DEPARTMENT OF BIOTECHNOLOGY

ANNA UNIVERSITY, CHENNAI

Vision:

The Department of Biotechnology is committed to evolve as a world class science and technology centre by integrating quality and ethics in teaching and research.

Mission:

The mission of the department is

- To provide students a unique and multidisciplinary learning experience that will foster the young minds to develop as a researcher, entrepreneur etc.
- To enhance academic and industrial collaborative research initiatives for the development of biotechnological, food and therapeutic products.
- To emphasise and equip the students towards innovative industrial and research updates.
- To serve the society with utmost commitment, integrity, enthusiasm, and dedication.

ANNA UNIVERSITY::CHENNAI - 600 025

UNIVERSITY DEPARTMENTS

B. TECH. FOOD TECHNOLOGY

REGULATIONS – 2019

CHOICE BASED CREDIT SYSTEM (CBCS)

1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

The Food Technology curriculum is designed to prepare graduates having knowledge with high ethical values and industrial preparedness

1. To understand and apply the concepts of basic sciences, Engineering and technology towards their application in the area of Food Technology.
2. Identification and analysis to solve problems for the development of products, processes, techniques to meet the demands of the society.
3. To apply the learnt theory and practical skills in Food Technology for industry, R&D and entrepreneurship.
4. To learn professional and ethical attitude especially its impact on safety, health and environment
5. Build an environment that is conducive to higher academic pursuit and nurture creative and innovative thoughts.

2. PROGRAMME OUTCOMES (POs)

After completion of four years of study, the Food technology Graduates will be able to

	Graduate Attribute	**Programme Outcomes**
PO1	Engineering Knowledge	Apply knowledge of mathematics, basic science and engineering.
PO2	Problem Analysis	Identify, formulate and solve problems in the area of Food Technology.
PO3	Design/ development of solutions	Design new processes/ modifying the existing system to improve the performance and to satisfy the constraints.
PO4	Conduct investigations of complex problems	Perform experiments, analyze and interpret the data.

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PO5	Modern tool usage	Apply variousfood analytical tools and techniques to improve the efficiency of the process and product.
PO6	The Engineer and society	Conduct themselves to uphold the professional and social obligations.
PO7	Environment and sustainability	Design the system with environment consciousness and sustainable development.
PO8	Ethics	Interact with industry, business and society in a professional and ethical manner.
PO9	Individual and team work	Ability to work in a multidisciplinary team.
PO10	Communication	Proficiency in oral and written communication.
PO11	Project management and finance	Implementation of cost effective projects and improve system.
PO12	Life-long learning	Continue professional development and learning as a life-long activity.

3. PROGRAMME SPECIFIC OUTCOMES (PSOs)

By the completion of Food Technology B. Tech programme the student will have following programme specific outcomes

- Students will develop theoretical and practical knowledge, develop effective communication and cognitive skills.
- Develop focus in the Food Technology and apply critical thinking and problem-solving skills to address current challenges in the food industry.
- Understand the importance of responsibility, dependability, punctuality, courtesy, sensitivity, respect for others and effort in the work place.
- Commit to the highest standards of professional integrity and ethical values.

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4. MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVE WITH PROGRAMME OUTCOMES

Programme educational objectives	PROGRAMME OBJECTIVES											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
1	√	√			√							√
2		√	√	√	√				√	√		
3		√	√	√		√		√	√	√	√	
4						√	√	√				
5		√				√	√				√	

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5. MAPPING OF COURSE OUTCOMES AND PROGRAMME OUTCOMES

		Course Name	PO1	PO2	PO3	PO4	PO 5	PO6	PO 7	PO8	PO9	PO10	PO11	PO1 2
YEAR 1	Semester 1	Technical English												
		Engineering Mathematics I												
		Engineering Physics												
		Engineering Chemistry												
		Problem solving and Python programming												
		Basic Sciences Laboratory												
		Problem solving and Python programming Laboratory												
	Semester 2	Professional communication												
		Engineering Mathematics II												
		Engineering Graphics												
		Basic Electrical and Electronics Engineering												

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		Food Microbiology	2	1	1	1	1	1	1	2	1	1	1	2
		Biochemistry and Nutrition	2	2	-	-	-	-	-	2	-	-	-	3
		Biochemistry and Nutrition Laboratory	3	3	2	3	2	-	-	3	2	-	-	2
		Food Microbiology Laboratory	1	2	1	1	3	1	-	2	3	1	-	2

		Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
YEAR 2	Semester 3	Transform Techniques & Partial differential Equations												
		Food Process Calculations	3	3	1	-	-	-	-	-	1	1	1	2
		Principles of Thermodynamics	3	3	3	3	-	2	-	1	3	-	2	1
		Fluid mechanics in Food processes	3	2	2	3	-	1	1	1	-	-	-	-
		Food Chemistry	1	2	-	-	-	-	-	2	2	-	-	3
		Food Chemistry Laboratory	3	3	2	3	2	-	-	3	2	-	-	2
		Elective - Humanities I												
	Semester 4	Elective - Humanities II												
		Environmental Sciences												
		Audit Course- I												
		Probability and Statistics												
		Heat and Mass transfer in Food Processes	2	2	1	2	-	1	1	2	1	1	2	2
		Unit operations in Food Industries	2	1	1	1	-	-	2	-	-	-	1	-
		Food analysis	-	3	1	3	2	3	-	3	3	-	-	3
		Chemical Engineering laboratory	2	2	2	3	2	--	-	-	1	1	1	1
		Food analysis Laboratory	-	3	1	3	2	1	-	1	3	-	-	3

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		Course Name	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
YEAR 3	Semester 5	Total quality management												
		Audit Course- II												
		Food Process Engineering	3	3	3	3	1	1	1	1	3	-	1	2
		Professional Elective I												
		Fruit and Vegetable Processing and Preservation	1	2	2	2	3	-	1	2	3	-	1	2
		Livestock and Marine Technology	1	1	2	2	2	1	1	3	2	1	1	2
		Professional Elective II												
		Livestock and Marine Technology Laboratory	1	1	2	2	2	1	1	3	2	1	1	2
		Fruit and Vegetable Processing Preservation Laboratory	1	1	2	2	2	1	1	3	2	1	1	2
	Semester 6	Food Packaging Technology	1	2	2	2	1	1	3	3	3	-	2	3
		Food Refrigeration Systems	3	3	3	1	1	-	-	2	3	-	-	2
		Cereals, Pulses and Oil Seed Technology	1	1	2	1	-	-	1	2	1	-	-	2
		Professional Elective III												
		Professional Elective IV												

		Open elective I												
		Food Packaging Technology laboratory	3	3	3	1	1	-	-	2	3	-	-	2
		Cereals and Baking technology Laboratory	1	1	2	1	2	-	1	2	1	-	-	2
		Internship/Training	1	3	-	3	3	3	2	3	2	3	2	3
YEAR 4	**Semester 7**	Food Safety, Quality and Regulation	1	1	2	-	1	1	2	2	2	2	1	3
		Dairy Process Technology	2	2	1	1	1	1	1	1	1	1	-	1
		Professional Elective V												
		Professional Elective VI												
		Professional Elective VII												
		Open Elective II												
		Dairy Process Technology Laboratory	2	2	1	1	1	1	1	1	1	1	-	1
		Internship/Training	1	3	-	3	3	3	2	3	2	3	2	3
		Project I	2	3	2	2	2	1	-	2	2	2	1	1
	Semester 8	Project II	2	3	2	2	2	1	-	2	2	2	1	1

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

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UNIVERSITY DEPARTMENTS

B. TECH. FOOD TECHNOLOGY

REGULATIONS – 2019

CHOICE BASED CREDIT SYSTEM CURRICULA AND

SYLLABI FOR I TO VIII SEMESTERS

SEMESTER I

SI.NO.	CODE NO	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	HS5151	Technical English	HSMC	4	0	0	4	4
2.	MA5158	Engineering Mathematics I	BSC	3	1	0	4	4
3.	PH5151	Engineering Physics	BSC	3	0	0	3	3
4.	CY5151	Engineering Chemistry	BSC	3	0	0	3	3
5.	GE5153	Problem solving and Python programming	ESC	3	0	0	3	3
PRACTICALS								
6.	BS5161	Basic Sciences Laboratory	BSC	0	0	4	4	2
7.	GE5161	Problem solving and Python programming Laboratory	ESC	0	0	4	4	2
		TOTAL		**16**	**1**	**8**	**25**	**21**

SEMESTER II

SI.NO.	CODE NO	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	HS5251	Professional Communication	HSMC	4	0	0	4	4
2.	MA5252	Engineering Mathematics II	BSC	3	1	0	4	4
3.	GE5151	Engineering Graphics	ESC	1	0	4	5	3
4.	EE5251	Basic Electrical and Electronics Engineering	ESC	3	0	0	3	3
5.	FT5201	Food Microbiology	PCC	3	0	0	3	3
6.	FT5202	Biochemistry and Nutrition	PCC	3	0	0	3	3
PRACTICALS								
7.	FT5211	Biochemistry and Nutrition Laboratory	PCC	0	0	4	4	2
8.	FT5212	Food Microbiology Laboratory	PCC	0	0	4	4	2
		TOTAL		**17**	**1**	**12**	**30**	**24**

SEMESTER III

SI.NO.	CODE NO	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MA5355	Transform Techniques & Partial Differential Equations	BSC	3	1	0	4	4
2.	FT5301	Food Process Calculations	PCC	2	1	0	3	3
3.	FT5302	Food Chemistry	PCC	3	0	0	3	3
4.	FT5303	Principles of Thermodynamics	ESC	3	0	0	3	3
5.	FT5304	Fluid mechanics in Food processes	ESC	2	1	0	3	3
6.		Elective - Humanities I	HSMC	3	0	0	3	3
PRACTICALS								
7.	FT5311	Food Chemistry Laboratory	PCC	0	0	4	4	2
		TOTAL		**16**	**3**	**4**	**23**	**21**

SEMESTER IV

SI.NO.	CODE NO	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.		Elective - Humanities II	HSMC	3	0	0	3	3
2.	GE5251	Environmental Sciences	BSC	3	0	0	3	3
3.		Audit Course - I*	AC	3	0	0	3	0
4.	MA5354	Probability and Statistics	BSC	3	1	0	4	4
5.	FT5401	Heat and Mass transfer in Food Processes	PCC	2	1	0	3	3
6.	FT5402	Unit operations in Food Industries	ESC	2	1	0	3	3
7.	FT5403	Food Analysis	PCC	3	0	0	3	3
PRACTICALS								
8.	IB5451	Chemical Engineering Laboratory	ESC	0	0	4	4	2
9.	FT5411	Food Analysis Laboratory	PCC	0	0	4	4	2
		TOTAL		**19**	**3**	**8**	**30**	**23**

***** Audit Course is optional

SEMESTER V

SI.NO.	CODE NO	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	GE5451	Total quality management	HSMC	3	0	0	3	3
2.		Audit Course - I*	AC	3	0	0	3	0
3.	FT5501	Food Process Engineering	PCC	2	1	0	3	3
4.	FT5502	Fruit and Vegetable Processing and Preservation	PCC	3	0	0	3	3
5.	FT5503	Livestock and Marine Technology	PCC	3	0	0	3	3
6.		Professional Elective I	PEC	3	0	0	3	3
7.		Professional Elective II	PEC	3	0	0	3	3
PRACTICALS								
8.	FT5511	Livestock and Marine Technology Laboratory	PCC	0	0	4	4	2
9.	FT5512	Fruit and Vegetable Processing & Preservation Laboratory	PCC	0	0	4	4	2
		TOTAL		**20**	**1**	**8**	**29**	**22**

***** Audit Course is optional

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SEMESTER VI

SI.NO.	CODE NO	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	FT5601	Food Packaging Technology	PCC	3	0	0	3	3
2.	FT5602	Food Refrigeration Systems	PCC	2	1	0	3	3
3.	FT5603	Cereals, Pulses and oil seed Technology	PCC	3	0	0	3	3
4.		Professional Elective III	PEC	3	0	0	3	3
5.		Professional Elective IV	PEC	3	0	0	3	3
6.		Open elective I	OEC	3	0	0	3	3
PRACTICALS								
7.	FT5611	Food Packaging Technology Laboratory	PCC	0	0	4	4	2
8.	FT5612	Cereal, Pulses and Oil Seed Technology Laboratory	PCC	0	0	4	4	2
9.	FT5712	Internship/ Training (Minimum 4 Weeks)*	EEC	-	-	-	-	-
		TOTAL		**17**	**1**	**8**	**26**	**22**

*Students should undergo Internship/ Training for which assessment will be done in the seventh semester

SEMESTER VII

SI.NO.	CODE NO	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	FT5701	Food Safety, Quality and Regulation	PCC	3	0	0	3	3
2.	FT5702	Dairy Process Technology	PCC	3	0	0	3	3
3.		Professional Elective V	PEC	3	0	0	3	3
4.		Professional Elective VI	PEC	3	0	0	3	3
5.		Professional Elective VII	PEC	3	0	0	3	3
6.		Open Elective II	OEC	3	0	0	3	3
PRACTICALS								
7.	FT5711	Dairy Process Technology Laboratory	PCC	0	0	4	4	2
8.	FT5712	Internship / Training	EEC	-	-	-	-	2
9.	FT5713	Project I	EEC	0	0	6	6	3
		TOTAL		**18**	**0**	**10**	**28**	**25**

SEMESTER VIII

SI.NO.	CODE NO	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
PRACTICALS								
1.	FT5811	Project II	EEC	0	0	16	16	8
		TOTAL		**0**	**0**	**16**	**16**	**8**

TOTAL CREDITS : 166

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PROFESSIONAL ELECTIVES (PEC)

SI. NO.	CODE NO	COURSE TITLE	CATE GORY	TOTAL CONTACT PERIODS	L	T	P	C
1.	FT5001	Principles of Biochemical Engineering	PEC	3	2	0	2	3
2.	FT5002	Analytical Methods for Food Products	PEC	3	3	0	0	3
3.	FT5003	Food Fermentation Technology	PEC	3	3	0	0	3
4.	FT5004	Functional Foods and Nutraceuticals	PEC	3	3	0	0	3
5.	FT5005	Post-Harvest Technology	PEC	3	3	0	0	3
6.	FT5006	Technology of Plantation Crops and Spices	PEC	3	3	0	0	3
7.	FT5007	Food Flavours	PEC	3	3	0	0	3
8.	FT5008	Instrumentation and Food Process Control	PEC	3	3	0	0	3
9.	IB5072	Biological Spectroscopy	PEC	3	3	0	0	3
10.	FT5009	Baking and Confectionery Technology	PEC	3	3	0	0	3
11.	FT5010	Food Plant Design and Layout	PEC	3	3	0	0	3
12.	IB5073	Chemical Reaction Engineering	PEC	3	2	1	0	3
13.	FT5011	Food Biotechnology	PEC	3	3	0	0	3
14.	FT5012	Food Allergens and Toxicology	PEC	3	3	0	0	3
15.	GE5076	Professional Ethics in Engineering	PEC	3	3	0	0	3
16.	FT5013	Traditional and Organic Foods	PEC	3	3	0	0	3
17.	FT5014	Food Process Economics and Industrial Management	PEC	3	3	0	0	3
18.	FT5015	Food Supply Chain Management	PEC	3	3	0	0	3
19.	FT5016	Food Plant Equipment Design	PEC	3	2	1	0	3
20.	FT5017	Food Ingredients and Additives	PEC	3	3	0	0	3

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BASIC SCIENCE COURSES (BSC)

Sl. No.	CODE NO	COURSE TITLE	L	T	P	CREDITS	SEMESTER
1.	MA5158	Engineering Mathematics I	3	1	0	4	I
2.	PH5151	Engineering Physics	3	0	0	3	I
3.	CY5151	Engineering Chemistry	3	0	0	3	I
4.	BS5161	Basic Sciences Laboratory	0	0	4	2	I
5.	MA5252	Engineering Mathematics II	3	1	0	4	II
6.	MA5355	Transform Techniques & Partial Differential Equations	3	1	0	4	III
7	GE5251	Environmental Sciences	3	0	0	3	IV
8.	MA5354	Probability and Statistics	3	1	0	4	IV

PROFESSIONAL CORE COURSES (PCC)

Sl. No.	CODE NO	COURSE TITLE	L	T	P	CREDITS	SEMESTER
1.	FT5201	Food Microbiology	3	0	0	3	II
2.	FT5202	Biochemistry and Nutrition	3	0	0	3	II
3.	FT5211	Biochemistry and Nutrition Laboratory	0	0	4	2	II
4.	FT5212	Food Microbiology Laboratory	0	0	4	2	II
5.	FT5301	Food Process Calculations	2	1	0	3	III
6.	FT5302	Food Chemistry	3	0	0	3	III
7	FT5311	Food Chemistry Laboratory	0	0	4	2	III
8.	FT5401	Heat and Mass transfer in Food Processes	2	1	0	3	IV

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9.	FT5403	Food Analysis	3	0	0	3	IV
10.	FT5411	Food Analysis Laboratory	0	0	4	2	IV
11.	FT5501	Food Process Engineering	2	1	0	3	V
12.	FT5502	Fruit and Vegetable Processing and Preservation	3	0	0	3	V
13.	FT5503	Livestock and Marine Technology	3	0	0	3	V
14.	FT5511	Livestock and Marine Technology Laboratory	0	0	4	2	V
15.	FT5512	Fruit and Vegetable Processing & Preservation Laboratory	0	0	4	2	V
16.	FT5601	Food Packaging Technology	3	0	0	3	VI
17.	FT5602	Food Refrigeration Systems	2	1	0	3	VI
18.	FT5603	Cereals, Pulses and oil seed Technology	3	0	0	3	VI
19.	FT5611	Food Packaging Technology Laboratory	0	0	4	2	VI
20.	FT5612	Cereal, Pulses and Oil Seed Technology Laboratory	0	0	4	2	VI
22.	FT5701	Food Safety, Quality and Regulation	3	0	0	3	VII
25.	FT5711	Dairy Process Technology Laboratory	0	0	4	2	VII

ENGINEERING SCIENCE COURSES (ESC)

Sl. No.	CODE NO	COURSE TITLE	L	T	P	CREDITS	SEMESTER
1.	GE5153	Problem solving and Python programming	3	0	0	3	I
2.	GE5161	Problem solving and Python programming Laboratory	0	0	4	2	I
3.	GE5151	Engineering Graphics	1	0	4	3	II
4.	EE5251	Basics of Electrical and Electronics Engineering	3	0	0	3	II
5.	FT5303	Principles of Thermodynamics	3	0	0	3	III
6.	FT5304	Fluid mechanics in Food processes	2	1	0	3	III
7	FT5402	Unit operations in Food Industries	2	1	0	3	IV
8.	IB5451	Chemical Engineering Laboratory	0	0	4	2	IV

HUMANITIES AND SOCIAL SCIENCES (HSMC) – MANAGEMENT AND OTHERS

Sl. No.	CODE	COURSE TITLE	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS	SEMESTER
			L	T	P			
1	HS5151	Technical English	4	0	0	4	4	I
2	HS5251	Professional Communication	4	0	0	4	4	II
5	GE5451	Total Quality Management	3	0	0	3	3	V

HSMC– ELECTIVES – HUMANITIES I (ODD SEMESTER)

Sl. No	Course Code	Course Title	Periods per week			Credits
			Lecture	Tutorial	Practical	
1.	HU5171	Language and Communication	3	0	0	3
2.	HU5172	Values and Ethics	3	0	0	3
3.	HU5173	Human Relations at Work	3	0	0	3
4.	HU5174	Psychological Process	3	0	0	3
5.	HU5175	Education, Technology and Society	3	0	0	3
6.	HU5176	Philosophy	3	0	0	3
7.	HU5177	Applications of Psychology in Everyday Life	3	0	0	3

HSMC– ELECTIVES – HUMANITIES II (EVEN SEMESTER)

Sl. No	Course Code	Course Title	Periods per week			Credits
			Lecture	Tutorial	Practical	
1.	HU5271	Gender Culture and Development	3	0	0	3
2.	HU5272	Ethics and Holistic Life	3	0	0	3
3.	HU5273	Law and Engineering	3	0	0	3
4.	HU5274	Film Appreciation	3	0	0	3
5.	HU5275	Fundamentals of Language and Linguistics	3	0	0	3
6.	HU5276	Understanding Society and Culture through Literature	3	0	0	3

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AUDIT COURSES (AC)
Registration for any of these courses is optional to students

Sl. No.	Course Code	Course Title	Periods per week			Credits	Semester
			Lecture	Tutorial	Practical		
1.	AD5091	Constitution of India	3	0	0	0	2/6
2.	AD5092	Value Education	3	0	0	0	
3.	AD5093	Pedagogy Studies	3	0	0	0	
4.	AD5094	Stress Management by Yoga	3	0	0	0	
5.	AD5095	Personality Development Through Life Enlightenment Skills	3	0	0	0	
6.	AD5096	Unnat Bharat Abhiyan	3	0	0	0	
7.	AD5097	Essence of Indian Knowledge Tradition	3	0	0	0	
8.	AD5098	Sanga Tamil Literature Appreciation	3	0	0	0	

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

Sl. No.	Code No	Course Title	L	T	P	Credits	Semester
1.	FT5712	Internship / Training (Minimum 4 Weeks)	0	0	0	2	VII
2.	FT5713	Project I	0	0	6	3	VII
3.	FT5811	Project II	0	0	16	8	VIII

SUMMARY										
	SUBJECT AREA	CREDITS PER SEMESTER								TOTAL CREDITS
		I	II	III	IV	V	VI	VII	VIII	
1	HSMC	4	4	3	3	3				17
2	BSC	12	4	4	7					27
3	ESC	5	6	6	5					22
4	PCC		10	8	8	13	13	14		66
5	AC (Non Credit)				0	0				0
6	PEC					6	6	3		15
7	OEC						3	3		6
8	EEC						0	5	8	13
	Total	21	24	21	23	22	22	25	8	**166**

SEMESTER I

HS5151	TECHNICAL ENGLISH	L	T	P	C
		4	0	0	4

OBJECTIVES

The course aims to

- familiarise first year students of engineering and technology with the fundamental aspects of technical English.
- develop all the four language skills by giving sufficient practice in the use of the skills in real life contexts.
- enhance the linguistic and communicative competence of first year engineering and technology students.

UNIT I INTRODUCING ONESELF 12

Listening Listening and filling a form, listening to speeches by specialists from various branches of engineering and completing activities such as answering questions, identifying the main ideas of the listening text, style of the speaker (tone and tenor) – **Speaking** Introducing oneself –introducing friend/ family - **Reading** Descriptive passages (from newspapers / magazines)- **Writing** Writing a paragraph (native place, school life)- **Grammar** Simple present, present continuous – **Vocabulary Development** One word substitution

UNIT II DIALOGUE WRITING 12

Listening Listening to conversations (asking for and giving directions) –**Speaking** making conversation using (asking for directions, making an enquiry), Role plays-dialogues- **Reading** Reading a print interview and answering comprehension questions-**Writing** Writing a checklist, Dialogue writing- **Grammar** Simple past – question formation (Wh- questions, Yes or No questions, Tag questions)-**Vocabulary Development** Stress shift, lexical items related to the theme of the given unit.

UNIT III FORMAL LETTER WRITING 12

Listening Listening to speeches by famous people and identifying the central message of the speech – answering multiple-choice questions)-**Speaking** Giving short talks on a given topic-**Reading** Reading motivational essays on famous engineers and technologists (answering open-ended and closed questions)- **Writing** Writing formal letters/ emails (Complaint letters)-**Grammar** Future Tense forms of verbs, subject and verb agreement-**Vocabulary Development** Collocations – Fixed expressions

UNIT IV WRITING COMPLAINT LETTERS 12

Listening Listening to short talks (5 minutes duration and fill a table, gap-filling exercise) note taking/note making- **Speaking** Small group discussion, giving recommendations-**Reading** Reading problem – solution articles/essays drawn from various sources- **Writing** Making recommendations – Writing a letter/ sending an email to the Editor- note making- **Grammar** Modals – Phrasal verbs – cause and effect sentences- **Vocabulary Development** Connectives, use of cohesive devices in writing, technical vocabulary.

UNIT V WRITING DEFINITIONS AND PRODUCT DESCRIPTION 12

Listening Listening to a product description (labeling and gap filling) exercises- **Speaking** Describing a product and comparing and contrasting it with other products- **Reading** Reading graphical material for comparison (advertisements)-**Writing** Writing Definitions (short and long) – compare and contrast paragraphs- **Grammar** Adjectives – Degrees of comparison - compound nouns- **Vocabulary Development** Use of discourse markers – suffixes (adjectival endings).

Attested

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TOTAL: 60 PERIODS

OUTCOMES

At the end of the course the students will be able to

CO 1 be exposured to basic aspects of technical English.

CO 2 have confidence to communicate effectively various academic situations.

CO 3 learn the use of basic features of Technical English.

TEXTBOOKS

1. Revised Edition of 'English for Engineers and Technologists' Volume 1 published by Orient Black Swan Limited 2019.

Assessment pattern

- Assessments will assess all the four skills through both pen and paper and computer based tests.
- Assessments can be pen and paper based, quizzes.

MA5158 ENGINEERING MATHEMATICS – I

(Common to all branches of B.E. / B.Tech. Programmes in I Semester)

L T P C
3 1 0 4

OBJECTIVES

The course aims to

- develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- familiarize the students with differential calculus.
- familiarize the student with functions of several variables. This is needed in many branches of engineering.
- make the students understand various techniques of integration.
- acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.

UNIT I MATRICES 12

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of eigenvalues and eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNITII DIFFERENTIAL CALCULUS 12

Limit of function – One sided limit – Limit Laws – Continuity – left and right continuity – types of discontinuities – Intermediate Value Theorem – Derivatives of a function - Differentiation rules – Chain rule – Implicit differentiation – logarithmic differentiation – Maxima and minima – Mean value theorem – (Optional Polar coordinate system – Differentiation in polar coordinates).

UNIT III FUNCTIONS OF SEVERAL VARIABLES 12

Partial derivatives – Homogeneous functions and Euler's theorem – Total derivative – Differentiation of implicit functions – Change of variables – Jacobians – Partial differentiation of

implicit functions – Taylor's series for functions of two variables – Errors and approximations – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT IV INTEGRAL CALCULUS **12**

Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

UNIT V MULTIPLE INTEGRALS **12**

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.

TOTAL: 60 PERIODS

OUTCOMES

At the end of the course the students will be able to

CO 1 use the matrix algebra methods for solving practical problems.
CO 2 apply differential calculus tools in solving various application problems.
CO 3 able to use differential calculus ideas on several variable functions.
CO 4 apply different methods of integration in solving practical problems.
CO 5 apply multiple integral ideas in solving areas, volumes and other practical problems.

TEXTBOOKS

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, New Delhi, 2017.
2. James Stewart, "Calculus with Early Transcendental Functions", Cengage Learning, 6th Edition, New Delhi,2013.
3. Joel Hass, Christopher Heil and Maurice D.Weir, "Thomas Calculus", Pearson, 14th Edition, New Delhi, 2018.
4. Narayanan S. and Manicavachagom Pillai T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.

REFERENCES

1. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), 7th Edition, New Delhi, 2009.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2015.
3. Greenberg M.D., "Advanced Engineering Mathematics", Pearson Education2nd Edition, 5th Reprint, Delhi, 2009.
4. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics",Narosa Publications, 5th Edition, New Delhi, 2017.
5. Peter V.O'Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, 7th Edition, New Delhi , 2012.
6. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., 11th Reprint, New Delhi, 2010.

PH5151 **ENGINEERING PHYSICS** **L T P C**

(Common to all branches of B.E / B.Tech. programmes) **3 0 0 3**

OBJECTIVES

The course aims to

- make the students understand the importance of mechanics.
- equip the students on the knowledge of electromagnetic waves.
- introduce the basics of oscillations, optics and lasers.
- enable the students in understanding the importance of quantum physics.
- elucidate the application of quantum mechanics towards the formation of energy bands in crystalline materials.

UNIT I MECHANICS **9**

Moment of inertia (M.I) - Radius of gyration - Theorems of M .I - M.I of circular disc, solid cylinder , hollow cylinder , solid sphere and hollow sphere - K.E of a rotating body – M.I of a diatomic molecule – Rotational energy state of a rigid diatomic molecule - centre of mass – conservation of linear momentum – Relation between Torque and angular momentum - Torsional pendulum.

UNIT II ELECTROMAGNETIC WAVES **9**

Gauss's law – Faraday's law - Ampere's law - The Maxwell's equations - wave equation; Plane electromagnetic waves in vacuum, Conditions on the wave field - properties of electromagnetic waves speed, amplitude, phase, orientation and waves in matter - polarization - Producing electromagnetic waves - Energy and momentum in EM waves Intensity, waves from localized sources, momentum and radiation pressure - Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium-vacuum interface for normal incidence.

UNIT III OSCILLATIONS, OPTICS AND LASERS **9**

Simple harmonic motion - resonance - waves on a string - standing waves - traveling waves - Energy transfer of a wave - sound waves - Doppler effect - reflection and refraction of light waves - Total internal reflection - interference - interferometers - air wedge experiment. Theory of laser - characteristics - Spontaneous and stimulated emission - Einstein's coefficients - population inversion - Nd-YAG laser, CO_2 laser, semiconductor laser - applications.

UNIT IV BASIC QUANTUM MECHANICS **9**

Photons and light waves - Electrons and matter waves - The Schrodinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization - Particle in a infinite potential well - Normalization, probabilities and the correspondence principle.

UNIT V APPLIED QUANTUM MECHANICS **9**

The harmonic oscillator - Barrier penetration and quantum tunneling - Tunneling microscope - Resonant diode - Finite potential wells - particle in a three dimensional box - Bloch's theorem for particles in a periodic potential, Kronig-Penney model and origin of energy bands.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 understand the importance of mechanics.
CO 2 express the knowledge of electromagnetic waves.
CO 3 know the basics of oscillations, optics and lasers.
CO 4 understand the importance of quantum physics.
CO 5 apply quantum mechanical principles towards the formation of energy bands in crystalline materials.

Released

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TEXT BOOKS:

1. D.Kleppner and R.Kolenkow. An Introduction to Mechanics. McGraw Hill Education, 2017.
2. D.Halliday, R.Resnick and J.Walker. Principles of Physics. John Wiley & Sons, 2015.
3. N.Garcia, A.Damask and S.Schwarz. Physics for Computer Science Students. Springer-Verlag, 2012.

REFERENCES:

1. R.Wolfson. Essential University Physics. Volume 1 & 2. Pearson, 2016.
2. D.J.Griffiths. Introduction to Electrodynamics. Pearson Education, 2015
3. K.Thyagarajan and A.Ghatak. Lasers Fundamentals and Applications. Springer, 2012.

CY5151	ENGINEERING CHEMISTRY (COMMON TO ALL BRANCHES)	L T P C 3 0 0 3

OBJECTIVES

The course aims to

- introduce the basic concepts of polymers, their properties and some of the important applications.
- impart knowledge on the basic principles and preparatory methods of nanomaterials.
- facilitate the understanding of the laws of photochemistry, photoprocesses and instrumentation & applications of spectroscopic techniques.
- familiarize the operating principles and applications of energy conversion, its processes and storage devices.
- inculcate sound understanding of water quality parameters and water treatment techniques.

UNIT I POLYMER CHEMISTRY 9

Introduction Functionality-degree of polymerization. Classification of polymers- natural and synthetic, thermoplastic and thermosetting. Types and mechanism of polymerization addition (free radical, cationic, anionic and living); condensation and copolymerization. Properties of polymers Tg, tacticity, molecular weight-weight average, number average and polydispersity index. Techniques of polymerization Bulk, emulsion, solution and suspension. Structure, Properties and uses of PE, PVC, PC, PTFE, PP, Nylon 6, Nylon 66, Bakelite, Epoxy; Conducting polymers – polyaniline and polypyrrole.

UNIT II NANOCHEMISTRY 9

Basics-distinction between molecules, nanomaterials and bulk materials; size-dependent properties. Types –nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. Characterization - Scanning Electron Microscope and Transmission Electron Microscope - Principle and instrumentation (block diagram). Properties (optical, electrical, mechanical and magnetic) and Applications of nanomaterials - medicine, agriculture, electronics and catalysis.

UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY 9

Photochemistry Laws of photochemistry - Grotthuss-Draper law, Stark-Einstein law and Lambert-Beer Law (derivation and problems). Photo physical processes – Jablonski diagram. Chemiluminescence, photo-sensitization and photoquenching – mechanism and examples.Spectroscopy Electromagnetic spectrum - absorption of radiation - electronic, vibrational and rotational transitions.Width and intensities of spectral lines.Atomic absorption spectroscopy, UV-Vis and IR spectroscopy- principles, instrumentation (Block diagram) and applications.

UNIT IV ENERGY CONVERSIONS AND STORAGE 9

Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant – fast breeder reactor.Solar energy conversion - solar cells. Wind energy. Batteries - types of batteries – primary battery (dry cell), secondary battery (lead acid, nickel-cadmium and lithium-ion-battery). Fuel cells – H_2-O_2 and microbial fuel cell.Explosives – classification, examples TNT, RDX, Dynamite; Rocket fuels and propellants – definition and uses.

UNIT V WATER TECHNOLOGY 9

Water – sources and impurities – water quality parameters colour, odour, pH, hardness, alkalinity, TDS, COD and BOD. Boiler feed water – requirement – troubles (scale & sludge, caustic embrittlement, boiler corrosion and priming & foaming. Internal conditioning – phosphate, calgon and carbonate treatment. External conditioning - zeolite (permutit) and ion exchange demineralization. Municipal water treatment process – primary (screening, sedimentation and coagulation), secondary (activated sludge process and trickling filter process) and tertiary (ozonolysis, UV treatment, chlorination, reverse osmosis).

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 recognize and apply basic knowledge on different types of polymeric materials, their general preparation methods and applications to futuristic material fabrication needs.

CO 2 identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.

CO 3 identify and apply suitable spectroscopic technique for material analysis and study different forms of photochemical reactions.

CO 4 recognize different forms of energy resources and apply them for suitable applications in energy sectors.

CO 5 demonstrate the knowledge of water and their quality in using at different industries.

TEXT BOOKS

1. Jain P. C. & Monica Jain., “Engineering Chemistry”, 16th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2015.
2. Sivasankar B., “Engineering Chemistry”, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2012.
3. S.S.Dara, “A text book of Engineering Chemistry”, Chand Publications, 2014.

REFERENCES

1. Sachdeva M V, “Basics of Nano Chemistry”, Anmol Publications Pvt Ltd, 2011
2. B.Sivasankar, “Instrumental Methods of Analysis”, Oxford University Press. 2012.
3. Friedrich Emich, “Engineering Chemistry”, Scientific International Ltd, 2015
4. V RGowariker, N V Viswanathan and Jayadev Sreedhar, “Polymer Science” New age International Publishers, 2015

GE5151 PROBLEM SOLVING AND PYTHON PROGRAMMING L T P C
3 0 0 3

OBJECTIVES

The course aims to

- know the basics of algorithmic problem solving.
- develop Python programs with conditionals and loops.
- define Python functions and use function calls.
- use Python data structures - lists, tuples, dictionaries.
- do input/output with files in Python.

UNIT I INTRODUCTION TO COMPUTING AND PROBLEM SOLVING 9

Fundamentals of Computing – Computing Devices – Identification of Computational Problems – Pseudocodesand Flowcharts – Instructions – Algorithms – Building Blocks of Algorithms – Introduction to Python Programming – Python Interpreter and Interactive Mode – Variables and Identifiers – Arithmetic Operators– Values and Types – Statements.

Suggested Activities

- Developing Pseudocodes and flowcharts for real life activities such as railway ticket booking using IRCTC, admission process to undergraduate course, academic schedules during a semester etc.
- Developing algorithms for basic mathematical expressions using arithmetic operations.
- Installing Python.
- Simple programs on print statements, arithmetic operations.

Suggested Evaluation Methods

- Assignments on pseudocodes and flowcharts.
- Tutorials on Python programs.

UNIT II CONDITIONALS AND FUNCTIONS 9

Operators – Boolean Values – Operator Precedence – Expression – Conditionals If-Else Constructs – Loop Structures/Iterative Statements – While Loop – For Loop – Break Statement – Function Call and Returning Values – Parameter Passing – Local and Global Scope – Recursive Functions.

Suggested Activities

- Simple Python program implementation using Operators, Conditionals, Iterative Constructs and Functions.
- Implementation of a simple calculator.
- Developing simple applications like calendar, phone directory, to-do lists etc.
- Flow charts for GCD, Exponent Functions, Fibonacci Series using conditionals and iterative statements.
- External learning - Recursion vs. Iteration.

Suggested Evaluation Methods

- Tutorials on the above activities.
- Group Discussion on external learning.

Attested

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UNIT III SIMPLE DATA STRUCTURES IN PYTHON 10

Introduction to Data Structures – List – Adding Items to a List – Finding and Updating an Item – Nested Lists – Cloning Lists – Looping Through a List – Sorting a List – List Concatenation – List Slices – List Methods – List Loop – Mutability – Aliasing – Tuples Creation, Accessing, Updating, Deleting Elements in a Tuple, Tuple Assignment, Tuple as Return Value, Nested Tuples, Basic Tuple Operations – Sets.

Suggested Activities

- Implementing python program using lists, tuples, sets for the following scenario
  - Simple sorting techniques
  - Student Examination Report
  - Billing Scheme during shopping.
- External learning - List vs. Tuple vs. Set – Implementing any application using all the three data structures.

Suggested Evaluation Methods

- Tutorials on the above activities.
- Group Discussion on external learning component.

UNIT IV STRINGS, DICTIONARIES, MODULES 10

Strings Introduction, Indexing, Traversing, Concatenating, Appending, Multiplying, Formatting, Slicing, Comparing, Iterating – Basic Built-In String Functions – Dictionary Creating, Accessing, Adding Items, Modifying, Deleting, Sorting, Looping, Nested Dictionaries Built-in Dictionary Function – Finding Key and Value in a Dictionary – Modules – Module Loading and Execution – Packages – Python Standard Libraries.

Suggested Activities

- Implementing Python program by importing Time module, Math package etc.
- Creation of any package (student's choice) and importing into the application.

Suggested Evaluation Methods

- Tutorials on the above activities.

UNIT V FILE HANDLING AND EXCEPTION HANDLING 7

Introduction to Files – File Path – Opening and Closing Files – Reading and Writing Files – File Position – Exception Errors and Exceptions, Exception Handling, Multiple Exceptions.

Suggested Activities

- Developing modules using Python to handle files and apply various operations on files.
- Usage of exceptions, multiple except blocks -for applications that use delimiters like age, range of numerals etc.
- Implementing Python program to open a non-existent file using exceptions.

Suggested Evaluation Methods

- Tutorials on the above activities.
- Case Studies.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 develop algorithmic solutions to simple computational problems.
CO 2 develop and execute simple Python programs.
CO 3 write simple Python programs for solving problems.
CO 4 decompose a Python program into functions.
CO 5 represent compound data using Python lists, tuples, dictionaries etc.
CO 6 read and write data from/to files in Python programs.

TEXT BOOKS:

1. Reema Thareja, "Python Programming using Problem Solving Approach", Oxford University Press, 2017.
2. Allen B. Downey, "Think Python How to Think Like a Computer Scientist", Second Edition, Shroff/O'Reilly Publishers, 2016. (http//greenteapress.com/wp/thinkpython/).

REFERENCES:

1. Guido van Rossum, Fred L. Drake Jr., "An Introduction to Python – Revised and Updated for Python 3.2", Network Theory Ltd., 2011.
2. John V Guttag, "Introduction to Computation and Programming Using Python", Revised and Expanded Edition, MIT Press , 2013
3. Charles Dierbach, "Introduction to Computer Science using Python", Wiley India Edition, 2016.
4. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd., 2015.
5. Kenneth A. Lambert, "Fundamentals of Python First Programs", Cengage Learning, 2012.

BS5161 **BASIC SCIENCES LABORATORY** **L T P C**
(Common to all branches of B.E. / B.Tech Programmes) **0 0 4 2**

PHYSICS LABORATORY (Any Seven Experiments)

OBJECTIVES:

The course aims to

- inculcate experimental skills to test basic understanding of physics of materials including properties of matter, thermal and optical properties.
- induce the students to familiarize with experimental determination of velocity of ultrasonic waves and band gap determination.

LIST OF EXPERIMENTS

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of disc
2. Non-uniform bending - Determination of young's modulus
3. Uniform bending – Determination of young's modulus
4. Lee's disc Determination of thermal conductivity of a bad conductor
5. Potentiometer-Determination of thermo e.m.f of a thermocouple
6. Laser- Determination of the wave length of the laser using grating
7. Air wedge - Determination of thickness of a thin sheet/wire
8. a) Optical fibre -Determination of Numerical Aperture and acceptance angle
   b) Compact disc- Determination of width of the groove using laser.
9. Acoustic grating- Determination of velocity of ultrasonic waves in liquids.
10. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
11. Post office box -Determination of Band gap of a semiconductor.
12. Spectrometer- Determination of wavelength using gating.
13. Photoelectric effect
14. Michelson Interferometer.
15. Estimation of laser parameters.
16. Melde's string experiment

TOTAL: 30 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 determine various moduli of elasticity and also various thermal and optical properties of materials.

CO 2 determine the velocity of ultrasonic waves, band gap determination and viscosity of liquids.

CHEMISTRY LABORATORY (Minimum of 8 experiments to be conducted)

OBJECTIVES

The course aims to

- inculcate experimental skills to test basic understanding of water quality parameters, such as, acidity, alkalinity, hardness, DO, chloride and copper.
- induce the students to familiarize with electroanalytical techniques such as, pH metry, potentiometry and conductometry in the determination of impurities in aqueous solutions.
- demonstrate the analysis of metals and polymers by spectroscopy and viscometry methods.

Attested

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LIST OF EXPERIMENTS

1. Estimation of HCl using Na2CO3 as primary standard and Determination of alkalinity in water sample.
2. Determination of total temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler‟s method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
11. Determination of molecular weight of polyvinylalcohol using Ostwald viscometer.
12. Pseudo first order kinetics-ester hydrolysis.
13. Corrosion experiment-weight loss method.
14. Phase change in a solid.

TOTAL: 30 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO.

CO 2 determine the amount of metal ions through volumetric and spectroscopic techniques

CO 3 determine the molecular weight of polymers by viscometric method.

CO 4 quantitatively analyse the impurities in solution by electroanalytical techniques

CO 5 design and analyse the kinetics of reactions and corrosion of metals

TEXTBOOKS:

1. Laboratory Manual- Department of Chemistry, CEGC, Anna University (2014).
2. Vogel‟s Textbook of Quantitative Chemical Analysis (8th edition, 2014).

GE5161 PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY L T P C
0 0 4 2

OBJECTIVES:

The course aims to

- understand the problem solving approaches.
- learn the basic programming constructs in Python.
- articulate where computing strategies support in providing Python-based solutions to real world problems.
- use Python data structures - lists, tuples, dictionaries.
- do input/output with files in Python.

LIST OF EXPERIMENTS

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same.
2. Python programming using simple statements and expressions.
3. Scientific problems using Conditionals and Iterative loops.
4. Implementing real-time/technical applications using Lists, Tuples.
5. Implementing real-time/technical applications using Sets, Dictionaries.
6. Implementing programs using Functions.
7. Implementing programs using Strings.
8. Implementing programs using written modules and Python Standard Libraries.
9. Implementing real-time/technical applications using File handling.
10. Implementing real-time/technical applications using Exception handling.
11. Exploring Pygame tool.
12. Developing a game activity using Pygame like bouncing ball, car race etc.

TOTAL: 60 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 develop algorithmic solutions to simple computational problems
CO 2 develop and execute simple Python programs.
CO 3 structure simple Python programs for solving problems.
CO 4 decompose a Python program into functions.
CO 5 represent compound data using Python data structures.
CO 6 apply Python features in developing software applications.

Attested

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SEMESTER II

HS5251	PROFESSIONAL COMMUNICATION	L	T	P	C
		4	0	0	4

OBJECTIVES

The course aims to

- improve the relevant language skills necessary for professional communication.
- develop linguistic and strategic competence in workplace context.
- enhance language proficiency and thereby the employability of budding engineers and technologists.

UNIT I TECHNICAL COMMUNICATION 12

Listening Listening to telephone conversations (intent of the speaker and note taking exercises)- Speaking Role play exercises based on workplace contexts, introducing oneself- Reading Reading the interview of an achiever and completing exercises (skimming, scanning and predicting)- Writing Writing a short biography of an achiever based on given hints- Grammar Asking and answering questions, punctuation in writing, prepositional phrases- Vocabulary Development use of adjectives.

UNIT II SUMMARY WRITING 12

Listening Listening to talks/lectures both general and technical and summarizing the main points- Speaking Participating in debates- Reading Reading technical essays/ articles and answering comprehension questions-Writing Summary writing-Grammar Participle forms, relative clauses- Vocabulary Development Use of compound words, abbreviations and acronyms.

UNIT III PROCESS DESCRIPTION 12

Listening Listening to a process description and drawing a flowchart-Speaking Participating in Group Discussions, giving instructions- Reading Reading instruction manuals- Writing Writing process descriptions- Writing instructions- Grammar Use of imperatives, active and passive voice, sequence words- Vocabulary Development Technical jargon

UNIT IV REPORT WRITING 12

Listening Listening to a presentation and completing gap-filling exercises- Speaking Making formal presentations- Reading Reading and interpreting charts/tables and diagrams- Writing Interpreting charts/tables and diagrams, writing a report- Grammar Direct into indirect speech, use of phrases- Vocabulary Development reporting words

UNIT V WRITING JOB APPLICATIONS 12

Listening Listening to a job interview and completing gap=filling exercises- Speaking Mock interview, telephone interviews- Reading Reading a job interview, SOP, company profile and completing comprehension exercises- Writing job applications and resumes and SOPs- Grammar Present perfect and continuous tenses- Vocabulary Development Technical vocabulary.

TOTAL: 60 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 read and comprehend technical texts effortlessly.
CO 2 write reports of a technical kind.
CO 3 speak with confidence in interviews and thereby gain employability.

TEXTBOOKS

1. Revised Edition of 'English for Engineers and Technologists' Volume 1 published by Orient Black Swan Limited 2019.

Assessment pattern

- Assessments will assess all the four skills through both pen and paper and computer based tests.
- Assessments can be pen and paper based, quizzes.

MA5252 ENGINEERING MATHEMATICS – II
(Common to all branches of B.E. / B.Tech. Programmes in II Semester)

L T P C
3 1 0 4

OBJECTIVES

The course aims to

- acquaint the students with the concepts of vector calculus which naturally arises in many engineering problems.
- develop an understanding of the standard techniques of complex variable theory in particular analytic function and its mapping property.
- familiarize the students with complex integration techniques and contour integration techniques which can be used in real integrals.
- acquaint the students with Differential Equations which are significantly used in Engineering problems.
- make the students appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

UNIT I VECTOR CALCULUS 12

Gradient and directional derivative – Divergence and Curl – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green's theorem, Stoke's theorem and Gauss divergence theorem – Verification and application in evaluating line, surface and volume integrals.

UNIT II ANALYTIC FUNCTION 12

Analytic functions – Necessary and sufficient conditions for analyticity - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions - Bilinear transformation .

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UNIT III COMPLEX INTEGRATION 12

Line integral - Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour with no pole on real axis.

UNIT IV DIFFERENTIAL EQUATIONS 12

Method of variation of parameters – Method of undetermined coefficients – Homogenous equations of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients.

UNIT V LAPLACE TRANSFORMS 12

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems – Transforms of derivatives and integrals – Initial and Final Value Theorems – Inverse Transforms – Convolution Theorem – Transform of periodic functions – Application to solution of linear ordinary differential equations with constant coefficients.

TOTAL: 60 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 calculate grad, div and curl and use Gauss, Stokes and Greens theorems to simplify calculations of integrals.

CO 2 construct analytic functions and use their conformal mapping property in application problems.

CO 3 evaluate real and complex integrals using the Cauchy's integral formula and residue theorem.

CO 4 apply various methods of solving differential equation which arise in many application problems.

CO 5 apply Laplace transform methods for solving linear differential equations.

TEXTBOOKS :

1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2015.
2. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, New Delhi, 2017.

REFERENCES:

1. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), 7th Edition, New Delhi, 2009.
2. Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education, 4th Edition, New Delhi, 2011.
3. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, 5th Edition, New Delhi, 2017.
4. Peter V.O'Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, 7th Edition, New Delhi, 2012.
5. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., 11th Reprint, New Delhi, 2010.

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GE5151 **ENGINEERING GRAPHICS** **L T P C**
1 0 4 3

OBJECTIVES

The course aims to prepare the students for

- drawing free hand sketches of basic geometrical shapes and multiple views of objects.
- drawing orthographic projections of lines and planes.
- drawing orthographic projections of solids.
- drawing development of the surfaces of objects.
- drawing isometric and perspective views of simple solids.

CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATION) **1**

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I PLANE CURVES AND FREE HANDSKETCHING **14**

Basic Geometrical constructions, Curves used in engineering practices-Conics – Construction of ellipse, parabola and hyperbola by different methods – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves. Visualization concepts and Free Hand sketching Visualization principles – Representation of Three-Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES **15**

Orthographic projection- principles-Principle planes-First angle projection-Projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes-Determination of true lengths and true inclinations by rotating line method and trapezoidal method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS **15**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to both the principal planes by rotating object method and auxiliary plane method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES **15**

Sectioning of solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes.

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UNITV ISOMETRIC AND PERSPECTIVE PROJECTIONS 12

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms pyramids and cylinders by visual ray method and vanishing point method.

COMPUTER AIDED DRAFTING (DEMONSTRATION ONLY) 3

Introduction to drafting packages and demonstration of their use

TOTAL: (L 15 + P 60)=75 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 draw free hand sketching of basic geometrical shapes and multiple views of objects.
CO 2 draw orthographic projections of lines and planes
CO 3 draw orthographic projections of solids
CO 4 draw development of the surfaces of objects
CO 5 draw isometric and perspective views of simple solids.

TEXT BOOKS:

1. Bhatt, N. D.,Panchal V M and Pramod R. Ingle, “Engineering Drawing”, Charotar Publishing House, 53rd Edition, 2014.
2. Parthasarathy, N. S. and Vela Murali, “Engineering Drawing”, Oxford University Press, 2015

REFERENCES:

1. Agrawal, B. and Agrawal C.M., “Engineering Drawing”, Tata McGraw, N.Delhi, 2008.
2. Gopalakrishna, K. R., “Engineering Drawing”, Subhas Stores, Bangalore, 2007.
3. Natarajan, K. V., “A text book of Engineering Graphics”, 28th Ed., Dhanalakshmi Publishers, Chennai, 2015.
4. Shah, M. B., and Rana, B. C., “Engineering Drawing”, Pearson, 2nd Ed., 2009.
5. Venugopal, K. and Prabhu Raja, V., “Engineering Graphics”, New Age,2008.

Publication of Bureau of Indian Standards

1. IS 10711 – 2001 Technical products Documentation – Size and lay out of drawing sheets
2. IS 9609 (Parts 0 & 1) – 2001 Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003 Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003 Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001 Technical drawings – Projection Methods.

Special points applicable to University Examinations on Engineering Graphics

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a Total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only.
4. The students will be permitted to use appropriate scale to fit solution within A3 size.
5. The examination will be conducted in appropriate sessions on the same day.

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EE5251 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING **LT P C**
3 0 0 3

OBJECTIVES

The course aims to

- understand the basic concepts of electric circuits, magnetic circuits and wiring.
- understand the operation of AC and DC machines.
- understand the working principle of electronic devices and circuits.

UNIT I BASIC CIRCUITS AND DOMESTIC WIRING 9

Electrical circuit elements (R, L and C)-Dependent and independent sources – Ohm's Law-Kirchhoff's laws - mesh current and node voltage methods (Analysis with only independent source) - Phasors – RMS-Average values-sinusoidal steady state response of simple RLC circuits. Types of wiring- Domestic wiring - Specification of Wires-Earthing-Methods-Protective devices.

UNIT II THREE PHASE CIRCUITS AND MAGNETIC CIRCUITS 9

Three phase supply – Star connection – Delta connection –Balanced and Unbalanced Loads-Power in three-phase systems – Comparison of star and delta connections – Advantages-Magnetic circuits-Definitions-MMF, Flux, Reluctance, Magnetic field intensity, Flux density, Fringing, self and mutual inductances-simple problems.

UNIT III ELECTRICAL MACHINES 9

Working principle of DC generator, motor-EMF and Torque equation-Types –Shunt, Series and Compound-Applications.Working principle of transformer-EMF equation-Operating principles of three phase and single phase induction motor-Applications.Working principles of alternator-EMF equation-Operating principles of Synchronous motor, stepper motor-Applications.

UNIT IV BASICS OF ELECTRONICS 9

Intrinsic semiconductors, Extrinsic semiconductors – P-type and N-type, P-N junction, VI Characteristics of PN junction diode, Zener effect, Zener diode, Zener diode Characteristics-Rectifier circuits-Wave shaping.

UNIT V CURRENT CONTROLLED AND VOLTAGE CONTROLLED DEVICES 9

Working principle and characteristics - BJT, SCR, JFET, MOSFET.

TOTAL: 45 PERIODS

OUTCOMES:

CO1 To be able to understand the concepts related with electrical circuits and wiring.
CO2 To be able to study the different three phase connections and the concepts of magnetic circuits.
CO3 Capable of understanding the operating principle of AC and DC machines.
CO4 To be able to understand the working principle of electronic devices such as diode and zener diode.
CO 5 To be able to understand the characteristics and working of current controlled and voltage controlled devices.

TEXT BOOKS:

1. Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", McGraw Hill Education, 2014
2. Del Toro, "Electrical Engineering Fundamentals", Second edition, Pearson Education, New Delhi, 1989.
3. John Bird, "Electrical Circuit theory and technology", Routledge; 5th edition, 2013

REFERENCES:

1. Thomas L. Floyd, 'Electronic Devices', 10th Edition, Pearson Education, 2018.
2. Albert Malvino, David Bates, 'Electronic Principles, McGraw Hill Education; 7th edition, 2017.
3. Kothari DP and I.J Nagrath, "Basic Electrical Engineering", McGraw Hill, 2010.
4. Muhammad H.Rashid, "Spice for Circuits and electronics", 4th ed.,Cengage India,2019.

FT5201 FOOD MICROBIOLOGY L T P C
3 0 0 3

OBJECTIVES

The course aims to

- enable students to understand the methods of isolating and characterizing various microbes associated with foods and food groups.
- enable students to understand and use various microbiological techniques for the study of foods.
- understand the methods used to detect pathogens in foods.

UNIT I MICROBES - STRUCTURE AND MULTIPLICATION 12

Basics of microbial existence; history of microbiology, classification and nomenclature of microorganisms, microscopic examination of microorganisms, light and electron microscopy; principles of different staining techniques like gram staining, acid fast, capsule staining and flagella staining. Nutritional requirements of bacteria; different media used for bacterial culture; growth curve and different methods to quantify bacterial growth; aerobic and anaerobic bioenergetics and utilization of energy for biosynthesis of important molecules.
Calculation of doubling time of bacteria.

UNIT II ROLE OF MICROBES IN SPOILAGE OF FOODS AND THEIR CONTROL 8

Factors affecting spoilage of foods, Microbial flora associated with various food groups their spoilage potential. Microbiological spoilage problems associated with typical food products. Use of antimicrobial chemicals- organic acids, sugars, sodium chloride, nitrites, phosphates, sulphites, Benzoates, Sorbates / Propionates naturally occurring antimicrobials; Physical methods- Low and high temperatures, drying, radiation and high pressure; Tolerance of microbes to chemical and physical methods in various foods.

UNIT III BENEFICIAL MICROBES IN FOODS 9

Microbes of importance in food fermentations, – Homo & hetero-fermentative bacteria, yeasts and fungi; Biochemistry of fermentations – pathways involved, Lactic acid bacteria fermentation and starter cultures, Alcoholic fermentations -Yeast fermentations - characteristics and strain selection, Fungal fermentations. Microbes associated with typical food fermentations- yoghurt, cheese, fermented milks, breads, idli, soy products, fermented vegetables and meats.

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UNIT IV MICROBIAL AGENTS OF FOOD BORNE ILLNESS 8

Food borne infections and food poisoning, Microbial toxins - types, Gram Negative and Gram positive food borne pathogens – *Salmonella, E. coli, Shigella, Vibrio cholerae,Staphylococcus* aureus; Clostridium botulinum; Lysteria monocytogenes. Toxigenic algae and fungi; Food borne viruses; helminths, nematodes and protozoa.

UNIT V MICROBIAL EXAMINATION OF FOODS 8

Detection & Enumeration of microbes in foods, Most Probable Number calculations; Indicator organisms and microbiological criteria; Rapid and automated microbial methods - development and impact on the detection of food borne pathogens; Applications of immunological techniques, importance of *Clostridium botulinum* to food industry; Detection methods for *E. coli,* Staphylococci, Yersinia, B. cereus, C. botulinum & Salmonella, Listeria monocytogenes, Norwalkvirus, Rotavirus, Hepatitis A virus from food samples.

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course the students will be able to

CO 1 understand the structure and identify the various microbes associated with foods and food groups.

CO 2 understand and identify the role of these microbes in food spoilage, food preservation.

CO 3 understand the role of pathogens in food borne infections and how to detect them

TEXT BOOKS

1. Prescott Harley, Klein“ Microbiology “: Authored by Wiley, Sherwood, Woolverton, 10th edition (2017) McGraw-Hill Higher Education
2. Ananthanarayanan, R. and C.K. JayaramPaniker, “Textbook of Microbiology”,9th Edition,Orient Longman, 2013.
3. Vijaya Ramesh “Food Microbiology”. MJP Publishers, 2007.
4. Jay, J.M. “Modern Food Microbiology”. 4th Edition. CBS Publishers, 2003.
5. Adams, M.R and M.O. Moss. “Food Microbiology”. New Age International, 2002.

REFERENCES

1. Pawsey, R.K. “Case Studies in Food Microbiology for Food Safety and Quality”. TheRoyal Society of Chemistry, 2001.
2. Orsythe, S.J. “The Microbiology of Safe Food”. Blackwell Science, 2000.
3. Harrigan, W.F. “Laboratory Methods in Food Microbiology” 3rd Edition, AcademicPress.1998.
4. Ray,Bibek. “Fundamental Food Microbiology” CRC press 2004.

Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme specific outcomes(PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	understand the structure and identify the various microbes associated with foods and food groups	1	-	-	-	-	-	-	2	1	-	-	2	1	-	-	-
CO2	understand and identify the role of these microbes in food spoilage, food preservation	2	1	-	-	3	1	-	2	1	-	1	2	1	1	-	-
CO3	understand the role of pathogens in food borne infections and how to detect them.	2	1	1	2	1	2	2	1	-	2	-	2	1	1	-	-
Over all CO		2	1	1	1	1	1	1	2	1	1	1	2	1	1	-	-

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

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FT5202 BIOCHEMISTRY AND NUTRITION L T P C
3 0 0 3

OBJECTIVES

The course aims to

- ensure students have a strong grounding in structures and reactions of biomolecules.
- introduce them to metabolic pathway of the major biomolecules
- enable the students to understand roles of each nutrients in growth and metabolism

UNIT I INTRODUCTION TO BIOMOLECULES 5

Basic principles of organic chemistry, role of carbon, types of functional groups, biomolecules, chemical nature of water, pH and biological buffers.

UNIT II STRUCTURE AND PROPERTIES OF IMPORTANT BIOMOLECULES 15

Carbohydrates mutarotation, glycosidic bond, reactions of monosaccharides and reducing sugars.Starch, glycogen, cellulose and chitin structures and functions .Proteoglycans, glycosaminoglycans.hyaluronic acid, chondroitin sulfate.

Lipids Fatty acids, glycerol, triacylglycerol, phospholipids, glycolipids, sphingolipids.Inherited metabolic disorders of Lipid-metabolism-Tay-Saach's disease, Niemann-Pick's disease and Gaucher's disease.Cholesterol, steroids, Bile acids and salts, Gluco-and Mineralo-corticosteroids.Prostaglandins and their functions.Lipoproteins. Cardiovascular disease and correlation with circulating lipid and lipoprotein concentration

Amino Acids, Peptides, and Proteins.Classification based on side-chain properties. Structures, hierarchy of organization primary, secondary, tertiary and quaternary structures, glycoproteins, lipoproteins.Nucleic acids Purines, pyrimidines, nucleosides, nucleotides, Chargaff's Rules. Base pairing,A-T and G-C, mRNA, rRNA and tRNA., Watson-Crick structure of DNA. reactions, properties,Tm and hypochromicity, Measurement of DNA and RNA. Nucleoprotein complexes

UNIT III AN OVERVIEW OF NUTRITION AND ENERGY BALANCE 6

Definition, six classes of nutrients, calculating energy values from food, using the RDA, nutritional status, nutritional requirement, malnutrition, nutritional assessment of individuals and populations, dietary recommendations, Balanced diet planning Diet planning principles, dietary guidelines; Glycemic and Non-glycemic carbohydrates, health effects of fiber and starch intake food groups, exchange lists, personal diet analysis; Digestion, Absorption and Transport Anatomy and physiology of the digestive tract, mechanical and chemical digestion, absorption of nutrients. Energy balance; body weight and body composition; health implications; obesity, BMR and BMI calculations

UNIT IV VITAMINS AND MINERALS 5

Water Soluble Vitamins B vitamins examined individually (Thiamine, Riboflavin, Niacin, Pyridoxine, Biotin, folate B12, choline, pantothenic acid, and carnitine) and in concert; B vitamin deficiencies, toxicities, and food sources; vitamin C roles and recommended intake, deficiency, toxicity and food sources. Fat Soluble Vitamins A, D, E, and K Function, recommended intakes, toxicities, food sources of vitamin A, D, E, and K; Water and Major Minerals Water balance and recommended intakes; fluid/electrolyte balance, acid-base balance; function, recommended intakes, and regulation of sodium, potassium, and calcium. Trace Minerals Food sources, function, recommended intakes, toxicities, deficiencies and transport of iron and zinc; importance of selenium, copper, fluoride, and chromium.

UNIT V INTERMEDIARY METABOLISM AND REGULATION 14

Enzymes, introduction to biocatalysts, metabolic pathways, primary and secondary metabolites. Glycolysis, TCA cycle, gluconeogenesis, pentose phosphate shunt, glyoxalate shunt, fatty acid synthesis and oxidation, reactions of amino acids, deamination, transamination and decarboxylation, urea cycle, Bioenergetics - High energy compounds, electronegative potential

of compounds, respiratory chain, ATP cycle, calculation of ATP yieldduring oxidation of glucose and fatty acids.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 understand the fundamentals of biomolecules, biochemical reactions in a living organism.
CO 2 understandthe importance of nutrients in growth and metabolism.
CO 3 gain knowledge of importance of nutrients in physiological function and biochemical pathways.

TEXT BOOKS:

1. Nelson, D.L. and M.M. Cox, “Lehninger’s Principles of Biochemistry”, 4th Edition, W.H. Freemen & Co., 2005.
2. Satyanarayana, U. and U. Chakerapani, “Biochemistry” 3rd Rev. Edition, Books & Allied (P) Ltd., 2006.
3. Rastogi, S.C. “Biochemistry” 2nd Edition, Tata McGraw-Hill, 2003.
4. Mann, Jim and Stewart Truswell “Essentials of Human Nutrition”. 3rd Edition. Oxford University Press, 2007.
5. Gibney, Michael J., et al., “Introduction to Human Nutrition”. 2nd Edition. Blackwell,2009.

REFERENCES:

1. Berg, Jeremy M. et al. “Biochemsitry”, 6th Edition, W.H. Freeman & Co., 2006.
2. Voet, D. and Voet, J.G., “Biochemistry”, 3rd Edition, John Wiley & Sons Inc.,2004.
3. Gropper, Sareen S. and Jack L.Smith “Advanced Nutrition and Human Metabolism”. 5th Edition. Wadsworth Publishing, 2008.

Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO 1	understanding on the fundamentals of biomolecules, biochemical reactions in a living organism.	2	2	-	-	-	-	-	2	-	-	-	3	2	3	3	3
CO 2	understand the importance of nutrientsin growth and metabolism.	2	2	-	-	-	-	-	2	-	-	-	3	2	3	3	3
CO 3	gain knowledge of importance of nutrients in physiological function and biochemical pathways.	2	2	-	-	-	-	-	2	-	-	-	3	2	3	3	3
Over all CO		2	2	-	-	-	-	-	2	-	-	-	3	2	3	3	3

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

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FT5211 BIOCHEMISTRY AND NUTRITION LABORATORY L T P C
0 0 4 2

OBJECTIVES

The course aims to

- learn and understand the principles behind the qualitative and quantitative estimation of biomolecules.
- understand the quantitative methods in assessing nutritional status of individuals and groups

LIST OF EXPERIMENTS

1. Units of volume, weight, density and concentration measurements and their range in biological measurements. Demonstration of proper use of volume and weight measurement devices.
2. Preparation of buffer –titration of a weak acid and a weak base.
3. Qualitative tests for carbohydrates – distinguishing reducing from non-reducing sugars and keto from aldo sugars.
4. Quantitative method for amino acid estimation using ninhydrin – distinguishing amino from amino acid.
5. Protein estimation by Biuret and Lowry's methods.
6. Protein estimation by Bradford and spectroscopic methods.
7. Extraction of lipids and analysis by TLC.
8. Enzymatic assay phosphatase from potato.
9. Nutritional anthropometry - Standards for reference – WHO, Body Mass Index and reference value
10. Techniques of measuring height, weight, head, chest and arm circumference, waist to hip ratio, skin-fold thickness, Calculation of percent Body fat using skin folds callipers
11. Calculation of the calories from nutrient composition of foods
12. Comparison of Food Composition data bases

TOTAL: 60 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 understandthe experimental protocols for qualitative and quantitative analysis of biomolecules.

CO 2 familiarize with the calculation of energy values of foods and composition table.

CO 3 gain knowledge of Nutritional anthropometry techniques.

TEXT BOOKS:

1. Gupta. R.C. and Bhargavan. S. Practical Biochemistry. 5th Edition, CBS Publishers and Distributors 2013.
2. David T. Phummer. Introduction of Practical Biochemistry, 3rd Edition. McGraw- Hill Publishing co. 2017.
3. Mann, Jim and Stewart Truswell "Essentials of Human Nutrition". 3rd Edition. OxfordUniversity Press, 2007.

REFERENCES:

1. R.K. Murray, D.K. Granner, P.A. Mayes and V.W.Rodwell, Harpers Biochemistry. McGraw- Hill Co. 26th Edition. 2003.
2. Thomas M. Devlin. Textbook of Biochemistry with clinical correlations. Wiley Publishers. 7th Edition. 2010.
3. .Gibney, Michael J., et al., "Introduction to Human Nutrition". 2nd Edition. Blackwell, 2009.

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Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO 1	understand the experimental protocols for qualitative and quantitative analysis of biomolecules.	3	3	2	3	2	-	-	3	2	-	-	2	3	3	3	3
CO 2	familiarize with the calculation of energy values of foods and composition table.	3	3	2	3	2	-	-	3	2	-	-	2	3	3	3	3
CO 3	gain knowledge of Nutritional anthropometry techniques.	3	3	2	3	2	-	-	3	2	-	-	2	3	3	3	3
Over all CO		3	3	2	3	2	-	-	3	2	-	-	2	3	3	3	3

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

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FT5212	FOOD MICROBIOLOGY LABORATORY	L T P C 0 0 4 2

OBJECTIVES

The course aims to

- enable students to understand the methods of isolating and characterizing various microbes associated with foods and food groups.
- enable students to understand and use various microbiological techniques for the study of foods.
- Understand the methods used to detect pathogens in foods.

LIST OF EXPERIMENTS

1. Introduction, Laboratory Safety, Use of Equipment; Sterilization Techniques; Culture Media-Types and Use; Preparation of Nutrient broth and agar
2. Culture Techniques, Isolation and Preservation of Cultures- Broth flask, test tubes; Solid Pour plates, streak plates, slants, stabs
3. Microscopy – Working and care of Microscope; Microscopic Methods in the Study of Microorganisms; Staining Techniques - Simple, Differential- Gram's Staining
4. Quantification of Microbes Sampling and Serial Dilution; Bacterial count in food products TVC
5. Microbiological quality of water (MPN)
6. Microbiological quality of milk
7. Enumeration of Lactic acid bacteria from fermented foods
8. Yeast & Mould count from fruits
9. Enumeration of spores from pepper
10. Inhibitory effect of spices on microbial load in fish & flesh foods
11. Enumeration & Isolation of E. coli from processed meat/chicken
12. Thermal destruction of microbes TDT & TDP
13. Enumeration & Isolation of Staphylococci from ready to eat street foods
14. Effect of cleaning and disinfection on microbial load

TOTAL: 60 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 different techniques for the identification,isolation and culture of microbes.
CO 2 analyse and identify microbial contamination in food
CO 3 disinfection techniques

REFERENCES

1. Harrigan, W.F. "Laboratory Methods in Food Microbiology" Academic Press, 2011.

Course Articulation Matrix

Course outcomes Statement		Programmes outcome (PO)												Programme specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	different techniques for the identification ,isolation and culture of microbes.	1	-	1	-	3	1	-	2	3	2	-	2	2	1	3	2
CO2	analyse and identify microbial contamination in food.	1	1	1	1	2	-	-	1	2	1	-	2	2	2	3	2
CO3	disinfection techniques .	1	2	1	2	3	1	-	3	3	1	-	2	2	2	3	2
Over all CO		1	2	1	1	3	1	-	2	3	1	-	2	2	2	3	2

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

SEMESTER III

MA5355 TRANSFORM TECHNIQUES AND PARTIAL DIFFERENTIAL EQUATIONS L T P C
3 1 0 4

OBJECTIVES

The course aims to

- introduce the effective mathematical tools for the solutions of partial differential equations that model physical processes;
- introduce Fourier series analysis which is central to many applications in engineering.
- develop the analytic solutions for partial differential equations used in engineering by Fourier series;
- acquaint the student with Fourier transform techniques used in wide variety of situations in which the functions used are not periodic;
- develop Z- transform techniques which will perform the same task for discrete time systems as Laplace Transform, a valuable aid in analysis of continuous time systems.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 12

Formation – Solutions of first order equations – Standard types and Equations reducible to standard types – Lagrange's Linear equation – Solution of linear equations of higher order with constant coefficients – Linear non-homogeneous partial differential equations.

UNIT II FOURIER SERIES 12

Dirichlet's conditions – General Fourier series – Odd and even functions – Half-range Sine and cosine series – Complex form of Fourier series – Parseval's identity – Harmonic Analysis.

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATION 12

Classification of partial differential equations- Method of separation of variables – Solutions of one dimensional wave equation and one-dimensional heat equation – Steady state solution of two-dimensional heat equation – Fourier series solutions in cartesian coordinates.

UNIT IV FOURIER TRANSFORM 12

Fourier integral theorem – Fourier transform pair - Sine and cosine transforms – Properties – Transform of elementary functions – Convolution theorem – Parseval's identity.

UNIT V TRANSFORM AND DIFFERENCE EQUATIONS 12

Z-transform – Elementary properties – Inverse Z-transform – Convolution theorem – Initial and final value theorems – Formation of difference equation – Solution of difference equation using Z - transform.

TOTAL: 60 PERIODS

OUTCOMES:

At the end of the course students will be able to

CO 1 solve partial differential equations which arise in application problems.
CO 2 analyze the functions as an infinite series involving sine and cosine functions.
CO 3 obtain the solutions of the partial differential equations using Fourier series.
CO 4 obtain Fourier transforms for the functions which are needed for solving application problems.
CO 5 manipulate discrete data sequences using Z transform techniques.

TEXTBOOKS:

1. Erwin kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 10th Edition, New Delhi, 2015.
2. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers,44th Edition, New Delhi,2017.

REFERENCES:

1. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,),7th Edition, New Delhi, 2009.
2. Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education, 4th Edition, New Delhi, 2011.
3. Peter V.O'Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd,7th Edition, New Delhi, 2012.
4. Ramana, B.V. "Higher Engineering Mathematics", Tata McGraw Hill, 11th Reprint, New Delhi, 2010.

FT5301 FOOD PROCESS CALCULATIONS L T P C
2 1 0 3

OBJECTIVES

The course aims to

- learn various units, dimensions and unit conversions
- learn mass and energy balance in unit operations and processes involved in food industries

UNIT I UNITS AND DIMENSIONS 9

Units and Dimensions Basic and derived units, use of model units in calculations, Methods of expression, compositions of mixture and solutions. Ideal and real gas laws – Gas constant - calculations of pressure, volume and temperature using ideal gas law.

UNIT II HUMIDITY CALCULATIONS 9

Fundamental food process Calculations and Humidity Calculation of absolute humidity, molal humidity, relative humidity and percentage humidity - Use of humidity in condensation and drying of foods - Humidity chart, dew point.

UNIT III STOICHIOMETRY AND MATERIAL BALANCE 9

Basic Principles of Stoichiometry - Importance of material balance and energy balance in a food Industry-Dimensions, Units, conversion factors and their use –Data sources, Humidity and applications. Material Balance Stoichiometric principles, Application of material balance in food operations like distillation, evaporation, crystallization, drying, extraction, Leaching.

UNIT IV ENERGY BALANCE 9

Energy Balance Heat capacity of solids, liquids, gases and solutions, use of mean heat capacity in heat calculations, problems involving sensible heat and latent heats for food products.

UNIT V ENTHALPY 9

Enthalpy Changes Standard heat of reaction, heats of formation, combustion, solution, mixing etc., calculation of standard heat of reaction - Effect of pressure and temperature on heat of reaction - Energy balance for systems without chemical reaction.

TOTAL: 45 PERIODS

(Use of Psychometric chart is permitted in the examination)

OUTCOMES:

At the end of the course the students will be able to

CO 1 make them understand different types of laws of chemistry of materials

CO 2 accurately calculate the stoichiometric relations between the materials involved in the unit operation process.

CO 3 performelementary material and energy balance for different unit operations.

TEXT BOOKS:

1. Bhatt, B.L and Vora, S.M., —Stoichiometry, 5th Edition, McGraw-Hill, New York, 2010.
2. Gavhane, K.A —Introduction to Process Calculations (Stoichiometery) NiraliPrakashanPublications, Pune, 2006.

REFERENCES:

1. Venkataramani, V. and Anantharaman, N., —Process Calculations, Prentice Hall of India, New Delhi, 2003.
2. Himmelblau, D.M., —Basic Principles and Calculations in Chemical Engineering, SixthEdition, Prentice Hall India, New Delhi, 2003.

Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programmespecific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	make them understand different types of laws of chemistry of materials.	3	3	1	-	-	-	-	-	1	1	1	2	3	3	1	1
CO2	accurately calculate the stoichiometric relations between the materials involved in the unit operation process.	3	3	1	-	-	-	-	-	1	1	1	2	3	3	1	1
CO3	perform elementary material and energy balance for different unit operations.	3	3	1	-	-	-	-	-	1	1	1	2	3	3	1	1
Over all CO		3	3	1	-	-	-	-	-	1	1	1	2	3	3	1	1

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively

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FT5303 PRINCIPLES OF THERMODYNAMICS LT P C
3 0 0 3

OBJECTIVES

The course aims to

- train the students on the basics and applications of energy in Mechanical Engineering
- impart knowledge on thermodynamics and thermal engineering power generating units such as engines and theory of machines

UNIT I BASIC CONCEPTS 9

Basic concepts - concept of continuum, comparison of microscopic and macroscopic approach.Path and point functions. Intensive and extensive, Total and specific quantities.System and their types.Thermodynamic Equilibrium State, path and process. Quasi-static, reversible and irreversible processes. Heat and work transfer, definition and comparison, sign convention. Displacement work and other modes of work.P-V diagram.

UNIT II LAWS OF THERMODYNAMICS 9

Zeroth law of thermodynamics – concept of temperature and thermal equilibrium– relationship between temperature scales –new temperature scales. First law of thermodynamics – application to closed and open systems – steady and unsteady flow processes. Heat Reservoir, source and sink. Heat Engine, Refrigerator, Heat pump. Statements of second law and its corollaries. Carnot cycle Reversed Carnot cycle, Performance. Clausius inequality. Concept of entropy, T-s diagram, Tds Equations, entropy change for - pure substance, ideal gases - different processes, principle of increase in entropy. Applications of II Law. High- and low-grade energy. Available and non-available energy of a source and finite body.Energy and irreversibility. Expressions for the energy of a closed system and open systems. Energy balance and entropy generation. Irreversibility. I and II law Efficiency.

UNIT III PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE 9

Formation of steam and its thermodynamic properties, p-v, p-T, T-v, T-s, h-s diagrams. p-v-T surface. Use of Steam Table and Mollier Chart.Determination of dryness fraction. Application of I and II law for pure substances. Ideal and actual Rankine cycles, Cycle Improvement Methods - Reheat and Regenerative cycles, Economiser, preheater, Binary and Combined cycles.

UNIT IV IDEAL AND REAL GASES, THERMODYNAMIC RELATIONS 9

Properties of Ideal gas- Ideal and real gas comparison- Equations of state for ideal and real gases- Reduced properties.Compressibility factor-.Principle of Corresponding states. - Generalised Compressibility Chart and its use-. Maxwell relations, Tds Equations, Difference and ratio of heat capacities, Energy equation, Joule-Thomson Coefficient, Clausius Clapeyron equation, Phase Change Processes. Simple Calculations.

UNIT V GAS MIXTURES AND PSYCHROMETRY 9

Mole and Mass fraction, Dalton's and Amagat's Law. Properties of gas mixture – Molar mass, gas constant, density, change in internal energy, enthalpy, entropy and Gibbs function. Psychrometric properties, Psychrometric charts. Property calculations of air vapour mixtures by using chart and expressions. Psychrometric process – adiabatic saturation, sensible heating and cooling, humidification, dehumidification, evaporative cooling and adiabatic mixing. Simple Applications

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 apply thermodynamic principles to Engineering Applications

CO 2 apply mathematical fundamentals to study the properties of steam, gas and gas mixture.

CO 3 apply fundamentals of thermodynamics and to perform thermal analysis on their behaviour and performance

TEXT BOOKS:

1. Nag P. K. Thermodynamics, 2005. 5th edition,Tata Mc Graw Hill, New Delhi. 2001.
2. EthirajanRathakrishnan. Fundamentals of Engineering Thermodynamics. (PHI). 2010.
3. Y. Cengel and M. Boles, Thermodynamics - An Engineering Approach, Tata McGraw Hill,7th Edition, 2011.
4. Chattopadhyay, P, "Engineering Thermodynamics",2nd Ed. Oxford University Press, 2014.
5. Venkatesh. A, "Basic Engineering Thermodynamics", Universities Press (India) Limited, 2007.
6. E. Rathakrishnan, "Fundamentals of Engineering Thermodynamics", 2nd Edition, Prentice Hall of India Pvt. Ltd, 2006.
7. Van Wylen and Sonntag, "Classical Thermodynamics", Wiley Eastern, 1987.

Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**89**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	apply thermodynamic principles to Engineering Applications	3	3	3	3	-	2	-	1	3	-	2	1	3	3	-	-
CO2	apply mathematical fundamentals to study the properties of steam, gas and gas mixture.	3	3	3	3	-	2	-	1	3	-	2	1	3	3	-	-
CO3	apply fundamentals of thermodynamics and to perform thermal analysis on their behaviour and performance	3	3	3	3	-	2	-	1	3	-	2	1	3	3	-	-
Over all CO		3	3	3	3	-	2	-	1	3	-	2	1	3	3	-	-

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

FT5304 FLUID MECHANICS IN FOOD PROCESSES L T P C
2 1 0 3

OBJECTIVES

The course aims to

- introduce about the mechanics of fluids through a thorough understanding of the properties of the fluids, behaviour of fluids under static conditions. The dynamics of fluids through the control volume approach which gives an integrated understanding of the transport of mass, momentum and energy.
- expose to the applications of the conservation laws to a) flow measurements b) flow through pipes (both laminar and turbulent) and c) forces on vanes.

UNIT I PROPERTIES OF FLUIDS 9

Properties of fluids – definition – units of measurement - Mass density – specific weight, specific volume – specific gravity, equation of state – perfect gas - Viscosity – vapour pressure– compressibility, elasticity & surface tension – capillarity. Fluid pressure and measurement – simple, differential and micro manometers - Mechanical gauges – calibration. Hydrostatic forces on surfaces – Total pressure and centre of pressure - Horizontal- vertical and inclined plane surface. Archimedes principles – buoyancy, applications - fluid food - case studies

UNIT II FLUID FLOW ANALYSIS 9

Types of fluid flow – velocity and acceleration of a fluid particle - Rotational – irrotational – circulation and vorticity - Flow pattern – stream line – equipotential line – stream tube – path line– steak line – flow net – velocity potential – stream function. Principles of conservation of mass– energy – momentum – continuity equation in Cartesian co-ordinates - Euler's equation of motion, applications - fluid food - case studies

UNIT III FLOW MEASUREMENTS 9

Bernoulli's equation – applications - Venturimeter – orifice meter – nozzle meter &rota meter –pitot tube. Orifice – sharp edged orifice – submerged orifice – mouth piece - Flow through orifice under variable head – time of emptying a tank with and without inflow. Flow through pipes – laminar and turbulent flow in pipes - Reynold's experiment - Darcy – Weisbach equation for friction head loss – Chezy's formula – Manning's formula – Hazen-William's formula - Major and minor losses in pipes. Valves, valve types and characteristics of valves, applications - fluid food - case studies

UNIT IV OPEN CHANNEL FLOW AND FLUID FLOW THROUGH BEDS 9

Types of flow in channel – uniform flow – most economical section of channel – rectangular – trapezoidal. Specific force - critical flow. Flow measurement in channels – notches rectangular triangular. Float method - Flow measurement in rivers/ streams/ canals. Weirs – free and submerged flow – current meter. Fluid flow through fixed and fluidized beds.

UNIT V DIMENSIONAL ANALYSIS & PUMPS 9

Dimensional analysis – concept of geometric, kinematic and dynamic similarity.Important non-dimensional numbers – Reynolds, Froude, Euler, Mach and Weber. Pump terminology – suction lift, suction head, delivery head, discharge, water horse power – selection of pump capacity. Centrifugal pumps – components – working – types of pumps and impellers – Priming– cavitation – characteristics curves. Turbine and submersible pumps - Jet pump – Other pumps – Air lift pump - reciprocating pump - sludge pump and vacuum pump-Hydraulic ram, applications - fluid food - case studies.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 get a basic knowledge of fluids in static, kinematic and dynamic equilibrium.

CO 2 gain the knowledge of the applicability of physical laws in addressing problems in hydraulics.

CO 3 perceive knowledge on metering and transportation of fluids.

TEXT BOOKS:

1. Modi, P.N. and Seth S.M. “Hydraulics and fluid mechanics”. Standard Publishers Distributors, New Delhi,2010.
2. Streeter, V.L. Wylie, E. B. and Bedford K.W, Fluid Mechanics. 9th Edition. Tata McGrawHill, New Delhi, 1998.

REFERENCES:

1. Bansal, R.K., “A text book of fluid mechanics and hydraulic machinery”, Laxmi publications (P) Ltd., New Delhi, 2002.
2. Grade, RJ.,.“Fluid mechanics through problems”. Wiley eastern Ltd., Madras,2002
3. Jain A. K. “Fluid Mechanics”. Khanna Publishers 2004.
4. JagadishLal,.“Hydraulic machines”. Metropolitan book house, New Delhi, 2000
5. Michael, A.M..“Irrigation Theory and practice”, Vikas publishing house, New Delhi, 2008.

Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	get a basic knowledge of fluids in static, kinematic and dynamic equilibrium.	3	1	1	2	-	1	1	-	-	-	-	-	1	2	2	1
CO2	gain the knowledge of the applicability of physical laws in addressing problems in hydraulics.	3	3	2	3	-	-	-	-	-	-	-	-	2	3	2	2
CO3	perceive knowledge on metering and transportation of fluids.	3	3	2	3	-	1	-	-	-	-	-	-	3	2	2	1
Over all CO		3	2	2	3	-	1	1	1	-	-	-	-	2	2	2	1

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

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FT5302	FOOD CHEMISTRY	L T P C
		3 0 0 3

OBJECTIVES

The course aims to

- develop the knowledge of students in the basic area of Food Chemistry such as the composition and properties of food and the chemical changes of nutrients during handling, processing, and storage.
- effective understanding of food processing and technology.
- appreciate the similarities and complexities of the chemical components in foods.

UNIT I CARBOHYDRATES 10

The principal carbohydrates in the human diet.Chemical properties of carbohydrates- dehydration, caramelization, Maillard reaction. Types Simple Sugars mono and disaccharides, solubility; Artificial sweeteners; Glucose syrup, fructose syrup, Sugar alcohols; Oligosaccharides structure, nomenclature, occurrence, uses in foods. Polysaccharides Starch- amylose and amylopectin- properties, thickening & gelatinization, modified starches, resistant starch, Dextrins and dextrans, Starch hydrolysates – Maltodextrins and dextrins; Structure of glycogen. Fiber-Cellulose & hemicellulose Pectins Gums & seaweeds- gel formation & viscosity.

UNIT II PROTEINS 9

The principal proteins in the human diet. Review of protein structure & conformation; Optical activity, solubility, hydration, swelling, foam formation & stabilization, gel formation, emulsifying effect, thickening & binding, amino acids in Maillard reaction, denaturation; Properties & reactions of proteins in food systems and Food enzymes and its role in food spoilage, application of food enzymes; Texturized proteins; Functional role and uses in foods.

UNIT III LIPIDS 10

Review of structure, composition and nomenclature of fats. Properties of fats & oils Edible oil refining processes, winterization, melting points, plasticity, isomerisation, hydrolysis of triglycerides, Saponification number, iodine value, Reichert-Meissl number. Types of fatty acids; Modification of fats hydrogenation- cis and trans isomers, inter-esterification, acetylation, Hydrolytic rancidity & oxidative rancidity; Shortening power of fats, tenderization, frying - smoke point, auto oxidation, polymerization, lipids having emulsifying properties, itsapplication in food industry and detergents; Shortening power of fats, chemistry of steroids, types of fat substitute.

UNIT IV FOOD COMPOSITION, WATER, MINERALS AND VITAMINS 7

Proximate composition of food, water activity in food, moisture content of food, water quality for food processing. Mineral & vitamin content of foods- stability & degradation during food processing.

UNIT V AROMA & IMPORTANT PHYTOCHEMICALS IN FOOD 9

Naturally occurring colours/pigments in food and impact on antioxidant level, Synthetic food grade Colours, enzymatic browning of food, flavour & aroma components present in herbs, spices, coffee, tea, cocoa, fruits, vegetables & fermented products; and Naturally similar /artificial flavours, Threshold values, off flavours & food taints. Naturally occurring toxic substances, protease inhibitors, bioactive components phytates, polyphenols, saponins, phytoestrogens etc.

OUTCOMES:

At the end of the course the students will be able to

CO 1 gain knowledge on chemical nature of food components.

CO 2 imparting knowledge on chemical changes of food components during food handling, processing, and storage.

CO 3 facilitate basic platform for further understanding of food analysis.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Belitz H.-D, Grosch W and Schieberle P. Food Chemistry, 4th Edition, Springer-Verlag, 2009.
2. Meyer, Lillian Hoagland “Food Chemistry”. CBS Publishers, 1987.
3. John M. deMan. “Principles of Food Chemistry”. 3rd Edition, Springer, 1999.
4. Chopra, H.K. and P.S. Panesar. “Food Chemistry”. Alpha Science International Limited,2010

REFERENCES:

1. Vaclavik, V. A. and Christian E. W. “Essentials of Food Science”. 4th Edition, Kluwer-Academic, Springer, 2014.
2. Richard Owusu-Apenten “Introduction to Food Chemistry” CRC Press, 2005.
3. Srinivasan Damodaran, Kirk L. Parkin, “ Fennema’s Food Chemistry “ 5th Edition, CRCPress, 2008.

Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme specific outcomes (PSO)			
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO1	gain knowledge on chemical nature of food components	1	2	-	-	-	-	-	2	2	-	-	3	2	3	-	3
CO2	imparting knowledge on chemical changes of food components during food handling, processing, and storage.	1	2	-	-	-	-	-	2	2	-	-	3	2	3	-	3
CO3	facilitate basic platform for further understanding of food analysis.	1	2	-	-	-	-	-	2	2	-	-	3	2	3	-	3
Over all CO		1	2	-	-	-	-	-	2	2	-	-	3	1	3	-	3

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

FT5311	FOOD CHEMISTRY LABORATORY	L T P C 0 0 4 2

OBJECTIVES

The course aims to

- study and understand the chemical properties of foods.
- study the physical, chemical, thermal properties of various food constituents

LIST OF EXPERIMENTS

1. Experiment to study the properties of carbohydrates- caramelization, Mailard reaction.
2. Experiment on enzymatic and acid hydrolysis of sucrose
3. Preparation of emulsions and study its stability
4. Determination of Foaming properties of proteins
5. Determination of Solubility, specific gravity and Refractive index of oils
6. Estimation of free fatty acid content of oil
7. Determination of peroxide value and Anisidine value of fats.
8. Experiment to study the effect of heat on proteins.
9. Determination of Iso-electric point of casein & experiment to study effect of rennin on milk proteins
10. Experiments to study the gelling properties of starch
11. Experimental study of gluten formation using wheat flour
12. Experimental study on enzymatic Browning in foods

TOTAL: 60 PERIODS

OUTCOMES

At the end of the course the students will be able to

CO 1 gainpractical knowledge on chemical nature of food components.
CO 2 expertise on the protocols of chemical properties of individual components in foods.
CO 3 facilitate for further understanding of food analysis lab.

REFERENCES

1. Weaver, C.M, and J.R. Daniel. “The Food Chemistry Laboratory – A Manual for Experimental Foods, Dietetics & Food Scientists.” 2nd Edition, CRC Press, 2005.

Course Articulation Matrix

Course outcomes Statement		Programme outcomes												Programme specific outcomes			
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO1	gain practical knowledge on chemical nature of food components	3	3	2	3	2	-	-	3	2	-	-	2	3	3	3	3
CO2	expertise on the protocols of chemical properties of individual components in foods.	3	3	2	3	2	-	-	3	2	-	-	2	3	3	3	3
CO3	facilitate for further understanding of food analysis lab.	3	3	2	3	2	-	-	3	2	-	-	2	3	3	3	3
Over all CO		3	3	2	3	2	-	-	3	2	-	-	2	3	3	3	3

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

SEMESTER IV

GE5251 ENVIRONMENTAL SCIENCES L T P C
3 0 0 3

OBJECTIVES

The course aims to

- introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.
- impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
- facilitate the understanding of global and Indian scenario of renewable and non-renewable resources, causes of their degradation and measures to preserve them.
- familiarize the influence of societal use of resources on the environment and introduce the legal provisions, National and International laws and conventions for environmental protection.
- inculcate the effect of population dynamics on human and environmental health and inform about human right, value education and role of technology in monitoring human and environmental issues.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition genetic, species and ecosystem diversity – bio geographical classification of India – value of biodiversity consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION 8

Definition – causes, effects and control measures of (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – soil waste management causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES 10

Forest resources Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources Land as a resource, land 47 degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment protection act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare Programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course the students will be able to

CO 1 recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.

CO 2 identify the causes, effects and environmental pollution and natural disasters and contribute to the preventive measures in the immediate society.

CO 3 identify and apply the understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.

CO 4 recognize different forms of energy and apply them for suitable applications in for technological advancement and societal development.

CO 5 demonstrate the knowledge of societal activity on the long and short term environmental issues and abide by the legal provisions, National and International laws and conventions in professional and personal activities and to identify and analyse effect of population dynamics on human value education, consumerism and role of technology in environmental issues.

TEXT BOOKS:

1. Anubha Kaushik and C. P. Kaushik's "*Perspectives in Environmental Studies", 6th Edition,* New Age International Publishers (2018).
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, (2016).
3. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education (2004).

REFERENCE BOOKS:

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media, 2012.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press (2005).
5. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.

MA5354 **PROBABILITY AND STATISTICS** **L T P C**
3 1 0 4

OBJECTIVES

- To understand the basics of random variables with emphasis on the standard discrete and continuous distributions.
- To understand the basic probability concepts with respect to two dimensional random variables along with the relationship between the random variables and the significance of the Central Limit theorem.
- To apply the small/ large sample tests through Tests of hypothesis.
- To understand the concept of analysis of variance and use it to investigate factorial dependence.
- To monitor a process and detect a situation when the process is out of control.

UNIT I RANDOM VARIABLES 12

Discrete and continuous random variables – moments – moment generating functions – binomial, poisson, geometric, uniform, exponential, gamma, weibull and normal distributions – functions of a random variable.

UNIT II TWO-DIMENSIONAL RANDOM VARIABLES 12

Joint distributions – marginal and conditional distributions – covariance – correlation and linear regression – transformation of random variables – central limit theorem (for independent and identically distributed random variables).

UNIT III TESTS OF SIGNIFICANCE 12

Type I and Type II errors – tests for single mean, proportion, difference of means (large and small samples) – tests for single variance and equality of variances – chi-square test for goodness of fit – independence of attributes – non-parametric tests: test for randomness and rank – sum test (wilcoxon test).

UNIT IV DESIGN OF EXPERIMENTS 12

Completely randomized design – randomized block design – latin square design – factorial design – taguchi's robust parameter design.

UNIT V STATISTICAL QUALITY CONTROL 12

Control charts for measurements ($\bar{X}$ and R charts) – control charts for attributes (p, c and np charts) tolerance limits – acceptance sampling.

TOTAL: 60 PERIODS

OUTCOMES

CO1 To analyze the performance in terms of probabilities and distributions achieved by the determined solutions

CO2 To be familiar with some of the commonly encountered two dimensional random variables and be equipped for a possible extension to multivariate analysis

CO3 To apply the basic principles underlying statistical inference(estimation and hypothesis testing)

CO4 To demonstrate the knowledge of applicable large sample theory of estimators and tests To obtain a better understanding of the importance of the methods in modern industrial processes.

TEXT BOOKS:

1. Devore, J.L. "Probability and Statistics for Engineering and the Sciences", Cengage Learning, 9th Edition, Boston, 2017.

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2. Johnson, R.A. and Gupta, C.B. “Miller and Freund’s Probability and Statistics for Engineers”, Pearson India Education, Asia, 9th Edition, New Delhi, 2017.
3. Walpole, R.E., Myers R.H., Myres S.L., and Ye, K. “Probability and Statistics for Engineers and Scientists”, Pearson Education, Asia, 9th Edition, New Delhi, 2011.

REFERENCES:

1. Krishnaiah, K. and Shahabudeen, P. “Applied Design of Experiments and Taguchi Methods”, Prentice Hall of India, New Delhi, 2012.
2. Milton, J.S. and Arnold, J.C. “Introduction to Probability and Statistics”, Tata McGraw Hill, 4th Edition, 3rd Reprint, New Delhi, 2008.
3. Ross, S.M. “Introduction to Probability and Statistics for Engineers and Scientists”, Elsevier, 5th Edition, New Delhi, 2014.
4. Spiegel, M.R., Schiller, J., Srinivasan, R.A. and Goswami, D., “Schaum’s Outline of Theory and Problems for Probability and Statistics”, McGraw Hill Education, 3rd Edition, Reprint, New Delhi, 2017.

FT5401 HEAT AND MASS TRANSFER IN FOOD PROCESSES L T P C
2 1 0 3

OBJECTIVES

The course aims to

- learn the principles and applications of heat and mass transfer operations in food industries.
- understand the mechanisms and concept of heat transfer effectively.
- Investigatethe mass transfer operational approaches.

UNIT I HEAT TRANSFER – CONDUCTION 9

Basic heat transfer processes - conductors and insulators - conduction – Fourier’s law of heat conduction – thermal conductivity and thermal resistance - linear heat flow – heat transfer through homogenous wall, composite walls, radial heat flow through cylinders and sphere – solving problems in heat transfer by conduction.

UNIT II HEAT TRANSFER - CONVECTION 9

Heat transfer - convection – free and forced convection - factors affecting the heat transfer coefficient in free and forced convection heat transfer – overall heat transfer coefficient - solving problems in foods.

UNIT III HEAT TRANSFER – RADIATION AND HEAT EXCHANGER 9

Radiation heat transfer – concept of black and grey body - monochromatic Total emissive power– Kirchhoff’s law – Planck’s law - Stefan-Boltzmann’s law –Heat exchangers – parallel,

counter and cross flow- Logarithmic Mean Temperature Difference – overall coefficient of heat transfer in shell and tube heat exchanger for food products.

UNIT IV MASS TRANSFER -DIFFUSION 9

Mass transfer in foods – introduction – Fick's law for molecular diffusion - molecular diffusion in gases – equimolar counters diffusion in gases and diffusion of A through non diffusing B, diffusion coefficients for gases - molecular diffusion in liquids, solids, biological solutions and gels.

UNIT V MASS TRANSFER – DISTILLATION 9

Vapour liquid equilibria - Raoult's law- Principle of distillation - flash distillation, differential distillation, steam distillation, multistage continuous rectification, Number of ideal stages by Mc.Cabe -Thiele method.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 apply the different heat and mass transfer principles in different approaches.
CO 2 gain knowledge on types of heat exchangers used in food industry
CO 3 design the heat and mass transfer equipments.

TEXT BOOKS:

1. Bellaney, P.L. "Thermal Engineering". Khanna Publishers, New Delhi, 2001.
2. Geankoplis C.J. "Transport Process and Unit Operations". Prentice-Hall of India Private Limited, New Delhi, 1999.

REFERENCES:

1. Jacob and Hawkins. "Elements of Heat Transfer".John Willey and Sons Inc. New York, 1983.
2. EcKert, E.R.G. "Heat and Mass Transfer". McGraw Hill Book Co., New York, 1981.
3. Holman, E.P. "Heat Transfer". McGraw-Hill Publishing Co. New Delhi, 2001.
4. Coulson, J.M. and etal. "Coulson & Richardson's Chemical Engineering", 6th Edition, Vol.I & II, Butterworth – Heinman (an imprint of Elsevier), 2004.
5. McCabe, W.L., J.C. Smith and P.Harriot "Unit Operations of Chemical Engineering",6th Edition, McGraw Hill, 2003.

Course Articulation Matrix

Course Outcomes Statement		Programme outcomes(PO)												Programme specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	apply the different heat and mass transfer principles in different approaches	2	2	1	2	-	2	1	2	2	-	3	2	2	2	1	1
CO2	design the heat and mass transfer equipment.	1	2	2	3	-	-	1	2	-	-	1	3	3	1	2	1
C03	gain knowledge on types of heat exchangers used in food industry.	2	1	-	1	-	-	-	2	-	1	3	-	2	2	2	1
Over all CO		2	2	1	2	-	1	1	2	1	1	2	2	2	2	2	1

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

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FT5402 UNIT OPERATIONS IN FOOD INDUSTRIES L T P C
2 1 0 3

OBJECTIVES

The course aims to

- understand the principles involved in separation methods.
- study about the types of crystallization and evaporation.

UNIT I EVAPORATION 9

Unit operations in food processing – evaporation – definition – liquid characteristics – single and multiple effect evaporation-performance of evaporators and boiling point elevation – capacity – economy and heat balance-types of evaporators – once through and circulation evaporators – short tube evaporators and long tube evaporators – agitated film evaporator

UNIT II MECHANICAL SEPARATION 9

Filtration – definition –filter media – types and requirements-constant rate filtration – constant pressure filtration – filter cake resistance-filtration equipment – rotary vacuum filter – filter press. Sedimentation – gravitational sedimentation of particles in a fluid – Stoke's law, sedimentation of particles - gas-cyclones – settling under sedimentation and gravitational sedimentation-centrifugal separations – rate of separations – liquid-liquid separation – centrifuge equipment.

UNIT III SIZE REDUCTION 9

Size reduction – grinding and cutting – principles of comminuting – characteristics of comminuted products – particle size distribution in comminuted products-energy and power requirements in comminuting – crushing efficiency – Rittinger's, Bond's and Kick's laws for crushing-size reduction equipments – crushers – jaw crusher, gyratory crusher-crushing rolls– grinders – hammer mills – rolling compression mills - attrition, rod, ball and tube mills – construction and operation. Closed and open Circuit Grinding.

UNIT IV CONTACT EQUILIBRIUM SEPARATION 9

Contact equilibrium separation processes – equilibrium concentration relationships – operating conditions – equilibrium processes -gas absorption – rate of gas absorption – stages– absorption equipment -properties of tower packing – types – construction – flow through packed towers. Adsorption Introduction -Types of absorption-Nature of adsorbents-types of adsorption operations.

UNIT V EXTRACTION AND CRYSTALLIZATION 9

Extraction – rate of extraction – Single and multi-stage extraction operation-equipment for leaching coarse solids – intermediate solids – basket extractor-extraction of fine material – Dorr agitator – continuous leaching – decantation systems – extraction towers. Crystallization– equilibrium -solubility and equilibrium diagram – rate of crystal growth – equilibrium crystallization-crystallization equipment – classification – construction and operation-tank, agitated batch, Swenson-Walker vacuum crystallizers.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 develop various separation techniques.
CO 2 apply the knowledge on filtration and centrifugation in food processing units
CO 3 design the different crystallizers and evaporator equipment.

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TEXT BOOKS:

1. Geankoplis, C.J. “Transport Processes and Separation Process Principles”, 4th Edition, Prentice Hall, 2003.
2. McCabe W.L., Smith J.C. “Unit Operations in Chemical Engineering”, 7th Edition, McGraw – Hill Int., 2001,
3. Earle, R.L. 2003. Unit Operations in Food Processing. Pergamon Press. Oxford. U.K.
4. Geankoplis C.J. Transport Process and Unit Operations. Prentice-Hall of India Private Limited, New Delhi.1999.

REFERENCES:

1. Richardson, J.E., “Coulson & Richardson’s Chemical Engineering” Vol.2 (Praticle Technology & Separation Processes”) 5th Edition, Butterworth – Heinemann / Elsevier, 2003.
2. Coulson, J.M and J.F. Richardson,“Chemical Engineering”. Volume I to V. ThePergamon Press. New York, 1999.
3. McCabe, W.L., J.C.Smith and P.Harriot,“Unit Operations of Chemical Engineering”.McGrawHill. Inc. Kosaido Printing Ltd. Tokyo, Japan, 2001.
4. Sahay, K. M. and K.K.Singh,“Unit operation of Agricultural Processing”, Vikas Publishing House Pvt. Ltd., New Delhi, 2004

Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	develop various separation techniques.	1	1	2	2	-	-	2	-	-	-	2	-	2	3	1	1
CO2	design the different crystallizers and evaporator equipments.	2	-	1	-	-	-	1	-	-	-	-	-	3	2	2	1
CO3	apply the knowledge on filtration and centrifugation in food processing units.	2	-	1	-	-	-	2	-	-	-	2	-	2	1	2	2
Over all CO		2	1	1	1	-	-	2	-	-	-	1	-	2	2	2	1

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

FT5403 **FOOD ANALYSIS** **L T P C**
3 0 0 3

OBJECTIVES

The course aims to

- expose the students to the principles, methods and techniques of food analysis.
- make the students to handle different chemical and instrumental methods of food analysis.

UNIT I SAMPLING METHODS FOR FOOD ANALYSIS 6

Introduction, Food Regulations and Standards - Sampling methods - Sample preparation and preservation- Extraction methods and Separation process of food components; Statistical evaluation of analytical data - Official Methods of Food Analysis. Proximate analysis of foods- Moisture in foods, Ash content of foods - determination by different methods; Titratable Acidity in foods, Determination of dietary fibre and crude fibre,

UNIT II LIPIDS AND PROTEINS ANALYSIS 9

Determination of Total fat in foods by different methods; Analysis of oils and fats for physical and chemical parameters, Quality standards, and adulterants.

Determination of Proteins Concentration- Colorimetric methods, Determination of Total nitrogen, Spectrophotometric determination; Protein Characterization- Electrophoresis and Isoelectric focussing; Analysis of Protein quality – Protein Efficiency Ratio (PER), Net Protein Utilization (NPU), Biological Value, Protein Digestibility- Corrected Amino acid Score (PDCAAS), *In vitro* Protein digestibility for C-PER; Measurement of Functional properties of proteins- Protein hydration properties, Surface properties of protein, Protein gel properties.Calculation of proximate and ultimate composition of foods.

UNITIII CARBOHYDRATE ANALYSIS, REFRACTOMETRY AND POLARIMETRY 9

Refractometry- Basic Principles and Instrumentation, and Applications-Brix Value of Fruit juices, Total soluble solids in fruit products.

Carbohydrate analysis- Colorimetric Quantification methods of Mono and Di-Saccharides, HPLC of Mono and Di-Saccharides using refractive index detection; Starch- Enzymatic quantification and Determination of Total amylose content; Cell wall polysaccharides-Determination of uronic acid content and ß-Glucan content, Degree of Methylation and Acetylation of pectin.

Polarimetry- Basic principles, Instrumentation and Applications-Determination of specific rotations of sugars; Estimation of simple sugars and disaccharides.

UNIT IV SPECTROSCOPIC AND CHROMATOGRAPHIC TECHNIQUES IN FOOD ANALYSIS 12

Spectrophotometry Basic Principles, Spectrophotometric analysis of food additives and food Components -IR Spectroscopy in online determination of components in foods; AAS and ICP-AES in mineral elements and toxic metals analysis; use of fluorimeter in vitamin assay- specific use of Tintometer in Vanaspati analysis.

Chromatography Basic Principles, Detection of adulterants in foods by paper chromatography and thin layer chromatography, Column chromatography for purification of pigments, Analysis of food additives, phytochemicals and aflatoxins, contaminants and other food components by HPLC, GC analysis of fatty acids, cis, trans Isomers - volatile oils, flavours and pesticides, contaminants and other volatile derivatives of food components; Significance MS detector in HPLC and GC. Ion Exchange Chromatography for amino acid purification, Affinity chromatography for protein purification, Problem solving using chromatogram.

UNITV SENSORY EVALUATION TECHNIQUES 9

Introduction to quality attributes of food Appearance, flavour, textural factors and additional quality factors; Gustation importance of gustation, Mechanism of taste perception, Chemical dimensions of basic tastes- sweet, salt, sour, bitter and umami, Taste measurement-Electronic Tongue; Olfaction definition and importance of odour and flavour, Mechanism of odour perception, Theories of odour classification, chemical specificity of odour, Odour measurement technique- e- nose; Colour importance of colour, Dimensions of colour and attributes of colour and gloss, Perception of colour, Colour Measurement; Texturedefinition and importance of texture, Phases of oral processing, Texture perception, Rheology of foods, Texture classification, Texture measurement and recent advances in texture evaluation.

Sensory Evaluation Objectives, Type of food panels, Characteristics of panel member, Layout of sensory evaluation laboratory, Sensitivity tests, Threshold value, Paired comparison test, Duo trio test, Triangle test, Hedonic scale.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 understand the principles behind analytical techniques in food analysis.
CO 2 know the methods of selecting appropriate techniques in the analysis of food products.
CO 3 appreciate the role of food analysis in food standards and regulations for the manufacture of food products and food quality control in food industries.
CO 4 familiarize with the current state of knowledge in food analysis.

TEXT BOOKS:

1. Pomeranz, Yeshajahu. “Food Analysis Theory and Practice”. 3rd Edition. AspenPublishers / Springer, 2000.
2. Kirk, R.S. and R. Sawyer “Pearson’s Composition and Analysis of Food”. 9th Edition.Longman, New York, 1991
3. Nielsen, S. Suzanne. “Food Analysis”. 4th Edition. Springer, 2010.

REFERENCES:

1. Ronald E. Wrolstad. “Handbook of Food Analytical Chemistry” Vol I, John Wiley & sons, 2005
2. Magdi M. Mossoba. “Spectral Methods in Food analysis” Marcel & Dekker, 1998.
3. Otles, Semih. “Methods of Analysis of Food Components and Additives”. CRC Press,2005.
4. Nollet, Leo M.L. “Hand Book of Food Analysis” II Rev. Edition. Vol. I, II & III, Marcel & Dekker, 2004.
5. Nollet, Leo M.L. “Food Analysis by HPLC”. II Rev. Edition, Marcel & Dekker, 2000.
6. Otles, Semih. “Handbook of Food Analysis Instruments”. CRC Press, 2009.
7. Meilgard. “Sensory Evaluation Techniques”, 3rd ed., CRC Press LLC, 1999.
8. Maynard A. Amerine, Rose Marie Pangborn, Edward B. Roessler. “Principles of Sensory Evaluation of food”, AcademicPress, 2013.

Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	understand the principles behind analytical techniques in food analysis.	-	3	1	3	2	3	-	3	3	-	-	3	3	3	-	1
CO2	know the methods of selecting appropriate techniques in the analysis of food products.	-	3	1	3	2	3	-	3	3	-	-	3	3	3	-	1
CO3	appreciate the role of food analysis in food standards and regulations for the manufacture of food products and food quality control in food industries.	-	3	1	3	2	3	-	3	3	-	-	3	3	3	-	1
CO4	familiarize with the current state of knowledge in food analysis.	-	3	1	3	2	3	-	3	3	-	-	3	3	3	-	1
Over all CO		-	3	1	3	2	3	-	3	3	-	-	3	3	3	-	1

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

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IB5451 CHEMICAL ENGINEERING LABORATORY L T P C
0 0 4 2

OBJECTIVES

The course aims to

- handle basic unit operation equipments in food industries
- measure fluid flows
- evaluate performance factors of various unit operation equipments

LIST OF EXERIMENTS

1. Flow measurement a) Orifice meter b) Venturimeter, c) Rotameter
2. Determination of economy and thermal efficiency of rotary flash evaporator
3. Solving problems on single and multiple effect evaporator
4. Determination of separation efficiency of centrifugal separator.
5. Determination of collection efficiency in cyclone separator.
6. Determination of efficiency of liquid solid separation by filtration.
7. Determination of absorption efficiency in a packing tower
8. Determination of porosity, coefficient of friction and angle of repose of grains.
9. Determination of particle size of granular foods by sieve analysis.
10. Performance evaluation of a sieve.
11. Determination of performance characteristics in size reduction using the burr mill.
12. Determination of energy requirement in size reduction using the ball mill and hammer mill.
13. Performance evaluation of pin mill and hammer mill.
14. Performance evaluation of a steam distillation process.

TOTAL: 60 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 have knowledge on the basic principles of various unit operations and its applications in food industry.

CO 2 gain hands on experience in handling various chemical engineering equipments.

CO 3 apply the skill of material balance and energy balance in unit operations.

Course Articulation Matrix

Course outcomes Statement		Programme outcomes(PO)												Programme specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	have knowledge on the basic principles of various unit operations and its applications in food industry.	3	3	2	3	2	-	-	-	1	1	1	1	3	3	1	1
CO2	gain hands on experience in handling various chemical engineering equipments	1	1	2	3	2	-	-	-	2	1	1	1	3	3	1	1
CO3	apply the skill of material balance and energy balance in unit operations.	3	3	2	3	2	-	-	-	1	1	1	1	3	3	1	1
Over all CO		2	2	2	3	2	--	-	-	1	1	1	1	3	3	1	1

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

FT5411 **FOOD ANALYSIS LABORATORY** **L T P C**
0 0 4 2

OBJECTIVES

The course aims to

- equip students with characterization and estimation of chemical compounds in food for its compliance with standards.
- learn the analysis of foods for the detection of adulterants in foods.

LIST OF EXPERIMENTS

1. Determination of moisture in spices powder by distillation method and Hot air oven method.
2. Determination of Total fat, protein in milk and milk products.
3. Rancidity test for fried foods to assess primary and secondary oxidative products.
4. Determination of Vitamin C in fruit juices.
   a. Titrimetric method using dichlorophenolindophenol dye
   b. Spectrophotometric method using dinitrophenylhydrazine
   c. HPLC method
5. Extraction and identification of synthetic Food colour in sweets, confectioneries and beverages.
6. Determination of Iron content in foods.
7. Determination of Iodine content in iodized salt.
8. Detection and estimation of Annatto, lead, MSG, sulphur-di-oxide, Emulsifiers and stabilizers in food products.
9. Estimation of antioxidant activity in foods by DPPH assay and ORAC assay.
10. Determination of soluble and insoluble fibre in foods.
11. Detection of adulterants in edible oil and ghee.
12. Column chromatographic separation of carotenoids
13. The identification of sugars in fruit juice using TLC.

TOTAL: 60 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 understand the analysis of foods and food products for chemical components.
CO 2 learn standards for food products.
CO 3 obtain knowledge of adulterants in foods.

TEXT BOOKS:

1. Shalini Sehgal, “A laboratory manual of food analysis”, I.K.International publishing, 2016.

REFERENCES:

1. Ceirwyn S. James, “Analytical chemistry of foods”, Springer, 1995.
2. S. Suzanne Nielsen, “Food analysis laboratory manual”, 3rd edition, Springer, 2017
3. Ronald E. Wrolstad, “Handbook of food analytical chemistry- Water, Proteins, Enzymes, Lipids and Carbohydrates”, John Wiley & sons, inc., 2005.

Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	understanding in analysis of foods and food products for chemical components.	-	3	1	3	2	-	-	1	3	-	-	3	3	3	-	1
CO2	knowing standards for food products.	-	3	1	3	-	-	-	2	3	-	-	3	3	3	-	1
CO3	obtain knowledge of adulterants in foods	-	3	1	3	2	3	-	-	3	-	-	3	3	3	-	1
Over all CO		-	3	1	3	2	1	-	1	3	-	-	3	3	3	-	1

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

SEMESTER V

GE5451	TOTAL QUALITY MANAGEMENT	L T P C 3 0 0 3

OBJECTIVES

The course aims to

- teach the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
- explain the TQM Principles for application.
- define the basics of Six Sigma and apply Traditional tools, New tools, Benchmarking and FMEA.
- describe Taguchi's Quality Loss Function, Performance Measures and apply Techniques like QFD, TPM, COQ and BPR.
- illustrate and apply QMS and EMS in any organization.

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality –Definition of TQM-- Basic concepts of TQM –-Gurus of TQM (Brief introduction) -- TQM Framework- Barriers to TQM –Benefits of TQM.

UNIT II TQM PRINCIPLES 9

Leadership - Deming Philosophy, Quality Council, Quality statements and Strategic planning- Customer Satisfaction –Customer Perception of Quality, Feedback, Customer complaints, Service Quality, Kano Model and Customer retention – Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition & Reward and Performance Appraisal-- Continuous process improvement –Juran Trilogy, PDSA cycle, 5S and Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating and Relationship development.

UNIT III TQM TOOLS & TECHNIQUES I 9

The seven traditional tools of quality - New management tools - Six-sigma Process Capability- Bench marking - Reasons to benchmark, Benchmarking process, What to Bench Mark, Understanding Current Performance, Planning, Studying Others, Learning from the data, Using the findings, Pitfalls and Criticisms of Benchmarking - FMEA - Intent , Documentation, Stages Design FMEA and Process FMEA.

UNIT IV TQM TOOLS & TECHNIQUES II 9

Quality circles – Quality Function Deployment (QFD) - Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures- Cost of Quality - BPR.

UNIT V QUALITY MANAGEMENT SYSTEM 9

Introduction-Benefits of ISO Registration-ISO 9000 Series of Standards-Sector-Specific Standards - AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements-Implementation-Documentation-Internal Audits-Registration-ENVIRONMENTAL MANAGEMENT SYSTEM Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001-Benefits of EMS.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 ability to apply TQM concepts and principles in a selected enterprise.

CO 2 ability to understand Six Sigma and apply Traditional tools, New tools, Benchmarking and FMEA.

CO 3 ability to understand Taguchi's Quality Loss Function, Performance Measures and apply QFD, TPM, COQ and BPR.

CO 4 ability to apply QMS and EMS in any organization.

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TEXT BOOKS:

1. Dale H.Besterfiled, Carol B.Michna,Glen H. Bester field,MaryB.Sacre,HemantUrdhware she and RashmiUrdhwareshe, “Total Quality Management”, Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression,2013.

REFERENCES:

1. Joel.E. Ross, “Total Quality Management – Text and Cases”,Routledge.,2017.
2. Kiran.D.R, “Total Quality Management Key concepts and case studies, Butterworth – Heinemann Ltd, 2016.
3. Oakland, J.S. “TQM – Text with Cases”, Butterworth – Heinemann Ltd., Oxford, Third Edition, 2003.
4. Suganthi,L and Anand Samuel, “Total Quality Management”, Prentice Hall (India) Pvt. Ltd., 2006

FT5501 FOOD PROCESS ENGINEERING L T P C
2 1 0 3

OBJECTIVES

The course aims to

- understand basic engineering properties of food.
- understand different thermal and non-thermal processes used in Food Industry.

UNIT I PROPERTIES OF FOOD 11

Engineering properties of food materials - Rheological and textural Properties, Thermal Properties, Thermodynamic Properties, surface and gas exchange properties, electric and dielectric properties

Water activity and states a thermodynamic quantity, water sorption isotherms, hysteresis, theories of sorption hysteresis, water activity measurement methods, water binding, control of water activity and moisture, principles of IMF and their application

UNIT II SEDIMENTATION AND CENTRIFUGATION 7

The velocity of particles moving in a fluid - terminal velocity - drag coefficient terminal velocity magnitude, Sedimentation - sedimentation equipment, Flotation, Sedimentation of Particles in a Gas Settling Under Combined Forces Cyclones- optimum shape, efficiency Impingement, separators Classifiers, Centrifugal separations - centrifugal force particle velocity Liquid Separation radial variation of pressure radius of neutral zone Centrifuge Equipment

UNIT III DRYING AND FREEZING 10

Basic Drying Theory - Three States of Water phase diagram for water, Heat Requirements for Vaporization, Thermodynamics of moist air (psychrometry) - Measurement of Humidity, Air Drying, Conduction Drying, Drying under varying external condition, methods of drying, Drying Equipment, Dryer Efficiencies, calculation of drying time, Concept of Osmotic dehydration, Factors influencing osmosis.

Freezing -Freezing curve for Homogenous and Non-homogenous food system, Freezing point depression, Freezing rate, Effect of freezing Physical and chemical changes in Foods, Enzyme activity, Microbe inactivation and Food quality sensory quality, nutritional aspects, freeze drying and freeze concentration

UNIT IV THERMAL PROCESSING 9

Principles of Thermal Processing, Heat Transfer in Thermal Processing, Characterization of Heat Penetration Data, Retort Come-Up Time, kinetics of thermal inactivation of microorganisms and enzymes, Concept of thermo bacteriology Temperature Dependence Reaction Rates, Processes and Systems for Stabilization of Foods for Shelf-Stable Storage, Heat transfer considerations in thermal processing - In-package, In-Flow

UNIT V FOOD MATERIAL PROCESSING 8

Membrane processes Ultra filtration, Reverse osmosis, Electrodialysis, per-evaporation and micro filtration – principles - application in food industry, Extrusion - Extrusion cookers - cold extrusion, single and twin-screw extrusion - Low pressure and high-pressure extrusion - properties of Food materials and its significance in equipment design - processing and handling application in food industry; Baking Principles, baked foods, baking equipment; Roasting Principles of roasting, roasting equipment

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 learn and apply basic engineering properties of foods
CO 2 familiarize with separation techniques involved in food industry
CO 3 learn various engineering operations in food processing

TEXTBOOKS:

1. Toledo, Romeo T. “Fundamentals of Food Process Engineering” II Edition. CBS Publishers, 2000.
2. Fellows, P J. “Food Processing Technology Principles and Practice”. 3rd Edition, Woodhead, 2009.
3. Smith P. G “Introduction to Food Process Engineering”. Springer, 2005
4. Earle, R.L, “Unit Operations in Food Processing”. Pergamon Press. Oxford. U.K, 2013.

REFERENCES:

1. Sahay, K. M. and K.K.Singh..“Unit operation of Agricultural Processing”, Vikas PublishingHouse Pvt. Ltd., New Delhi, 2004.
2. Berk, Zeki. “Food Process Engineering and Technology”. Elsevier, 2009.

Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	learn and apply basic engineering properties of foods	3	3	3	3	1	-	1	-	3	-	1	2	3	3	-	-
CO2	familiarize with separation techniques involved in food industry	3	3	3	3	1	1	1	-	3	-	1	2	3	3	-	-
CO3	learn various engineering operations in food processing	3	3	3	3	1	1	1	1	3	-	1	2	3	3	-	-
Over all CO		3	3	3	3	1	1	1	1	3	-	1	2	3	3	-	-

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

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FT5502 FRUIT AND VEGETABLE PROCESSING AND PRESERVATION LT P C
3 0 0 3

OBJECTIVES

The course aims to

- develop the knowledge of students in the area of vegetable and fruit processing and technology.
- enable students to appreciate the application of scientific principles in the processing of fruits and vegetables.

UNIT I BASIC AGRICULTURAL ASPECTS OF VEGETABLES AND FRUITS 8

Ability to identify all commercially important fruits and vegetables with their names in important Indian languages, important regions, season, Morphology, structure and composition of fruit and vegetable.Production and processing scenario of fruits and vegetable India and World.Scope of Fruit and Vegetable Preservation Industry in India. Present status, constraints and prospectus. Problem solving in post-harvest quality of fruits and vegetables

UNIT II FRESH FRUITS AND VEGETABLES 8

Physical, Textural characteristics, structure and composition.Maturity standards; Importance, methods of Maturity determinations maturity indices for selected fruits and vegetables.Harvesting of important fruits and vegetables.Fruit ripening- chemical changes, regulations, methods. Calculation of respiration rates, Storage practices Control atmospheric, Bead atmosphere, hypotactic storage, cool store, Zero energy cool chamber, stores striation. Commodity pre-treatment's - chemicals, wax coating, pre-packaging, phytonutrients in fruits and vegetables grading, cleaning, Physiological post harvest diseases chilling injury and disease. Handling and packaging of fruits and vegetables

UNIT III PRESERVATION OF FRUITS AND VEGETABLES 9

Preservation by fermentation- Definition, Advantages, disadvantages, Types of fermentation, equipments; Fruit wine. Irradiation applications for fruits and Vegetable. Minimally processed fruits and vegetables, solving problems with respect to natural resistance of fruit, Emerging technologies for fruits and vegetables processing technologies General pre processing, drying and freezing problems associated with specific fruits and vegetables, problem solving in Post-cutting treatments to extend the shelf-life of fresh-cut products.

UNIT IV CANNING, PUREES AND JUICES 12

Canning- General pre-processing, specific or salient points in fruits and vegetables like – Blanching, exhausting, processing conditions; Indian Food Regulation and Quality assurance Fruit Juice / pulp/ Nectar/Drinks, concentrates – General and specific processing, different packing including aseptic. Indian Food Regulation and Quality assurance Vegetable Purees/pastes - General and specific processing, different packing including aseptic. Technology for juice pressing, juice extraction and clarification, methods of bottling, enzymatic clarification and debittering of juices, fruit juice powders- preparation and packaging

UNIT V FRUIT AND VEGETABLE PRODUCTS 8

Ready to eat fruit and vegetable products, Jams/Marmalades, Squashes/cordials, Ketchup/sauces, Chutneys, Fruit Bar, Soup powders, Candied Fruits, Natural colors, Fruit and Vegetable Fibres- General and specific processing, different packing including aseptic, Dried Onion, Powder. Garlic Dried Garlic, Powder, Oil. Potato Wafer; starch, Papad, Carrot Preserve, candy, Pickle, Jam. Cauliflower and cabbage Dried cauliflower and cabbage, Sauerkraut, Pickle Leafy vegetables; Dried Leafy Vegetables. (Spinach, Fenugreek, Coriander leaves, Curry leaves).Bitter gourd Pickle, Dried bitter gourd. Indian Food Regulation and Quality assurance,
Case studies- Improving the nutritional quality of processed fruits and vegetables, Waste management in fruit and vegetable processing industries.

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TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 understand the concepts of physiological characteristics of fruits and vegetables.
CO 2 haveinsight about fruit losses during storage and ways to prevent it.
CO 3 have thorough Knowledge and understandings of the specific processing technologies

TEXT BOOKS:

1. Fellows, P J. “Food Processing Technology Principles and Practice”. 3rd Edition, Woodhead, 2009.
2. Salunke,D . K and S. S Kadam “Hand Book of Fruit Science and Technology Production, Composition, Storage and Processing”. Marcel Dekker, 2005.
3. Sivasankar, B. “Food Processing & Preservation”, Prentice Hall of India, 2002.

Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	understand of the concepts of physiological characteristics of fruits and vegetables	1	2	2	2	3	-	1	2	3	-	1	2	3	3	1	1
CO2	have insight about fruit losses during storage and ways to prevent it.	1	2	2	2	3	-	1	2	3	-	1	2	3	3	1	1
CO3	have Knowledge and understandings of the specific processing technologies	1	2	2	2	3	-	1	2	3	-	1	2	3	3	1	1
Over all CO		1	2	2	2	3	-	1	2	3	-	1	2	3	3	1	1

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

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FT5503 LIVESTOCK AND MARINE TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES

The course aims to

- develop the knowledge of students in the area of animal product processing and technology.
- enable students to appreciate the application of scientific principles in the processing of these materials.

UNIT-I EGG PROCESSING 9

Structure, composition, nutritive value, calculation of nutritive value and functional properties of eggs, Factor affecting egg quality and measures of egg quality.Preservation of egg by different methods. Egg powder processing, drying and freezing of egg products, Freezingcalculation of Egg Products, Egg Dehydration calculation problems.

UNIT II MEAT PROCESSING 9

Meat Types of Meat and its sources, composition, structure, of meat and meat products. Ante mortem handling, slaughtering of animals, modern abattoirs, slaughter house and its features Mechanical deboning, inspection and grading of meat. Post-mortem changes of meat. Colour, microbiology and spoilage factors of meat and meat products, Factors affecting post-mortem changes, properties and shelf-life of meat. Meat tenderization – natural and artificial, Poultry Introduction, Types and characteristics of poultry meat, composition, nutritive value, Stunning and slaughter of poultry, Primary processing of poultry, Microbial hazards in poultry production and processing.

UNIT III MEAT PRODUCTS 9

Flavours and Flavour Generation of Meat Products, Meat quality evaluation, Marination, Preservation techniques - aging, pickling, smoking.Dried and Cured meat. Canned meat, Frozen meat, Cooked and Refrigerated meat, Meat Fermentation, meat packaging, meat refrigeration, chemical treatment, irradiation and other emerging methods, Developments in Meat Bacterial Starters, problem solving in measuring shelf-life and spoilage of meat and meat products, Spoilage Detection, Calculation of mycotoxin content in Poultry and Processed Meats.

UNIT IV MARINE FOOD PROCESSING 9

Composition of marine fish, fresh water fish, finfish and shell fish – major species, structure and spoilage factors of fish. Post-mortem changes in fish. Handling and transportation of fish.Processing and preservation of shrimp, lobster, crab, crawfish, molluscan shellfish, surimi and surimi seafood.

UNIT V MARINE FOOD PRODUCTS 9

Seaweed products and their economic significance, fish meal and oil, protein concentrates, industrial products, bioactive compounds, Seafood quality Assurance, sea food safety – illness associated with consumption –toxins, allergies and intolerances.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 understand and identify the specific processing technologies used for meat and marine products.

CO 2 familiarize with quality evaluation techniques formeat and marine products..

CO 3 grasp the changes in the composition of foods with respect to the type of processing technology used.

Attested

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TEXT BOOKS:

1. Govindan. T.K, —Fish Processing Technology, Oxford and IBH Publishers, New Delhi,1985.
2. Lawrie, R.A. —Meat Science, Second Edition. Pergamon Press, Oxford, UK. 1975.
3. Stadelmen, W.J. and Cotterill, O.J., —Egg Science and Technology. 2nd Edition, AVI,Westport, 1995.

REFERENCES:

1. Joseph Kerry, John Kerry and David Ledwood. —Meat Processing‖, Woodhead Publishing Limited, England (CRC Press), 2002.
2. Mead, G. —Poultry Meat Processing and Quality, Woodhead Publishing, England, 2004.
3. Wheaton, F.W. and Lawson, T.B., —Processing of Aquatic Food Products, John Wiley & Sons Publishers, New York. 1985.

Course Articulation Matrix

Course outcomes Statement		Programme outcome (PO)												Programme specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	understand and identify the specific processing technologies used for meat and marine products.	1	1	2	2	2	1	1	3	2	1	1	2	2	2	-	1
CO2	familiarize with quality evaluation techniques for meat and marine products.	1	1	2	2	2	-	-	3	2	1	1	2	2	2	-	1
CO3	grasp the changes in the composition of foods with respect to the type of processing technology used.	1	1	2	2	2	1	1	3	2	1	1	2	2	2	-	1
Over all CO		1	1	2	2	2	1	1	3	2	1	1	2	2	2	-	1

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

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FT5511 LIVESTOCK AND MARINE TECHNOLOGY LABORATORY L T P C
0 0 4 2

OBJECTIVES

The course aims to

- enable students to perform and analyse, livestock, fish and marine products for its proximate and chemical constituents
- understand different industrial processes involved in livestock, fish and marine products.

LIST OF EXPERIMENTS

1. Proximate analysis of meat, poultry and fish - Direct and indirect method of Moisture Determination, fat Content, Vitamin, Mineral and Trace Element Analysis
2. Quality analysis of Meat, poultry and fish – Color, Texture, pH, Water/Protein Ratio
3. Determination of vitamin content in meat using HPLC.
4. Analysis of the Technological Quality of Fat in meat - Fatty Acid Profile, Lipid Fractions, Cholesterol, Fat Firmness, Oxidation Status
5. Determination of Microbial load and Toxins in Meat and Meat Products
6. Determination of Total Volatile Basic Nitrogen (TVBN)
7. Determination of Picric Acid Turbidity (PAT)
8. Effect of chemical preservatives on meat – Sorbates, Nitrite and Nitrate in meat.
9. i) Assessment of Lipid and protein Oxidation in meat
   ii) Determination of proteolysis and lipolysis of meat
10. Determination of Meat Swelling Capacity (MSC)
11. Determine % of different components & constituents such as yolk portion, white portion, ash, Total solid, moisture, specific gravity of egg.
12. Determine the efficiency of reduction in microbial load during egg Pasteurization
13. Determine the effect of drying temperature on production of egg white powder using spray dryer.

TOTAL: 60 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 understand the specific processing technologies used for meat and marine products.
CO 2 familiarize with quality evaluation techniques formeat and marine products..
CO 3 familiarize with physiochemical analytical techniques.

REFERENCES:

1. FSSAI Lab manual, “Manual of methods of analysis- Meat & Meat products, Fish & Fish products”, 2016

Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	understand and identify the specific processing technologies used for meat and marine products.	1	1	2	2	2	1	1	3	2	1	1	2	2	2	-	1
CO2	familiarize with quality evaluation techniques for meat and marine products.	1	1	2	2	2	-	-	3	2	1	1	2	2	2	-	1
CO3	familiarize with physiochemical analytical techniques.	1	1	2	2	2	1	1	3	2	1	1	2	2	2	-	1
Over all CO		1	1	2	2	2	1	1	3	2	1	1	2	2	2	-	1

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

FT5512 FRUIT AND VEGETABLE PROCESSING & PRESERVATION LABORATORY

L T P C
0 0 4 2

OBJECTIVES

The course aims to

- analyze spices, fruits and vegetable crops for its chemical compounds
- understand the processing and preservation techniques for storage of spices, fruits and vegetable crops

EXPERIMENTS

1. Proximate analysis of fruits and vegetables - moisture, ash, mineral matter, protein, starch, Crude fat and % Total sugars
2. Estimation of quality criteria- maturity indices, color, texture, brix, pH in various fruits and vegetables
3. Determination of effective freezing and cooling time for fruits and vegetables
4. Osmotic dehydration of fruits and vegetables
5. Accelerated shelf life testing of canned fruits and vegetables.
6. Optimization of ingredients (pectin and sugars) of Jam and its analysis – colour, texture, TSS, titrable acidity
7. Optimization of ingredients and its analysis of Ready to serve products - colour, viscosity, TSS
8. Experimental study on effect of thickeners, stabilizers and preservatives in tomato sauce.
9. Dehydration kinetics of
   i) Vegetable products – onion/garlic/ginger
   ii) Fruits products – grapes/fig/banana
10. Waste management in fruit and vegetable processing industries.
    i) Pectin (Extraction, purification, Characterization and Estimation)
    ii) Pigments (Extraction and characterization) - carotene, xanthophylls and lycopene
    iii) Polysaccharides
    iv) Phytochemicals (qualitative) – flavanoids, tannin, saponin, anthocyanin
11. Identification and characterization of flavouring compounds of spices
12. Estimation of oil contents in different spices – clove/ pepper/ cardamom/ chilli
13. Extraction and quantification of oleoresins - Turmeric/ ginger/ pepper/ clove
14. Phytochemicals (quantitative) estimation in spices - Turmeric/ ginger/ pepper/ clove
15. Preparation of fermented soy products
16. Fermented vegetable products – sauerkraut.

TOTAL: 60 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 understand the processing technologies used for fruit and Vegetable processing.
CO 2 familiarize with quality evaluation techniques
CO 3 familiarize with physiochemical, analytical and applications techniques.

REFERENCES:

1. Gustavo V. Barbosa-Canovas, 2017, Food Engineering Laboratory Manual, CRC Press
2. Shri K. Sharma, Steven J. Mulvaney, Syed S. H. Rizvi, Food Process Engineering Theory and Laboratory Experiments, 1999, Wiley.
3. FSSAI Lab manual, “Manual of methods of analysis- Fruit and Vegetable products”, 2016
4. FSSAI Lab manual, “Manual of methods of analysis- oils and fat”, 2015

5. FSSAI Lab manual, “Manual of methods of analysis- spices and condiments”, 2015

Course Articulation Matrix

Course outcome Statements		Programme outcome(PO)												Programme specific outcome (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	understand the processing technologies used for fruit and Vegetable processing.	1	1	2	2	2	1	1	3	2	1	1	2	2	2	-	1
CO2	familiarize with quality evaluation techniques	1	1	2	2	2	-	-	3	2	1	1	2	2	2	-	1
CO3	familiarize with physiochemical, analytical and applications techniques.	1	1	2	2	2	1	1	3	2	1	1	2	2	2	-	1
Over all CO		1	1	2	2	2	1	1	3	2	1	1	2	2	2	-	1

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

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SEMESTER VI

FT5601 FOOD PACKAGING TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES

The course aims to

- understand the different methods involved in development of food packaging systems.
- understand the different packaging system available for food packaging

UNIT I BASICS OF PACKAGING 6

Packaging –Concepts, definition, Significance, classification. Packaging – Development, Retail/Unit; Packaging of foods –fresh and processed, Hazards to the Packaging

UNIT II PACKAGING MEDIA & MATERIALS 12

Metal packaging- Metals Tinplate, tinning process, components of tinplate, tin free can (TFC) types of can, metallic films, lacquers. Glass as package material, manufacture, advantages, disadvantages; Paper as package material, its manufacture, types, advantages of corrugated and paper board boxes. Plastic as package material, classification of polymers, properties of each plastics, uses of each plastic; Caps and closures, inks and lacquers, cushioning materials, reinforcements

UNIT III PACKAGING SYSTEMS AND METHODS 9

Lamination, need of lamination, types, properties, advantages & disadvantages of each type.Coating on paper & films, types of coatings. Need of coating, methods of coatings, Vacuum packaging, gas flush packaging - CAP & MAP, aseptic & retort packaging, box in box, edible, Active packaging systems and their food applications.

UNIT IV PACKAGING OF FOOD PRODUCTS AND TESTING OF PACKAGE 9

General classification and packaging types - Packaging of Specific Foods with its properties like bread, biscuits coffee, milk powder, egg powder, carbonated beverages Snack foods etc, pallets & containers. Interaction of Food Material with Packaging Material, Testing & evaluation of packaging media – retail packs & transport packages

UNIT V REGULATORY ASPECTS OF PACKAGING 9

Food marketing and role of packaging; Packaging aesthetic and graphic design; Food Packaging Laws and Regulations, Food Labelling, coding and marking including bar coding. Packaging Costs; Packaging Environmental consideration and restoration – sustainable development, biodiversity, global environment facility, environmental impact assessment, environmental protection act, national conservation strategies, ISO 14000. & wastemanagement, Sources-Reduce, Reuse and Recycling (3R's), 7R's of Packaging, Biodegradable materials, Recycling techniques/methods – Paper/Paperboard, Plastics, Metals, Glass

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 understand the concepts, types of food packaging systems
CO 2 analyse complex systems of food packaging and logistics.
CO 3 understand the importance of law, regulations and monitoring agencies involved in labelling of foods.

TEXT BOOKS

1. Robertson, G.L. "Food Packaging Principles and Practice". 2nd Edition. Taylor & Francis,2006.
2. Han, Jung H. "Innovations in Food Packaging". Elsevier, 2005.
3. Ahvenainen, Raija. "Novel Food Packaging Techniques". Wood Head Publishing, 2003.
4. Mathlouthi, M. "Food packaging and Preservation". Aspen Publications, 2013

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Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	understand the concepts, types of food packaging systems	2	3	3	3	2	1	3	3	3	-	2	3	3	3	-	3
CO2	analyse complex systems of food packaging and logistics.	1	3	3	3	2	1	3	3	3	-	2	3	3	3	-	3
CO3	understand the importance of law, regulations and monitoring agencies involved in labelling of foods.	1	1	1	1	1	1	3	3	3	-	2	3	3	3	-	3
Over all CO		1	2	2	2	1	1	3	3	3	-	2	3	3	3	-	3

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

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FT5602 FOOD REFRIGERATION SYSTEMS L T P C
2 1 0 3

OBJECTIVES

The course aims to

- study the principles of cooling, air conditioning and freezing
- achieve effective and efficient food refrigeration design solutions

UNIT I REFRIGERATION PRINCIPLES AND REFRIGERANTS 5

Introduction to Refrigeration - Unit of Refrigeration and C.O.P– Desirable properties of refrigerants- physical, chemical, safety, thermodynamic and economical. Cryogenics, application of cryogens in food. Production of low temperatures Expansion of a liquid with flashing, reversible/ irreversible adiabatic expansion of a gas/ real gas, thermoelectric cooling, adiabatic demagnetization. Chloroflouro Carbon (CFC) refrigerants - effect on environmental pollution - alternate refrigerants - application of refrigeration.

UNIT II VAPOUR REFRIGERATION SYSTEM 12

Vapour compression cycle p-h and T-s diagrams - deviations from theoretical cycle - sub-cooling and super heating- effects of condenser and evaporator pressure on COP- multi-pressure system - low temperature refrigeration - Cascade systems – problems.
Vapour-absorption refrigeration system vapour absorption cycle – theoretical - deviation in practice - Electrolux refrigerator – construction and principles.
Equipments Type of Compressors, Condensers, Expansion devices, Evaporators.

UNIT III PSYCHROMETRIC PROPERTIES AND PROCESSES 8

Properties of moist Air-Gibbs Dalton law, Specific humidity, Dew point temperature, Degree of saturation, Relative humidity, Enthalpy, Humid specific heat, Wet bulb temperature Thermodynamic wet bulb temperature, Psychrometric chart; Psychrometric of air-conditioning processes, mixing of air streams

UNIT IV FOOD REFRIGERATION 10

Food Cooling and Precooling, Food Cooling and Precooling, Cool and Cold Storage - types - CAS, Respiration (Heat Generation), Transpiration (Moisture Loss), Cooling Process Parameters – Analysis – estimation of cooling time. Food Freezing Process – changes during freezing– ice crystal formation - Freezing Rate, Freezing Equipment, Thawing, Frozen food storage, simple applied problems

UNIT V COLD CHAIN 10

Introduction, need for the chain for chilled / frozen food item, various links of the chain; importance of shelf- life; just – in-time deliveries; Refrigerated transport Handling and distribution, cold chain, refrigerated product handling, refrigerated vans, refrigerated display. Challenges in international food supply chain – managing challenges; Trends in supply chain relationships; PPP and TTT concepts; Temperature monitoring; -Critical temperatures; Temperature –time indicators (TTI); Thaw indicators.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 understand the principles and working of refrigeration, air conditioning, and cold chain.
CO 2 gain knowledge on refrigeration and problem solving ability on types of loads.
CO 3 design refrigeration and cold storage system for food products.

Attested

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TEXT BOOKS:

1. Arora, C.P., Refrigeration and Air Conditioning, McGraw Hill, 3rd ed, New Delhi, 2010.
2. Sun, Da-Wen. " Advances in Food Refrigeration". Leatherhead Publishing, 2001.
3. Kennedy, Christopher J. "Managing Frozen Foods". CRC / Woodhead Publishing, 2000.
4. James, S.J. and C. James. " Meat Refrigeration". CRC / Woodhead Publishing, 2002.
5. Stringer, Mike and C. Dennis. "Chilled Foods A Comprehensive Guide". 2nd Edition CRC / Woodhead Publishing, 2002.

REFERENCES:

1. Roy J. Dossat, Principles of Refrigeration, Pearson Education Asia, 4th Edition, 2009.
2. Stoecker, W.F. and Jones J. W., Refrigeration andAir Conditioning, McGraw Hill, New Delhi, 1986.
3. ASHRAE Hand book Refrigeration, Fundamentals 2010 by American Society of Heating, Refrigerating and Air-Conditioning Engineers
4. Jones W.P., Air conditioning engineering, Elsevier Butterworth-Heinemann, 5th Edition, 2001

Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	understand the principles and working of refrigeration, air conditioning, and cold chain.	3	3	3	1	1	-	-	2	3	-	-	2	3	2	-	-
CO2	gain knowledge on refrigeration and problem solving ability on types of loads.	3	3	3	1	1	-	-	2	3	-	-	2	3	2	-	-
CO3	able to design refrigeration and cold storage system for food products.	3	3	3	1	1	-	-	2	3	-	-	2	3	2	-	-
Over all CO		3	3	3	1	1	-	-	2	3	-	-	2	3	2	-	-

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

Attested

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FT5603 CEREALS, PULSES AND OIL SEED TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES

The course aims to

- develop the knowledge of students in the area of Cereal, pulse and oilseed processing and technology.
- effective understanding specific aspects of food processing related to these foods.

UNIT I WHEAT AND RICE 10

Status, major growing areas and production of cereals, millets, pulses and oil seeds in India and the world, structure, Physical properties, Chemical composition,Distribution of nutrients, nutritional and anti-nutritional factors. Wheat Morphology, Physicochemical properties, Wheat Quality, Wheat Milling, quality aspects of flour, wheat proteins and their function, rheology of wheat flour. Paddy Processing and treatment for quality improvement, Milling of rice Conventional Milling, Modern milling, Advantages and disadvantages of milling machineries,calculation of milling efficiency, By products of rice milling, Parboiling of rice, Aging of rice, Enrichment and fortification.

Cereal based baked products – Bread, Biscuit, Cakes, Extruded processing and products, Pizza, Chapatis malting and malt products -Processed Foods from rice Breakfast cereals, flakes, puffing, canning and instant rice

UNIT II MILLETS AND OTHER CEREALS 9

Sorghum, Pearl Millet, Finger millet, Foxtail millet, Kodo Millet - storage, insect control; processing - Pearling, Milling, Malting, Malt based foods, value addition, by product utilization, flaked and fermented products; Traditional and Nutritional products based on finger millet. Other cereals Corn - Morphology, Physico-chemical properties, Corn milling - Wet and dry milling, Milling fractions and modify starches Corn Products – Corn flakes, Corn starch, canned corn products, puffed product; HFCS; Oats- Milling, Oat Products – Steel cut, rolled oats, quick cooking; Rye bread; Traditional and Fermented cereal products.

UNIT III LEGUME PROCESSING 10

Legumes Pre-treatment of pulses for milling, milling of major pulses.Processing of legumes Home scale, cottage Scale and commercial methods of dehulling.Modern techniques in Dal mills.Dal milling – Principle, methods, equipments and effect on quality. Dry and Wet milling of legumes, Fermented Products of legumes. Soaking – Principles, Methods of socking - Sprouting, Puffing, Roasting & Parboiling of Legumes, Physical and Bio-chemical changes during these processes. Cooking quality of dhal – methods, factors affecting quality of dhaland cooking of dhal.Quick cooking dhal, Instant dhal. Soy processing Soya as a source of protein and oil; soya milk, soy protein Isolate, soya paneer, soya sauce; extrusion technology and production of textured vegetable proteins.

UNIT IV OIL SEEDS AND NUTS 8

Chemical composition and characters of oil seed and nuts, Anti-nutritional factors, elimination Methods. Post Harvest Technology of Oil seeds, Handling Drying, Storage, Grading, Pre-treatments, cleaning, Dehulling, solving problems in size reduction and flaking.

UNIT V OIL SEED PROCESSING 8

Oil seeds Processing Sesame, Coconut, Groundnut, Mustard, Soybean, Sunflower, Safflower. Oil extraction Traditional Methods, New Technologies in oil seed processing, calculation of extraction efficiency, Oil modification process- hydrogenation, inter esterification and dry fractionation ,utilization of oil seed meals of different food uses. High protein product, like protein concentrates and isolates.

TOTAL: 45 PERIODS

Attested

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OUTCOMES:

At the end of the course the students will be able to

CO 1 gain knowledge on the identify the specific processing technologies for cereals, pulses and oilseeds

CO 2 understand the application of scientific principles in the processing technologies related to these foods.

CO 3 understand the specific aspects of products from these foods.

TEXT BOOKS:

1. Hamm, Wolf and Richard J Hamilton “Edible Oil Processing” Blackwell Publishing, 2004
2. Gunstone, Frank D. “The Chemistry of Oils and Fats Sources, Composition, Properties and Uses” Blackwell Publishing, 2004.
3. Matz, Samuel A. “ The Chemistry and Technology of Cereals as Food and Feed” 2nd Edition, CBS, 1991.
4. Delcour, Jan A. and R. Carl Hoseney. “Principles of Cereal Science and Technology”. 3rd Edition. American Association of Cereal Chemists, 2010.
5. Kulp, Karel “Handbook of Cereal Science and Technology”. 2nd Edition,CRC Press, 2000.
6. Chakraverty A. Post-harvest Technology of Cereals, Pulses and Oilseeds. Oxford & IBH.2006.

Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	gain knowledge on the identify the specific processing technologies for cereals, pulses and oilseeds	1	1	2	1	-	-	1	2	1	-	-	2	2	1	-	-
CO2	understand the application of scientific principles in the processing technologies related to these foods.	1	1	2	-	-	-	1	2	1	-	-	2	2	1	-	-
CO3	understand the specific aspects of products from these foods	1	1	2	1	-	-	1	2	1	-	-	2	2	1	-	-
Over all CO		1	1	2	1	-	-	1	2	1	-	-	2	2	1	-	-

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

Attested

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FT5611	FOOD PACKAGING TECHNOLOGY LABORATORY	L T P C 0 0 4 2

OBJECTIVES

The course aims to

- analyzedifferent kind of packaging materials.
- analyze and evaluate different packing characteristics for development of food packages

LIST OF EXPERIMENTS

1. Identification of different types of packaging and packaging materials
2. Measurement of thickness of packaging films, papers and boards
3. Measurement of water absorption of paper, paper boards
4. Measurement of bursting strength of paper of paper boards
5. Determination of tensile/compression strength of given material
6. Destructive and non-destructive test on glass container, drop test
7. Determination of wax weights, tensile strength of papers, bursting strength
8. Determination of WVTR of various packaging materials
9. Determination of Oxygen Transmission Rate of various packaging materials
10. Determination of coating on package materials
11. Evaluation of residue migration from package to food
12. Tests for identification of plastic films.

TOTAL: 60 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 understand the principles and working of refrigeration, air conditioning, and cold chain.
CO 2 gain knowledge on refrigeration and problem solving ability on types of loads.
CO 3 design refrigeration and cold storage system for food products.

TEXTBOOKS:

1. Robertson, G. L. Food Packaging Principles and Practices, Marcel Decker, 2006.
2. Han, J.H. Innovation in Food Packaging, Elsevier Publications, 2005.

Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme specific outcomes(PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	understand the principles and working of refrigeration, air conditioning, and cold chain.	3	3	3	1	1	-	-	2	3	-	-	2	3	2	-	-
CO2	gain knowledge on refrigeration and problem solving ability on types of loads.	3	3	3	1	1	-	-	2	3	-	-	2	3	2	-	-
CO3	design refrigeration and cold storage system for food products.	3	3	3	1	1	-	-	2	3	-	-	2	3	2	-	-
Over all CO		3	3	3	1	1	-	-	2	3	-	-	2	3	2	-	-

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

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FT5612 CEREAL, PULSES AND OIL SEED TECHNOLOGY LABORATORY L T P C
0 0 4 2

OBJECTIVES

The course aims to

- evaluate different physical and chemical properties of cereals, pulses and oil seeds.
- determine the effects of different processing and conditions for cereals, pulses and oilseeds

LIST OF EXPERIMENTS

1. Determination of physical and chemical properties of grain and flour- thousand grain weight, sieve analysis, colour, sedimentation value, Liquid number, falling number, hardness, gluten index.
2. Production of malt and Value added products from cereals and millets.
3. Production and characterisation of modified starch.
4. Studies on cooking quality of cereals (cooking time, grain elongation, etc)
5. To study the methods of extraction of oil from oilseeds
6. Determination of under milled grains from polished rice
7. Production of Ready–to-eat breakfast cereals by extrusion cooking
8. Determination of alcoholic acidity of the sample of the wheat flour / Maida.
9. Experiment on leavening action of baking powder, sodium- bicarbonate and ammonium bicarbonate in cake.
10. Determination of dough rising capacity of yeast
11. Studies of dough characteristics- farinographic, amylograph and extensiographic
12. Preparation & evaluation of biscuits and bread
13. Shelf life studies of cereal and legume grains having different moisture levels.
14. Determination of Polenske value of wheat flours.
15. Optimization and production of fermented bakery products,

TOTAL: 60 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 gain knowledge of processing technologies for cereals, pulses and oilseeds in compliance with food standards

CO 2 understand the application of scientific principles in the processing technologies related to these foods.

CO 3 understand the specific aspects of products from these foods.

TEXTBOOKS:

1. Matz, Samuel A. “The Chemistry and Technology of Cereals as Food and Feed” 2nd Edition, CBS, 1991.
2. Chakravarty A. Post-harvest Technology of Cereals, Pulses and Oilseeds. Oxford & IBH.2006.

Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	gain knowledge of processing technologies for cereals, pulses and oilseeds in compliance with food standards	1	1	2	1	2	-	1	2	1	-	-	2	2	1	-	-
CO2	understand the application of scientific principles in the processing technologies related to these foods.	1	1	2	-	2	-	1	2	1	-	-	2	2	1	-	-
CO3	understand the specific aspects of products from these foods	1	1	2	1	2	-	1	2	1	-	-	2	2	1	-	-
Over all CO		1	1	2	1	2	-	1	2	1	-	-	2	2	1	-	-

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

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SEMESTER VII

FT5701 FOOD SAFETY, QUALITY AND REGULATION L T P C
3 0 0 3

OBJECTIVES

The course aims to

- characterize different type of food hazards, physical, chemical and biological in the industry and food service establishments
- help become skilled in systems for food safety surveillance
- aware of the regulatory and statutory bodies in India and the world

UNIT I INTRODUCTION TO FOOD SAFETY 10

Definition of food safety and concept of safe food; characterization of food hazards- physical, chemical and biological; Hygienic design of food plants and equipments, Food Contaminants (Microbial, Chemical, Physical), Food Adulteration (Common adulterants), Food Additives (functional role, safety issues), Food Packaging &l abeling. Sanitation in warehousing, storage, shipping, receiving, containers and packaging materials.Control of rats, rodents, mice, birds, insects and microbes.Cleaning and Disinfection.

UNIT II FOOD QUALITY 8

Food quality Various Quality attributes of food, Instrumental, chemical and microbial Quality control. Sensory evaluation of food and statistical analysis.Water quality and other utilities.

UNIT III HAZARDS AND QUALITY CONTROL 10

Critical Quality control point in different stages of production including raw materials and processing materials. Food Quality and Quality control including the HACCP system. Food inspection and Food Law, Risk assessment – microbial risk assessment, dose response and exposure response modelling, risk management, implementation of food surveillance system to monitor food safety, risk communication. ISO 22000 – Importance and Implementation.

UNIT IV REGULATIONS 9

Indian and global regulations FAO in India, Technical Cooperation programmes, Bio-security in Food and Agriculture, World Health Organization (WHO), World Animal Health Organization (OIE), International Plant Protection Convention (IPPC)

UNIT V CODEX COMMISSION 8

Codex Alimentarius Commission - Codex India – Role of Codex Contact point, National Codex contact point (NCCP), National Codex Committee of India – ToR, Functions, Shadow Committees etc.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 gain knowledge about adulteration and contamination in foods
CO 2 acquire thorough Knowledge of food hazards, GMP,HACCP in industry and food service establishments
CO 3 have awareness on regulatory and statutory bodies in India and the world

REFERENCES:

1. Handbook of Food Toxicology by S. S. Deshpande, 2002
2. The Food Safety Information handbook by Cynthia A. Robert, 2009
3. Food Safety Handbook by Ronald H. Schmidt, Gary E. Rodrick, A John Wiley & Sons Publication, 2003.

Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme Specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	gain knowledge about adulteration and contamination in foods	1	1	2	-	1	2	2	2	2	2	1	3	2	2	-	2
CO2	acquire thorough Knowledge of food hazards, GMP,HACCP in industry and food service establishments	1	1	2	-	1	2	2	2	2	2	1	3	2	2	-	2
CO3	have awareness on regulatory and statutory bodies in India and the world	1	1	2	-	-	-	2	2	2	2	1	3	2	2	-	2
Over all CO		1	1	2	-	1	1	2	2	2	2	1	3	2	2	-	2

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

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FT5702 DAIRY PROCESS TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES

The course aims to

- introduce the students to dairy industry, properties and processing of milk
- enable the learning in manufacture of dairy products, sanitation and effluent treatment in dairy industry

UNIT I PROPERTIES OF MILK 7

History white revolution present milk industry scenario and its future.Milk-Types-Composition-Physical-Chemical and Thermal Properties-Heat Capacity, Density Freezing-Boiling point-Expansion-Agitation-Viscosity-Classification of milk Market and Special Milk Handling-effects of Merits on Milk-toxicity of metals.

UNIT II PROCESSING AND QUALITY PARAMETERS OF MILK 10

Processing of Milk- calculation and standardisation of raw milk, Pasteurization-HTST, UHT, sterilization, Homogenization, Filtering and Clarification of Milk-cream separation-Methods and Equipment's-Emulsification – Fortification, packaging of milk and milk products, judging and grading of milk, national and international standards of milk and milk products. membrane separation of milk – ultra filtration - reverse osmosis—membrane material and structures.

UNIT III MILK PRODUCTS 12

Traditional dairy products, Technology of traditional Indian dairy products. Technology of fermented milk and milk products and probiotic milk based products., Manufacturing of Yogurt, Cheese, Butter, Ghee, Ice-cream, overrun calculation in ice-cream, malted products, evaporated milk products - properties, Classification-processing Methods, Equipment used, standards and quality parameters.

UNIT IV MILK POWDER PROCESSING AND MILK SUBSTITUTES 9

Processing of Milk Powder- Composition - Properties- methods of drying,comparision of different drying methodsand calculating of drying efficiency, quality evaluation, Instantization, flow ability dustiness, reconstituability, dispersability, wet ability, sink ability and appearance of milk powders substitutes for milk and milk products – casein, lactose and other by-products and its use in formulated foods , weaning foods, therapeutic foods, fortification and enrichment.

UNIT V STORAGE SANITATION AND EFFLUENT TREATMENT 7

Storage of Milk in Tanks-Storage of ice cream and other milk products - in cold storage Cleaning and Sanitation-Importance-Detergents-Properties-Cleaning procedures-Cleaning in place-Dairy effluent treatment and disposal.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 gain knowledge about functioning of cooperatives and dairy processing methods.
CO 2 understand the manufacturing processes of various dairy products.
CO 3 gain knowledge of sanitation and effluent treatment in dairy industry.

TEXT BOOKS:

1. Ananthakrishnan, C.P., and Sinha, N.N., "Technology and Engineering of Dairy PlantOperations, Laxmi Publications, New Delhi, 1987.
2. Warner, J.N., "Principles of Dairy Processing", Wiley Eastern Pub. Co., New York, 1984.
3. Walstra, P., "Dairy Technology Principles of Milk Properties and Processes". Marcel Dekker, 1999
4. Spreer, Edgar "Milk and Dairy Product Technology". Marcel Dekker, 2005.

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REFERENCES:

1. Tufail Ahmed., "Dairy Plant Engineering and Management", KitabMahal Publishers,Allahabad, 1997.
2. Lampert, Lincoln M. "Modern Dairy Products Composition, Food Value, Processing, Chemistry, Bacteriology, Testing, Imitation Dairy Products". Chemical Publishing Company, 1998.
3. Selia, Jane dos Reis Coimbra and Jose A. Teixeir "Engineering Aspects of Milk and Dairy Products". Jane Selia dos Reis Coimbra & Jose A. Teixeir, CRC Press, 2009.

Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	gain knowledge about functioning of cooperatives and dairy processing methods	2	2	1	1	1	1	1	1	1	1	-	1	1	1	-	1
CO2	understand the manufacturing processes of various dairy products.	2	2	1	1	1	1	1	1	1	1	-	1	1	1	-	1
CO3	gain knowledge of sanitation and effluent treatment in dairy industry.	2	2	1	1	1	1	1	1	1	1	-	1	1	1	-	1
Over all CO		2	2	1	1	1	1	1	1	1	1	-	1	1	1	-	1

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

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FT5711 DAIRY PROCESS TECHNOLOGY LABORATORY L T P C
0 0 4 2

OBJECTIVES

The course aims to

- learn about the preservation and analytical techniques in milk and milk products
- educate about the use of various techniques in milk product processing and quality analysis

LIST OF EXPERIMENTS

1. Sampling, chemical and microbial examination of pasteurized, sterilized and UHT processed milk.
2. Determination of viscosity, density and specific gravity of milk
3. Detection of adulterants and preservatives in milk.
4. Batch and Continuous pasteurization of milk – study on Different controls on pasteurizer and Different sterilizers
5. Determination of the rate of filtration and settling
6. Study of construction and operation of Vacuum pan, Double effect evaporator, Spray dryer, Vacuum and atmospheric drum dryers.
7. Study and operation of Butter, Ghee, Ice-cream and cheese making equipment,
8. Study the Reverse Osmosis and Ultra filtration system
9. Determination of water activity and sorption isotherms of milk products.
10. Determination of thermal load during retort processing of milk and milk products
11. Determination of Functional properties of powders
12. Determination of degree of browning-chemical/physical methods.
13. Freeze drying of milk/milk products, and heat sensitive products.
14. Homogenization of milk and its efficiency determination.
15. Production of probiotic food products
16. Fermentation using enzymes-Cheese production

TOTAL: 60 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 gain knowledge of platform test in dairy processing.
CO 2 understand the manufacturing processes of milk and milk products and the equipments used
CO 3 gain knowledge of functional properties.

TEXT BOOKS:

1. Ananthakrishnan, C.P., and Sinha, N.N., “Technology and Engineering of Dairy PlantOperations, Laxmi Publications, New Delhi, 1987.
2. Warner, J.N., “Principles of Dairy Processing”, Wiley Eastern Pub. Co., New York, 1984.
3. Walstra, P., “Dairy Technology Principles of Milk Properties and Processes”. Marcel Dekker, 1999.
4. Spreer, Edgar “Milk and Dairy Product Technology”. Marcel Dekker, 2005.

Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme Specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	gain knowledge of platform test in dairy processing.	2	2	1	1	1	1	1	1	1	1	-	1	1	1	-	1
CO2	understand the manufacturing processes of milk and milk products and the equipments used	2	2	1	1	1	1	1	1	1	1	-	1	1	1	-	1
CO3	gain knowledge of functional properties.	2	2	1	1	1	1	1	1	1	1	-	1	1	1	-	1
Over all CO		2	2	1	1	1	1	1	1	1	1	-	1	1	1	-	1

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

FT5712 **INDUSTRIAL TRAINING**
(4 WEEKS DURING VI SEMESTER - SUMMER)

L T P C
0 0 0 2

OBJECTIVES

This course aims to

- encourage the students to get connected with any industry/ laboratory/research institute
- acquire knowledge on solving practical problems, gaining work experience and skills
- Learn to work in an academic/ industrial/research environment.

The students individually undergo training in reputedcompanies/ research institutes/ organizations for the specified duration.

OUTCOMES:

At the end of the industrial training the students will be able to

CO 1 work in an industry/academia/research institute

CO2 gain experience to work as an individual as well as a member of a team

CO 3 acquire practical knowledge and enhance skills

Course Articulation Matrix

Course outcomes	Statement	Programme outcomes (PO)												Programme specific outcomes(PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	learn to work in an industrial/academic/research institute	1	3	-	3	3	3	2	3	2	3	2	3	1	2	-	-
CO2	gain experience to work as an individual as well as a member of a team	1	3	-	3	3	3	2	3	2	3	2	3	1	2	1	1
CO3	Acquire practical knowledge and enhance skills	1	3	-	3	3	3	2	3	2	3	2	3	1	2	3	1
Overall CO		1	3	-	3	3	3	2	3	2	3	2	3	1	2	1	1

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

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FT5713 **PROJECT I**

L T P C
0 0 6 3

OBJECTIVES

The course aims to

- make the students identify a project/ problem/process relevant to their field of interest that can be carried out
- make them equipped to search databases and journals to collect relevant data and identify a solution
- plan, learn and perform experiments to verify the solution

TOTAL: 90 PERIODS

OUTCOMES:

At the end of the project work the students will be able to

CO 1 identification of field of interest

CO 2 equip the students to search and think about logical solutions

Course Articulation Matrix

Course outcomes	Statement	Programme outcomes (PO)												Programme specific outcomes(PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	identification of field of interest	2	3	2	2	1	2	-	2	2	1	1	1	1	1	2	1
CO2	equip the students to search and think about logical solutions													1	1	2	2
Overall CO		2	3	2	2	2	1	-	2	2	2	1	1	1	2	1	2

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

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FT5811 **PROJECT II**

L T P C
0 0 16 8

OBJECTIVES

The Course aims to

- train students to analyze a problem/ think innovatively to develop a new product /process
- make them understand how to find solutions/ create products economically and in an environmentally sustainable way
- enable them to acquire technical and experimental skills to validate the solution, analyze the results and communicate
- enable them to effectively think about strategies to commercialize the product.

TOTAL: 240 PERIODS

OUTCOMES:

At the end of the project the student will be able to

CO 1 formulate and analyze a problem/ create a new product/process.

CO2 plan experiments to find solutions in a logical manner/ work out sustainability

CO 3 analyze the results, interpret and communicate/strategies for commercialization

Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme specific outcomes(PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	formulate and analyze a problem/ create a new product/process	1	3	2	2	2	1	-	2	2	2	1	1	1	2	1	3
CO2	plan experiments to find solutions in a logical manner/ work out sustainability	2	3	2	2	2	1	-	2	2	2	1	1	1	2	1	3

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CO3	analyze the results, interpret and commu nicate/st rategies for commer cializati on	2	3	2	2	2	1	-	2	2	2	1	1	1	2	1	2
		2	3	2	2	2	1	-	2	2	2	1	1	1	2	1	3

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium) and substantial (high) respectively.

FT5001 PRINCIPLES OF BIOCHEMICAL ENGINEERING LT P C
2 0 2 3

OBJECTIVES

The course aims to

- expose the students in enzyme studies and overview of fermentation processes so that the knowledge can be applied in food processing industries
- understand the Enzyme kinetics, Inhibition kinetics, Immobilization
- understand the concept of basic fermentation processes and its control systems etc.
- get a practical knowledge about running the fermenter and its scale – up and modes of operation etc.

UNITI ENZYME STUDIES 12

Enzyme Kinetics- Single substrate reactions; Estimation of Michaelis – Menten parameters, turnover number, Multisubstrate reactions- mechanisms and kinetics; Enzyme Inhibition Kinetics- Enzyme Immobilization methods.

UNITII BASICS OF FERMENTER & MEDIA FORMULATION 12

Basic configuration of fermenter and ancillaries, main parameters to be monitored and controlled in fermentation processes. - Medium formulation for optimal growth and product formation-Medium Optimization Methods-Sterilization Concepts- Thermal death kinetics of microorganisms, batch and continuous heat sterilization of liquid media, filter sterilization of liquid, media & air.

UNITIII STUDIES ON CELL GROWTH 12

Stoichiometry of cell growth and product formation, elemental balances, degrees of reduction of substrate and biomass, available electron balances, yield coefficients of biomass and product formation, maintenance coefficients, energetic analysis of microbial growth and product formation, oxygen consumption and heat evolution in aerobic cultures, thermodynamic efficiency of growth.

UNITIV REACTOR TYPES & MODES OF OPERATION 12

Batch, fed batch and continuous cultivation. Simple unstructured kinetic models for microbial growth, Monod model, growth of filamentous organisms, product formation kinetics - leudeking-piret models. Types of reactor- Air Lift Reactor, Bubble Column Reactor, Immobilized enzyme reactors- packed bed, fluidized bed, membrane reactors.

UNITV GAS EXCHANGE & SCALE-UP OF BIOREACTORS 12

Regime analysis of bioreactor processes, oxygen mass transfer in bioreactors – Mass transfer Coefficient- methods for the determination of mass transfer coefficients; mass transfer correlations; Power requirements of Bioreactors. Scale-up considerations on heat transfer, oxygen transfer, power consumption and impeller tip speed.

PRACTICALS

1. Growth of bacteria – estimation of biomass, calculation of specific growth rate, yield coefficient
2. Medium optimization – Plackett Burman design, response surface methodology
3. Enzyme kinetics – MichelisMenton parameter, effect of temperature and pH
4. Enzyme immobilization – gel entrapment, cross linking
5. Preparation of bioreactor, utilities for bioreactor operation
6. Thermal death kinetics
7. Batch cultivation, estimation of kLa – dynamic gassing method
8. Estimation of kLa – sulphite oxidation method.

TOTAL:60 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 get familiarized with the fundamentals about Enzymes and its reaction kinetics
CO 2 gained the knowledge on the concept of basic fermentation processes
CO 3 know the applications of both enzyme and fermentation studies which may help during scale up operations in industries.

TEXT BOOKS:

1. Shuler, M.L. and Kargi, F. "Bioprocess Engineering Basic Concepts", 3rd Edition, PHI, 2017.
2. Palmer, Trevor "Enzymes Biochemistry, Biotechnology, Clinical Chemistry", AffiliatedEast-West Press Pvt. Ltd., 2004.
3. Stanbury, P.F., A. Whitaker and S.J. Hall "Principles of Fermentation Technology", 3rd Edition, Butterworth – Heinemann (an imprint of Elsevier), 2016.

REFERENCES:

1. Doran, P.M. "Bioprocess Engineering Principles", 2 nd Edition Academic Press, 2013.
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.
5. Moser, Anton. "Bioprocess Technology Kinetics and Reactors", Springer Verlag,1988.
6. Bailey, J.E. and Ollis, D.F. "Biochemical Engineering Fundamentals" 2nd Edition, McGrawHill, 1988.
7. Lee, James M. "Biochemical Engineering", Prentice – Hall, 1992.
8. Wiseman, Alan "Handbook of Enzyme Biotechnology", 3rd Edition, Ellis Harwood Publications, 1999.
9. Hartmeier, Winfried "Immobilized Biocatalysts An Introduction", Springer –Verlag,1986.

Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme Specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	familiarized with the fundamentals about Enzymes and its reaction kinetics	3	2	2	3	3	2	3	3	2	2	2	2	3	3	2	3
CO2	gained the knowledge on the concept of basic fermentation processes	3	2	2	3	1	2	3	3	2	2	2	2	3	3	2	3
CO3	knowing the applications of both enzyme and fermentation studies, may help during scale up operations	3	3	3	3	3	1	3	3	3	2	3	2	3	3	2	3
Over all CO		3	2	2	3	3	2	3	3	2	2	2	2	3	3	2	3

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium) and substantial (high) respectively.

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FT5002 ANALYTICAL METHODS FOR FOOD PRODUCTS L T P C
3 0 0 3

OBJECTIVES

The course aims to

- expose the students to the principles, methods and techniques of chemical and instrumental methods of food analysis.
- enable the students about the quality analysis of the functional groups in fruits and vegetables.

UNITI ANALYSIS OF WATER 9

Parameters tested as per FSSAI Regulations- Organoleptic and Physico-chemical Parameters- Colour ,Odour, pH, Taste, Turbidity, General Chemical parameters- Ammoniacal nitrogen, Anionic surface active agent, Boron, Nitrate, Chloride, Magnesium, Fluoride, Total hardness , Alkalinity , Sulphates , Residual free chlorine& Chloramines Sulphide , Cyanide, Calcium, Total Dissolved Solids, Phenol, Sodium , Hexavalent chromium ,Total solids, Nitrite , Mineral Oil ,Estimation of Anions in Drinking water by Ion Chromatography, Metals A By AAS- By Flame AAS (Zn, Mg, Ca,), By Graphite furnace AAS(Al,Cu,Fe,Mn,Se,Ag,Cd,Pb,Hg,Mo,Ni,As,Cr), By Cold Vapour AAS (Hg) B. By ICP-MS (Zn, Mg, Ca, Al, Cu, Fe, Mn, Se, Ag, Cd, Pb, Hg, Mo, Ni, As, Cr, Hg), Toxic substances- Pesticide Residues, Polychlorinated Biphenyls, Polyaromatic Hydrocarbons, IS protocol 10500 and 14543.

UNIT II ANALYSIS OF PLANTATION PRODUCTS 9

Tea & Coffee- Preparation of sample, Moisture content, Total ash, Water soluble ash, Determination of Caffeine content by different methods, Microscopic examination, Determination of solubility in boiling water, Determination of Iron filings and size of the particles, Test for presence of added colouring matter

Spices- Sample preparation, Determination of moisture, Acid insoluble ash, Determination of Cold Water Extract, Determination of Alcohol Soluble Extract , Calcium Oxide, Non Volatile Ether Extract, Volatile Oil, Crude Fibre, Allyl isothiocyanate in Mustard, p-hydroxybenzyl isothiocyanate in white mustard, Microscopic Examination of Spices, Black Pepper- Determination of Bulk density, Light berries, Piperine content, Turmeric- Determination of curcumin content, Starch content, Detection of chromate content, Detection of Argemone seeds in Mustard, Detection of Mineral Oil in Black Pepper, Detection of Papaya seeds in Black Pepper, Detection of Turmeric in Chillies and Coriander, Detection of Oil Soluble Colour, Determination of Light and Heavy Filth in Spices and Condiments, Determination of capsaicin content in chilli powder.

UNITIII ANALYSIS OF FRUIT & VEGETABLE PRODUCTS, OILS & FATS 9

Thermally Processes fruits and vegetables- Physical examination, Determination of Vacuum, Drained weight, Internal conditions of can, Determination of sodium chloride in brine; Jams and Jellies- Insoluble matter, pH, Titratable Acidity, Volatile oils, Total sugars, Vitamin C, Determination of fruit content.

UNITIV ANALYSIS OF BAKING AND CONFECTIONERY PRODUCTS 9

Bread- Sample preparation, Determination of alcoholic acidity, Acid-insoluble ash, Non-Fat milk solids in milk bread, Biscuits- Determination of acidity of extracted fat,

Confectionery- Preparation of Sample, Determination of Moisture, Determination of Sulphated Ash, Determination of Sulphated Ash on salt free basis, Determination of Ash in dil. HCl, Test for presence of added synthetic colour, Determination of Total Protein, Determination of Fat, Determination of Reducing Sugar, Determination of Sucrose, Determination of Sulphur dioxide, Determination of Lead, Copper and Zinc.

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UNITV ANALYSIS OF MEAT AND FISH PRODUCTS 9

Preparation of Sample for Meat and Processed Meat products, Determination of Nitrite in Processed animal foods, Determination of Ascorbic acid, Alternate method for Determination of Ascorbic acid, Determination of Total Phosphorous, Test for presence of Polyphosphates, Determination of Glucono-delta-lactone, Additional tests ,Determination of physico-chemical quality of meat and meat products- pH, Extract Release Volume (ERV) ,Meat Swelling Capacity (MSC), Total Volatile Basic Nitrogen (TVBN), Picric Acid Turbidity (PAT), Determination of dye reduction capacity

Preparation of sample for Fish and Processed Fish, Frozen Fish- Determination of Histamine, Dried fish- Moisture content, Sodium chloride content, Acid insoluble ash.

Milk & Milk products- Preparation of sample, Detection test for adulterants and contaminants, Alkaline phosphatase test, Turbidity test, Determination of Total solids, Determination of fat.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 understand the principles behind analytical techniques in food analysis.

CO 2 know the methods of selecting appropriate techniques in the analysis of food products.

CO 3 appreciate the role of food analysis in food standards and regulations for the manufacture and the sale of food products and food quality control in food industries.

CO 4 familiarize with the current state of knowledge in food analysis.

REFERENCES:

1. FSSAI Lab Manual 6, “Manual of Methods of Food Analysis- Meat& Meat Products/ Fish & Fish Products”, 2016
2. FSSAI Lab Manual 3, “Manual of Methods of Food Analysis- Cereal & Cereal Products”, 2016
3. FSSAI Lab Manual 4, “Manual of Methods of Food Analysis- Beverages, Sugar & Confectionery Products”, 2016
4. FSSAI Lab Manual 10, “Manual of Methods of Food Analysis- Spices and Condiments”, 2016
5. FSSAI Lab Manual 5, “Manual of Methods of Food Analysis- Fruit & Vegetable Products”, 2016
6. FSSAI Lab Manual, “Manual of Methods of Food Analysis- Water”, 2016

Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	understand the principles behind analytical techniques in food analysis.	-	3	1	3	2	3	-	3	3	-	-	3	3	3	-	1
CO2	know the methods of selecting appropriate techniques in the analysis of food products.	-	3	1	3	2	3	-	3	3	-	-	3	3	3	-	1
CO3	appreciate the role of food analysis in food standards and regulations for the manufacture of food products and food quality control in food industries.	-	3	1	3	2	3	-	3	3	-	-	3	3	3	-	1
CO4	familiarize with the current state of knowledge in food analysis.	-	3	1	3	2	3	-	3	3	-	-	3	3	3	-	1
Over all CO		-	3	1	3	2	3	-	3	3	-	-	3	3	3	-	1

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium) and substantial (high) respectively.

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FT5003 FOOD FERMENTATION TECHNOLOGY L T P C

3 0 0 3

OBJECTIVES

The course aims to

- impart knowledge and skills related to process technologies in fermented food products
- learn about the different equipment used for the production of various fermented food products.

UNIT I INTRODUCTION 6

History of food fermentations; types of fermented foods and substrates/raw materials used, traditional fermented foods, major biotransformation of raw materials during fermentation, Modern fermented foods industry, Properties of fermented foods, Fermented foods in the twenty-first century, Health benefits of fermented foods and beverages.

UNIT II STARTER CULTURES AND FERMENTATIVE METABOLISM 9

Microorganisms and metabolism- Bacteria used in the manufacture of fermented foods, Yeasts and molds used in the manufacture of fermented foods. Fermentation and metabolism basics- Sugar metabolism, Protein metabolism, Other metabolic systems of bacteria, yeast and molds. Starter cultures History, Starter culture microorganisms- bacteria, yeast and mold starter cultures, Strain identification, Culture composition, Manufacture of starter cultures, Evaluation of culture performance, Usage of starter cultures, Starter culture maintenance- Bacteriophages and their control, Engineered phage resistance, Starter culture technology in the twenty-first century-Encapsulated and immobilized cells, Probiotics and culture adjuncts

UNIT III FERMENTED DAIRY, FRUIT AND VEGETABLE PRODUCTS 12

Fermented Dairy products Introduction, Consumption of cultured dairy products, Cultured dairy products- Yogurt, Cultured buttermilk, Sour cream, Kefir, Other cultured dairy products. Cheese- Introduction, Manufacturing principles, General steps in cheese making, Types of cheese, Cheese ripening, Microbial defects, Recent technological advances in cultured dairy products technology. Fermented Vegetable products- Introduction, Production principles, Manufacture of Sauerkraut, Principles of pickle production, fermented olives, Kimchi, Fermented vegetables and biogenic amines.Fermented Fruit products; Wine Basics, Grape composition, Wine manufacture principles-Harvesting and preparation of grapes, Crushing and maceration, Sulphur dioxide treatment, Separation and pressing, Fermentation, Yeast metabolism, Factors affecting yeast metabolism, Sulphur and nitrogen metabolism, stuck fermentations, Adjustments, blending, and clarification, Aging, Malolactic fermentation, Types of wine, Wine spoilage and defects

UNIT IV FERMENTED CEREAL AND LEGUME PRODUCTS 12

Fermented Cereal products Introduction, Biochemical changes during cereal fermentation, Rice based product- Idli batter method of preparation, Physicochemical and microbiological changes during fermentation, Antinutritional factors in idli, Nutritional composition and quality of idli. Wheat based product- Bread Wheat chemistry, Flour composition, Baker's yeast, Bread manufacturing principles, Modern bread technology, Sourdough fermentation, Bread spoilage and preservation, Recent technological advances in bread fermentation.

Millet and cereal based product - Koozh Introduction, Nutritional quality, methods of preparation by primary and secondary fermentation, changes during fermentation, safety issues of spontaneously fermented koozh.Beer- Beer spoilage and the origins of modern science, modern beer industry, Beer manufacturing principles, Enzymatic reactions malting and mashing, Hops, Kettle boil, Beer fermentation- Brewer's yeast, Inoculation, Yeast metabolism, Flocculation, Post-fermentation steps, Beer defects.

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Fermented Legumes- Major legumes used for fermentation, biochemical changes during fermentation, Soy based products- Soy sauce, Miso, Natto and Tempeh Manufacturing steps, biochemical and microbiological changes during fermentation.

UNIT V FERMENTED MEAT AND FISH PRODUCTS **6**

Fermented Meat product Sausages- History and evolution of the fermented meats industry, Meat composition, Fermentation principles, Meat starter cultures, Principles of fermented sausage manufacture, Manufacture of fermented sausage- Cutting and mixing, Stuffing, Casing materials, Fermentation, Cooking, drying, and smoking, Mold-ripening, Flavour of fermented meats, Defects and spoilage of fermented meats. Fermented fish products Fish sauces, Fish paste- Manufacturing steps, Biochemical changes, Storage and Shelf-life of products.

TOTAL:45 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 understand the concepts, principles and procedures involved in the area of fermented food production.
CO 2 evaluate the raw materials quality and their influence on the properties of final products
CO 3 describe malting, brewing, winemaking spirit and dairy production processes from raw materials to final products
CO 4 distinguish the characteristic faults of fermented food products

TEXT BOOKS:

1. Joshi, V. K. “Biotechnology Food Fermentation” Volume 1. Educational Publishers&Distributors, 2004.
2. Robert W. Hutkins. “Microbiology and Technology of Fermented Foods”, 2nd Edition, Blackwell, 2006
3. Hui Y. H “Handbook of Food and Beverage Fermentation Technology”. Marcel Dekker, 2004.
4. Wood, Brian J. B. “Microbiology of Fermented Foods” Volume 1 & 2. II Edition. BlackieAcademic & Professional, 1998.

REFERENCES:

1. Farnworth, Edward R. “Handbook of Fermented Functional Foods” II Edition. CRC Press, 2008.
2. Ramesh C. Ray and Didier Montet, “Fermented Foods, Part- II Technological Interventions”,CRC Press, 2017.
3. N.R. Reddy, “Legume based Fermented foods”, CRC Press, 2018.

Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	understand concepts, principles and procedures involved in the area of fermented food production.	1	3	3	1	2	1	3	2	3	-	-	3	3	3	-	1
CO2	evaluate raw materials quality and their influence on the properties of final products	1	3	3	1	2	1	3	2	3	-	-	3	3	3	-	1
CO3	describe malting, brewing, winemaking spirit and dairy production processes from raw materials to final products	1	3	3	1	2	1	3	2	3	-	-	3	3	3	-	1
CO4	distinguish the characteristic faults of fermented food products	1	3	3	1	2	1	3	2	3	-	-	3	3	3	-	1
Over all CO		1	3	3	1	2	1	3	2	3	-	-	3	3	3	-	1

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

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FT5004 FUNCTIONAL FOODS AND NUTRACEUTICALS L T P C
3 0 0 3

OBJECTIVES

The course aims to

- understand the basic concepts of Nutraceuticals and functional food, their chemical nature and methods of extraction.
- understand the role of Nutraceuticals and functional food in health and disease

UNIT I CLASSIFICATION AND SIGNIFICANCE 6

Introduction to Nutraceutical Industry Organizational elements, classification of nutraceuticals, dietary supplements, fortified foods, classification of functional foods and their benefits, Phytochemicals, zoo chemicals and microbes in food, plants, animals and microbes. Scope involved in the industry, Indian and global scenario.

UNIT II ANALYSIS OF PHYTOCHEMICALS 12

Sources and role of Isoprenoids, Isoflavones, Flavonoids, carotenoids, Tocotrienols, polyunsaturated fatty acids, sphingolipids, lecithin, choline.terpenoids . Qualitative and quantitative methods phytoestrogens in plants; isoflavones; flavonols, polyphenols, tannins, saponins, lignans, In vitro and In vivo methods for the assessment of antioxidant activity, Comparison of different In Vitro methods to evaluate the antioxidant, Optimising phytochemical release by process technology; Variation of Antioxidant Activity during technological treatments, new food grade peptidases from plant sources

UNIT III ROLE IN HEALTH AND TREATMENT OF DISEASE 12

Nutraceuticals and Functional foods in Gastrointestinal disorder, Cancer, CVD, Diabetic Mellitus; Importance and function of probiotics, prebiotics and synbiotics and their applications, Functional foods and immune competence; role and use in obesity and nervous system disorders

UNIT IV NUTRACEUTICAL STABILITY CONCERNS AND SHELF LIFE TESTING 6

Kinetic modelling of Chemical Reactions- Effect of Temperature on stability, effect of moisture on stability, effect of oxygen on stability, effect of ingredients on stability- accelerated shelf life testing.

UNIT V MARKETING, REGULATORY AND SAFETY ASPECTS 9

Health Claims, regulations and safety issues- International and national. Regulatory Background - Appearance of Permissive Health Claims on Food Products, Pursuit of Qualified Health Claims for Food Products, Issues and Implications for Investment Future Issues Nutrigenomics and Food Nanotechnology. Introduction to Consumer Marketing Issues for Nutraceuticals and Functional Foods, Potential Product Positioning. Physical Components, Emotional Components, Well-Being Components, Social Components, Financial Components

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 have knowledge of the basic concepts of nutraceuticals and its role in health and disease

CO 2 understand the chemical nature of nutraceuticals and methods of extraction

CO 3 understand the role of Nutraceuticals and functional food in health and disease

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TEXT BOOKS:

1. Bisset, Normal Grainger and Max Wich H “Herbal Drugs and Phytopharmaceuticals”, 2nd Edition, CRC, 2001.
2. Wildman, Robert “Handbook of Nutraceuticals and Functional Foods”. CRC, 2006.
3. Webb, P P. “Dietary Supplements and Functional Foods”. Blackwell, 2006.
4. Ikan, Raphael “Natural Products A Laboratory Guide”, 2nd Edition, Academic Press Elsevier, 2005.
5. Tipnis, H.P. “Bioavailability and Bioequivalence An Update” New Age International, 1996

REFERENCES:

1. Shi, John, Fereidoon Shahidi and Chi-Tang Ho “Asian Functional Foods”. CRC/Taylor&Francis, 2007.
2. Watson, Robald Ross “Functional Foods and Nutraceuticals in Cancer Prevention”.Blackwell Publishing, 2007.
3. Gibson, G.R. and C.M.Willams. “Functional Foods Concept to Product”. Woodhead, 2000.
4. Hanson, James R. “Natural Products The Secondary Metabolites”, Royal Society ofChemistry, 2003.
5. Benjamin .K. Simpson, Food Biochemistry and Food processing 2nd edition. .2012
   Wiley Blackwell
6. Malavolta, Mocchegiani (Ed) Molecular basis of nutrition and aging : Academic Press, Elsevier 2016

Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	knowledge of the basic concepts of Nutraceuticals and functional food.	2	-	-	-	-	-	2	2	-	-	-	2	2	1	2	-
CO2	understand the chemical nature of nutraceuticals and methods of extraction	2	-	-	-	3	-	3	3	-	-	-	2	2	1	-	-
CO3	understand the role of Nutraceuticals and functional food in health and disease	1	1	2	3	1	-	2	2	-	-	-	2	2	1	2	-
Over all CO		2	1	2	3	2		2	2	-	-	-	2	2	1	2	

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

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FT5005 **POST HARVEST TECHNOLOGY** **L T P C**
3 0 0 3

OBJECTIVES

The course aims to

- To develop the knowledge of students in the area of post-harvest processing of various foods and related technology.
- To enable students to appreciate the application of scientific principles in the processing of post harvesting materials.

UNIT I INTRODUCTION 7

Post-harvest engineering of crops – objectives - post harvest systems and losses in agricultural commodities structure, engineering properties of agricultural materials, optimum stage of harvest, importance of loss reduction; Post Harvest Handling operations. Pre-drying operation-Moisture content, RH measurement, air-grain measurement.

UNITII CLEANING, THRESHING AND GRADING 10

Threshing and shelling operation - principles and operation - various decorticators/dehullers/shellers, description of groundnut decorticators, maize shellers, etc. Cleaning – principles and machineries – Cleaning of grains, washing of fruits and vegetables, types of cleaners, screens, types of screens - rotary screens, vibrating screens, machinery for cleaning of fruits and vegetables (air cleaners, washers), cleaning efficiency, care and maintenance; Peeling, Sorting and Grading - grain grading system, effectiveness of separation and performance index., hydrothermal treatment and conditioning of grains, Size grading, colour grading, specific gravity grading; screening, equipment for grading of fruits and vegetables, grading efficiency. Separation - Magnetic separator, de-stoners, electrostatic separators, pneumatic separator

UNIT III MATERIAL HANDLING 10

Introduction to different conveying equipment used for handling of grains, fruits and vegetables; Scope and importance of material handling devices Classification, principles of operation, conveyor system selection/design**.** Belt conveyor Principle, characteristics, design, relationship between belt speed and width, capacity, inclined belt conveyors, idler spacing, belt tension, drive tension, belt tripper. Chain conveyor -Principle of operation, advantages, disadvantages, capacity and speed, conveying chain. Screw conveyor Principle of operation, capacity, power, troughs, loading and discharge, inclined and vertical screw conveyors. Bucket elevator Principle, classification, operation, advantages, disadvantages, capacity, speed, bucket pickup, bucketdischarge, relationship between belt speed, pickup and bucket discharge, buckets types, power requirement. Pneumatic conveying system types, air/product separators; Gravity conveyor design considerations, capacity and power requirement.

UNITIV PRINCIPLES AND PRACTICE OF STORAGE 10

Importance of scientific storage systems, post-harvest physiology of semi-perishables and perishables. Damages Direct damages, indirect damages, causes of spoilage in storage (moisture, temperature, humidity, respiration loss, heat of respiration, sprouting), destructive agents (rodents, birds, insects, etc.), sources of infestation and control.Storage structures Traditional storage structures, improved storage structures, modern storage structures; Farm silos Horizontal silos, tower silos, pit silos, trench silos, size and capacity of silos.

Storage of perishables Cold storage, controlled and modified atmospheric storage, hypobaric storage, evaporative cooling storage, conditions for storage of perishable products, control of temperature and relative humidity inside storage

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UNIT V PEST CONTROL 8

Primary and secondary insect pests, rodents and microorganisms of stored food grains and their control, integrated pest management, Fumigation and controlled atmosphere storage of food grains, Rodent Control.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 understand and identify the specific processing technologies used for different foods and the various products derived from these materials.

CO 2 understand the application of scientific principles in the processing technologies specific to the materials.

CO 3 understand and design storage systems for different food products

TEXTBOOKS:

1. Sahay, K. M. and K.K.Singh..“Unit operation of Agricultural Processing”, Vikas Publishing House., Pvt Ltd. 2004.
2. Chakravarty et al Handbook of Post-Harvest Technology Marcel Dekker. 2003.
3. Araullo, E.V., dePadna, D.B. and Graham, Michael. Rice Post Harvest Technology. International Development Res. Centre, Ottawa, Canada. 1976.
4. Birewar, B.R., Krishnamurthy, K., Girish, G.K., Varma, B.K. and Kanjilal, S.C.. Modern Storage Structures. Indian Grain Storage Institute, Hapur.1983.
5. Earle, R.L, “Unit Operations in Food Processing”. Pergamon Press. Oxford. U.K, 2003

Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	understand and identify the specific processing technologies used for different foods and the various products derived from these materials.	3	3	2	2	3	1	2	2	3	-	1	3	3	2	-	-
CO2	understand the application of scientific principles in the processing technologies specific to the materials.	3	2	2	1	3	2	-	-	3	-	-	2	3	1	1	-
CO3	understand and design storage systems for different food products	3	3	3	2	3	3	2	3	3	-	3	2	3	3	1	-
Over all CO		3	3	2	2	3	2	2	2	3	-	1	2	3	2	1	-

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

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FT5006 TECHNOLOGY OF PLANTATION CROPS AND SPICES L T P C
3 0 0 3

OBJECTIVES

The course aims to

- understand about coffee and its processing techniques, instant coffee, and quality grading, cocoa and its processing, chocolate manufacturing technology
- understand about different types of tea and its manufacturing techniques, instant tea, quality parameters of Tea
- understand about the processing and chemistry of major and minor spices

UNITI IMPORTANCE AND PROCESSING OF SPICES **9**

A. Major Spices

Post-Harvest Technology, composition, processed products of - Pepper, Cardamom, onion, ginger and turmeric – Oleoresins and essential oils – Method of manufacture – Chemistry of the volatiles –Enzymatic synthesis of flavour identical - Quality control, Flavor of major spices, Spice oil and oleoresins.

B. Minor Spices

Post-Harvest Technology, composition, processed products of - Cumin, Coriander, Cinnamon, fenugreek, pepper, Garlic, Clove and Vanilla - Oleoresins and essential oils – Method of manufacture – Chemistry of the volatiles – flavors, Quality control, Present trends in synthesis of volatiles – micro-organisms, plant suspension cultures

UNITII PROCESSING OF COFFEE AND TEA **12**

A. Coffee - Occurrence–chemical constituents–harvesting–fermentation of coffee beans–changes taking place during fermentation – drying – roasting – Process flow sheet for the manufacture of coffee powder – Instant coffee, methods, process and equipment involved–Chicory chemistry - Quality grading of coffee

B. Tea - Occurrence–chemistry of constituents–harvesting–types of tea–green, oolongandctc – Chemistry and technology of CTC tea – Manufacturing process and equipment involved – Green tea manufacture – Instant tea manufacture – Grading of tea, Processing and quality control.

UNITIII CHEMISTRY AND TECHNOLOGY OF COCOA AND COCOA PRODUCTS **9**

Occurrence - Chemistry of the cocoa bean – changes taking place during fermentation of cocoa bean – Processing of cocoa bean – cocoa powder – cocoa liquor, manufactureChocolates – Types – Chemistry and technology of chocolate manufacture – Quality control of chocolates

UNITIV PROCESSING OF COCONUT, OILPALM, ARECANUT AND CASHEW **9**

Processing of plantation crops – production and importance – processing of coconut, oil palm, arecanut, cashew– harvesting and stages of harvest – drying, cleaning and grading – production of value added products – packaging and storage of produces.

UNITV PACKAGING, GRADING AND QUALITY ANALYSIS OF SPICES **6**

Cleaning and grading of spices - packaging and storage of spices – grading specifications – AGMARK, ASTA, ESA specifications - processes involved in the manufacture of oleoresins and essential oils – quality analysis of spices and their derivatives

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 learn about processing steps involved in different types of coffee, tea, instant coffee, instant tea and quality grading parameters.

CO 2 acquire knowledge on cocoa processing and chocolate manufacturing technology

CO 3 learn about processing and chemistry of major and minor spices.

TEXT BOOKS:

1. Pandey, P. H. Post-Harvest Engineering of Horticultural Crops through objectives. Saroj Prakasam, Allahabad. 2002.
2. Pruthi, J.S. Major Spices of India – Crop Management and Post-Harvest Technology. Indian Council of Agricultural Research, Krish iAnusandhan Bhavan, Pusa, New Delhi. 1998.
3. Shanmugavelu KG , Kumar N, Production Technology of Spices and Plantation Crops, 1st Edition, Peter KV Publisher : Agrobios (India), 2018.

REFERENCES:

1. ASTA, Official analytical methods of the American Spice Trade Association, IV Edition, 1997.
2. Pruthi, J.S. Spices and Condiments Chemistry, Microbiology and Technology. 1st Edition. Academic Press Inc., New York, USA. 2011.

Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme specific outcome (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	processing steps involved in different types of coffee, tea, instant coffee, instant tea and quality grading parameters	1	1	2	1	-	-	1	2	1	-	-	2	2	1	-	-
CO2	knowledge on cocoa processing and chocolate manufacturing technology	1	1	2	-	-	-	1	2	1	-	-	2	2	1	-	-
CO3	processing and chemistry of major and minor spices.	1	1	2	1	-	-	1	2	1	-	-	2	2	1	-	-
Over all CO		1	1	2	1	-	-	1	2	1	-	-	2	2	1	-	-

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

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FT5007 **FOOD FLAVOURS** **L T P C**
3 0 0 3

OBJECTIVES

The course aims to

- describe manufacturing procedures used to produce the common food flavouring materials
- understand the flavour compounds involved in development of flavour
- understand the analytical techniques involved in flavour analysis
- understand mechanisms of flavour perception

UNIT I INTRODUCTION **9**

Problems in flavour research – classification of food flavours; chemical compounds responsible for flavour.

UNIT II FLAVOUR COMPOUNDS **9**

Chemical compound classes and their flavour responses; flavour development during biogenesis, flavour development during food processing; use of biotechnology to develop flavours.

UNIT III FLAVOUR PERCEPTION **9**

Flavour and taste perception, smell and taste sensation, olfaction, flavour compounds, volatile flavour compounds, chemesthesis and chemesthetic responses, tactile response, Aroma compounds, flavour profile, bio-flavour and reconstituted flavour

UNIT IV FLAVOUR ANALYSIS **9**

Subjective versus Objective methods of analysis; psychophysics and sensory evaluation; Instrumental analysis; sample handling and artifacts; data handling

UNIT V TEACHING FLAVOUR CONCEPTS **9**

Problem based learning; tongue and nose; Onion-Beverage-Maillard reaction-Thio-stench, Flavour legislation, flavour release, Useful principles to predict the performance of polymeric flavor delivery systems, Delivery of flavours from food matrices, Packaging and flavour compounds.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of course students will be able to

CO 1 understand mechanisms of flavour formation and flavour release
CO 2 explain metabolic routes leading to flavour formation in plants
CO 3 recognize off-flavour defects in foods and strategies of identification.

TEXT BOOKS:

1. Fisher, Carolyn and Thomas R. Scott. “Food Flavours Biology and Chemistry”. The RoyalSociety of Chemistry, 1997.
2. Heath, H.B. and G. Reineccius. “Flavour Chemistry and Technology”. CBS Publishers, 1996.
3. Reineccius, Gary. “Flavour Chemistry and Technology”. 2 nd Edition, Taylor & Francis, 2006.
4. Shahidi, Fereidoon and Chi-Tang Ho. “Flavour Chemistry of Ethnic Foods”. Kluwer AcademicPlenum, 1999.
5. Ashurst, Philip R. “Food Flavourings”. 3 rd Edition, Aspen Publications, 1999.

Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	understand mechanisms of flavor formation and flavor release	2	3	3	2	3	1	-	2	2	-	1	2	3	3	1	1
CO2	explain metabolic routes leading to flavorformation in plants	2	3	1	1	3	-	-	2	2	-	-	2	3	3	1	1
CO3	recognize off-flavor defects in foods and strategies of identification	2	3	3	3	3	1	-	3	2	-	1	2	3	3	1	1
Over all CO		2	3	2	2	3	1	-	2	2	-	1	2	3	3	1	1

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

FT5008 INSTRUMENTATION AND FOOD PROCESS CONTROL L T P C
3 0 0 3

OBJECTIVES

The course aims to

- Introduce the dynamic response of open and closed loop systems, control loop components and stability of control systems.
- Learn instrumentation for the measurement of key process variables in food processing
- Update the applications of sensors in food processing Industry

UNIT I PROCESS INSTRUMENTATION 12

Principles of measurements and classification of process instruments, measurement of temperature, pressure, fluid flow, liquid weight and weight flow rate, viscosity, pH, concentration, electrical and thermal conductivity, humidity of gases.

UNIT II OPEN LOOP SYSTEMS 7

Laplace transformation, application to solve ODEs. Open-loop systems, first order systems and their transient response for standard input functions, first order systems in series, linearization and its application in process control, second order systems and their dynamics; transportation lag.

UNIT III CLOSED LOOP SYSTEMS 7

Closed loop control systems, development of block diagram for feed-back control systems, servo and regulatory problems, transfer function for controllers and final control element, principles of pneumatic and electronic controllers, transient response of closed-loop control systems and their stability.

UNIT IV FREQUENCY RESPONSE 7

Introduction to frequency response of closed-loop systems, control system design by frequency response techniques, Bode diagram, stability criterion, tuning of controller settings

UNIT V ADVANCED SENSOR APPLICATIONS FOR FOOD PROCESSING 12

Ultrasound sensors - Electric impedance sensors - Gas sensors - Electronic noses, tongues and testers - Chemosensors, biosensors, immunosensors and DNA probes - Sensors for food flavourand freshness; Biosensors for process monitoring and quality assurance; Conductance/impedance techniques for microbial assay - Commercial devices based on biosensors; New biosensors.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of course students will be able to

CO 1 gain skills and knowledge in instrumentation and process control of the food process system.

CO 2 apply principles of process control to analyze the performance of industrial processes.

CO 3 apply concepts of measurement and sensor selection to specify, install, configure, calibrate, troubleshoot, and maintain various process instruments commonly used in industry

CO 4 understand the prerequisites of control strategies and design different process control systems

CO 5 evaluate the suitable controllers for different food processes.

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CO 6 enable students aware of recent developments in monitoring and control of food processes using sensors

TEXT BOOKS:

1. Seborg., Process Dynamics and Control, Wiley, 2016
2. Stephanopoulos, G., "Chemical Process Control", Prentice Hall of India, 2003.
3. Coughnowr, D., "Process Systems Analysis and Control ", 3rd Edition., McGraw Hill, New York, 2008.
4. E Kress-Rogers C J B Brimelow eds., Instrumentation and Sensors for the Food Industry 2nd Edition, 2001, CRC Press

REFERENCES:

1. Marlin, T. E., "Process Control ", 2nd Edition, McGraw Hill, New York, 2000.
2. Smith, C. A. and Corripio, A. B., "Principles and Practice of Automatic Process Control", 2nd Edn., John Wiley, New York, 1997.
3. Process Dynamics and Control, 4th Edition, Prentice Hall, 2003.
4. Manual for plant operators by Milk industry foundation, Washington, DC, 1959.
5. Process system analysis and control by Donald RC., 3rd edition, Mc-Graw Hill, 2017.
6. Process Instrumentation by Patranobish., 3rd edition, Tata Mc-Graw Hill, 2010.
7. Transducers and Instrumentation by Murty DVS., Prentice Hall of India, 2008.
8. Process Control Instrumentation Technology by Johnson C. 8th edition, Prentice Hall of India, 2006.

Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	have a comprehensive understanding of the principles and in instrumentation and process control of the food process systems	3	3	3	3	3	3	-	-	-	-	-	-	3	-	-	-
CO2	apply principles of process control to analyze the performance of industrial food processes	3	3	3	3	3	3	-	-	-	-	-	-	3	-	-	-
CO3	apply concepts of measurement and sensor selection to specify, install, configure, calibrate, troubleshoot, and maintain various process instruments commonly used in food	3	3	3	3	3	3	-	-	-	-	-	-	3	-	-	-

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	industry																
CO4	understand the prerequisites of control strategies and design different process control systems	3	3	3	3	3	3	-	-	-	-	-	-	3	-	-	-
CO5	evaluate the suitable controllers for different food processes	2	2	2	2	2	2	-	-	-		-	-	2	-	-	-
CO6	enable students aware of recent developments in monitoring and control of food processes using sensors	2	2	2	2	2	2	-	-	-	-	-	-	2	-	-	-
Over all CO		3	3	3	3	3	3	-	-	-	-	-	-	3	-	-	

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

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IB5072 **BIOLOGICAL SPECTROSCOPY** **L T P C**
3 0 0 3

OBJECTIVES

The course aims to

- deliver the knowledge of spectroscopic techniques and its functions
- provide the technical information of spectroscopy for biological applications

UNITI CIRCULAR DICHROISM (CD) AND OPTICAL ROTATORY DISPERSION (ORD)

Polarized light – optical rotation – circular dichroism – circular dichroism of nucleic acids and proteins.

UNIT II FLUORESCENCE AND RAMAN SPECTROSCOPY 10

Molecular energy level diagrams – principles of fluorescence and Raman – parameters for measurement – excited state processes - fluorescence polarization – Forster Resonance Energy Transfer – fluorescence quenching – single molecule spectroscopy - application to proteins and nucleic acids.

UNIT III NUCLEAR MAGNETIC RESONANCE 10

Chemical shifts – spin – spin coupling – relaxation mechanisms – nuclear over Hauser effect– multidimensional NMR spectroscopy – determination of macromolecular structure by NMR – magnetic resonance imaging.

UNIT IV MASS SPECTROMETRY AND X-RAY DIFFRACTION 15

Mass Spectrometry- Ion sources sample introduction – mass analysers and ion detectors – biomolecule mass spectrometry – peptide and protein analysis – carbohydrates and small molecules – specific applications.

X-Ray Diffraction- Scattering by x- rays – diffraction by a crystal – measuring diffraction pattern – Bragg reflection – unit cell – phase problem – anomalous diffraction – determination of crystal structure – electron and neutron diffraction.

UNIT V SPECIAL TOPICS AND APPLICATIONS 5

Electron microscopy – transmission and scanning electron microscopy – scanning tunnelling and atomic force microscopy – combinatorial chemistry and high throughput screening methods.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 understand the principle of spectroscopic techniques widely used in many quantitative experiments

CO 2 understand the central techniques associated with the elucidation of structure and composition molecules in natural and life sciences

CO 3 comprehend the high-resolution imaging techniques to assess surface and intracellular complexity.

TEXT BOOKS:

1. Banwell, Colin N., and Elaine M.McCash “Fundamentals of Molecular Spectroscopy”, 4 th Edition. TataMcGraw-Hill, 1995.
2. Hammes, Gordon G. “Spectroscopy for the Biological Sciences”. Wiley Interscience, 2005.
3. Pavia,Donald L., Gary M. Lampman and George S.Kriz “Introduction to Spectroscopy”. 3rd Edition. Thompson/Brooks/Cole, 2001.
4. Aruldas, G. “Molecular Structure and Spectroscopy”. 2nd Edition. PHI, 2007.
5. Siuzdak, Gary “Mass Spectrometry for Biotechnology”. Academic Press, 2005.

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Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	understand the principle of spectroscopic techniques widely used in many quantitative experiments	2	3	2	3	2	-	-	-	-	-	-	3	2	2	2	3
CO2	understand the central techniques associated with the elucidation of structure and composition molecules in natural and life sciences	2	2	2	3	2	-	-	-	-	-	-	2	2	2	2	3
CO3	comprehend the high-resolution imaging techniques to assess	2	2	2	3	2	-	-	-	-	-	-	2	2	2	2	3

	surface and intracellular complexity.																
Over all CO		2	2	2	3	2	-	-	-	-	-	-	2	2	2	2	3

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

FT5009 BAKING AND CONFECTIONERY TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES

The course aims to

- familiarize with the different methods of baking bread and recent advances in baking industry.
- learn microbiological aspects of bakery products, sanitation and hygiene of baking industries.

UNIT I INTRODUCTION TO BAKING 9

Classification of bakery products. Bakery ingredients and their functions-Essential ingredients Flour, yeast and sour dough, water, salt- Other ingredients Sugar, color, flavor, fat, milk, milk powder and bread improvers. Leaveners and yeast foods. Shortenings, emulsifiers and antioxidants.

UNIT II EQUIPMENTS 9

Introduction to utensils and equipments used in bakery industry with their purpose.Bulk handling of ingredients- Dough mixing and mixers, Dividing, rounding, sheeting, and laminating-Fermentation enclosures and brew equipment - Ovens and Slicers. Rheology of dough Farinograph, Amylograph, Alveograph and Extensiograph.

UNIT III BREAD MAKING PROCESS 9

The Chemistry of dough Development. Bread making methods- Straight dough/bulk fermentation Sponge and dough- Activated dough development- Chorley wood bread process- Dough retarding and freezing-emergency No time process. Advantages and disadvantages of various methods of bread-making. Characteristics of good bread Internal characters; external characters. Bread defects/faults and remedies. Spoilage of bread-Causes, detection and prevention.

UNIT IV BAKERY PRODUCTS 9

Production of cakes and cookies/ biscuits. Types of biscuit dough‘s –Developed dough, short dough‘s, semi-sweet, enzyme modified dough‘s and batters. Cake making Ingredients and their function Structure builders. Tenderizers, moisteners and flavor enhancers. Production process for Wafers- type of flour, raising agents and maturing. Other miscellaneous products-puff pastry, chemically leavened. Problems of baking.

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UNIT V CONFECTIONERY PRODUCTS 9

Definition, importance of sugar confectionery. General technical aspects of industrial sugar confectionery manufacture - compositional effects. Manufacture methods of high boiled sweets - Ingredients -.prevention of recrystalization and stickiness Types of confectionery products-Caramel, Toffee and Fudge and other confections-- ingredients - Formulation - Processing method- Quality control- Aerated confectionery- Methods of aeration- Manufacturing process-Chemistry of Hydrocolloids, Hydrocolloid pre treatment Processes - product quality parameters, faults and corrective measures. Spoilage of confectionery products.Optimization of ingredients for different types of bread, toffees and sugar boiled confectionary.

TOTAL:45 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 understand and optimize different food Ingredients in baking process.
CO 2 different methods of preparation of baking products
CO 3 understand the rheological properties and microbiological aspects of baking products

TEXT BOOKS:

1. Matz, Samuel A., —Bakery Technology and Engineering, 1992, 3rd Edition, Chapman & Hall, London.
2. Cauvain, Stanley P, and Young, Linda S., —Technology of Bread Making, 2007, springer

REFERENCES:

1. Edwards W.P. — Science of bakery products, RSC, UK, 2007
2. Samuel A. Matz., —Equipment for Bakers, Pan Tech International Publication. 1988.
3. Sugar Confectionery manufacture-(Ed) E.B.Jackson, 2nd Edition, Blackie Academic and professional, Glasgow,1995

Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	understand and optimize different food Ingredients in baking process.	2	2	1	-	1	1	-	1	-	-	-	2	2	1	-	-
CO2	different methods of preparation of baking products	2	2	1	-	1	1	-	1	-	-	-	2	2	1	-	-
CO3	understand the rheological properties and microbiological aspects of baking products.	2	2	1	-	1	1	-	1	-	-	-	2	2	1	-	-
Over all CO		2	2	1	-	1	1	-	1	-	-	-	2	2	1	-	-

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

FT5010 FOOD PLANT DESIGN AND LAYOUT L T P C
3 0 0 3

OBJECTIVES

The course aims to

- understand the process development and design consideration of food plant layout.
- understand the quantitative analysis of cost estimation and practical consideration of food plant layout.

UNIT I OVERALL DESIGN OF AN ENTERPRISE 9

Plant design, sales planning for plant design.Plant Location, levels of Plant location. Location of layout location factors, plant site selection. Location theory and models, industrial buildings and grounds. Classification of Dairy and Food Plants, farm level collection and Chilling centre. Space requirement.

UNIT II PREPARATION OF A PLANT LAYOUT 9

Plant Layout problem, importance, objectives, classical types of layouts. Evaluation of Plant Layout.Advantages of good layout. Organizing for Plant Layout, Data forms.

UNIT III DEVELOPMENT AND PRESENTATION OF LAYOUT 9

Development of the pilot layout, constructing the detailed layout Functional design Siting of different sections in a plant, Layout installations.

UNIT IV QUANTITATIVE ANALYSIS FOR PLANT LAYOUT 9

Engineering economy, Linear programming, Queuing theory, Common Problems in Plant Layout and Process scheduling, Siting of Process sections, Equipment selection and capacity determination, Arrangement of process, and service equipment, Estimation of Services and Utilities, Office layout, line balancing, Flexibility.

UNIT V PRACTICAL LAYOUTS 9

Practical layouts Common materials of construction of Food plant, building.Maintenance of Food Plant Building, Illumination and ventilation, Cleaning & sanitization, painting and colour coding, Fly and insect control.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of course students will be able to

CO 1 design and setting up of new food processing plant as Entrepreneur and/or consultant

CO 2 help to minimize the food industry losses and maximize the processed food production

CO 3 prepare cost estimate and economic analysis of food industry

TEXT BOOKS:

1. M Moore, Mac Millan, “Plant Layout & Design”. Lames, New York, 1971.
2. H.S. Hall & Y.S. Rosen, “Milk Plant Layout”. FAO Publication, Rome, 1963.
3. Antonio Lopez-Gomez, Gustavo V. Barbosa-Canovas,“Food Plant Design (Food Science and Technology)”, CRC Press, 2005.

REFERENCES:

1. “Food plant engineering system” by Theunis C. Robberts, II Edition, CRC Press, Washington,2013.
2. “Food plant economic” by Zacharias B. Maroulis and George D. Saravacos published by Taylor and Francis Group, LLC, 2008
3. John Holah, HuubLelieveld, “Hygienic Design of Food Factories”, Woodhead Publishing, 2011.
4. Slade, S. “Food Processing Plant” Vol. 1, Leonard Hill Books, 1990.

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Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme specific outcome (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	design and setting up of new food processing plant as Entrepreneur and/or consultant	3	3	3	2	3	3	2	3	3	1	3	2	3	3	1	2
CO2	help to minimize the food industry losses and maximize the processed food production	2	3	2	3	3	1	2	1	3	1	3	2	3	3	2	2
CO3	prepare cost estimate and economic analysis of food industry	2	3	2	3	2	3	-	3	3	1	3	2	3	3	2	2
Over all CO		2	3	3	3	3	2	1	2	3	1	3	2	3	3	2	2

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

IB5073 **CHEMICAL REACTION ENGINEERING** **L T P C**
2 1 0 3

OBJECTIVES

The course aims to
- impart knowledge of reaction rate theories and reaction mechanisms to deriveexpressions forrate equations mass and energy balances.
- provide a core foundation for the analysis and design of chemical reactors.

UNITI SCOPE OF CHEMICALREACTION ENGINEERING 9

Broad outline of chemical reactors; rate equations; concentration and temperature dependence; development of rate equations for different homogeneous reactions.Industrial scale reactors.

UNITII I DEAL REACTORS 9

Isothermal batch, flow, semi-batch reactors; performance equations for single reactors; multiple reactor systems; multiple reactions.

UNIT III IDEAL FLOW AND NON IDEAL FLOW 9

RTD in non-ideal flow; non-ideal flow models; reactor performance with non-ideal flow.

UNIT IV GAS-SOLID, GAS-LIQUID REACTIONS 9

Resistances and rate equations; heterogeneous catalysis; reactions step; resistances and rate equations.

UNIT V FIXED BED AND FLUID BED REACTORS 9

G/L reactions on solid catalysis; trickle bed, slurry reactors; three phase-fluidized beds; reactors for fluid-fluid reactions; tank reactors.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 write the rate equation for any type of reaction

CO 2 design reactors for homogeneous and heterogeneous reactions and optimize operating conditions

CO 3 relate and calculate the conversions, concentrations and rates in a reaction and identify, formulate and solve chemical engineering problems.

TEXT BOOKS:

1. Levenspiel O. Chemical Reaction Engineering. III Edition. John Wiley.1999.
2. Fogler H.S. Elements of Chemical Reaction Engineering. Prentice Hall India.2002

REFERENCES:

1. MissenR.W.,MimsC.A.,SavilleB.A.IntroductionToChemicalReactionEngineering and Kinetics. John Wiley.1999.

Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	write the rate equation for any type of reaction	3	3	2	1	1	1	-	-	1	1	-	2	3	2	1	1
CO2	design reactors for homogeneous and heterogeneous reactions and optimize operating conditions	3	3	2	1	1	1	-	-	1	1	-	2	2	2	1	1
CO3	relate and calculate the conversions, concentrations and rates in a reaction and identify, formulate and solve chemical engineering problems.	3	3	2	1	1	1	-	-	1	1	-	2	2	2	1	1
Over all CO		3	3	2	1	1	1	-	-	1	1	-	2	2	2	1	1

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

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FT5011 **FOOD BIOTECHNOLOGY** **L T P C**
3 0 0 3

OBJECTIVES

The course aims to

- acquaint with the fundamentals of biotechnology in relation to raw materials for food processing.
- enable the students to learn about food fermentations, waste utilization and use better genetic resources in food industry.

UNIT I INTRODUCTION TO GENETIC MATERIAL 9

Genetic material, Chemical nature, properties, and functions of the genetic material, Overview of bacterial DNA replication Origin of replication, Enzymes and proteins required for DNA replication, Overview of replication Bacterial transcription Types of RNA and overview of bacterial transcription, Bacterial translation Genetic code and overview of bacterial translation, Mutation and DNA repair Types of mutation, mechanisms of repair of damaged DNA (photo reactivation, excision repair, recombination repair, SOS repair and mismatch repair).

UNIT II OVERVIEW OF GENETIC RECOMBINATION IN BACTERIA 9

Bacterial transformation Griffith experiment, Avery, MacLeod & McCarty experiment and Mechanism of bacterial transformation. Bacterial Conjugation Lederberg & Tatum experiment, Bernard &Devis ('U' tube experiment), F factor and mechanism of bacterial conjugation. Bacterial Transduction Structure of bacteriophage, replication cycle of bacteriophage and Mechanism of bacterial transduction. Regulation of gene expression in prokaryotes Fine structure of gene (Operator, Promoter, Structural and regulatory gene sequence) and Mechanism of bacterial gene expression regulation - Lac operon.

UNIT III INTRODUCTION TO RECOMBINANT DNA TECHNOLOGY 9

DNA modifying enzymes Restriction enzymes and other modifying enzymes, Cloning vectors Introduction, plasmid and other vectors, Steps of gene cloning Isolation and purification of insert DNA, selection and isolation of vector DNA, construction of recombined DNA, and introduction of recombined DNA into host cell, identification and selection of cells containing cloned genes.

UNIT IV DNA LIBRARIES, SEQUENCING AND AMPLIFICATION OF DNA 9

DNA Library Construction of genomic and cDNA libraries, Artificial chromosomes – BACs and YACs, Screening of DNA libraries using nucleic acid probes and antisera.

DNA Amplification- Maxam Gilbert's and Sanger's methods of DNA sequencing. Inverse PCR, Nested PCR, AFLP-PCR, Allele specific PCR, Assembly PCR, Asymmetric PCR, Hot start PCR, inverse PCR, Colony PCR, single cell PCR, Real-time PCR/qPCR – SYBR green assay, Taqman assay, Molecular beacons. Site directed mutagenesis.

UNIT V TRANSGENIC TECHNOLOGY & APPLICATIONS IN FOODS 9

DNA microinjection, Retroviral vectors, Transgenic animals – Knock in and knock out animals, Transgenic plants – Ti plasmid. Genetically engineered proteins Bovine Somatotropin in Milk; Genetically engineered bacteria Chymosin Lite beer; Tryptophan; Transgenic plants CalgeneFlavrSavr^{TM} tomato, Monsanto Round-Up TM Ready, Ciba Geigy Basta TM resistant crops; Edible vaccines Cholera vaccine in potatoes; Transgenic Fish Atlantic salmon.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 understand the Basics of Biotechnological concepts.
CO 2 understand the genetically modified plants, animals and modified microorganisms
CO 3 familiarize in Food Technological applications of genetically engineered plants

TEXT BOOKS:

1. B.D. Singh. “Biotechnology - Expanding Horizons”, Kalyani Publishers, 2014.
2. Meenakshi Paul. “Biotechnology and Food Processing Mechanics”, Gene-Tec Books, 2007.
3. James D. Watson. “Molecular Biology of the Gene”, 7th Edition. Benjamin Cummings, 2013.
4. Oliver Brandenberg, Zephaniah Dhlamini, Alessandra Sensi, Kakoli Ghosh and Andrea
5. Sonnino. “Introduction to Molecular Biology and Genetic Engineering”. FAO, 2011.
6. S.B. Primrose and R.M. Twyman. “Principles of Gene Manipulation and Genomics”, 7th Edition. Blackwell Publishing, 2006.
7. Ashok Agarwal and Pradeep Parihar. “Industrial Microbiology Fundamentals and Applications” Agrobios, 2005.

REFERENCES:

1. Bains W. “Biotechnology from A to Z”, Oxford Univ. Press., 2004, 3rd Edition
2. Joshi VK & Pandey A. “Biotechnology Food Fermentation”., Vols. I, 2nd Edition. Education Publ. 1999.
3. Knorr D. “Food Biotechnology”., Marcel Dekker., 1985.
4. Lee BH. “Fundamentals of Food Biotechnology”., VCH., 1996.
5. Perlman D. “Annual Reports of Fermentation Processes”., 1979.

Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	understand the Basics of Biotechnological concepts.	1	2	3	3	3	3	2	2	3	-	-	3	3	3	-	-
CO2	Understand the geneticallly modified plants, animals and modified microorganisms.	1	2	3	3	3	3	2	2	3	-	-	3	3	3	-	-
CO3	familiarize in Food Technological applications of geneticallly engineered plants.	1	2	3	3	3	3	2	2	3	-	-	3	3	3	-	-
Over all CO		1	2	3	3	3	3	2	2	3	-	-	3	3	3	-	-

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

FT5012 FOOD ALLERGENS AND TOXICOLOGY L T P C
3 0 0 3

OBJECTIVES

The course aims to

- familiarize with hazards, and toxicity associated with food and their implications for health.
- know the various kinds of allergens and basis of allergic reactions
- familiarize with various natural toxins in food.

UNIT I INTRODUCTION 9

Definition and need for understanding food toxicology; Hazards - Microbiological, nutritional and environmental. Basics of immune resources - humoral and cell media resources.Allergen and mechanism of allergic resources.

UNITII FOOD ALLERGY AND SENSITIVITY 9

Chemistry of food allergens, celiac disease, food disorders associated with metabolism, lactose intolerance, and asthma

UNITIII PRINCIPLES OF TOXICOLOGY 9

Natural food toxicants - toxicity of mushroom alkaloids, seafood, vegetables, fruits, pulses, and antinutritional compounds. Biological factors that influence toxicity, toxin absorption in the G.I. track, Industrial microflora, blood, brain barrier, storage and excretion of toxins

UNIT IV DETERMINATION OF TOXICANTS IN FOOD SAMPLING 9

Quantitative and qualitative analysis of toxicants in foods; Biological determination of toxicants Assessment of food safety – Risk assessment and risk benefit indices of human exposure, acute toxicity, mutagen city and carcinogenicity, reproductive and developmental toxicity, neurotoxicity and behavioural effect, immunotoxicity.

UNITV TOXICANTS FORMED DURING FOOD PROCESSING 9

Intentional direct additives, preservatives, nitrate, nitrite, and N- nitroso compound flavour enhancers, food colours, indirect additives, residues and contaminants, heavy metals, other organic residues and packaging materials.Toxicity of heated and processed foods, food carcinogens and mutagens - Polycyclic aromatic hydrocarbons, N - nitrosamines, Acrylamide and their mode of action.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 understand the basics of immune system and its response
CO 2 learn about allergens,natural toxins and their nature
CO 3 understand the toxin production during food processing and their detection

TEXTBOOKS:

1. Helferich, William and Carl K.Winter “Food Toxicology” CRC Press, 2001.
2. Alluwalia, Vikas “Food Hygiene and Toxicology” Paragon International Publishers, 2007.
3. Shibamoto, Takayuki and Leonard F.Bjeldanzes “Introduction to Food Toxicology” 2nd Edition.Academic Press, 2009.
4. Maleki, Soheila J. A.Wesley Burks, and RickiM.Helm “Food Allergy” ASM Press, 2006.

REFERENCES:

1. Labbe, Ronald G. and Santos Garcia “Guide to Food Borne Pathogens” John Wiley & Sons,2001.
2. Cliver, Dean O. and Hans P. Riemann “Food Borne Diseases” 2 nd Edition. AcademicPress/Elsevier, 2002.
3. Riemann, Hans P. and Dean O. Cliver “Food Borne Infections and Intoxications” 3rd Edition. Academic Press/Elsevier, 2006.

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Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	learnt basics about the immune system and its response.	2	-	-	2	2	-	-	2	-	-	2	1	1	-	1	1
CO2	learnt and about allergens, natural toxins and their nature.	2	-	2	-	2	-	-	2	-	-	2	3	3	-	-	1
CO3	toxin production during food processing and their detection.	2	-	2	-	2	-	-	2	-	-	2	3	3	-	-	1
Over all CO		2	-	2	2	2	-	-	2	-	-	2	3	3	-	1	1

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

GE5076 PROFESSIONAL ETHICS IN ENGINEERING L T P C
3 0 0 3

OBJECTIVES

The course aims to

- identify the core values that shape the ethical behaviour of an engineer.
- utilize opportunities to explore one's own values in ethical issues
- learn about the ethical concerns and conflicts
- enhance familiarity with codes of conduct.
- increase the ability to recognize and resolve ethical dilemmas.

UNITI ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories.

UNIT II ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study.

UNIT III ENGINEER'S RESPONSIBILITY FOR SAFETY 9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing Risk – The Government Regulator's Approach to Risk - Chernobyl Case Studies and Bhopal

UNIT IV RESPONSIBILITIES AND RIGHTS 9

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

UNIT V GLOBAL ISSUES 9

Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 apply ethics in society,
CO 2 have responsibility of an engineer towards safety
CO 3 acquire social responsibility in society

TEXT BOOKS:

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York (2005).
2. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics Concepts and Cases", Thompson Learning, (2000).

REFERENCES:

1. Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, 1999.
2. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, 2003
3. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, 2001.
4. David Ermann and Michele S Shauf, "Computers, Ethics and Society", Oxford University Press, 2003.

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Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	apply ethics in society.	-	-	-	3	-	3	2	3	3	-	2	3	-	-	2	2
CO2	have responsibility of an engineer towards safety.	-	1	2	2	-	3	3	3	3	-	-	3	-	-	2	2
CO3	acquire social responsibility in society	-	-	-	-	-	3	2	3	3	-	-	3	-	-	2	2
Over all CO		-	-	2	-	-	3	3	3	3	-	-	3	-	-	2	2

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

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FT5013 TRADITIONAL AND ORGANIC FOODS L T P C
3 0 0 3

OBJECTIVES

The course aims to

- understand the traditional methods of food processing and production.
- understand the commercialization and health aspects of traditional and organic foods.

UNIT I HISTORICAL AND CULTURAL PERSPECTIVES 9

Food production and accessibility - subsistence foraging, horticulture, agriculture and pastoralization, origin of agriculture, earliest crops grown. Food as source of physical sustenance, food as religious and cultural symbols; importance of food in understanding human culture - variability, diversity, from basic ingredients to food preparation; impact of customs and traditions on food habits, heterogeneity within cultures (social groups) and specific social contexts - festive occasions, specific religious festivals, mourning etc. Kosher, Halal foods; foods for religious and other fasts.

UNIT II TRADITIONAL METHODS OF FOOD PROCESSING 9

Traditional methods of milling grains – rice, wheat and corn – equipment and processes as compared to modern methods. Equipment and processes for edible oil extraction, paneer, butter and ghee manufacture – comparison of traditional and modern methods. Energy costs, efficiency, yield, shelf life and nutrient content comparisons. Traditional methods of food preservation – sun-drying, osmotic drying, brining, pickling and smoking.

UNIT III TRADITIONAL FOOD PATTERNS 9

Typical breakfast, meal and snack foods of different regions of India.Regional foods that have gone Pan Indian / Global. Popular regional foods; Traditional fermented foods, pickles and preserves, beverages, snacks, desserts and sweets, street foods; IPR issues in traditional foods

UNIT IV COMMERCIAL PRODUCTION OF TRADITIONAL FOODS 12

Commercial production of traditional breads, snacks, ready-to-eat foods and instant mixes, frozen foods – types marketed, turnover; role of SHGs, SMES industries, national and multinational companies; commercial production and packaging of traditional beverages such as tender coconut water, neera, lassi, buttermilk, dahi. Commercial production of intermediate foods – ginger and garlic pastes, tamarind pastes, masalas (spice mixes), idli and dosa batters.

UNIT V HEALTH ASPECTS 6

Comparison of traditional foods with typical fast foods / junk foods – cost, food safety, nutrient composition, bioactive components; energy and environmental costs of traditional foods; traditional foods used for specific ailments /illnesses.Organic foods types of organic foods, identifying organic foods, organic food & preservatives

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 understand the historical and traditional perspective of foods and food habits

CO 2 understand the wide diversity and common features of traditional Indian foods and meal patterns.

CO 3 familiarize with health benefits of bioactive components rich traditional foods over junk foods

TEXT BOOKS:

1. Sen, Colleen Taylor “Food Culture in India” Greenwood Press, 2005.
2. Davidar, Ruth N. “Indian Food Science A Health and Nutrition Guide to Traditional Recipes,East West Books, 2001.

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Course Articulation Matrix

Course outcomes	Statement	Programme outcomes (PO)												Programme specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	understand the historical and traditional perspective of foods and food habits	1	1	1	1	1	1	1	2	3	-	-	2	3	3	-	-
CO2	understand the wide diversity and common features of traditional Indian foods and meal patterns	1	1	1	1	1	1	1	2	3	-	-	2	3	3	-	-
CO3	familiarize with health benefits of bioactive components rich traditional foods over junk foods.	1	1	1	1	1	1	1	2	3	-	-	2	3	3	-	-
Over all CO		1	1	1	1	1	1	1	2	3	-	-	2	3	3	-	-

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

FT5014 FOOD PROCESS ECONOMICS AND INDUSTRIAL MANAGEMENT L T P C
3 0 0 3

OBJECTIVES

The course aims to

- introducethe students about the process economics and industrial management principles.
- improve the management and planning skills in students thus enabling them for functional role in industries.

UNITI PRODUCTION MANAGEMENT AND ORGANISATION 15

Planning, organization, staffing, coordination, directing, controlling, communicating, organization as a process and a structure; types of organizations Method study; work measurement techniques; basic procedure; motion study; motion economy; principles of time study; elements of production control; forecasting; planning; routing; scheduling; dispatching; costs and costs control, inventory and inventory control.

UNIT II ENGINEERING ECONOMICS FOR PROCESS ENGINEERS- INTEREST, INVESTMENT COSTS AND COST ESTIMATION 10

Time Value of money; capital costs and depreciation, estimation of capital cost, manufacturing costs and working capital, invested capital and profitability.

UNITIII PROFITABILITY, INVESTMENT REPLACEMENT 8

Estimation of project profitability, sensitivity analysis; investment alternatives; replacement policy; forecasting sales; inflation and its impact.

UNIT IV ANNUAL REPORTS AND ANALYSIS OF PERFORMANCE 4

Principles of accounting; balance sheet; income statement; financial ratios; analysis of performance and growth.

UNITV ECONOMIC BALANCE AND QUALITY AND QUALITY CONTROL 8

Essentials of economic balance – Economic balance approach, economic balance for insulation, evaporation, heat transfer. Elements of quality control, role of control charts in production and quality control.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 perform economic analysis for process to calculate equipment cost and profitability.
CO 2 evaluate the economic feasibility analysis of an food industry.
CO 3 perform various aspects behind management and organization that will enable the students to perform as efficient managers

.

TEXT BOOKS:

1. Peters, M. S., and Timmerhaus, C. D., “Plant Design and Economics for Chemical Engineers”,5th Edition., McGraw Hill, 2002.
2. Holand, F.A., Watson, F.A. and Wilkinson, J.K., " Introduction to process Economics ", 2nd Edition., John Wiley, 1983.
3. Narang, G.B.S. and Kumar, V., “Production and Costing”, Khanna Publishers, New Delhi, 1988.

REFERENCES:

1. Allen, L.A., “Management and Organization”, McGraw Hill, 1958.
2. Perry, R. H. and Green, D., “Chemical Engineer’s Handbook “, 9th Edition., McGraw Hill, 2018.

Course Articulation Matrix

Course outcomes Statement		Programme outcome (PO)												Program Specific Outcomes (PSO)			
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO1	perform economic analysis for process to calculate equipment cost and profitability	3	3	1	-	1	1	1	1	2	2	3	2	2	2	1	1
CO2	evaluate the economic feasibility analysis of an food industry.	3	3	1	-	1	1	1	1	2	2	3	2	2	2	1	1
CO3	perform various aspects behind management and organization that will enable the students to perform as efficient managers	1	1	2	-	1	1	1	2	2	2	3	2	2	2	1	1
Over all CO		2	2	1	-	1	1	1	2	2	2	3	2	2	2	1	1

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

FT5015 FOOD SUPPLY CHAIN MANAGEMENT L T P C
3 0 0 3

OBJECTIVES

The course aims to

- introduce students to key aspects of supply chain (SC) management which are critical to improving the overall resilience of the global food supply network.
- make them aware about variousglobal regulatory guidelines in food supply management.

UNIT I INTRODUCTION 9

Supply chain, logistics, Evolution of logistics concept, Logistical mission and strategic Issues, Logistics in India, Importance of logistics management, Strategic logistics planning process, Operational objectives, Components of logistics management, Functions of logistics management, Integrated logistics system, Agribusiness Environment & Policy - Agricultural Production Management - Business Ethics & Global Business Environment Sources of cereals and legumes, fruits and 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.

UNIT II LOGISTICS, SUPPLY AND DISTRIBUTION 9

Principles of Logistics Production and sale of food products at global 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
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

UNIT III MANAGEMENT CHALLENGES IN COLD CHAIN 9

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 - Fresh Food and Supply Chain Management Challenges, Life Cycle Assessment Studies of Food Product, Retail logistics changes and challenges Retail logisticsand 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, Value Chain, Global Value Chain

UNIT IV FOOD SAFETY MANAGEMENT 9

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, Traceability system In order to nurture a diverse viewpoint capable of understanding and analysing traceability, Recalls

UNIT V QUALITY CONTROL AND MANAGEMENT REGULATION 9

Organizational Behaviour - Human Resource Management - Financial Management of Agribusiness Managerial Accounting and Control, Quality Management in Agribusiness - Agribusiness and Society International food Legislation & Standards Concepts and trends in food legislation. International and federal standards Codex Alimentarius, ISO series, food safety

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in USA.Legislation in Europe EU, Enforcers of Food Laws Approval Process for Food Additives Nutritional Labeling. Distribution - 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

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 assess the impact of different SC strategies on the competitive strategy in the Food and Drinks industry.
CO 2 design a successful collaborative initiative through the use of frameworks and tools.
CO 3 examine the challenges around managing sustainable supply chains.

REFERENCES:

1. Supply Chain Management Theories & Practices, R. P. Mohanty, S. G. Deshmukh, Dreamtech Press, 2005.
2. Total Supply Chain Management by Ron Basu, J. Nevan Wright, 1st edition 2008, Elsevier
3. Supply Chain Management, Chopra and peter, Pearson, 5th edition, 2013
4. Logistics Engineering and Management, Blanchard, pearson, 6th edition 2004

Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	assess the impact of different SC strategies on the competitive strategy in the Food and Drinks industry.	1	3	3	3	2	1	1	1	2	-	1	2	3	2	1	1
CO2	design a successful collaborative initiative through the use of frameworks and tools.	3	3	3	3	2	1	1	1	2	-	1	2	3	2	1	1
CO3	examine the challenges around managing sustainable supply chains.	2	3	-	3	1	1	1	1	2	-	1	2	3	2	1	1
CO4	evaluate the risk inherent in the SC through the application of tools and techniques learnt.	1	3	-	3	3	1	1	1	2	-	1	2	3	2	1	1
Over all CO		2	3	1	3	2	1	1	1	2	-	1	2	3	2	1	1

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

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FT5016 **FOOD PLANT EQUIPMENT DESIGN**

L T P C
2 1 0 3

OBJECTIVES

The course aims to

- understand the engineering properties of different materials for the development of food plant equipment
- understand the design of different processing requirement for food industry.

UNIT I MATERIALS AND PROPERTIES 9

Materials for fabrication, mechanical properties, ductility, hardness, corrosion, protective coatings, corrosion prevention linings equipment, choice of materials, material codes

UNIT II DESIGN CONSIDERATIONS 9

Stresses created due to static and dynamic loads, combined stresses, design stresses and theories of failure, safety factor, temperature effects, radiation effects, effects of fabrication method, economic considerations

UNIT III DESIGN OF STORAGE VESSEL AND EXCHANGERS 9

Design of pressure and storage vessels Operating conditions, design conditions and stress; Design of shell and its component, stresses from local load and thermal gradient, mountings and accessories.

Design of heat exchangers Design of shell and tube heat exchanger, plate heat exchanger, scraped surface heat exchanger, sterilizer and retort.

Design of agitators and separators Design of agitators and baffles; Design of agitation system components and drive for agitation

UNIT IV DESIGN OF DRYER, FREEZER AND FERMENTERS 9

Design of freezing equipment Design of icecream freezers and refrigerated display system Design of dryers Design of tray dryer, tunnel dryer, fluidized dryer, spray dryer, vacuum dryer, freeze dryer and microwave dryer

Design of fermenters Design of fermenter vessel, design problems

UNIT V EXTRUDERS AND EQUIPMENT SAFETY 9

Extrusion cookers - cold extrusion, single and twin screw extrusion- Low pressure and high pressure extrusion - properties of Food materials and its significance in equipment design - processing and handling - Cold and hot extruder design, design of screw and barrel, design of twin screw extruder.

Hazards in process industries, analysis of hazards, safety measures, safety measures in equipment design, pressure relief devices

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO1 understand principle and working of food processing equipment.
CO2 familiarize with the design of advanced machinery available for food processing sectors
CO3 apply their knowledge to design projects for setting up a food processing industry.

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TEXTBOOKS:

1. R. Paul Singh and Dennis R. Heldman. Introduction to Food Engineering, 5th Edition.
Elsevier, Amsterdam, The Netherlands.2014.
2. Albert Ibarz and Gustavo V. Barbosa-Cánovas. Unit Operations in Food Engineering. CRC Press, Boca Raton, FL, USA.2003.
3. George D. Saravacos and Athanasios E. Kostaropoulos. Handbook of Food Processing Equipment. Springer Science+Business Media, New York, USA.2002.
4. R. K. Sinnott. Chemical Engineering, Vol. 6, Chemical Engineering Design, 3rd Edition. Butterworth-Heinemann, Oxford, UK.1999.
5. Kenneth J. Valentas, Enrique Rotstein and R. Paul Singh. Handbook of Food Engineering Practice. CRC Press, Boca Raton, FL, USA. 1997.

REFERENCES:

1. Peter F. Stanbury, Allan Whitakar and Stephen J. Hall. 2013, Principles of Fermentation Technology, 2nd Edition. Elsevier Science Ltd., Burlington, MA, USA.
2. J.F. Richarson and D.G. Peacock. Coulson &Richardsons's ChemicalEngineering, Vol. 3, Chemical &Biochemical Reactors & Process Control, 3rd Edition. Elsevier Butterworth- Heinemann, Amsterdam, The Netherlands. 1994.
3. James R. Couper, W. Roy Penney, James R. Fair and Stanley M. Walas Chemical Process Equipment Selection and Design. Elsevier Inc. 2012.
4. Mahajani, V. V. and Umarji, S. B., Process equipment design, 4th edition, 2009, Macmillan publishers.
5. Bhattacharyya, B. C., Introduction to Chemical Equipment design, 2008, CBS Publishers and Distributors.
6. Geankoplis C. J. Transport processes and unit operations,1983, Prentice-Hall

Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	understand principle and working of food processing equipment.	3	3	3	1	2	1	-	2	3	-	2	2	3	2	2	-
CO2	familiarize with the design of advanced machinery available for food processing sectors	3	3	3	1	2	1	-	2	3	-	2	2	3	2	2	-
CO3	apply their knowledge to design projects for setting up a food processing industry.	3	3	3	1	2	1	-	2	3	-	2	2	3	2	2	-
Over all CO		3	3	3	1	2	1	-	2	3	-	2	2	3	2	2	-

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

FT5017 FOOD INGREDIENTS AND ADDITIVES L T P C
3 0 0 3

OBJECTIVES

The course aims to

- understand the need of different food ingredients and additives in the development of valuable food products.
- understand the law, regulation and standards involved in use of food additives

UNITI INTRODUCTION 9

Definition, role of food additives, classification of food additives based on their role, Risks and benefits of food additives,Legal and regulations- INS numbering system, General standards for food additives/Codex standards, safety requirements of food additives- role of JECFA in safety assessment of food additives, Principles of safety assessment- Food additive intake assessment methods, Procedures to fix ADI and maximum levels of food additives, ADI Calculation, Excessive food additive intakes and population risk groups, Case studies on risk assessment of food additives, Status of food additives with respect to Indian laws- GMP and permissible upper levels of food additives under Indian food laws.

UNITII ACIDITY REGULATORS, ANTIOXIDANTS AND ANTIMICROBIAL AGENTS 9

Acidity Regulators – definition, chemical structure, role and importance, pH modulation and taste, acidity profile, permitted acidity regulators, levels of usage and food applications. Antioxidants - Chemistry of oxidative deterioration of food and its constituents and its effect on the quality; defining antioxidant; water soluble and oil soluble antioxidants and their chemical structure, permitted antioxidants; mechanism of action, permitted levels and food application.

Preservatives of chemical and microbial origin; mode of action on spoilage organisms and pathogens, factors affecting the performance of preservatives, active forms of preservatives, necessity in a food and levels of usage; permitted preservatives and food applications. Case studies / illustrations.

UNIT III EMULSIFIERS, STABILIZERS AND THICKENERS 9

Emulsion, surface tension, oil in water and water in oil emulsion, Hydrophilic and Lipophilic balance (HLB), role of emulsifiers, different classes of emulsifiers and their chemical structure, their HLB values and role in emulsion stabilization; role of different stabilizers and other substances in emulsion stability; emulsion formation process and equipment; measurement of emulsion stability; permitted emulsifiers and stabilizers and food applications. Optimisation of emulsifiers and stabilizers – case study. Thickeners – definition, chemical structure, role in food processing and product end characteristics, list of permitted thickeners and food applications

UNIT IV COLORS, FLAVORS, FLAVOR ENHANCERS AND SWEETENERS 9

Color – Natural and synthetic food colors, their chemical structure, shades imparted, stability, permitted list of colors, usage levels and food application.

Flavouring agents- natural and synthetic flavourings, Flavours from vegetables, cocoa, chocolate, coffee, vanilla beans and Spices. Evaluation tests for flavours. Stability of flavours during food processing, Extraction techniques of flavours, Flavour emulsions; Essential oils and Oleoresins;Flavour enhancers- Chemical properties, Functions in foods, Glutamate in foods, Biochemicals & Toxicology

Sweeteners – list, structure, taste profile, permitted list, usage levels and food applications.

UNITV OTHER FOOD ADDITIVES & FOOD INGREDIENTS 9

Anticaking agents, Antifoaming, Glazing agents, Bulking agents, Humectants, Firming agents, Softening agents, Crystal modifiers, Flour improvers, Flour treatment agents, Dough conditioners, and Enzymes – definition, role and mode of action, permitted list of agents and food application.

Proteins, starches and lipids as functional ingredient; isolation, modification, specifications, functional properties and applications in foods.

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TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the students will be able to

CO 1 understand the principles of chemical preservation of foods

CO 2 understand the role of different food additives in the processing of different foods and their specific functions in improving the shelf life, quality, texture and other physical and sensory characteristics of foods

CO 3 know the regulations and the monitoring agencies involved in controlling the safer use of additives in foods

TEXTBOOKS:

1. Branen, A. L. “Food Additives” 2nd Edition, CRC press, 2002.
2. .Mahindru, S. N. “Food Additives- Characteristics Detection and Estimation”, TATA McGraw Hill, 2000.
3. Titus A. M. Msagati. “The Chemistry of Food Additives and Preservatives”, Wiley-Blackwell, 2013.

REFERENCES:

1. Thomas. E. Furia, “Handbook of food additives” 2nd Edition, Volume 2, CRC press, 1980
2. P. Michael Davidson, John N. Sofos, and A. L. Branen, “Antimicrobials in food”, 3rd Edition, CRC press 2005
3. Peter A Williams and Glyn O Philips, “Gums and stabilizers for the Food Industry”, RSC, 2007.
4. Madhavi, D. L. S. S. Deshpande, and D. K. Salunkhe. “Food antioxidants”, CRC Press, 1996
5. Dr Kay O’Donnell et al , “Sweeteners and sugar alternatives in food technology”, wiley& sons, 2012.
6. Carmen Socaciu, “Food Colorants Chemical and functional properties”, CRC Press, 2007.
7. Gary Reineccius, “Flavor chemistry and technology”, 2nd Edition, CRC Press, 2016.

Course Articulation Matrix

Course outcomes Statement		Programme outcomes (PO)												Programme specific outcomes (PSO)			
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO1	understand the principles of chemical preservation of foods	1	2	2	1	1	1	1	1	3	-	-	1	2	2	-	-
CO2	understand the role of different food additives in the processing of different foods and their specific functions in improving the shelf life, quality, texture and other physical and sensory characteristics of foods	1	2	2	1	1	1	1	1	3	-	-	1	2	2	-	-
CO3	know the regulations and the monitoring agencies involved in controlling the safer use of additives in foods	1	2	2	1	1	1	1	1	3	-	-	1	2	2	-	-
Over all CO		1	2	2	1	1	1	1	1	3	-	-	1	2	2	-	-

1,2 and 3 are correlation levels with weightings on slight (low) moderate (medium)and substantial (high) respectively.

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AUDIT COURSES (AC)

AD5091 CONSTITUTION OF INDIA L T P C
3 0 0 0

OBJECTIVES:

- Teach history and philosophy of Indian Constitution.
- Describe the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- Summarize powers and functions of Indian government.
- Explain emergency rule.
- Explain structure and functions of local administration.

UNIT I INTRODUCTION 9

History of Making of the Indian Constitution-Drafting Committee- (Composition & Working) - Philosophy of the Indian Constitution-Preamble-Salient Features

UNIT II CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES 9

Fundamental Rights-Right to Equality-Right to Freedom-Right against Exploitation Right to Freedom of Religion-Cultural and Educational Rights-Right to Constitutional Remedies Directive Principles of State Policy-Fundamental Duties

UNIT III ORGANS OF GOVERNANCE 9

Parliament-Composition-Qualifications and Disqualifications-Powers and Functions-Executive President-Governor-Council of Ministers-Judiciary, Appointment and Transfer of Judges, Qualifications Powers and Functions

UNIT IV EMERGENCY PROVISIONS 9

Emergency Provisions - National Emergency, President Rule, Financial Emergency

UNIT V LOCAL ADMINISTRATION 9

District's Administration head- Role and Importance-Municipalities- Introduction- Mayor and role of Elected Representative-CEO of Municipal Corporation-Pachayati raj- Introduction- PRI- Zila Pachayat-Elected officials and their roles- CEO ZilaPachayat- Position and role-Block level-Organizational Hierarchy (Different departments)-Village level- Role of Elected and Appointed officials-Importance of grass root democracy

TOTAL: 45 PERIODS

OUTCOMES:

CO1: Able to understand history and philosophy of Indian Constitution.
CO2: Able to understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
CO3: Able to understand powers and functions of Indian government.
CO4: Able to understand emergency rule.
CO5: Able to understand structure and functions of local administration.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

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TEXTBOOKS:

1. Basu D D, Introduction to the Constitution of India, Lexis Nexis, 2015.
2. Busi S N, Ambedkar B R framing of Indian Constitution, 1st Edition, 2015.
3. Jain M P, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. The Constitution of India (Bare Act), Government Publication,1950

AD5092 VALUE EDUCATION L T P C
3 0 0 0

OBJECTIVES:

- Develop knowledge of self-development
- Explain the importance of Human values
- Develop the overall personality through value education
- Overcome the self destructive habits with value education
- Interpret social empowerment with value education

UNIT I INTRODUCTION TO VALUE EDUCATION 9

Values and self-development –Social values and individual attitudes, Work ethics, Indian vision of humanism, Moral and non- moral valuation, Standards and principles, Value judgements

UNIT II IMPORTANCE OF VALUES 9

Importance of cultivation of values, Sense of duty, Devotion, Self-reliance, Confidence, Concentration, Truthfulness, Cleanliness. Honesty, Humanity, Power of faith, National Unity, Patriotism, Love for nature, Discipline

UNIT III INFLUENCE OF VALUE EDUCATION 9

Personality and Behaviour development - Soul and Scientific attitude. Positive Thinking, Integrity and discipline, Punctuality, Love and Kindness, Avoid fault Thinking, Free from anger, Dignity of labour, Universal brotherhood and religious tolerance, True friendshipHappiness Vs suffering, love for truth.

UNIT IV REINCARNATION THROUGH VALUE EDUCATION 9

Aware of self-destructive habits, Association and Cooperation, Doing best for saving nature Character and Competence –Holy books vs Blind faith, Self-management and Good health, Science of reincarnation

UNIT V VALUE EDUCATION IN SOCIAL EMPOWERMENT 9

Equality, Non violence, Humility, Role of Women, All religions and same message,Mind your Mind, Self-control, Honesty, Studying effectively

TOTAL: 45 PERIODS

OUTCOMES:

CO1 – Gain knowledge of self-development
CO2 – Learn the importance of Human values
CO3 – Develop the overall personality through value education
CO4 – Overcome the self destructive habits with value education
CO5 – Interpret social empowerment with value education

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1							□	□		□		□□
CO2							□	□	□	□		□□
CO3							□	□	□	□		□□
CO4							□	□		□		□□
CO5							□	□		□		□□

Attested

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REFERENCES:

1. Chakroborty , S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press ,New Delhi

AD5093 PEDAGOGY STUDIES L T P C
3 0 0 0

OBJECTIVES:

- Understand the methodology of pedagogy.
- Compare pedagogical practices used by teachers in formal and informal classrooms in developing countries.
- Infer how can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.
- Illustrate the factors necessary for professional development.
- Identify the Research gaps in pedagogy.

UNIT I INTRODUCTION AND METHODOLOGY: 9

Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions - Overview of methodology and Searching.

UNIT II THEMATIC OVERVIEW 9

Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.

UNIT III EVIDENCE ON THE EFFECTIVENESS OF PEDAGOGICAL PRACTICES 9

Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers’ attitudes and beliefs and Pedagogic strategies.

UNIT IV PROFESSIONAL DEVELOPMENT 9

Professional development: alignment with classroom practices and follow up support - Peer support - Support from the head teacher and the community - Curriculum and assessment - Barriers to learning: limited resources and large class sizes

UNIT V RESEARCH GAPS AND FUTURE DIRECTIONS 9

Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact.

TOTAL: 45 PERIODS

OUTCOMES:

- Understand the methodology of pedagogy.
- Understand Pedagogical practices used by teachers in formal and informal classrooms in developing countries.
- Find how can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.
- Know the factors necessary for professional development.
- Identify the Research gaps in pedagogy.

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1											□	□□
CO2												□
CO3												□□
CO4												□□
CO5											□	□

REFERENCES:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.

AD5094 **STRESS MANAGEMENT BY YOGA** **L T P C**
3 0 0 0

OBJECTIVES:

- Develop healthy mind in a healthy body thus improving social health also improve efficiency
- Invent Do's and Don't's in life through Yam
- Categorize Do's and Don't's in life through Niyam
- Develop a healthy mind and body through Yog Asans
- Invent breathing techniques through Pranayam

UNIT I INTRODUCTION TO YOGA **9**

Definitions of Eight parts of yog.(Ashtanga)

UNIT II YAM **9**

Do`s and Don't's in life.
Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT III NIYAM **9**

Do`s and Don't's in life.
Ahinsa, satya, astheya, bramhacharya and aparigraha

UNIT IV ASAN **9**

Various yog poses and their benefits for mind & body

UNIT V PRANAYAM **9**

Regularization of breathing techniques and its effects-Types of pranayam

TOTAL: 45 PERIODS

OUTCOMES:

CO1 – Develop healthy mind in a healthy body thus improving social health also improve efficiency
CO2 – Learn Do's and Don't's in life through Yam
CO3 – Learn Do's and Don't's in life through Niyam
CO4 – Develop a healthy mind and body through Yog Asans
CO5 – Learn breathing techniques through Pranayam

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1							□	□		□		□□
CO2							□	□		□		□□
CO3							□	□		□		□□
CO4							□	□		□		□□
CO5							□	□		□		□□

REFERENCES:

1. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata
2. 'Yogic Asanas for Group Tarining-Part-I" : Janardan Swami Yogabhyasi Mandal, Nagpur

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AD5095 PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

L T P C
3 0 0 0

OBJECTIVES:

- Develop basic personality skills holistically
- Develop deep personality skills holistically to achieve happy goals
- Rewrite the responsibilities
- Reframe a person with stable mind, pleasing personality and determination
- Discover wisdom in students

UNIT I NEETISATAKAM-HOLISTIC DEVELOPMENT OF PERSONALITY - I 9

Verses- 19,20,21,22 (wisdom) - Verses- 29,31,32 (pride & heroism) – Verses- 26,28,63,65 (virtue)

UNIT II NEETISATAKAM-HOLISTIC DEVELOPMENT OF PERSONALITY - II 9

Verses- 52,53,59 (dont's) - Verses- 71,73,75,78 (do's)

UNIT III APPROACH TO DAY TO DAY WORK AND DUTIES 9

Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48 - Chapter 3-Verses 13, 21, 27, 35 Chapter 6-Verses 5,13,17,23, 35 - Chapter 18-Verses 45, 46, 48

UNIT IV STATEMENTS OF BASIC KNOWLEDGE – I 9

Statements of basic knowledge - Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 Chapter 12 -Verses 13, 14, 15, 16,17, 18

UNIT V PERSONALITY OF ROLE MODEL - SHRIMAD BHAGWADGEETA 9

Chapter2-Verses 17, Chapter 3-Verses 36,37,42 - Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63

TOTAL: 45PERIODS

OUTCOMES:

CO1: To develop basic personality skills holistically
CO2: To develop deep personality skills holistically to achieve happy goals
CO3: To rewrite the responsibilities
CO4: To reframe a person with stable mind, pleasing personality and determination
CO5: To awaken wisdom in students

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									□			□
CO2									□			□
CO3									□			□
CO4									□			□
CO5									□			□

REFERENCES:

1. Gopinath,Rashtriya Sanskrit Sansthanam P, Bhartrihari's ThreeSatakam , Niti-sringar-vairagya, New Delhi,2010
2. Swami Swarupananda , Srimad Bhagavad Gita, Advaita Ashram,Publication Department, Kolkata,2016

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AD5097	ESSENCE OF INDIAN KNOWLEDGE TRADITION	L T P C 3 0 0 0

COURSE OBJECTIVES

The course will introduce the students to

- get a knowledge about Indian Culture
- Know Indian Languages and Literature religion and philosophy and the fine arts in India
- Explore the Science and Scientists of Ancient, Medieval and Modern India
- Understand education systems in India

UNIT I INTRODUCTION TO CULTURE 9

Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India.

UNIT II INDIAN LANGUAGES AND LITERATURE 9

Indian Languages and Literature – I: Languages and Literature of South India, – Indian Languages and Literature – II: Northern Indian Languages & Literature

UNIT III RELIGION AND PHILOSOPHY 9

Major religions practiced in India and Understanding their Philosophy – religious movements in Modern India (Selected movements only)

UNIT IV FINE ARTS IN INDIA (ART, TECHNOLOGY& ENGINEERING) 9

Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India

UNIT V EDUCATION SYSTEM IN INDIA 9

Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India

TOTAL: 45PERIODS

nCOURSE OUTCOMES

After successful completion of the course the students will be able to

- Understand philosophy of Indian culture.
- Distinguish the Indian languages and literature.
- Learn the philosophy of ancient, medieval and modern India.
- Acquire the information about the fine arts in India.
- Know the contribution of scientists of different eras.
- Understand education systems in India

REFERENCES:

1. Kapil Kapoor, “Text and Interpretation: The India Tradition”,ISBN: 81246033375, 2005
2. “Science in Samskrit”, Samskrita Bharti Publisher, ISBN 13: 978-8187276333, 2007
3. NCERT, “Position paper on Arts, Music, Dance and Theatre”, ISBN 81-7450 494-X, 200
4. Narain, “Examinations in ancient India”, Arya Book Depot, 1993
5. Satya Prakash, “Founders of Sciences in Ancient India”, Vijay Kumar Publisher, 1989
6. M. Hiriyanna, “Essentials of Indian Philosophy”, Motilal Banarsidass Publishers, ISBN 13: 978- 8120810990, 2014

AD5098 SANGA TAMIL LITERATURE APPRECIATION L T P C
3 0 0 0

Course Objectives: The main learning objective of this course is to make the students an appreciation for:

1. Introduction to Sanga Tamil Literature.
2. 'Agathinai' and'Purathinai' in SangaTamil Literature.
3. 'Attruppadai' in SangaTamil Literature.
4. 'Puranaanuru' in SangaTamil Literature.
5. 'Pathitrupaththu' in SangaTamil Literature.

UNIT I SANGA TAMIL LITERATUREANINTRODUCTION 9

Introduction to Tamil Sangam–History of Tamil Three Sangams–Introduction to Tamil Sangam Literature–Special Branches in Tamil Sangam Literature- Tamil Sangam Literature's Grammar-Tamil Sangam Literature's parables.

UNIT II 'AGATHINAI'AND'PURATHINAI' 9

Tholkappiyar's Meaningful Verses–Three literature materials–Agathinai's message- History of Culturefrom Agathinai– Purathinai–Classification–Mesaage to Society from Purathinai.

UNIT III 'ATTRUPPADAI'. 9

AttruppadaiLiterature–Attruppadaiin'Puranaanuru'-Attruppadaiin'Pathitrupaththu'-Attruppadai in 'Paththupaattu'.

UNIT IV 'PURANAANURU' 9

Puranaanuru onGood Administration,Rulerand Subjects–Emotion&itsEffectin Puranaanuru.

UNIT V 'PATHITRUPATHTHU' 9

Pathitrupaththuin'Ettuthogai'–Pathitrupaththu'sParables–Tamildynasty:Valor,Administration, Charity in Pathitrupaththu- Mesaage to Society from Pathitrupaththu.

Total (L:45) = 45 PERIODS

COURSE OUTCOMES: Upon completionofthiscourse, the studentswillbeableto:

1. Appreciate and apply the messages in Sanga Tamil Literature in their life.
2. Differentiate'Agathinai' and'Purathinai'in their personal andsocietallife.
3. Appreciate and apply the messages in' Attruppadai' in their personal and societalife.
4. Appreciate and apply the messages in' Puranaanuru' in their personal and societallife.
5. Appreciate and apply the messages in' Pathitrupaththu' in their personal and societallife.

REFERENCES:

1. Sivaraja Pillai, The Chronology oftheEarlyTamils,SagwanPress,2018.
2. HankHeifetz andGeorgeL. Hart, The Purananuru,Penguin Books,2002.
3. Kamil Zvelebil, The Smile of Murugan: OnTamil Literature of South India, Brill Academic Pub,1997.

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CO	P												PS		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1									0.9						0.6
2									0.9						0.6
3									0.9						0.6
4									0.9						0.6
5									0.9						0.6

HSMC– ELECTIVES – HUMANITIES I (ODD SEMESTER)

HU5171 LANGUAGE AND COMMUNICATION LT P C

3 0 0 3

COURSE DESCRIPTION

This course offers an introduction to language and communication. The primary goal of this course is to familiarize students with key ideas related to communication using language as well as non verbal means. Ideas related to the use of language and the underlying power structures are also examined. The course also examines the role of media in communication and in the dissemination of ideas as well as opinions.

Objectives

- ✓ To familiarize students with the concept of communication using linguistic and non linguistic resources.
- ✓ To help students ask critical questions regarding facts and opinions.
- ✓ To provide students with the material to discuss issues such as language and power structures.
- ✓ To help students think critically about false propaganda and fake news.

Learning Outcomes

- ➢ Students will be able to use linguistic and non linguistic resources of language in an integrated manner for communication.
- ➢ Students will be able to analyse communication in terms of facts and opinions.
- ➢ Students will be able to discuss, analyse and argue about issues related to language and power.

UNIT I LINGUISTIC AND NON-LINGUISTIC RESOURCE OF COMMUNICATION: 9

a) Writing and Speech

b) Distinction between language structure and language use, form and function, acceptability and grammaticality

c) Gestures and Body language, pictures and symbols, cultural appropriacy

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d) Communicative Competency, context and situation, combination of linguistic and non-linguistic elements of communication

UNIT II STRUCTURE OF WRITING/CONVERSATION: 9

a) Language skills and the communication cycle; speaking and listening, writing and reading

b) Initiating and closing conversations, intervention, turn taking

c) Writing for target reader, rhetorical devices and strategies

d) Coherence and Cohesion in speech and writing

UNIT III POWER STRUCTURE AND LANGUAGE USE: 9

a) Gender and language use

b) Politeness expressions and their use

c) Ethical dimensions of language use

d) Language rights as part of human rights

UNIT IV MEDIA COMMUNICATION: 9

a) Print media, electronic media, social media

b) Power of media

c) Manufacturing of opinion, fake news and hidden agendas

UNIT V PERSUASIVE COMMUNICATION AND MISCOMMUNICATION: 9

a) Fundamentals of persuasive communication

b) Persuasive strategies

c) Communication barriers

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Austin, 1962, J.L. How to do things with words. Oxford: Clarendon Press. Grice, P.1989. Studies in the way of words. Cambridge, M.A: Harvard University Press.
2. Chomsky, N.1966. Aspects of the theory of syntax, The MIT press, Cambridge. Chomsky, N.2006. Language and Mind, Cambridge University Press.
3. Hymes. D.N. 1972, On communication competence in J.B. Pride and J.Holmes (ed), Sociolinguistics, pp 269-293, London Penguin.
4. Gilbert, H.Harman, 1976. Psychological aspect of the theory of syntax in Journal of Philosophy, page 75-87.
5. Stephen. C. Levenson, 1983, Pragmatics, Cambridge University press.

6. Stangley, J. 2007. Language in Context. Clarendon press, Oxford. 7. Shannon, 1942. A Mathematical Theory of Communication. 8. Searle, J.R. 1969. Speech acts: An essay in the philosophy of language. Cambridge: Cambridge University Press.

HU5172	VALUES AND ETHICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Teach definition and classification of values.
- Explain Purusartha.
- Describe Sarvodaya idea.
- Summarize sustenance of life.
- Conclude views of hierarchy of values.

UNIT I DEFINITION AND CLASSIFICATION OF VALUES 9

Extrinsic values- Universal and Situational values- Physical- Environmental-Sensuous- Economic-Social-Aesthetic-Moral and Religious values

UNIT II CONCEPTS RELATED TO VALUES 9

Purusartha-Virtue- Right- duty- justice- Equality- Love and Good

UNIT III IDEOLOGY OF SARVODAYA 9

Egoism- Altruism and universalism- The Ideal of Sarvodaya and Vasudhaiva Kutumbakam

UNIT IV SUSTENANCE OF LIFE 9

The Problem of Sustenance of value in the process of Social, Political and Technological Changes

UNIT V VIEWS ON HIERARCHY OF VALUES 9

The Problem of hierarchy of values and their choice, The views of Pt. Madan Mohan Malviya and Mahatma Gandhi

TOTAL: 45 PERIODS

OUTCOMES:

CO1: Able to understand definition and classification of values.

CO2: Able to understand purusartha.

CO3: Able to understand sarvodaya idea.

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CO4: Able to understand sustenance of life.

CO5: Able to understand views of hierarchy of values.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1								✓	✓			✓
CO2								✓	✓			✓
CO3								✓	✓			✓
CO4								✓	✓			✓
CO5								✓	✓			✓

TEXTBOOKS :

1. AwadeshPradhan :MahamanakeVichara. (B.H.U., Vanarasi-2007)
2. Little, William, : An Introduction of Ethics (Allied Publisher, Indian Reprint 1955)
3. William, K Frankena : Ethics (Prentice Hall of India, 1988)

HU5173 HUMAN RELATIONS AT WORK L T P C

3 0 0 3

OBJECTIVES:

- Illustrate human relations at work its relationship with self.
- Explain the importance of interacting with people at work to develop teamwork.
- Infer the importance of physical health in maintaining human relations at work.
- Describe the importance of staying psychologically healthy.
- Identify the essential qualities for progressing in career.

UNIT I UNDERSTANDING AND MANAGING YOURSELF 9

Human Relations and You: Self-Esteem and Self-Confidence: Self-Motivation and Goal Setting; Emotional Intelligence, Attitudes, and Happiness; Values and Ethics and Problem Solving and Creativity.

UNIT II DEALING EFFECTIVELY WITH PEOPLE 9

Communication in the Workplace; Specialized Tactics for Getting Along with Others in the Workplace; Managing Conflict; Becoming an Effective Leader; Motivating Others and Developing Teamwork; Diversity and Cross-Cultural Competence.

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UNIT III STAYING PHYSICALLY HEALTHY 9

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Yoga, Pranayam and Exercise: Aerobic and anaerobic.

UNIT IV STAYING PSYCHOLOGICALLY HEALTHY 9

Managing Stress and Personal Problems, Meditation.

UNIT V DEVELOPING CAREER THRUST 9

Getting Ahead in Your Career, Learning Strategies, Perception, Life Span Changes, and Developing Good Work Habits.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

CO1: Understand the importance of self-management.

CO2: Know how to deal with people to develop teamwork.

CO3: Know the importance of staying healthy.

CO4: Know how to manage stress and personal problems.

CO5: Develop the personal qualities essential for career growth.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						□		□□□	□□			□
CO2									□□	□	□	□□
CO3						□□		□□	□		□	□
CO4								□			□	□
CO5						□	□	□	□	□		□□

TEXT BOOK:

1. Dubrien, A. J. (2017). Human Relations for Career and Personal Success: Concepts, Applications, and Skills, 11th Ed. Upper Saddle River, NJ: Pearson.

REFERENCES:

1. Greenberg, J. S. (2017). Comprehensive stress management (14th edition), New York: McGraw Hill.
2. Udai, Y. (2015). Yogasanaurpranayam. New Delhi: N.S. Publications.

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HU5174	PSYCHOLOGICAL PROCESSES	L T P C 3 0 0 3

COURSE DESCRIPTION

Psychological Processes course is designed for students to be aware of the basic principles of psychology for the better understanding of people's psyche and behaviour around them. This course enables learners to use the optimal use of different forms of thinking skills and thereby results in effective communication in diverse situations. Every unit of the syllabus highlights the psychological process of people, the most powerful and constructive use of perceptions.

OBJECTIVES

The major objectives of this course is

- To develop students' awareness – on psychology, learning behavior and usage of perception effectively.
- To learn to use the various kinds of thinking in a formal context.
- To critically evaluate content and comprehend the message on the bases of perception, personality and intelligence.

UNIT 1: INTRODUCTION

What is psychology? - Why study psychology? - Psychology as science – Behavior and its role in human communication – socio-cultural bases of behaviour – Biological bases of behavior - Brain and its functions – Principles of Heredity – Cognition and its functions Fields of psychology – Cognitve and Perceptual – Industrial and Organizational.

UNIT 2: SENSORY & PERCEPTUAL PROCESSES

Some general properties of Senses: Visual system – the eye, colour vision – Auditory system – Hearing, listening, Sounds - Other senses - Selective attention; physiological correlates of attention; Internal influences on perception learning – set - motivation & emotion - cognitive styles; External influences on perception figure and ground separation – movement – organization – illusion; Internal- external interactions: Constancy - Depth Perception- Binocular & Monocular Perception; Perceptual defense & Perceptual vigilance; Sensory deprivation -Sensory bombardment; ESP - Social Perception.

UNIT 3: COGNITION & AFFECT

Learning and memory – philosophy of mind – concepts - words – images – semantic features – Association of words – Repetition – Retrieval – Chunking - Schemata - Emotion and motivation – nature and types of motivation – Biological & Psychosocial motivation – nature and types of

emotions – physiological & cognitive bases of emotions – expressions of emotions – managing negative emotions - enhancing positive emotions.

UNIT 4: THINKING, PROBLEM-SOLVING & DECISION MAKING

Thinking skills – Types of thinking skills – Concrete & Abstract thinking – Convergent & Divergent - Analytical & Creative thinking – Problem & Possibility thinking – Vertical & Lateral thinking – Problem solving skills – stages of problem solving skills – Decision making - intuition and reasoning skills - Thinking and language - The thinking process- concepts, problem solving, decision-making, creative thinking; language communication.

UNIT 5: PERSONALITY & INTELLIGENCE

Psychological phenomena & Attributes of humans - cognition, motivation, and behavior - thoughts, feelings, perceptions, and actions – personality dimensions, traits, patterns - Specialized knowledge, performance accomplishments, automaticity or ease of functioning, skilled performance under challenge - generative flexibility, and speed of learning or behavior change.

References

1. Morgan, C.T.and King, R.A (1994) Introduction to Psychology, Tata McGraw Hill Co Ltd, New Delhi.
2. Robert A. Baron (2002), Psychology, 5th Edition, Prentice Hall, India.
3. Michael W.Passer, Ronald E.smith (2007), Psychology: The science of mind and Behavior,3rd Edition Tata McGraw-Hill Edition.
4. Robert S.Feldman (2004) Understanding Psychology 6th Edition Tata McGraw – Hill.
5. Endler, N. S., & Summerfeldt, L. J. (1995). Intelligence. personality. psychopathology. and adjustment. In D. H. Saklofske & M. Zeidner (Eds.). International handbook of personality and intelligence (pp. 249-284). New York: Plenum Press.
6. Ford, M. E. (1994). A living systems approach to the integration of personality and intelligence. In R. J. Sternberg. & P. Ruzgis (Eds.). Personality and intelligence (pp. 188-21 7). New York: Cambridge University Press.

- De Bono, E (1990) Lateral Thinking, Harper Perennial, New York.

HU5175	EDUCATION, TECHNOLOGY AND SOCIETY	L	T	P	C
		3	0	0	3

COURSE DESCRIPTION

This course introduces students to multidisciplinary studies in Education, Technology and Society. Students will get an understanding of the relationship between education, technology and society.

They will also learn about the long lasting impact of good education in a technologically advanced society.

COURSE OBJECTIVES:

The course aims

- To help learners understand the basics of different types of technology utilised in the field of education
- To make them realize the impact of education in society
- To make them evolve as responsible citizen in a technologically advanced society

LEARNING OUTCOMES

By the end of the course, learners will be able to

- Understand the various apps of technology apps and use them to access, generate and present information effectively.
- Apply technology based resources and other media formats equitably, ethically and legally.
- Integrate their technical education for betterment of society as well as their personal life.

UNIT I INDIAN EDUCATION SYSTEM

Gurukul to ICT education – Teacher as facilitator – Macaulay's Minutes – English medium vs Regional medium – Importance of Education in Modern India - Challenges in Education

UNIT II LEARNING THEORIES

Learning Theories – Behaviorism – Cognitivism – Social Constuctivism – Humanism Learning Styles – Multiple Intelligences – Emotional Intelligence – Blooms Taxonomy

UNIT III TECHNOLOGICAL ADVANCEMENTS

Web tools – Social media in education – elearning – MOOCs – Mobile assisted learning – Learning Apps – Blended learning - Self-directed learning

UNIT IV EDUCATIONAL TECHNOLOGY

Technological implications on Education – Teaching, Learning & Testing with Technology - Advantages and drawbacks – Critical analysis on the use of technology

UNIT V ETHICAL IMPLICATIONS

Plagiarism – Online Copyright issues – Ethical and value implications of education and technology on individual and society.

TOTAL:45 PERIODS

TEACHING METHODS

Teaching modes include guest lectures, discussion groups, presentations, visual media, and a practicum style of learning.

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EVALUATION

As this is course is not a content based course, it focuses more on the ethical use of technology in education and society, and so, evaluation can be based on assignments and discussions. So there is no need for an end semester examination. Internals marks can be taken for the total marks.

INTERNAL (100 % WEIGHTAGE)

(a) Written Test (40 marks)

(b) Assignment: Write a real time report of the technology use in any school / college (15 marks)

(c) Presentation: Students choose any one of the technological tools and present its relevance to education and society (15 marks)

(d) Group discussion: Students discuss in groups on case studies relating to various challenges in education and technology use in society (20 marks)

(e) Blog entry: Making weekly blog posts in Class Blog on the topics related to the course posted by the instructor and commenting on others' posts. (10 marks)

REFERENCES

1) Education and Social order by Bertrand Russel
2) Theories of learning by Bower and Hilgard
3) Technology and Society by Jan L Harrington

HU5176	PHILOSOPHY	L T P C
		3 0 0 3

OBJECTIVES

- To create a new understanding by teaching philosophy through a comparison of Indian and Western traditions.
- To Fosters critical thinking and imagination by dealing with inter-related concepts in literature and science.
- To bridge the gap between the sciences and humanities through introspective analyses.
- To nurture an understanding of the self and elucidates ways to progress towards a higher understanding of one's self and others.

UNIT I KNOWLEDGE 9

Knowledge (Vidya) Versus Ignorance (Avidya)- Brihadaranyaka Upanishad. Unity and Multiplicity – Isha Upanishad. What is True Knowledge? Ways to True Knowledge. Introduction to Philosophy of Yoga, Socratic Debate, Plato's Views. Asking and Answering Questions to Stimulate Critical Thinking and to Draw Ideas. Argumentative Dialogues. Dialectical Methods to Arrive at Conclusions.

UNIT II ORIGIN 9

Origin of Universe And Creation – 'Nasidiya Sukta' in Relation With Big Bang Theory. Greek Concept of Chaos. The Concept of Space – Space as the Final Goal – Udgitha. Relationship Between Teacher And Student – The Knowledge Of Combinations, Body And Speech – Siksha Valli – Taittriya Upanishad.

UNIT III WORD 9

Aum- Speech and Breath as Pair – Chandogya Upanishad and Brihadaryanaka Upanishad. Significance of Chants, Structure of Language and Cosmic Correspondences. The Non-Dual Word – Bhartrihari's Vakyapadiyam. Sphota-Ultimate Reality Expressed Through Language. Intention. Thought 'Sabdanaor' and Speaking.

UNIT IV KNOWLEDGE AS POWER/OPPRESSION 9

Power- as Self-Realization in Gita. Krishna's Advice to Arjuna on How to Conquer Mind. Francis Bacon – Four Idols – What Prevents One From Gaining Knowledge? Michel Foucault- Knowledge as Oppression. Panopticon. Rtam (Truth) and Satyam (Eternal Truth).

UNIT V SELF KNOWLEDGE/BRAHMAN 9

Knowledge about Self, Transcendental Self. The Different Chakras and the Stages of Sublimation. Philosophy of Yoga and Siva for Union of Mind and Body. Concept of Yin/Yang. Aspects of the Feminine / Masculine.

TOTAL : 45 PERIODS

OUTCOMES:

On completion of the course, the students will be able to:

1. Think sceptically, ask questions and to arrive at deductions.
2. Connect and relate different branches of thought.
3. Comprehends the relation between language, thought and action.
4. Arrive at a better understanding of self and others and forms a new outlook.

REFERENCES:

1. Swami Nikhilananda: The Upanishads, Swami Nikhilananda, Advaita Ashrama, Kolkata.
2. Swamy Tapasyananda: Srimad Bhagavad Gita, The Scripture of Mankind, Sri Ramakrishna Math, Chennai.
3. Subrahmanyam, Korada: Vakyapadiyam of Bhartrhari Brahmakanda, Sri Garib Dass series.
4. Swami Lokeswarananda: Chandogya Upanishad, Swami Lokeswarananda, Ramakrishna Mission Institute of Culture, Kolkata.
5. Brahma, Apuruseya: The Four Vedas: Translated in English.
6. Haich, Elizabeth: Sexual Energy and Yoga.
7. Bacon, Francis: Power as Knowledge
8. Vlastos, Gregory: Socrates Ironist and Moral Philosopher.
9. Plato: The Republic, Penguin.
10. Gutting, Garry: Foucault A Very Short Introduction, Oxford.

HU5177	APPLICATIONS OF PSYCHOLOGY IN EVERYDAY LIFE	L T P C 3 0 0 3

UNIT I INTRODUCTION 7

Nature and fields.

UNIT II PSYCHOLOGY IN INDUSTRIES AND ORGANIZATIONS 9

Job analysis; fatigue and accidents; consumer behavior.

UNIT III PSYCHOLOGY AND MENTAL HEALTH 11

Abnormality, symptoms and causes psychological disorders

UNIT IV PSYCHOLOGY AND COUNSELING 7

Need of Counseling, Counselor and the Counselee, Counseling Process, Areas of Counseling.

UNIT V PSYCHOLOGY AND SOCIAL BEHAVIOUR 11

Group, group dynamics, teambuilding, Prejudice and stereotypes; Effective Communication, conflict and negotiation.

TOTAL: 45 PERIODS

TEXTBOOKS

1. Schultz, D. & Schultz, S.E. (2009). Psychology and Work Today (10th ed.). New

Jersey:Pearson/Prentice Hall

2. Butcher, J. N., Mineka, S., & Hooley, J. M. (2010). Abnormal psychology (14th ed.). New York: Pearson

3. Gladding, S. T. (2014). Counselling: A comprehensive profession. New Delhi: Pearson Education

4. Aronson, E., Wilson, T. D., & Akert, R. M. (2010). Social Psychology (7th Ed.).

Upper Saddle River, NJ: Prentice Hall

HSMC– ELECTIVES – HUMANITIES II (EVEN SEMESTER)

HU5271 GENDER, CULTURE AND DEVELOPMENT L T P C

3 0 0 3

COURSE DESCRIPTION

This course offers an introduction to Gender Studies that asks critical questions about the meanings of sex and gender in Indian society. The primary goal of this course is to familiarize students with key issues, questions and debates in Gender Studies, both historical and contemporary drawing from Indian literature and media studies, to examine cultural assumptions about sex, gender, and sexuality. This course integrates analysis of current events through student presentations, aiming to increase awareness of contemporary and historical experiences of women, and of the multiple ways that sex and gender interact with class, caste and other social identities. This course also seeks to build an understanding of the concepts of gender, gender-based violence, sexuality, and rights and their impact on development through a number of discussions, exercises and reflective activities.

Objectives

- ✓ To familiarize students with the concepts of sex and gender through literary and media texts.
- ✓ To help students ask critical questions regarding gender roles in society.
- ✓ To provide students with the material to discuss gender issues such as gender based discrimination, violence and development.
- ✓ To help students think critically about gender based problems and solutions.

Learning Outcomes

- ➢ Students will be able to critically read literary and media texts and understand the underlying gender perspectives in them.
- ➢ Students will be able to analyse current social events in the light of gender perspectives.
- ➢ Students will be able to discuss, analyse and argue about issues related to gender and their impact on society, culture and development.

UNIT I: Introduction to Gender

- Definition of Gender
- Basic Gender Concepts and Terminology
- Exploring Attitudes towards Gender
- Social Construction of Gender

Texts:

1. Sukhu and Dukhu (Amar Chitra Katha)
2. The Cat who Became a Queen (Folk tale, J. Hinton Knowles, Folk-Tales of Kashmir. London: Kegan Paul, Trench, Trübner, and Company, 1893, pp. 8-10.)

UNIT II: Gender Roles and Relations

- Types of Gender Roles
- Gender Roles and Relationships Matrix
- Gender-based Division and Valuation of Labour

Texts:

1. Muniyakka (Short Story, Lakshmi Kannan, Nandanvan and Other Stories, Hyderabad: Orient Blackswan, 2011)
2. Video: Witness: Freeing Women From Cleaning Human Waste (2014, HRW, Manual Scavenging, India)

UNIT III: Gender Development Issues

- Identifying Gender Issues
- Gender Sensitive Language
- Gender, Governance and Sustainable Development
- Gender and Human Rights
- Gender and Mainstreaming

Texts:

1. The Many Faces of Gender Inequality (Essay, Amartya Sen, Frontline, Volume 18 - Issue 22, Oct. 27 - Nov. 09, 2001)
2. Tell Us Marx (Poem, Mallika Sengupta, Translated by Sanjukta Dasgupta)

UNIT IV: Gender-based Violence

- The concept of violence
- Types of Gender-based violence
- The relationship between gender, development and violence
- Gender-based violence from a human rights perspective

Texts:

1. Lights Out (Play, Manjula Padmanabhan)

2. Lights Out (Video of play enacted)

UNIT V: Gender and Culture

- Gender and Film
- Gender, Media and Advertisement

Texts:

1. Mahanagar (Movie: Satyajit Ray)
2. Beti Bachao Beti Padhao Advertisements

READINGS: Relevant additional texts for readings will be announced in the class. Classes will consist of a combination of activities: dialogue-based lectures, discussions, collaborative learning activities, group work and in-class assignments.

ASSESSMENT AND GRADING:

Discussion & Classroom Participation: 20%

Project/Assignment: 30%

End Term Exam: 50%

HU5272 **ETHICS AND HOLISTIC LIFE** **L T P C**

3 0 0 3

OBJECTIVES:

- To emphasize the meaning and nature of ethics, human values and holistic life for leading a good, successful and happy life through continuous examination of thoughts and conduct in day to day life.
- To understand the status and responsible role of individual in abatement of value crisis in contemporary world in order to develop a civilized and human society. Understanding the process of ethical decision making through critical assessment of incidents/cases of ethical dilemmas in personal, professional and social life.
- To view the place of Ethics and Human Values in the development of individual and society through identification and cross examination of life values and world view of his/her role models in society.

UNIT I HUMAN LIFE, ITS AIM AND SIGNIFICANCE

The concept of a successful life, happy life and a meaningful life, Ethical and decision making capability and its development: Meaning of Ethical dilemma, sharing real life experiences.

UNIT II CREATIVE AND LEADERSHIP ABILITY AND THEIR DEVELOPMENT

Intellectual, Emotional, Creative, Ethico- spiritual development, Aesthetic sense, Self-dependency, Activeness, Development of positive attitude.

UNIT III HARMONY IN PERSONAL AND SOCIAL LIFE:

Concept of personal and group Ethics; Balance between - rights and duties-welfare of self and welfare of all, Creating a value based work culture in hostel, classroom and other places in the campus and society.

UNIT IV CHARACTER, RIGHTEOUSNESS AND VIRTUES FOR A MEANINGFUL LIFE

Egolessness, Humility, Righteousness, Purity, Truthfulness, Integrity, Self-restraint, Self-control, Sense of responsibility, Empathy, Love, Compassion, Maitri / Comradeship, Cooperation, Tolerance.

UNIT V DILEMMA BETWEEN MATERIALISTIC DEVELOPMENT AND

HUMAN WELFARE

Science, Technology, Consumerism, Relation with Nature and Environment, New dimension of Global Harmony: Democracy, Equality, Social Justice

TOTAL:45 PERIODS

OUTCOMES:

On completion of the course, the students will be able to:

1. Enable students to understand the concept of contemporary ethics at different levels: Individual, local and Global and enable them to cross examine the ethical and social consequences of the decisions of their life-view and world view.
2. Develop the ability of students to create a balance between their individual freedom and social responsibilities and enable them to identify the personal, professional and social values and integrate them in their personality after cross examination.
3. Enable students to cross examine their earlier decisions taken in life and understand the meaning of ethical dilemma to overcome the ethical dilemmas and engage in critical reflection.
4. Develop positive habits of thought and conduct and work cohesively with fellow beings who have variety of strengths, experiences, shortcomings and challenges, hence to enable them to handle diverse type of personalities.
5. Enable students to develop a method for making ethically sound decisions for themselves, within hostels, classrooms, university campus and society.

HU5273 LAW AND ENGINEERING L T P C

3 0 0 3

UNIT I THE LEGAL SYSTEM: SOURCES OF LAW AND THE COURT STRUCTURE 9

Enacted law -Acts of Parliament are of primary legislation, Common Law or Case law- Principles taken from decisions of judges constitute binding legal rules. The Court System in India and Foreign Courtiers. (District Court, District Consumer Forum, Tribunals, High Courts, Supreme Court) Arbitration: As an alternative to resolving disputes in the normal courts, parties who are in dispute can agree that this will instead be referred to arbitration.

UNIT II LAWS 9

Basic principles of contract law, sale of goods law, laws relating to industrial pollution, accident, environmental protection, health and safety at work, patent law, constitutional law: the supreme law of the land, Information technology law and cyber crimes.

UNIT III BUSINESS ORGANISATIONS 9

Sole traders (Business has no separate identity from you, all business property belongs to you).

Attested

Partnerships: Types of Partnerships - Limited Liability Partnership, General Partnership, Limited

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Partnerships. Companies: The nature of companies, Classification of companies, Formation of companies, Features of a public company, Carrying on business, Directors– Their Powers and Responsibilities/Liabilities.

UNIT IV LAW AND SOCIETY 9

Interdisciplinary nature of law, legal ideologies/philosophy/ schools of jurisprudence.

UNIT V CASE STUDIES 9

Important legal disputes and judicial litigations

TOTAL: 45 PERIODS

HU5274 FILM APPRECIATION L T P C

3 0 0 3

COURSE DESCRIPTION

This is an intensive course designed to promote comprehensive understanding and insights into the nature of cinema and other related forms and practices. Movies, though at times are used more as escapism, they are also a true art form and expressive tool used by writers, directors and actors. This course will explore the aesthetics of cinema, the concepts behind storytelling and various other elements of a film. It will also explore the impact of movies in our society and in our lives. It also encourages students to use films as a medium to analyse visual texts and read underlying messages.

OBJECTIVES:

- To help learners understand the various movie genres and its types.
- To understand various elements that contributes to film making.
- To make them realize the impact of film in society.
- To analyse the visual media and interpret the underlying messages.

UNIT I THE COMPONENTS OF FILMS 9

Story, Screenplay & Script – Actors – Director – Crew Members – Mis En Scene – Structure of A Film – Narrative Elements – Linear & Non-Linear – Types of Movie Genres: Mysteries, Romantic Comedies, Horror Etc.

UNIT II EVOLUTION OF FILM 9

History of Films – Early Cinema – Silent Movies – Talkies – Film Language, Form, Movement – Film Theories – Realist, Auteurists, Feminist, Psychonalyic, Idealogical Theories.

UNIT III FILMS ACROSS THE WORLD 9

European Films – Russian Films – Japanese Films – Korean Films – Hollywood Film – Studio Culture – All Time Great Movies.

Attested

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UNIT IV INDIAN FILMS 9

The Early Era – History Of Indian Cinema – Movies for Social Change – Hindi Movies that Created Impact – Regional Movies – Documentaries – Cultural Identity.

UNIT V INTERPRETING FILMS 9

Film Criticism & Appreciation – Censorship in Movies – Cultural Representation in Movies – Television – New Media & Online Media – Films Beyond Entertainment.

TOTAL: 45 PERIODS

OUTCOMES

On completion of the course, the students will be able to:

- Recognize types of films, their impact on society and their roles in our lives.
- Have an understanding of the concepts of storytelling, Mise en Scene, and other elements of film making.
- Interpret the underlying messages in the movies.

Teaching Methods

- Each unit consists of reading materials, learning activities videos, websites. Students are expected to watch movies sometimes in class and at times at home and discuss in class.

Evaluation

- As this is course is critical appreciation course on films, there is no written end semester examination. The course is more on learning how to critically analyse a movie and appreciate its finer elements. Therefore evaluation can be based on assignments and discussions. Internals marks can be taken for the total marks.

Internal (100 % weightage)

- Assignment 1: Write a movie review with critical analysis (20 marks).
- Assignment2 : Write a script for a scene taken from a short story / novella (20 marks).
- Presentation: Students choose any one topic related to films and present it to the audience. (25 marks)
- Group discussion : Students discuss in groups on the various aspects of movies and its impact on society. (25 marks)
- Blog entry: Making weekly blog posts in Class Blog on the topics related to the course posted by the instructor and commenting on others' posts. (10 marks)

REFERENCES

1. A Biographical Dictionary of Film by David Thomson, Secker & Warburg, 1975
2. Signs and Meaning in the Cinema by Peter Wollen, Secker & Warburg, 1969
3. The World Viewed by Stanley Cavell 1971
4. Film Style and Technology: History and Analysis by Barry Salt, Starword, 1983
5. The Encyclopedia of Indian Cinema Edited by Ashish Rajadhyaksha and Paul Willemen, BFI, 1994.

HU5275 FUNDAMENTALS OF LANGUAGE AND LINGUISTICS L T P C

3 0 0 3

OBJECTIVES

- To broadly introduce students to the formal and theoretical aspects of linguistics.
- To enable learners to understand the various practical applications of language and recent findings in the field of applied linguistics.

CONTENTS : -

UNIT I LANGUAGE AND LINGUISTICS: AN OVERVIEW 9

Language and Linguistics-Linguistic Knowledge-Knowledge of Sound Systems & Words – Creativity of Language – Relationship of form and meaning. Grammar – descriptive, prescriptive,universal-Human Language – Animal Language – Sign Language- Computers and Language.

UNIT II MORPHOLOGY - WORDS OF LANGUAGE 9

Content and function words – morphemes -free & bound –prefixes – suffixes – roots and stems – inflectional and derivational morphology-compound words and their formation – malapropisms – slips of the tongue.

UNIT III SYNTAX- THE SENTENCE PATTERNS OF LANGUAGE AND SEMANTICS-THE MEANING OF LANGUAGE 9

Syntax : Rules of Syntax- Sentence Structure-Structural Ambiguity-Syntactic Categories. Semantics: Lexical Semantics – Anomaly-Metaphors- Idioms- Synonyms – Antonyms – Homonyms -Pragmatics– Speech Acts

UNIT IV PHONETICS – THE SOUNDS OF LANGUAGE 9

Speech sounds- Introduction to branches of Phonetics- The Phonetic Alphabet – IPA – Consonants - Vowels – Diphthongs- Tone and Intonation.

UNIT V APPLIED LINGUISTICS - THE PRACTICAL APPLICATIONS OF LANGUAGE 9

Language learning and teaching (ELT)- lexicography-translation studies-computational linguistics-neurolinguistics (speech pathology and language disorders)- forensic linguistics – sociolinguistics.

Attested

TOTAL : 45 PERIODS

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Teaching Methods :

Lectures, discussion.

Evaluation Internal and External :

Internal: 2 written tests + assignments, seminars, project (50+15+15+20).

External: A 3 hour written exam (50 marks)

REFERENCES :

1.Victoria Fromkin, Robert Rodman, Nina Hyams.2019.An Introduction to Language.USA.CENGAGE.11th edition

2. Cook. G,2003. Applied linguistics.UK: Oxford University Press.

HU5276 UNDERSTANDING SOCIETY AND CULTURE THROUGH LITERATURE L T P C

3 0 0 3

OBJECTIVES

- To internalize the importance of language by understanding its role in the transformation of man.
- To look at language, literature and culture as locus of identity and change.
- To extract meaning from existing literatures and cultures.
- To identify meanings in modern life by reconnecting with lost cultures.

Unit 1 Introduction

Why study literature? Tracing the origin – pictures. Tokens as precursors of writing. Movement from three dimensions to two dimensions- Pictography. From visual to oral -Logography. Reading out literature to young children- Edmund J Farrell.

Unit 2. Reading Culture

Reading culture through language, signs and consumables- Roland Barthes. Culture through poems- Nissim Ezekiel's ' The night of the Scorpion' . 'Nothing's Changed'- Tatamkhulu Afrika- Apartheid. Ruskin Bond- 'Night train at Deoli'- How real life is different from movies.

Unit 3. Identifying Meaning

Searching and locating meaning through literature. Looking for order in a chaotic world. The Myth of Sisyphus (Albert Camus) and Adi Shankar's 'Jagat Mithya'- the world as an illusion. The Indian version as 'meaninglesss meaning'.

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Unit 4. Post Modernism

'If on a winter's night a traveler'- Italo Calvino. The book about the reader- the experience of reading as reading. Metafiction. Selfie Culture. Visual Culture as purpose of modern life.

Unit 5. Returning to Pictures

Literature of the present- Emphasis on the visual world. Twitterature. SMS. Whatsapp language. Consumer culture. Change in fixed gender notions. Interactive sessions. Introspection.

Reading list

1. Bond, Ruskin: 'Night train at Deoli'
2. Ezekiel, Nissim: ' The Night of the Scorpion'
3. Afrika,Tatamkhulu: 'Nothing's Changed'
4. Barthes, Roland: *Mythologies*
5. Shankaracharya: *Viveka Chudamani*
6. Camus, Albert- *The Myth of Sisyphus*
7. Calvino, Italo: *If on a winter's night a traveler*
8. Farrell, Edmund J: 'Listen, my children, and you shall read'

Outcome

- Can identify the connections among language, literature and culture.
- Is able to relate between seemingly different aspects of life.
- Understands the fractions in modern life and can assimilate meanings.