June 2018**

Pre-requisites	**:**	Students should have knowledge of Food Process Engg. I and II, Food Chemistry, Food Biochemistry, Food Microbiology
Type of Course	**:**	Theory
Course Domain	**:**	Core
Skills Imbibed	**:**	List Skills based on the Bloom's Taxonomy decide whether it come under Cognitive, Affective domain , Psychomotor domain

Course Assessment Methods:

1. Continuous Internal Evaluation: Unit Test I & Unit Test II, Regular Tutorial, home assignments
2. Semester End Examination.

Course Objectives:

1. To impart knowledge and technical proficiency in Clean milk production and handling Processing of milk Manufacture of western and indigenous dairy products Testing and quality control of milk and milk products.
2. To make the student to become acquainted with the principles of handling and processing of milk and milk products
3. To emphasis on to the principles of operation of equipment used in the milk processing industry
4. To apply of Engineering principle and concepts to handle store and process of milk and milk products
5. To provide students with information about the importance of quality control in dairy industry

Course Outcomes:

1. Explain processes involved in production of milk and milk products
2. Classify and explain the different types of milk products
3. Understand purpose and functions of hygiene in dairy industry
4. Produce flow chart for the production processes of various milk products
5. Be able to explain organization and operations involved in milk processing unit
6. Precautions that should be taken when processing milk and dairy products

	Hours
UNIT I Introduction	**4**
Present status and future prospects of dairy industry,	
UNIT II Properties of milk	
Definition of milk, composition of milk from different species, colostrums, Nutritive value of milk and milk products. Physico – Chemical properties of milk.	**10**
UNIT III Processing of milk	**10**
Collection, Processing: Pasteurization and sterilization of milk, Distribution of milk, Dairy equipments.	
UNIT IV Milk Products	
Butter and butter oil (Ghee), yoghurt and cheese: Classification, manufacturing process and quality controls, Ice-cream : Types of ice creams and manufacturing process	**10**
Indigenous milk products	
Dahi, Khoa, Channa, Shrikhand, Paneer, Lassi, Butter milk, Rasgolla, pedha and burfi	**10**
UNIT V Condensation & Evaporation of milk	
Condensed milk, Kheer, Basundi, Milk powder: Skim milk powder and whole milk powder,	**8**
UNIT VI Hygiene & Sanitation in Dairy Industry	
Hygiene, Sanitation & cleaning in Dairy Industry	

Text Books	:	
Reference Books	:	

1. Garret Smit. G., Dairy Processing. Woodhead Publishing Limited, England. 2005.
2. Edger Spreer: Milk and Dairy Product Technology Marcel Dekkar Inc. New York, USA

(2005).

3. James N. Warner "Principles of Dairy Processing" ,Wiley Eastern Ltd.

4. Eckles, Combs and Macy "Milk and Milk Products", Tata McGraw Hill.

<table>
<tr><td>Class & Semester</td><td>:</td><td colspan="6">T. Y. B. Tech (Food Technology), Part III, Semester V</td></tr>
<tr><td colspan="8"></td></tr>
<tr><td>Course Title</td><td>:</td><td colspan="3">Food Process Engineering II</td><td>Course Code:</td><td>:</td><td>FT 314</td></tr>
<tr><td>Teaching Scheme (Hours)</td><td>:</td><td colspan="3">Lectures 4 hours/weeks=4 x 13 weeks= 52 hours minimum
Tutorial= 0 hour/week
Practical= 02 hours/week</td><td>Total Credits</td><td>:</td><td>04+01=05</td></tr>
<tr><td>Evaluation Scheme (Marks)</td><td>:</td><td>CIE = 50
SEE = 50</td><td>IPE=NIL
IOE=50
EPE= NIL</td><td>:
:
:</td><td>Grand Total=150</td><td>Evaluation Scheme (Marks)</td><td>:</td><td>CIE = 50
SEE = 50</td></tr>
<tr><td>Revision:</td><td>:</td><td colspan="3"></td><td>Month</td><td>:</td><td>June 2018</td></tr>
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Pre-requisites	**:**	Students should have knowledge of Principles of Food Preservation, Food Chemistry, Food Process Engineering I subjects
Type of Course	**:**	Theory
Course Domain	**:**	Core
Skills Imbibed	**:**	List Skills based on the Bloom's Taxonomy decide whether it come under Cognitive, Affective domain , Psychomotor domain

Course Assessment Methods:

1. Continuous Internal Evaluation: Unit Test I & Unit Test II, Regular Tutorial, home assignments
2. Semester End Examination.

Course Objectives:

1. To introduce students to food unit operation applied in food process industries
2. To introduce students to different machines/equipment used in food processing
3. To make the student to become acquainted with the principles of handling and processing food and agricultural products.
4. To emphasis on to the principles of operation of equipment used in the processing industry and the response of biological materials to these operations.
5. To apply engineering principle and concepts to handle store and process of various food products.
6. To design food processing and operating equipment for production of various food products.

Course Outcomes:

1. Students will be able to know the machines/equipment used for the different unit operations in food processing carry out some of the basic unit operations in food processing
2. Students will have understanding of specific processing technologies used for various food products
3. Students will develop an ability to identify, formulate, and solve engineering problems
4. Students will have a comprehensive understanding of the aspects required to be controlled during food processing.
5. Students will have problem evaluation and problem solving skills regarding food processing operations that can affect the quality of foods
6. Students will have developed self-learning and practical proficiency and team work in food processing techniques to specific commodities and industrial plant unit operations.

	Hours
UNIT I Thermal processing Principles of Blanching, Pasteurization and Sterilization. Microbial survivor curves, thermal death time F, spoilage probability, methods for process calculations.	**8**
UNIT II Evaporation Principles of evaporation, types and selection of evaporators, mass and energy balance. Design of single and multiple effect evaporators, applications in food industries.	**8**
UNIT III Drying & psychometric chart **The psychometric chart**: construction and use of psychometric chart for food unit operations.	**10**
Drying : Principles of drying, drying rate kinetics, Dehydration systems, dehydration system design by mass and energy balance, drying time prediction.	**8**
UNIT IV Refrigeration and Freezing **Refrigeration**: Refrigeration system and its components. Selection of a refrigerant. Cold–storage plants **Freezing**: Food Freezing systems, Frozen food properties, Calculation of freezing time by Plank's equation and other modified methods	
UNIT V Extrusion processes of Food Basics principle of extrusion, Extrusion systems : cold and hot extrusion; single screw and twin screw extruder design, extrusion cooking, application of extrusion	**8**
UNIT VI Crystallization Theory and principles of Crystallization, nucleation, crystal growth, crystallization equipment, applications of crystallization in food processing.	**10**

Text Books	:	

1. Berk, Zeki "Food Process Engineering and Technology" Academic Press, 2009.
2. Smith, P.G. "Introduction to Food Process Engineering". Springer, 2004.
3. Toledo, Romeo T. "Fundamentals of Food Process Engineering". 3rd Edition, Springer, 2007.

Reference Books	:	

1. Ibarz A. & Barbosa-Canovas G. V., "Unit operation in food engineering". CRC PRESS, 2013.
2. Bark Z. "Food Process engineering and technology". Academic Press. 1st Edition, 2009.
3. Smith P.G., " Introduction to food processing engineering". Springer, 2nd education, 2011.
4. Fellows P.J. "Food processing Technology-Principles and Practices". Woodhead Publishing Limited, 2ND Edition, 2000.
5. Coulson J.M & Richardsons J.F., "Chemical engineering". Butterworth Heinemann, 5th Edition, vol 2, 2002.
6. Paul Singh R, and Dennis R.Heldman "Introduction to Food Engineering" 4th Edition. Academic Press – Elsevier India Private Ltd. New Delhi, 2008.

Class & Semester	:	**T. Y. B. Tech (Food Technology), Part III, Semester V**				
Course Title	:	**Process Instrumentation, Dynamics and control**			*Course Code*:	: **FT315**
Teaching Scheme (Hours)	:	**Lectures 3 hours/weeks= 3 x 13 weeks= 39 hrs minimum** **Tutorial= Nil** **Practicals 2 hours/weeks= 2 x 13 weeks= 26 hrs minimum**			*Total Credits*	: **04+ 00 +01 =05**
Evaluation Scheme (Marks)	:	**CIE = 50** **SEE = 50**	**IPE=Nil** **IOE=50** **EPE=Nil**	: : :	**Grand Total=150**	*Duration of SEE* : **3 hours**
Revision:	:	**Third**			*Month*	: **June 2018**

Pre-requisites	**:**	Students are expected to have a background in mathematics through differential equations, Laplace transformation, material and energy balance concepts, and unit operations.
Type of Course	**:**	Theory
Course Domain	**:**	Core
Skills Imbibed	**:**	Cognitive: Recall, Understand, Apply, Affective : Awareness Psychomotor: manipulation

Course Assessment Methods:

Students are evaluated during Continuous Internal Evaluation (Unit Test I & Unit Test II) , Semester End Examination ,Internal oral examination and home assignments

Course Objectives:

1. To understand working principles of basic instruments available for flow, pressure, level and temperature measurement
2. To understand dynamic behavior and modeling of process systems and equipments.
3. To learn the Laplace and Inverse Laplace Transforms in order to obtain transfer functions and dynamic responses.

4. To understand and analyze stability characteristics of dynamic systems.
5. To provide knowledge of P, PI and PID controllers in chemical and process industries.
6. To understand frequency response of dynamic systems

Course Outcomes:

1. The student will be able to understand working principles of basic instruments available for flow, pressure, level and temperature measurement
2. The student will be able to model dynamical systems.
3. The students will be able to understand the use and measurement of transfer functions
4. The students will be able apply knowledge of mathematics [Laplace Transforms] to model and solve the models describing dynamics of chemical processes.
5. The students will be able to evaluate stability of control loops.
6. The students will be able to understand dynamic behavior and stability of chemical process control systems

Curriculum Content	Hours
Unit:I Measuring Instruments: Theory, practice and applications of measurements of temperature, mass and levels. Measurement of pressure, vacuum, humidity and pH in process industry.	4
Unit:II Flow measuring instruments: Flow measuring devices for incompressible and compressible fluids. Electro-hydraulic valves, hydraulic servomotors, electro-pneumatic valves. Pneumatic actuators.	5
Unit:III Dynamic behavior of Chemical Processes: Characteristics of Chemical Process Control, Mathematical Modeling of Chemical Processes, Linearization of non linear systems, Solution of Linear differential equation using Laplace Transform. First and higher order systems. Pure capacity process, First order system with variable time constant and gain, Response of first order system in series: Interacting and Non-interacting systems, Dynamic behavior of second order system: Under damped and over damped and critically damped systems, Transportation lag.	8 8
Unit:IV Introduction to feedback control: Elements of Control loop - controller, measuring device, final control element, transmission lines, transducers, transmitters, development of block diagram. Concept of servo and regulatory problems. Selection of measured, manipulated and controlled variables. Types of controller - on-off ,P, PI, PID. Effects of proportional, integral and derivative actions.	6

Unit :V Stability and Freqency response: Stability analysis by Routh criteria, Root Locus Diagram. Design of feedback control system using frequency response technique: Bode's stability criteria, gain and phase margin. Ziegler- Nichols tuning technique. Nyquist stability criteria. **Unit: VI** Other control strategies: Feed forward controller - design with steady state model, design with dynamic model, combination of feed forward-feedback structure, Cascade control structure - analysis and design, Ratio control, split range control, selective control, override control, auctioneering control.	8

Reference Books	:	

1. "Chemical Process Control: An Introduction to Theory and Practice ", Stephanopoulos, G.,Prentice-Hall, New Jersey, 1984
2. "Process systems Analysis and Control ", Coughanowr, D. R. and L. B. Koppel, Mc-Graw-Hill, 2nd. Ed., 1991.
3. "Process Modelling Simulation and Control for Chemical Engineers ", Luyben, W. L., McGraw Hill, 1990

Class & Semester	:	**T. Y. B. Tech (Food Technology), Part III, Semester VI**									
Course Title	:	**Food Packaging Laboratory**						*Course Code*:	:	**FT311L**	
Teaching Scheme (Hours)	:	**2 hr /week= 2 x13= 26 hours**						*Credits*	:	**1**	
Evaluation Scheme (Marks)	:	**IPE** **IOE**	: :	**Nil** **50**	**EPE** **EOE**	: :	**Nil** **Nil**	*Duration of Exam (in case of External Evaluation)*	:	**02 hours**	
Revision:	:	**Third**						*Month*	:	**June 2018**	

Pre-requisites **:** The students should have knowledge of Food Preservation, Food Engg. I &II, Food Chemistry and Food Microbiology

Type of Course **:** Practical

Course Domain **:** Core

Skills Imbibed **:**
Cognitive: Understand, Apply, Analyze, Evaluate, Create
Affective : Awareness, Respond, Value, Organize
Psychomotor: Perception, Imitation, manipulation, articulation

Course Assessment Methods:

Practical Journal Assessment, External Oral Examination

Course Objectives:

1. *To impart practical knowledge and skills*
2. To introduce students to food unit operation i.e. packaging use in food process industries
3. To introduce students to different machines/equipment used for packaging
4. To make the student to become acquainted with the principles of handling and processing packaging material testing equipments.
5. To inculcate the practical proficiency in a food packaging laboratory.
6. To make the students to develop a *new packaging material and new packaging techniques* as per requirement of society.

Course Outcomes:

1. The students will understand the food unit operation i.e. packaging use in food process industries.
2. Students will be able to know and apply the machines/equipment used for the different packaging materials.
3. The students will have the practical proficiency in a food packaging units.

4. Students will have an ability to identify, formulate, and solve packaging problems
5. Students will have problem evaluation and problem solving skills regarding food packaging operations that can affect the quality of foods.
6. Students will have developed self-learning and practical proficiency and team work in food processing techniques.

Experiments List **:**

1. Classification of various packages based on material and rigidity,
2. Measurement of thickness of paper and paper boards,
3. Measurement of water absorption of paper, paper boards,
4. Measurement of bursting strength of paper of paper boards,
5. Measurement Tear resistance of papers,
6. Measurement of puncture resistance of paper and paperboard,
7. Measurement of tensile strength of paper of paper boards,
8. Determination of gas transmission rate of package films,
9. Determination of WVTR of film,
10. Identification of Packaging materials,
11. Edible packaging of Fruits,
12. Visit to packaging industry

Lab Manual **:**

Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow etc.

Class & Semester	:	**T. Y. B. Tech (Food Technology), Part III, Semester V**								
Course Title	:	**Fruits and Vegetables Processing Technology-Lab**						*Course Code*:	:	**FT312L**
Teaching Scheme (Hours)	:	**2 hr /week= 2 x13= 26 hours**						*Credits*	:	**1**
Evaluation Scheme (Marks)	:	**IPE** **IOE**	: :	**Nil** **Nil**	**EPE** **EOE**	: :	**50** **Nil**	*Duration of Exam (in case of External Evaluation)*	:	**02 hours**
Revision:	:	**Third**						*Month*	:	**June 2018**

Pre-requisites **:** Knowledge of Principles of Food Preservation, Food Chemistry, Food Biochemistry, Food Additives and Contaminants, Food Process Engineering I subjects etc.

Type of Course **:** Practical

Course Domain **:** Core

Skills Imbibed **:** Cognitive: Understand, Apply, Analyze, Evaluate, Create
Affective : Awareness, Respond, Value, Organize
Psychomotor: Perception, Imitation, manipulation, articulation

Course Assessment Methods:

Practical Journal Assessment, External Practical Examination

Course Objectives:

1. *To impart practical knowledge and skills*
2. To introduce students to fruits and vegetable processing technology
3. To introduce students to different machines/equipment used in fruits and vegetables processing
4. To make the student to become acquainted with the principles of handling and processing food and agricultural products
5. To inculcate the practical proficiency in a fruits and vegetables processing

laboratory

6. To make students to develop a *new fruits and vegetables products* as per requirement of society

Course Outcomes:

1. The students will understand the processing of fruits and vegetable products followed in food industries.
2. Students will be able to know and apply the machines/equipment used for the different unit operations in fruits and vegetable processing industry.
3. The students will have the practical proficiency in a fruits and vegetable processing units.
4. Students will have an ability to identify, formulate, and solve agricultural and industrial problems.
5. Students will have problem evaluation and problem solving skills regarding fruits and vegetables processing operations that can affect the quality of products.
6. Students will have developed self-learning and practical proficiency and team work in fruits and vegetables processing techniques.

Experiments List **:**

1.Demonstration of canning of Fruits and Vegetables,
2. Preparation of fruit jam,
3. Preparation of fruit jelly,
4. Preparation of fruit marmalade,
5. Preparation of fruit preserve and candy,
6. Preparation of fruit RTS/Syrups,
7. Preparation of fruit squash
8. Preparation of grape raisin,
9. Preparation of pickle
10. Dried vegetables

Lab Manual **:**

Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow etc.

Class & Semester	:	**T. Y. B. Tech (Food Technology), Part III, Semester V**									
Course Title	:	**Dairy Technology Laboratory**						*Course Code*:	:	**FT313L**	
Teaching Scheme (Hours)	:	**2 hr /week= 2 x13= 26 hours**						*Credits*	:	**1**	
Evaluation Scheme (Marks)	:	**IPE** **IOE**	: :	**Nil** **Nil**	**EPE** **EOE**	: :	**Nil** **50**	*Duration of Exam (in case of External Evaluation)*	:	**02 hours**	
Revision:	:	**Third**						*Month*	:	**June 2018**	

Pre-requisites	**:**	Students should have knowledge of Food Process Engg. I and II, Food Chemistry and Food Microbiology
Type of Course	**:**	Practical
Course Domain	**:**	Core
Skills Imbibed	**:**	Cognitive: Understand, Apply, Analyze, Evaluate, Create Affective : Awareness, Respond, Value, Organize Psychomotor: Perception, Imitation, manipulation, articulation

Course Assessment Methods:

Practical Journal Assessment and External Practical Examination (EPE)

Course Objectives:

1. To acquire knowledge of analytical skills of milk and milk products.
2. To introduce students to starter culture technology and selection of starters for production of different dairy products.
3. To introduce the students to latest developments in milk processing technologies
4. To give exposure of different equipments used in dairy industry to students
5. To inculcate the practical proficiency in a Milk and milk processing laboratory.
6. To introduce the students to latest developments in milk processing technologies and new product development.

Course Outcomes:

1. Explain processes involved in production of milk and milk products
2. Classify and explain the different types of milk products
3. Understand purpose and functions of hygiene in dairy industry
4. Produce flow chart for the production processes of various milk products
5. Be able to explain organization and operations involved in milk processing unit
6. Precautions that should be taken when processing milk and dairy products

Experiments List	**:**	

1. Sampling and analysis of milk – physico chemical properties and composition,
2. DMC and DYC reduction tests, presence of adulterants and preservatives.
3. Standardization of milk for markets,
4. Clarification and separation of milk,
5. Preparation of butter and ghee,
6. Ice-cream preparation,
7. Preparation of dahi, shrikhand, lassi etc,
8. Preparation of khoa and khoa based sweets,
9. Preparation of channa, paneer and chana based sweets,

   Visit to Dairy plant

Lab Manual	**:**	

Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Class & Semester	:	**T. Y. B. Tech (Food Technology), Part III, Semester V**									
Course Title	:	**Food Process Engineering II Laboratory**						*Course Code*:	:	**FT314L**	
Teaching Scheme (Hours)	:	**2 hr /week= 2 x13= 26 hours**						*Credits*	:	**1**	
Evaluation Scheme (Marks)	:	**IPE** **IOE**	: :	**Nil** **50**	**EPE** **EOE**	: :	**Nil** **Nil**	*Duration of Exam (in case of External Evaluation)*	:	**02 hours**	
Revision:	:	**Third**						*Month*	:	**June 2018**	

Pre-requisites **:** In order to complete the course studies successfully, it is important to have a good knowledge of Principles of Food Preservation, Food Chemistry, Food Process Engineering I subjects

Type of Course **:** Practical

Course Domain **:** Core

Skills Imbibed **:** Cognitive: Understand, Apply, Analyze, Evaluate, Create
Affective : Awareness, Respond, Value, Organize
Psychomotor: Perception, Imitation, manipulation, articulation

Course Assessment Methods:

Practical Journal Assessment, Internal Oral Examination and External Practical Examination

Course Objectives:

1. *To impart practical knowledge and skills.*
2. To introduce students to food unit operation applied in food process industries
3. To introduce students to different machines/equipment used in food processing
4. To make the student to become acquainted with the principles of handling and processing food and agricultural products.
5. To inculcate the practical proficiency in a food process engineering laboratory.
6. To make students to develop a *new product* as per requirement of society

Course Outcomes:

1. Better understanding of food unit operation applied in food process industries
2. Students will be able to know and apply the machines/equipment used for the different unit operations in food processing
3. The students will have the practical proficiency in a food processing units
4. Students will have an ability to identify, formulate, and solve engineering problems
5. Students will have problem evaluation and problem solving skills regarding food

processing operations that can affect the quality of foods

6. Students will have developed self-learning and practical proficiency and team work in food processing techniques.

Experiments List **:**

1. Numerical problem on Thermo bacteriology (D, Z, & F)
2. Study of evaporator
3. Design problems on evaporators,
4. Determination of air properties using psychometric chart
5. Study of dryers
6. Osmotic Dehydration of Foods.
7. Design problems on Dryers
8. Study of Freezing of foods by different methods
9. Study of refrigeration of foods
10. Determination of freezing time of a food material,
11. Study of Extrusion process in food
12. Study of crystalliser
13. Industrial visit

Lab Manual **:**

Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Class & Semester	:	**T. Y. B. Tech (Food Technology), Part III, Semester V**									
Course Title	:	**Process Instrumentation and Control Laboratory**						*Course Code*:	:	**FT315L**	
Teaching Scheme (Hours)	:	**2 hr /week= 2 x13= 26 hours**						*Credits*	:	**1**	
Evaluation Scheme (Marks)	:	**IPE** **IOE**	: :	**Nil** **50**	**EPE** **EOE**	: :	**Nil** **Nil**	*Duration of Exam (in case of External Evaluation)*	:	**02 hours**	
Revision:	:	**Third**						*Month*	:	**June 2018**	

Pre-requisites **:** In order to complete the course studies successfully, it is important to have a good knowledge of Food Process Engineering I and II subjects

Type of Course **:** Practical

Course Domain **:** Engineering

Skills Imbibed **:** Cognitive: Understand, Apply, Analyze, Evaluate, Create
Affective : Awareness, Respond, Value, Organize
Psychomotor: Perception, Imitation, manipulation, articulation

Course Assessment Methods:

Practical Journal Assessment and Internal Oral Examination

Course Objectives:

1. To understand the process dynamics and various forms of mathematical models to express them, including differential equations, Laplace transfer functions, and frequency response plots,
2. To analyze, design and tune feedback / feed forward controllers in the context of various control strategies used to control Food and biological processes

Course Outcomes:

1. Understand and discuss the importance of process control in process operation and the role of process control engineers
2. Understand and design the modem hardware and instrumentation needed to implement process control.
3. Develop mathematical models of chemical and biological processes by writing unsteady-state mass and energy balances**.**
4. Recognize unit operations and effect of other parameters on them.
5. Evaluate instrumentation and control related with the unit operations.
6. Identify unit operations used in different industries.

Experiments List **:**

Dynamic behavior of first order system

1. Mercury Thermometer 2. Single tank system. 3. C.S.T.R.

Dynamic behavior of first order system in series

4. Two tank non-interacting system. 5. Two tank interacting system.

Dynamic behavior of second order system

6. Mercury Manometer

Dynamic behavior of final control Element

7. Pneumatic control valve. Study of Pneumatic controllers.

8. Proportional Controller

9. Proportional Derivative Controller

10. Proportional Integral Controller

11. Proportional Integral Derivative

Controller Control Systems

12. Study of closed loop control system.

Lab Manual **:**

Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Class & Semester	:	**T. Y. B.Tech. (Food Technology), Part III, Semester V**									
Course Title	:	**Internship I**							*Course Code*:	:	**FT316**
Teaching Scheme (Hours)	:	**Nil**							*Credits*	:	**1**
Evaluation Scheme (Marks)	:	**IPE** **IOE**	:	**Nil** **50**	**EPE** **EOE**	:	**Nil** **Nil**		*Duration of Exam (in case of External Examination)*	:	--
Revision	:	**Third**							*Month*	:	**June 2018**

Pre-requisites **:** The pre-requisite for this course is to have the idea of the overview of the fundamental courses of Food Technology.

Type of Course **:** Industrial Training

Course Domain **:** Core

Skills Imbibed **:** Cognitive: Understand, Apply, Analyze, Evaluate, Create
Affective : Awareness, Respond, Value, Organize
Psychomotor: Perception, Imitation, Manipulation, Articulation

Course Assessment Methods:

Students are evaluated by Internal Oral Examination. The evaluation will be based on the internship report as well as completion certificate issued by the concerned organization.

Course Objectives:

1. To expose students to the 'real' working environment and get acquainted with the organization structure, business operations and administrative functions;
2. To have hands-on experience in the students' related field so that they can relate and reinforce what has been taught at the university;
3. To promote cooperation and to develop synergetic collaboration between industry and the university in promoting a knowledgeable society;
4. To set the stage for future recruitment by potential employers;

Course Outcomes: After successful completion of this course, the student will be able to:

1. Acquaint to actual working environment.
2. Acquire ability to utilize technical resources.
3. Write technical documents and give oral presentations related to the work completed.
4. Develop attitude of a team player and aptitude for lifelong learning.

Course Description

The primary objective of internship is to expose students to meaningful and relevant workplace attachment to better connect their learning to the workplace and deepen their skills, so that they are better prepared for their transition to the workplace after graduation.

As a part of the B.Tech Food Technology curriculum, 'FT316 Internship I' is similar to a

practical course, which the students of Food Technology must undergo in reputed Private / Public Sector / Government organization / companies as an Internship of minimum Four weeks after the IV Semester End Examination i.e. during the summer vacation after their Second Year B.Tech and Prior to the commencement of Third Year B.Tech.

Class & Semester	:	**T. Y. B.Tech (Food Technology), Part III, Semester V**								
Course Title	:	**Introduction to Foreign Language**						*Course Code*:	:	**LS311**
Teaching Scheme (Hours)	:	**2 hr /week= 2 x13= 26 hours**						*Credits*	:	**Nil**
Evaluation Scheme (Marks)	:	**Assignments** **Viva voce**	: :	**50** **25**	**Written Test** **Grand Total**	: :	**25** **100**	*Duration of Exam*	:	**Not Applicable**
Revision	:	**Third**						*Month*	:	**June 2018**

Pre-requisites **:** As it is the introduction to the language, it has no pre-requisites

Type of Course **:** Audit Course at institute level

Course Domain **:** Linguistics

Skills Imbibed **:** Cognitive: Understand, Predicting Situation, Comprehend,
Affective : Receive, Listen, Respond, Showing self-reliance, Organize
Psychomotor: Imitation, adaptation, articulation, origination

Course Assessment Methods:

The students will be given five assignments each for 10 marks. At the end of the course, there will be a written test of 25 marks and a viva voce of 25 marks. There will be assessment for a total of 100 marks. Based on the marks obtained, they will be awarded with a grade similar to other credit courses. Though it is an audit course, obtaining passing grade is essential.

Course Objectives:

1. To make the students able to communicate and translate in foreign languages for the *technical and scientific documentation*, beneficial to Defense and other Government sector services;
2. To make them globally competent in the era of industrial liberalization;
3. To complement their core studies in international business;
4. To make them confident while opting for better career prospects in Multinational Companies (MNCs) for technical and scientific translation/ interpretation tasks while working for joint ventures or collaborative partnership;

Course Outcomes:

1. The students will be able to acquire a good knowledge the basic grammar of foreign language and learn Alphabet, Common Words and Phrases in foreign language.
2. The students will also be able to learn to read the simple texts in foreign language.
3. The students would be able to speak a little using the greetings, well wishes etc. in Foreign Language.
4. The students will learn to count numbers, answer to the questions like, what is your name, surname, tell age, and can initiate little communication in Foreign Language.
5. The students can also translate simple sentences in foreign language.

Curriculum Content	Hours
Unit I: General Information on Basic Grammar of the foreign language, Introduction to Alphabet.	**04**
Unit II: Gender of Noun, Number of Noun, Pronouns, Adjectives, Verbs and their usage in simple sentences, Numbers (up to 10), Simple Greetings in foreign language.	**05**
Unit III General Questions in foreign language, like What is your name/surname? Who/What is this? Etc.	**04**
Unit IV: Simple narration about self/family/friend/University in foreign language chosen for studies. Practicing the learnt topics in the class itself.	**05**
Unit V: Formation of simple sentences using Parts of Speech, Information on Cases, One or Two simple lessons from any book.	**04**
Unit VI: Basic information on Country & Culture of language under study.	**04**

Reference Books **:**

1. V.N.Wagner and V. G. Ovsienko, Russian, People's Publishing House, New Delhi.
2. S. Khavronina and A. Shirochenskaya, Russian in Exercises.
3. Genki – Japan Times
4. Aural Comprehension in Japanese – Osamu & Nobuko Mizutani.
5. An Introduction to Modern Japanese - Osamu & Nobuko Mizutani.
6. Japanese for Today – Y. Yoshida.
7. Lagune 1(Full set), Published by Langers, (An imprint of Saraswati House Pvt.Ltd), New Delhi 1 10002 (India).

Class & Semester	:	**T. Y. B. Tech (Food Technology), Part III, Semester VI**						
Course Title	:	**Sugar and Confectionery Technology**				*Course Code*:	:	**FT321**
Teaching Scheme (Hours)	:	**Lectures 4 hours/weeks=4 x 13 weeks= 52 hours minimum** **Tutorial= 0 hour/week** **Practical= 02 hours/week**				*Total Credits*	:	**04+01=05**
Evaluation Scheme (Marks)	:	**CIE = 50** **SEE = 50**	**IPE=NIL** **IOE= NIL** **EPE= 50**	: : :	**Grand Total=150**	*Evaluation Scheme (Marks)*	:	**CIE = 50** **SEE = 50**
Revision:	:	**Third**				*Month*	:	**June 2018**

Pre-requisites	**:**	Students should have knowledge of Food Process Engg. I and II, Food Chemistry
Type of Course	**:**	Theory
Course Domain	**:**	Core
Skills Imbibed	**:**	List Skills based on the Bloom's Taxonomy decide whether it come under Cognitive, Affective domain , Psychomotor domain

Course Assessment Methods:

1. Continuous Internal Evaluation: Unit Test I & Unit Test II, Regular Tutorial, home assignments
2. Semester End Examination.

Course Objectives:

1. To study the methods of manufacturing of sugar and other allied products.
2. To study about the machineries involved in confectionery manufacturing.
3. To elaborate the role of gelling agents, stabilizers and preservatives in sugar and confectionery
4. To know the importance and role of various ingredients used in sugar and confectionary products.
5. To understand the different types of sugar confectionary products and their process

Course Outcomes:

1. Explain processes involved in production of cocoa processing and chocolate manufacturing
2. Classify and explain the different types of Sugar and confectionary products
3. Understand purpose and functions of hygiene in cocoa processing and chocolate manufacturing industry
4. Produce flow chart for the production processes of various Sugar and confectionary products
5. Be able to explain organization and operations involved in Sugar and chocolate manufacturing industry
6. Precautions that should be taken when processing Sugar and confectionary industry

UNIT I Introduction of sugar and Confectionary	**Hours**
Present status and future scope of sugar and confectionery industries.	**4**
UNIT II Properties of ingredients	
Sugar : sugar qualities, physical, chemical, optical properties of sugar.	**10**
Other Ingredients : Properties of invert sugar, glucose syrup, dextrose, fructose, lactose, caramel, maltose, honey, sorbitol, xylitol, iso malt, soy maltose, polydextrose, lactitol, maltitol, Additives used in confectionery.	
UNIT III Sugar, **Cocoa and Chocolate processing**	**10**
Sugar : Processing of sugar, Cocoa :cocoa bean processing, roasting, fermentation, production of cocoa butter, cocoa powder, its quality	
Chocolate : Ingredients, mixing, refining, conching, tempering, moulding, cooling, coating, fat bloom	
UNIT IV High boiled sweets	**10**
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	
UNIT V Toffee, Fudge and Caramel	**10**
Definition, composition, types of ingredient and their role. batch and continuous method of Toffee, Fudge and Caramel	
UNIT VI Lozenges ,Fondant and Chewing Gums	**8**
Definition recipe, method of manufacture, compositions, factors affecting quality, industrial production, checklist of faults	

Text Books	:	
Reference Books	:	

1. R. Less and E.B. Jackson "Sugar Confectionery and Chocolate Manufacture"

2. E.B. Jackson: Sugar Confectionery Manufacture, Second edition, Aspen publishers Inc., 1999. Great Britain
3. Minifie, B.W. Chocolate, cocoa and confectionery – Science and Technology. 3rd Edition,Aspen Publishers Inc., Great Britain. 2010.
4. .W.Ray, Junk & Harry M. Pancost: Hand Book of Sugars – for Processors, Chemists and Technologists: AVI Publishing, West port (1973)
5. Industrial Chocolate Manufacture: S.T. Beckett
6. Sugar Confectionery: Jackson and Lees

Class & Semester	:	**T. Y. B. Tech (Food Technology), Part III, Semester VI**					
Course Title	:	**Technology of Cereals & Bakery Products**			*Course Code*:	:	**FT 322**
Teaching Scheme (Hours)	:	**Lectures 4 hours/weeks=4 x 13 weeks= 52 hours minimum** **Tutorial= 0 hour/week** **Practical= 02 hours/week**			*Total Credits*	:	**04+01=05**
Evaluation Scheme (Marks)	:	**CIE = 50** **SEE = 50**	**IPE=NIL** **EOE=50** **EPE= NIL**	: : :	**Grand Total=150**	*Evaluation Scheme (Marks)*	:	**CIE = 50** **SEE = 50**
Revision:	:	Third				*Month*	:	**June 2018**

Pre-requisites	**:**	In order to complete the course studies successfully, it is important to have a good knowledge of food chemistry, food biochemistry, principle of food preservation and food process engineering I and II
Type of Course	**:**	Theory
Course Domain	**:**	Core
Skills Imbibed	**:**	List Skills based on the Bloom's Taxonomy decide whether it come under Cognitive, Affective domain , Psychomotor domain

Course Assessment Methods:

1. Continuous Internal Evaluation: Unit Test I & Unit Test II, Regular Tutorial, home assignments
2. Semester End Examination.

Course Objectives:

1. To have knowledge of different cereal grains produced and used worldwide.
2. To characterize the chemical composition of cereal grains and their functional properties.
3. To understand the processes of dry, wet and modern milling technology of cereals
4. To knowledge of processing of bakery products

Course Outcomes:

1. Able to identify the structure of cereal grains and their components.
2. Able to process cereal grains into raw materials for bakery products.

3. Understand the important quality attributes and quality indicators of cereals
4. Understand how a cereal mill and quality lab operates.
5. Able to process cereals into bakery products
6. Identify the common faults and causes in Bakery products

	Hours
UNIT I Introduction of Cereals Present status and future prospects of cereals (Rice, Wheat, Corn, Sorghum, Rye)	**6**
UNIT II Wheat Morphology, Structure, composition, milling, Parboiling, Products	**8**
UNIT III Rice Morphology, Structure, composition, milling, Parboiling, Products	**8**
UNIT IV Corn Wet milling and dry milling, corn flakes, starch and its hydrolyzed syrups.	**8**
UNIT V Barley, Sorghumand Millets – Oat / Rye Barley Morphology, Physico-chemical properties and processing (Malting) **Sorghum** Morphology, Physico-chemical properties, Milling, Malting, Pearling and industrial utilization **Millets – Oat / Rye** Importance of Millet, composition, processing of millets for food uses	**14**
UNIT VI Bakery products Bread, biscuits, cookies, Cake, Pastry (Role of ingredients, processing, major machineries, Quality control)	**8**

Text Books :

1.Matz Samuel A “Cereal technology:” AVI publishing co. Inc Westport Connecticut 1970

2.Kent Jones W.D. & Amos A.J., “Modern Cereal Chemistry” Food Trade Press Ltd. London 1976

Reference Books :

1. Pomeranz Y. “Wheat chemistry & technology”, edited by American Association of cereal chemists, Minnesota 1978
2. Daniel A.R “Bakery materials & methods” Mc Larene & sons Ltd.London 1947
3. Manufacture of biscuits cakes & wafers by Fritsch J. & Grosspicrre, London 1932.
4. Matz S.A, “Snack food technology” AVI publishing Co.1976.

<table>
<tr><td>Class & Semester</td><td>:</td><td colspan="6">T. Y. B. Tech (Food Technology), Part III, Semester VI</td></tr>
<tr><td>Course Title</td><td>:</td><td colspan="3">Biochemical Engineering</td><td>Course Code:</td><td>:</td><td>FT 323</td></tr>
<tr><td rowspan="3">Teaching Scheme (Hours)</td><td rowspan="3">:</td><td colspan="3">Lectures 4 hours/weeks=4 x 13 weeks= 52 hours minimum</td><td rowspan="3">Total Credits</td><td rowspan="3">:</td><td rowspan="3">04+01=05</td></tr>
<tr><td colspan="3">Tutorial= 0 hour/week</td></tr>
<tr><td colspan="3">Practical= 02 hours/week</td></tr>
<tr><td>Evaluation Scheme (Marks)</td><td>:</td><td>CIE = 50
SEE = 50</td><td>IPE=NIL
IOE=50
EPE= NIL</td><td>:
:
:</td><td>Grand Total=150</td><td>Evaluation Scheme (Marks)</td><td>:</td><td>CIE = 50
SEE = 50</td></tr>
<tr><td>Revision:</td><td>:</td><td colspan="3">Third</td><td>Month</td><td>:</td><td>June 2018</td></tr>
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Pre-requisites	**:**	Students should have basic understanding of Food engineering I and II, Food microbiology, Food chemistry, physics and mathematics
Type of Course	**:**	THEORY
Course Domain	**:**	Core
Skills Imbibed	**:**	List Skills based on the Bloom's Taxonomy decide whether it come under Cognitive, Affective domain , Psychomotor domain
Course Assessment Methods: 1. Continuous Internal Evaluation: Unit Test I & Unit Test II, Regular Tutorial, home assignments 2. Semester End Examination.		

Course Objectives:

1. To understand the mechanism and application of the bioreactor.
2. To understand thoroughly the food processing unit operations.
3. To understand and apply the principles of heat transfer and mass transfer phenomena
4. To understand the fermentation technology.

Course Outcomes:

1. Describe and compare the different structures and growth modes of diverse microorganisms
2. Describe key biochemical components and biochemical pathways
3. Understanding of biological basics and bioprocess engineering
4. Understanding the difference between bioprocesses and chemical processes
5. Knowledge of designing and operation of bioreactor
6. Heat & mass transfer considerations and scale up of bioprocesses

	Hours
UNIT I Kinetics of microbial growth and death Definition, fermentation kinetics rate of cell synthesis, product formation and effect of environment. Types of kinetics, Batch and continuous type, control measures	**6**
UNIT II Simple enzyme kinetics Simple kinetics model for enzyme substrate interaction. Derive the equation of Michelin Menton, for reaction rate, product formation, calculation of Km and V max values. Complex enzyme kinetics: Oxidation – reduction form of enzymes, observed apparent rate constant, factors affecting the inhibition, competitive, non competitive inhibition, substrate interaction	**10**
UNIT III Kinetics pattern of various fermentations Classification of kinetics pattern, as per different scientists, simple, simultaneous, consecutive, stepwise, complex reactions and their examples	**8**
UNIT IV Air sterilization, aeration and agitation Definition, thermal death time, media heat sterilization, advantages of continuous sterilization. **Aeration and agitation :**Oxygen requirement of industrial fermentations, determination of K_La Value, factors affecting K_La Value	**10**
UNIT V Fermenter Design, operation and their problems during Scale up, management of cellular process.	**8**
UNIT VI Downstream processing and product recovery Separation techniques like adsorption, chromatography, precipitation, ultra filtration etc., purification techniques: spray drying, fluidized bed drying etc, Product formation for value added products using bioconversions techniques, production of antibiotics, economic process, utilization of byproducts through bioconversion, present mode of utilization and their nutritional value.	**10**

Text Books	:	

1. Shuler, M.L. and Kargi, F. “Bioprocess Engineering: Basic Concepts”, 2ndEdition, PHI, 2002.
2. Palmer, Trevor “Enzymes: Biochemistry, Biotechnology, Clinical Chemistry”, Affiliated East-West Press Pvt. Ltd., 2004.
3. Stanbury, P.F., A. Whitaker and S.J. Hall “Principles of Fermentation

<table>
<tr><td colspan="3">Technology", 2nd
4. Edition, Butterworth – Heinemann (an imprint of Elsevier), 1995.</td></tr>
<tr><td>Reference Books</td><td>:</td><td></td></tr>
<tr><td colspan="3">1. Doran, P.M. "Bioprocess Engineering Principles", Academic Press, 1995.
2. Najafpour, D. Ghasem. "Biochemical Engineering & Biotechnology". Elsevier, 2007.
3. Bryce, C.F.A and EL. Mansi. "Fermentation Microbiology & Biotechnology, 1999.
4. Blanch, H.W. and Clark, D.S. "Biochemical Engineering", Marcel Decker Inc., 1997.</td></tr>
</table>

Class & Semester	:	**T. Y. B. Tech (Food Technology), Part III, Semester VI**					
Course Title	:	**Process Equipment Design and Drawing**			*Course Code*:	:	**FT 324**
Teaching Scheme (Hours)	:	**Lectures 4 hours/weeks=4 x 13 weeks= 52 hours minimum** **Tutorial= 0 hour/week** **Practical= 02 hours/week**			*Total Credits*	:	**04+01=04**
Evaluation Scheme (Marks)	:	**CIE = 50** **SEE = 50**	**IPE=NIL** **IOE=50** **EPE= NIL**	: : :	**Grand Total=150**	*Evaluation Scheme (Marks)*	:	**CIE = 50** **SEE = 50**
Revision:	:	**Third**				*Month*	:	**June 2018**

Pre-requisites	**:**	In order to complete the course studies successfully, it is important to have a good knowledge of Fundamental statistics of the design of equipment safely and economically efficient manner.
Type of Course	**:**	Theory
Course Domain	**:**	core
Skills Imbibed	**:**	List Skills based on the Bloom's Taxonomy decide whether it come under Cognitive, Affective domain , Psychomotor domain

Course Assessment Methods:

1. Continuous Internal Evaluation: Unit Test I & Unit Test II, Regular Tutorial, home assignments
2. Semester End Examination.

Course Objectives:

1. To learn about the design procedures of process equipment's used in chemical and food process plants.
2. To learn the process and mechanical aspects of equipment design.
3. To be exposed to various design codes and standards used in design of equipment.

4. To learn to draw various process equipment's and mechanical components as per calculated design.

Course Outcomes:

1. Understand the role of design engineer in designing procedure and knowledge of basics of process equipment design
2. Understand the design of important components like flange, coupling and belt drive
3. Understand key criteria involved in the design of internal pressure vessels as per IS Code.
4. Able to design heat transfer equipments used in food processing
5. Ability to design storage vessels and various parts of vessels (e.g. heads, bottom plate)
6. Understand the relationship between process design, safety and environment.

	Hours
UNIT I Measuring Instruments Theories, practice and applications of measurements of temperature, mass and levels. Measurement of pressure, vacuum, humidity & pH in process industry.	**8**
UNIT II Flow measuring instruments Flow measuring devices for incompressible and compressible fluids. Electro-hydraulic valves, hydraulic servomotors, electro-pneumatic valves. Pneumatic actuators.	**8**
UNIT III Introduction to simple system analysis Characteristics of Chemical Process Control, Mathematical Modeling of Chemical Processes, State Variables and State Equation for Chemical Processes. Input – Output Model, Linearization of non linear systems, Solution of Linear differential equation using Laplace Transform. Block diagrams, linearization. First and higher order systems.	**10**
UNIT IV Dynamic behavior of first & second order system Pure capacity process, First order system with variable time constant and gain, Response of first order system in series: Interacting and Non-interacting systems. Under damped and over damped and critically damped systems, Transportation lag. Higher order systems. Introduction to feedback control, Controllers and final control elements. Control action block diagram of chemical reactant control systems.	**8**
UNIT V Dynamic behavior of feedback control processes P, PD, PI, and PID. Design of feedback controller, Performance criteria, selection of type of controller, Tuning of feedback controller. Stability analysis by Routh criteria, Root Locus Diagram.	**8**

UNIT VI Frequency response analysis of linear processes Bode's diagram, Nyquist plots. Design of feedback control system using frequency response technique: Bode's stability criteria, gain and phase margin. Ziegler – Nichols tuning technique. Nyquist stability criteria, Control Systems with Multiple Loops, Feed forward control, Cascade control, Ratio control, selective control, split range control, Adaptive an Inferential control. Multi Variable Control	**10**

Text Books	**:**	

1. Joshi M. V., Mahajani V. V., 'Process Equipment Design', Macmillan, 2010.
2. Bhattacharya B. C., 'Introduction to Chemical Equipment Design Mechanical Aspects', CBS Publishers, Delhi, 1991.
3. E. Brownell and Edwin, H. Young, 'Process Equipment Design − Vessel Design ', John Wiley, New York 1963.

Reference Books	**:**	

1. M. S. Peters & K. D. Timmerhaus, "Plant Design and economics for chemical engineers." Mc Graw Hill (2002).
2. Richard Turton, R.C. Bailie, W.B. Whiting, J.A. Shaeiwitz, "Analysis, Synthesis and Design of Chemical Processes", Prentice Hall
3. R.K Sinnot," Coulson & Richardson's Chemical Engineering- Chemical Engineering Design", Vol. 6, Butterworth-Heinemann
4. Kalyanmoy Deb, "Optimization For Engineering Design-Algorithms and Examples", PHI Learning Private Limited
5. S.S. Rao, "Engineering Optimization- Theory and Practice", New Age International

Class & Semester	:	**T. Y. B. Tech (Food Technology), Part III, Semester VI**				
Course Title	:	**INDUSTRIAL ECONOMICS AND MANAGEMENT**		*Course Code*:	:	**FT 325**
Teaching Scheme (Hours)	:	**Lectures 4 hours/weeks=4x 13 weeks= 52 hours minimum** **Tutorial= 0 hour/week** **Practical= 00 hours/week**		*Total Credits*	:	**04+00=04**
Evaluation Scheme (Marks)	:	**CIE = 50** **SEE = 50**	**IPE=NIL** **IOE=NIL** **EPE= NIL**	: : : **Grand Total=100**	*Evaluation Scheme (Marks)*	:	**CIE = 50** **SEE = 50**
Revision:	:				*Month*	:	**June 2018**

Pre-requisites	**:**	Students should have basic knowledge of food processing industries working nature and basic commerce and economics
Type of Course	**:**	Theory
Course Domain	**:**	Management
Skills Imbibed	**:**	List Skills based on the Bloom's Taxonomy decide whether it come under Cognitive, Affective domain , Psychomotor domain

Course Assessment Methods:

1. Continuous Internal Evaluation: Unit Test I & Unit Test II, Regular Tutorial, home assignments
2. Semester End Examination.

Course Objectives:

1. To make the students to know the broad and sound basic knowledge in administrative and economic areas
2. To introduce students to basic working structure of management of food process industries
3. To Make the students to be familiar with process basic economics in food industries
4. To develop the entrepreneurial spirit and plan to start their own enterprise.
5. To make the students to analyze cost/revenue data and carry out make economic analyses in the decision making process to justify or reject alternatives/projects on an economic basis.
6. To provide knowledge to understand theory, models, methods, and concepts within

microeconomics and game theory to explain and predict the behavior of consumers, producers and other economic agents (such as governments) that participate in and influence markets and market outcomes (prices and quantities).

Course Outcomes:

1. The students will able to demonstrate the concepts of Management and organizational structure
2. The students will understand the economic and operations management concepts useful in the production process.
3. The students will apply the project management tools in effective development and implementation of the business activities
4. The students will able perform supply and demand analysis in input factor markets with varying market structures;
5. The students will be able to carry out and evaluate benefit/cost, life cycle and breakeven analyses on one or more economic alternatives.
6. The students will have entrepreneurial spirit and plan to start their own enterprise.

	Hours
Unit I Economic problem & National income	
Economic problem Law of demand, equilibrium between demand and supply, concepts of costs, cost curves and revenue curves of a firm, equilibrium of a firm under perfect competition, break-even analysis, break-even point.	**8**
National income Concept of national income, estimation of national income, difficulties in measurement of national income, uses of national income figures.	
Unit II Inflation	
Meaning, types of inflation, causes, effects, control of inflation, value of money, index construction, utility, limitations, business cycles, phases of business cycles.	**8**
Unit III Industrialization	
Need, capital requirement, block and working, raising, finance, cottage and small scale industries, role in the Indian economy, problems of small scale industries, remedies.	**8**

Unit IV Principles of management Definition, nature, levels of management, functions of management. i. Planning: Nature, importance, types of plans, planning process, decision making. ii. Organization: Principles of organization, organizational structure. iii. Directing: Theories of motivation, communication, process and barriers, leadership styles. iv. Controlling: Control techniques.	**8**
Unit V Production management Selection of site, plant layout, its type, functions of P.P.C. Materials management, purchase, inventory control, production and quality control.	**8**
Unit VI Finance management & Marketing management **Finance management** Scope and importance, capital structure planning, working capital management, sources of funds, financial industries of India. **Marketing management** Marketing concepts, physical distribution, advertising and sales promotion, marketing research, sales management.	**12**

Text Books	**:**	

1. Stonier, A. W. and Hague, D. C., "A Text Book of Economic Theory", Longman.

2. Bach, George Leland, "Economics -Analysis, Decision Making and policy", Prentice- Hall Inc. Englewood Cliffs N. J.

3. Bonham F., "Economics", Sir Isaac Pitman and Sons Ltd., London.

4. Seth, M. L., "Principles of Economics", Lakshmi Narayan Agarwal, Agra.

Reference Books	**:**	

1. Kuchhal, S. C., "Financial Management: An- Analytical & Conceptual Approach",Chaitanya Publishing House, Allahabad.

2. Pandey, L. M., "Financial Management", Vikash Publishing House Pvt. Ltd., New Delhi.

3. Kotlel, Philip, "Marketing Management: Analysis, Planning & Control", Prentice –Hall of India Pvt. Ltd: New Delhi

4. Sinha, J. C., "Marketing and Salesmanship", S. Chand & Co., Delhi.

5. H.L. Ahuja, "Modern economics", S. Chand and co. ltd., New Delhi.

Class & Semester	:	**T. Y. B. Tech (Food Technology), Part III, Semester V**								
Course Title	:	**Sugar and Confectionery Technology Laboratory**						*Course Code*:	:	**FT321L**
Teaching Scheme (Hours)	:	**2 hr /week= 2 x13= 26 hours**						*Credits*	:	**1**
Evaluation Scheme (Marks)	:	**IPE** **IOE**	: :	**Nil** **Nil**	**EPE** **EOE**	: :	**50** **Nil**	*Duration of Exam (in case of External Evaluation)*	:	**02 hours**
Revision:	:	**Third**						*Month*	:	**June 2018**

Pre-requisites	**:**	Students should have knowledge of Food Process Engg. I and II, Food Chemistry
Type of Course	**:**	Practical
Course Domain	**:**	Core
Skills Imbibed	**:**	Cognitive: Understand, Apply, Analyze, Evaluate, Create Affective : Awareness, Respond, Value, Organize Psychomotor: Perception, Imitation, manipulation, articulation

Course Assessment Methods:

Practical Journal Assessment and External Practical Examination (EPE)

Course Objectives:

1. To elaborate the role of gelling agents, stabilizers and preservatives in sugar and confectionery.
2. To know the importance and role of various ingredients used in sugar and confectionary products.
3. To understand the different types of sugar confectionary products and their process.
4. To inculcate the practical proficiency in a sugar and confectionary product development
5. To introduce the students to latest developments in coca and hardboiled confections
6. To provide hands on experience of different equipments used in Coca processing and Chocolate manufacturing

Course Outcomes:

1. Explain processes involved in production of cocoa processing and chocolate manufacturing
2. Classify and explain the different types of Sugar and confectionary products
3. Understand purpose and functions of hygiene in cocoa processing and chocolate manufacturing industry
4. Produce flow chart for the production processes of various Sugar and confectionary products
5. Be able to explain organization and operations involved in Sugar and chocolate manufacturing industry
6. Precautions that should be taken when processing Sugar and confectionary industry

Experiments List	**:**	

1. Production of invert sugar
2. Preparation of hard boiled sweets
3. Preparation of toffee
4. Preparation of fudge
5. Preparation of chewing gum
6. Preparation of chocolate
7. Preparation of fruit toffee
8. Preparation of lozenge
9. Preparation of traditional Indian confection
10. Visit to confectionary industry

Lab Manual	**:**	

Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Class & Semester	:	**T. Y. B. Tech (Food Technology), Part III, Semester VI**				
Course Title	:	**Technology of Cereals & Bakery Products Laboratory**		*Course Code*:	:	**FT322L**
Teaching Scheme (Hours)	:	**Practical= 02 hours/week**		*Total Credits*	:	**01**
Evaluation Scheme (Marks)	:	**IPE=NIL** **IOE=NIL**	: : :	**EOE=50** **EPE= NIL**	*Evaluation Scheme (Marks)*	:	**02 hours**
Revision:	:	Third			*Month*	:	**June 2018**

Pre-requisites	**:**	In order to complete the course studies successfully, it is important to have a good knowledge of food chemistry, food biochemistry, principle of food preservation and food process engineering
Type of Course	**:**	Practical
Course Domain	**:**	Core
Skills Imbibed	**:**	List Skills based on the Bloom's Taxonomy decide whether it come under Cognitive, Affective domain , Psychomotor domain

Course Assessment Methods:

1. External oral examination (EOE)

Course Objectives:

1. To learn to appreciate the complex nature of flour and the intricacies of modern baking technology.
2. To understandmilling technology for wheat, rice and other cereal grains
3. To develop competency to critically evaluate quality of finished baked products in terms of underlying properties of flour, dough/batter, ingredient function, product formulation and processing, and molecular mechanisms.

Course Outcomes:

1. Understand the structure of the wheat and rice grains.
2. Able to characterize minor cereal grains

3. Able to evaluate quality of cereal products 4. Able to develop packaging for bakery products 5. Students will gain knowledge about cereal processing into products 6. Able to develop functional bakery products	
List of Experiments 1. Physico-chemical properties grains 2. Physico-chemical properties flours, 3. Determination of gluten content 4. Preparation of bread, 5. Preparation of biscuits, 6. Preparation of cookies, 7. preparation of crackers, 8. Preparations of buns, 9. Preparation of cake, 10. Preparation of low calorie cake 11. Preparation of low calorie cookies 12. Visit to rice milling industry 13. Visit to Bakery industry	

Class & Semester	:	**T. Y. B. Tech (Food Technology), Part III, Semester VI**				
Course Title	:	**Biochemical Engineering Laboratory**		*Course Code*:	:	**FT 323L**
Teaching Scheme (Hours)	:	**2 hr /week= 2 x13= 26 hours**		*Total Credits*	:	**01**
Evaluation Scheme (Marks)	:	**IPE= Nil** **IOE= 50**	**EOE= Nil** **EPE= Nil**	*Duration of Exam (in case of External Evaluation)*	:	**02 hours**
Revision:	:	**Third**		*Month*	:	**June 2018**

Pre-requisites	**:**	Students should have basic understanding of Food Engineering, Food microbiology, Food chemistry, physics and mathematics
Type of Course	**:**	Practical
Course Domain	**:**	Core
Skills Imbibed	**:**	List Skills based on the Bloom's Taxonomy decide whether it come under Cognitive, Affective domain , Psychomotor domain

Course Assessment Methods:

1. Internal oral examination (IOE)

Course Objectives:

1. To design experiments to evaluate the performance of the bioreactor.
2. To enhance skills in the areas of biochemical processes.
3. This course will provide the fundamentals to solve real life problems
4. To understand and apply the principles of heat transfer and mass transfer phenomena

Course Outcomes:

1. Describe and identify the main groups of microorganisms
2. Describe and compare the different structures and growth modes of diverse microorganisms
3. Describe and explain how (microbial) genetics determines microbial metabolic and functional activity.
4. Describe key biochemical and cellular components and biochemical pathways
5. Calculate yield and production rates in a biological production process and also interpret data.
6. Undertake a range of practical approaches associated with microbiology and biochemistry e.g. microbial isolation and culture, microscopy biochemical and genetic analyses and be able to record, describe, present and explain data

List of Experiments

1. Instrumentation and their control in fermentation industry - physical parameter
2. Instrumentation and their control in fermentation industry – chemical parameter,
3. To study the different parts and operation of laboratory fermentors
4. To study the thermal stability of peroxidase enzyme in potato
5. To asses the amylase activity from given foods sample
6. To measure the microbial growth during fermentation
7. Digestion of protein into amino acid
8. Starch hydrolysis by amylase
9. Batch submerged fermentation of baker's yeast in a shaker flask
10. Wine fermentation
11. To study the time temperature relationship for destruction of microorganisms
12. To study the ethyl alcohol production through bioconversion
13. Visit to Distillery Plant

Class & Semester	:	**T. Y. B. Tech (Food Technology), Part III, Semester VI**								
Course Title	:	**Process Equipment Design and Drawing**						*Course Code*:	:	**FT324L**
Teaching Scheme (Hours)	:	**2 hr /week= 2 x13= 26 hours**						*Credits*	:	**1**
Evaluation Scheme (Marks)	:	**IPE** **IOE**	: :	**Nil** **50**	**EPE** **EOE**	: :	**Nil** **Nil**	*Duration of Exam (in case of External Evaluation)*	:	**02 hours**
Revision:	:	**Third**						*Month*	:	**June 2018**

Pre-requisites	**:**	It is important to have a good knowledge of design equipment safely and basic idea of equipment drawings.
Type of Course	**:**	Practical
Course Domain	**:**	Engineering Design
Skills Imbibed	**:**	Cognitive: Understand, Apply, Analyze, Evaluate, Create Affective : Awareness, Respond, Value, Organize Psychomotor: Perception, Imitation, manipulation, articulation

Course Assessment Methods:

Practical Journal Assessment, Internal Oral Examination

Course Objectives:

1. To conduct technical design of process equipment such as: pressure vessels, non-pressure vessels, compressors, heat exchangers, plate distillation columns, packed absorption columns, fluidized beds.
2. To design and layout pipelines.
3. To select valves and pumps.
4. To be familiar with general concepts of process equipment design so that other process equipment not covered in this subject can be designed.
5. To design equipment in compliance with regulations and standards.
6. To design equipment in an economically efficient manner

Course Outcomes:

1. Understand the design of important components
2. Display an understanding of the principles of process equipment design, the mechanical aspects of the design and operation of process equipment, including safety considerations
3. Students will have completed detailed designs of several unit operations
4. Students should be able to develop process flow sheets and lay out of equipment and pipelines in chemical process plants

5. Students able to design heat transfer equipments understand heat exchanger sizing and develop a heat exchanger data sheet.
6. Students ability to design storage vessels and various parts of vessels (e.g. heads, bottom plate)

Experiments List	:	

1) Standard equipment symbols , Standard instrumentation symbols
2) Pipe fittings , flanges and gaskets, Heads and closures
3) Keys and couplings ,
4) Riveted and Welded joints
5) Pressure relief devices
6) Design and drawing supports for vessels-Bracket Support
7) Design and drawing Leg Support, Skirt Support.
8) Design and drawing of packed absorption tower
9) Design of heat exchangers.
10) Design of tall vertical vessels,
11) Design of reaction vessel.
12) Design of evaporator.
13) Design of agitation system

Lab Manual	:	

Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.

Class & Semester	:	**T. Y. B.Tech. (Food Technology), Part III, Semester VI**								
Course Title	:	**Mini Project**						*Course Code*:	:	**FT325L**
Teaching Scheme (Hours)	:	**Lecture= Nil** **Tutorial= 1hr/Week/Batch x13=13** **Practical= Nil**						*Credits*	:	**1**
Evaluation Scheme (Marks)	:	**IPE** **IOE**	: :	**Nil** **50**	**EPE** **EOE**	: :	**Nil** **50**	*Duration of Exam (in case of External Examination)*	:	**05 hours for entire class**
Revision	:	**Third**						*Month*	:	**June 2018**

Pre-requisites	**:**	Pre-requisites include basic knowledge of soft skills, presentation and familiarity of Food Technology field overview.
Type of Course	**:**	Laboratory
Course Domain	**:**	Research Skills.
Skills Imbibed	**:**	Cognitive: Understand, Apply, Analyze, Evaluate, Create Affective : Awareness, Respond, Value, Organize Psychomotor: Perception, Imitation, Manipulation, Articulation

Course Assessment Methods:

Students' evaluation is by continuous internal examination and based on External Oral Evaluation at the end of the semester, based on attendance during the entire semester, project report submission at the end of semester.

Course Objectives:

1. To plan for various activities of the project and distribute the work amongst team members;
2. To promote self-study, critical thinking and independent research ability;
3. To make the students initiate their own small conceptual or practical based projects individually or as a team of no more than 4 members;
4. To make them use Research Methodology for the task undertaken;
5. To have a trial exercise that may help them to satisfactorily complete their major project in the final year

Course Outcomes: After successful completion of this course, the student will be able to:

1. Develop the ability to choose the problem and formulate it.
2. Apply their fundamental knowledge according to their competency for solve engineering problems.
3. Develop their leadership quality.
4. Achieve the project's goals.
5. Prepare a technical report based on the Mini project.
6. Deliver technical seminar based on the Mini Project work carried out.

Curriculum Content

The students either individually or in a group of maximum 4 members will undertake a mini project on a particular topic under the guidance of an internal course teacher. Prior to the topic selection, the course in charge will guide them about searching topic. The work progress will be monitored from time to time in batch wise review conducted during the semester.

A 25 to 30-pages report is to be written upon completion of the activity. The report should include academic contents such as the background, objectives, product/process description, the work done, conclusion and market survey. The Department will provide a specific format for report writing.

The assessment of the mini project work will be based on: 1. Attendance 2. Physical Demonstration of their work 3. Seminar delivery based on the work carried out and 4. Mini Project reports submitted.

Class and Semester	:	**T. Y. B. Tech. (Food Technology), Part III, Semester VI**									
Course Title	:	**RESEARCH METHODOLOGY**						Course Code		RM321	
Teaching Scheme (Hours)	:	**2 hr /week= 2 x13= 26 hours**						*Credits*	:	**Nil**	
Evaluation Scheme (Marks)	:	**Assignments** **Viva voce**	: :	**50** **25**	**Written Test** **Grand Total**	: :	**25** **100**	*Duration of Exam*	:	**Not Applicable**	
Revision	:	**Third**						*Month*	:	**June 2018**	

Pre-requisites	**:**	H.S.C level English Language Competency
Type of Course	**:**	Audit Course at institute level
Course Domain	**:**	Research Skills
Skills Imbibed	**:**	Cognitive: Understand, Predicting Situation, Comprehend, Affective : Receive, Listen, Respond, Showing self-reliance, Organize Psychomotor: Imitation, adaptation, articulation, origination

Course Assessment Methods:

The students will be given five assignments each for 10 marks. At the end of the course, there will be a written test of 25 marks and a viva voce of 25 marks. There will be assessment for a total of 100 marks. Based on the marks obtained, they will be awarded with a grade similar to other credit courses. Though it is an audit course, obtaining passing grade is essential.

Course Objectives:

1. To gain familiarity with research phenomenon or to achieve new insights into it (known as exploratory or formulative research studies) ;
2. To develop an understanding of various research designs and techniques;
3. To identify various sources of information for literature review and data collection;
4. To judge the frequency with which something occurs or with which it is associated with something else (known as diagnostic research studies);
5. To know about testing a hypothesis of a causal relationship between variables (known as hypothesis-testing research studies)

Course Outcomes: At the end of the course, the students

1. Will be able to understand some basic concepts of research and its methodologies;
2. Will be able to identify appropriate research topics ;
3. Will be able to select and define appropriate research problem and parameters;
4. Will be able to prepare a project proposal (to undertake a project) ;
5. Will be able to organize and conduct research (advanced project) in a more appropriate manner

Curriculum Content	Hours
Unit I:Introduction to Research Definition and basic Types of research, Research process and steps in it, Concept of Hypothesis, Research proposals and aspects.	**03**
Unit II: Basic Statistics required for any research Introduction to Descriptive Statistics, Statistical data, Variable, Classification of data, exploratory data analysis, Measures of central tendency, Dispersion-Standard deviation, Correlation and regression analysis.	**05**
Unit III: Introduction to Design of Experiment: Concept of design of experiment, its objectives, strategies, Factorial experimental design, designing engineering experiments, basic principles, of replication. Guidelines of experiments.	**06**
Unit IV : Single Factor Experiment: Hypothesis testing, Analysis of Variance components (ANOVA) for fixed effect model; Total, treatment and error of squares, Degrees of freedom, Confidence interval; ANOVA for random effects model, Estimation of variance components, goodness of fit tests, Chi-Square test, Kolmogorov-Smirnov(K-S) test.	**06**
Unit V: Two factor Factorial Design: Basic definitions and principles, main effect and interaction, response surface and contour plots, General arrangement for a two□factor factorial design; Models□Effects, means and regression, Hypothesis testing.	**06**
Reference Books **:**	
1. Kothari, C.R., Research Methodology –Methods and techniques, New Age Publications, New Delhi, 2009. 2. Montgomery, Douglas C. (2007), 5/e, Design and Analysis of Experiments, Wiley India. 3. Montgomery, Douglas C. and Runger, George C. (2007), 3/e, Applied Statistics and Probability for Engineers, Wiley India. 4. J.Medhi, Statistics Methods, New Age Publications, New Delhi 2009. 5. Nabendu Pal and Saheb Sarkar, Statistics: Concepts and Applications, Prentice Hall of India Pvt.Ltd. New Delhi, 2004. 6. Panneerselvam, R., Research Methodology, Prentice-Hall of India, New Delhi, 2004.	

Equivalence of Third Year B.Tech (Food Technology) Semester V and VI

The above detailed syllabus is a revised version of the Third Year B. Tech (Food Technology) Program being conducted by the Shivaji University at the Technology Department of the University. This syllabus is to be implemented from June 2018, (Academic year 2018-19). The prime feature of this revision is the transformation of the existing curriculum into the Outcome based curriculum as specified in NBA rules and regulations.

The Equivalence for the subjects/courses of Food Technology at Third Year B Tech Semester V and VI pre-revised Program under the faculty of Engineering and Technology is as follows.

Third Year B.Tech Semester V (Food Technology)

Sr.No	Third Year B.Tech(Food Technology) Semester V Pre-revised syllabus	Third Year B.Tech(Food Technology) Semester V Revised syllabus	Remark
1.	Process Instrumentation, Dynamics & Control	Process Instrumentation, Dynamics & Control	Change in number of lectures and content
2.	Food Process Engineering-II	Food Process Engineering-II	Change in number of lectures and content
3.	Fruits and Vegetables Processing Technology	Fruits& Vegetables Processing Technology	Change in number of lectures and content
4.	Technology of Cereals & Bakery Products	Food Packaging	Interchange of subject for better arrangements of available laboratory. Change in number of lectures and content
5.	Dairy Technology	Dairy Technology	Change in number of lectures and content
6.	Process Instrumentation, Dynamics & Control Lab	Process Instrumentation, Dynamics & Control Laboratory	Change in nomenclature Change in number and titles of practicals
7.	Food Process Engineering-II Lab	Food Process Engineering-II Lab Laboratory	Change in nomenclature Change in number and titles of practicals
8.	Fruits& Vegetables Processing Technology Lab	Fruits& Vegetables Processing Technology Laboratory	Change in nomenclature Change in number and titles of practicals
9.	Technology of Cereals & Bakery Products Lab	Food Packaging Laboratory	Interchange of subject for better arrangements of

			available laboratory.Change in nomenclature Change in number and titles of practicals
10.	Dairy Technology Lab	Dairy Technology Laboratory	Change in nomenclature Change in number and titles of practicals
11.	Presentation and Communication	-	Shifted to Semester IV as soft skill development
12.	-	Introduction to Foreign Language	Shifted from Semester III for uniformity with Department with change in number of lectures and content
13.		Internship I	Introduction of new subject as per instructions of AICTE new circular

Third Year B.Tech. Semester VI (Food Technology)

Sr.No	Third Year B Tech(Food Technology) Semester VI Pre-revised syllabus	Third Year B.Tech(Food Technology) Semester VI Revised syllabus	Remark
1.	Sugar and Confectionery Technology	Sugar and Confectionery Technology	Change in number of lectures and content
2.	Food Packaging	Technology of Cereals & Bakery Products	Interchange of subject for better arrangements of available laboratory. Change in number of lectures and content
3.	Industrial Economics and Management	Industrial Economics and Management	Change in number of lectures and content
4.	Biochemical Engineering	Biochemical Engineering	Change in number of lectures and content
5.	Process Equipment Design And Drawing	Process Equipment Design And Drawing	Change in number of lectures and content
6.	Sugar and Confectionery Technology Lab	Sugar and Confectionery Technology Laboratory	Change in nomenclature Change in number and titles of practicals
7.	Food Packaging lab	Technology of Cereals & Bakery Products Laboratory	Interchange of subject for better arrangements of available laboratory.Change in nomenclature Change in number and titles of practicals
8.	Biochemical Engineering lab	Biochemical Engineering	Change in nomenclature

		Laboratory	Change in number and titles of practicals
9.	Process Equipment Design And Drawing lab	Process Equipment Design And Drawing Laboratory	Change in nomenclature Change in number and titles of practicals
10.	Mini Project	Mini Project	Change in nomenclature and content
11.	Audit Course III Research Methodology	Audit Course III Research Methodology	Change in number of lectures and content

Audit course have not been assigned any credits. The students will be evaluated for these courses by the concerned course in charge. There will be grade conferred to the student. The grade will be based on conversion of marks obtained out (Obtaining passing grade is essential). Please refer to chart in the detail examination scheme. The chart shows the marks range and the respective grade.