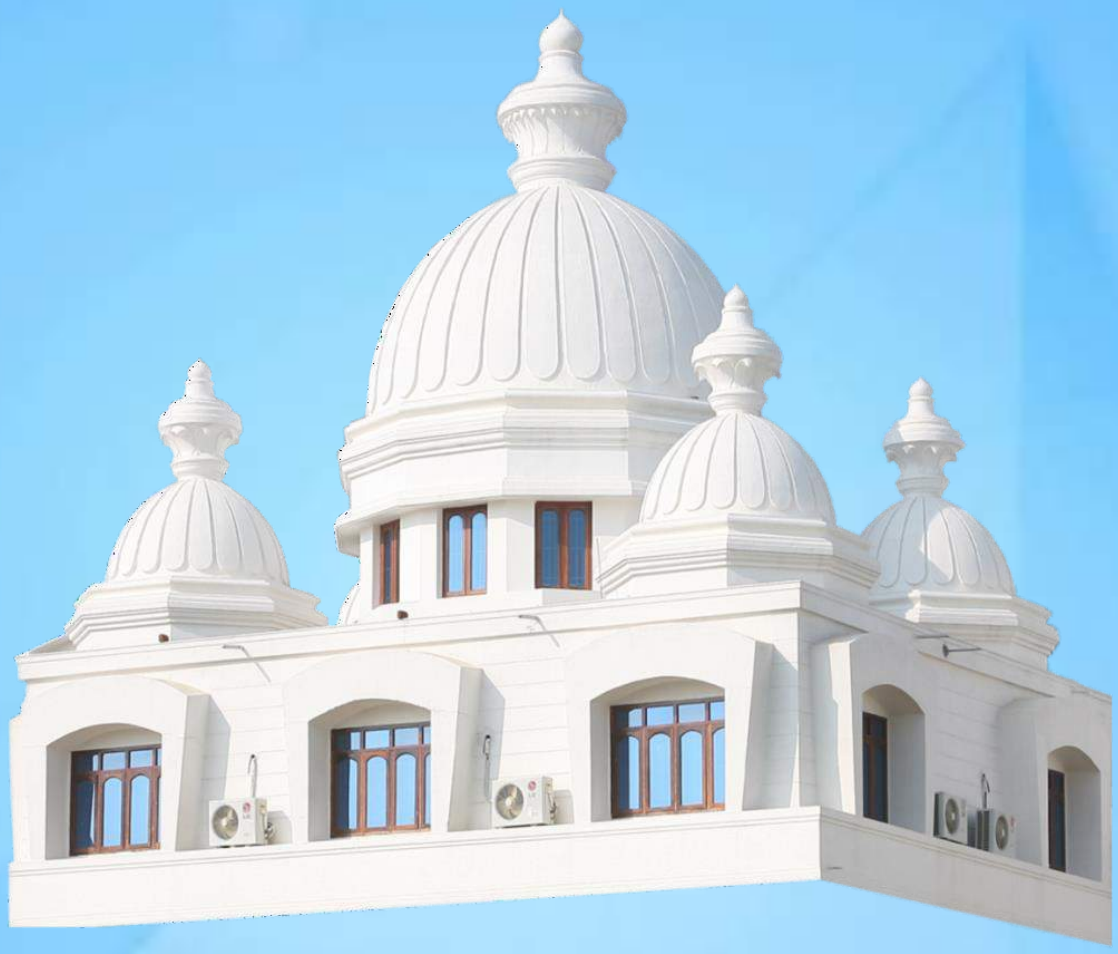
B.Tech. Food Technology

R-2023: Curriculum & syllabus



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DEPARTMENT OF FOOD TECHNOLOGY
B. TECH Food Technology
REGULATION – 2023
CHOICE BASED CREDIT SYSTEM
Curriculum for Semesters – I to VIII

I – SEMESTER									
Code No.	Course	Category	Periods/Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
Theory Course(s)									
23MA102	Matrices and Calculus	BS	3	1	0	4	40	60	100
23FT101	Biochemistry and Nutrition	PC	3	0	0	3	40	60	100
23FT102	Food Microbiology	PC	3	0	0	3	40	60	100
23HS102	Heritage of Tamils (தமிழர் மரபு)	HSS	1	0	0	1	100	0	100
Theory with Practical Courses									
23LEZXX	Language Elective – I	HSS	2	0	2	3	50	50	100
23CH102	Chemistry for Material Sciences	BS	3	0	2	4	50	50	100
23ME101	Engineering Graphics	ES	1	0	4	3	50	50	100
Mandatory Course									
23MC101	Induction Programme	MC	2 Weeks			0	100	0	100
TOTAL			**16**	**1**	**8**	**21**	**470**	**330**	**800**

Language Electives – I									
Code No.	Course	Category	Periods/Week			C	Maximum Marks		
			L	T	P		CA	FE	Total
23ENE01	Communicative English	HSS	2	0	2	3	50	50	100
23LEE02	Advanced Communicative English	HSS	2	0	2	3	50	50	100

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II – SEMESTER									
Code No.	**Course**	**Category**	**Periods/Week**			**C**	**Maximum Marks**		
			L	**T**	**P**		**CA**	**FE**	**Total**
Theory Courses									
23MA202	Mathematical Foundations for Engineering	BS	3	1	0	4	40	60	100
23FT201	Fundamentals of Food Processing	PC	3	0	0	3	40	60	100
23FT202	Food Chemistry	PC	3	0	0	3	40	60	100
23LET08	Tamils & Technology (தமிழரும் தொழில்நுட்பமும்)	HSS	1	0	0	1	100	0	100
Theory with Practical Courses									
23LEZXX	Language Elective – II	HSS	2	0	2	3	50	50	100
23PH202	Materials Physics	BS	3	0	2	4	50	50	100
23CS203	Problem Solving using Python Programming	ES	3	0	2	4	50	50	100
Practical Courses									
23FT203	Food Practice Laboratory	PC	0	0	4	2	60	40	100
Mandatory Course									
23MCXXX	Mandatory Course – II	MC	2	0	0	0	100	0	100
Total			**20**	**1**	**10**	**24**	**530**	**370**	**900**

Language Electives – II									
Code No.	**Course**	**Category**	**Periods/Week**			**C**	**Maximum Marks**		
			L	**T**	**P**		**CA**	**FE**	**Total**
23LEE02	Advanced Communicative English	HSS	2	0	2	3	50	50	100
23LEH03	Hindi	HSS	2	0	2	3	50	50	100
23LEF04	French	HSS	2	0	2	3	50	50	100
23LEG05	German	HSS	2	0	2	3	50	50	100
23LEJ06	Japanese	HSS	2	0	2	3	50	50	100

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III – SEMESTER									
Code No.	**Course**	**Category**	**Periods/Week**			**C**	**Maximum Marks**		
			L	**T**	**P**		**CA**	**FE**	**Total**
Theory Courses									
23FT301	Food Process Calculation	PC	3	0	0	3	40	60	100
23FT302	Applied Thermodynamics for Food Technology	PC	3	0	0	3	40	60	100
23FT303	Fluid Mechanics and Unit Operations	PC	3	0	0	3	40	60	100
23UH001	Universal Human Values	HSS	3	0	0	3	40	60	100
Theory with Practical Courses									
23MA301	Transforms and Boundary Value Problems	BS	3	0	2	4	50	50	100
23FT304	Food Analysis	PC	3	0	2	4	50	50	100
Practical Courses									
23FT305	Fluid Mechanics and Unit Operations Laboratory	PC	0	0	4	2	60	40	100
Mandatory Course									
23MCXXX	Mandatory Course – III	MC	0	0	2	0	100	0	100
Total			**18**	**0**	**10**	**22**	**420**	**380**	**800**

IV – SEMESTER									
Code No.	**Course**	**Category**	**Periods/Week**			**C**	**Maximum Marks**		
			L	**T**	**P**		**CA**	**FE**	**Total**
Theory Courses									
23FT401	Heat and Mass Transfer in Food Technology	PC	3	0	0	3	40	60	100
23FT402	Meat, Fish and Poultry Processing Technology	PC	3	0	0	3	40	60	100
23FT403	Food Processing and Preservation	PC	3	0	0	3	40	60	100
23FT405	Food Additives	PC	3	0	0	3	40	60	100
Theory with Practical Courses									
23MA402	Statistical and Numerical Methods	BS	3	0	2	4	50	50	100
23FT404	Fruits and Vegetable Processing Technology	PC	3	0	2	4	50	50	100
Practical Courses									
23FT406	Food Processing and Preservation Laboratory	PC	0	0	2	1	60	40	100
Mandatory Course									
23MCXXX	Mandatory Course – IV	MC	2	0	0	0	100	0	100
Total			**20**	**0**	**6**	**21**	**420**	**380**	**800**

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V – SEMESTER									
Code No.	**Course**	**Category**	**Periods/Week**			**C**	**Maximum Marks**		
			L	**T**	**P**		**CA**	**FE**	**Total**
Theory Courses									
23FT501	Dairy Processing Technology	PC	3	0	0	3	40	60	100
23FT502	Biochemical Engineering	PC	3	0	0	3	40	60	100
23FT503	Functional Foods and Nutraceuticals	PC	3	0	0	3	40	60	100
23FT504	Refrigeration and Cold Chain Management	PC	3	0	0	3	40	60	100
23FTEXX	Professional Elective – I	PE	3	0	0	3	40	60	100
23YYOXX	Open Elective – I	OE	3	0	0	3	40	60	100
Practical Courses									
23FT505	Dairy Processing Technology Laboratory	PC	0	0	4	2	60	40	100
23FT506	Biochemical Engineering Laboratory	PC	0	0	4	2	60	40	100
Mandatory Course									
23MCXXX	Mandatory Course – V	MC	0	0	2	0	100	0	100
Total			**18**	**0**	**10**	**22**	**460**	**440**	**900**

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VI – SEMESTER									
Code No.	**Course**	**Category**	**Periods/Week**			**C**	**Maximum Marks**		
			L	**T**	**P**		**CA**	**FE**	**Total**
Theory Courses									
23FT601	Baking and Confectionery Technology	PC	3	0	0	3	40	60	100
23FT602	Food Quality and Safety Regulations	PC	3	0	0	3	40	60	100
23FT603	Fermentation Technology	PC	3	0	0	3	40	60	100
23FTEXX	Professional Elective – II	PE	3	0	0	3	40	60	100
23FTEXX	Professional Elective – III	PE	3	0	0	3	40	60	100
23YYOXX	Open Elective – II	OE	3	0	0	3	40	60	100
Practical Courses									
23FT604	Baking and Confectionery Technology Laboratory	PC	0	0	4	2	60	40	100
23FT605	Design Thinking & Mini Project	EEC	1	0	2	2	40	60	100
23FT606	Internship	EEC	Two Weeks			1	100	0	100
Mandatory Course									
23MCXXX	Mandatory Course – VI	MC	0	0	2	0	100	0	100
Total			**19**	**0**	**8**	**23**	**540**	**460**	**1000**

VII- SEMESTER									
Code No.	**Course**	**Category**	**Periods/Week**			**C**	**Maximum Marks**		
			L	**T**	**P**		**CA**	**FE**	**Total**
Theory Courses									
23FT701	Food Packaging Technology	PC	3	0	0	3	40	60	100
23FT702	Food Processing and Engineering Economics	PC	3	0	0	3	40	60	100
23FT703	Food Equipment Design	PC	2	1	0	3	40	60	100
23FTEXX	Professional Elective – IV	PE	3	0	0	3	40	60	100
23FTEXX	Professional Elective – V	PE	3	0	0	3	40	60	100
23YYOXX	Open Elective – III	OE	3	0	0	3	40	60	100
Practical Courses									
23FT704	Food Packaging Technology Laboratory	PC	0	0	2	1	60	40	100
23FT705	Design Project	EEC	0	0	4	2	40	60	100
Total			**17**	**1**	**6**	**21**	**340**	**460**	**800**

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VIII- SEMESTER									
Code No.	**Course**	**Category**	**Periods/Week**			**C**	**Maximum Marks**		
			L	**T**	**P**		**CA**	**FE**	**Total**
Theory Courses									
23FTEXX	Professional Elective-VI	PE	3	0	0	3	40	60	100
23FT801	Major Project	EEC	0	0	16	8	40	60	100
Total			**3**	**0**	**16**	**11**	**80**	**120**	**200**

MANDATORY COURSES (MC)									
Code No.	**Course**	**Category**	**Periods / Week**			**C**	**Maximum Marks**		
			L	**T**	**P**		**CA**	**FE**	**Total**
23MC101	Induction Programme	MC	2 Weeks			0	100	-	100
23MC202	Environmental Sciences	MC	2	0	0	0	100	-	100
23MC203	Interpersonal Skills	MC	0	0	2	0	100	-	100
23MC004	Indian Constitution	MC	2	0	0	0	100	-	100
23MC005	Yoga and Values for Holistic Development	MC	0	0	2	0	100	-	100
23MC006	Soft Skills	MC	0	0	2	0	100	-	100

OPEN ELECTIVE COURSES (For Other Branches)									
Code No.	**Course**	**Category**	**Periods/Week**			**C**	**Maximum Marks**		
			L	**T**	**P**		**CA**	**FE**	**Total**
Theory Courses									
23FTO01	Valorization of Agriculture Products	OE	3	0	0	3	40	60	100
23FTO02	Mushroom Technology	OE	3	0	0	3	40	60	100
23FTO03	Principles of Food Science and Nutrition	OE	3	0	0	3	40	60	100
23FTO04	Basics of Food Technology	OE	3	0	0	3	40	60	100
23FTO05	Entrepreneurship in Food Technology	OE	3	0	0	3	40	60	100
23FTO06	Food Industry Waste Management	OE	3	0	0	3	40	60	100

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PROFESSIONAL ELECTIVES (PE)									
Stream – I (Food Processing Technology)									
Code No.	**Course**	**Category**	**Periods/Week**			**C**	**Maximum Marks**		
			L	**T**	**P**		**CA**	**FE**	**Total**
23FTE01	Fat and Oil Processing Technology	PE	3	0	0	3	40	60	100
23FTE02	Enzyme Technology	PE	3	0	0	3	40	60	100
23FTE03	Ready to Eat Processing Technology	PE	3	0	0	3	40	60	100
23FTE04	Cereals and Pulses Processing Technology	PE	3	0	0	3	40	60	100
23FTE05	Beverage Technology	PE	3	0	0	3	40	60	100
23FTE06	Emerging Technologies in Food Processing	PE	3	0	0	3	40	60	100
23FTE07	Food Toxicology	PE	3	0	0	3	40	60	100
23FTE08	Food Biotechnology	PE	3	0	0	3	40	60	100
23FTE09	Sensory Evaluation of Food Products	PE	3	0	0	3	40	60	100
23FTE10	Processing of Spices and Plantation Crops Produce	PE	3	0	0	3	40	60	100
23FTE11	Technology of Extruded Products	PE	3	0	0	3	40	60	100
23FTE12	Food Product Supply Chain Management	PE	3	0	0	3	40	60	100
Stream – II (Food Engineering)									
23FTE13	Food Plant Design and Layout	PE	3	0	0	3	40	60	100
23FTE14	Food Storage Engineering	PE	3	0	0	3	40	60	100
23FTE15	Design and Formulation of Food	PE	3	0	0	3	40	60	100
23FTE16	Instrumentation and Process Control in Food Industry	PE	3	0	0	3	40	60	100
23FTE17	Food Plant Utilities and Services	PE	3	0	0	3	40	60	100
23FTE18	Modeling and Simulation of Food Processes	PE	3	0	0	3	40	60	100
23FTE19	Optimization Techniques in Food Technology	PE	3	0	0	3	40	60	100
23FTE20	Design of Innovative Packaging	PE	3	0	0	3	40	60	100
23FTE21	Food Materials Science	PE	3	0	0	3	40	60	100
23FTE22	Food Product Development	PE	3	0	0	3	40	60	100
23FTE23	Food Plant Organization and Management	PE	3	0	0	3	40	60	100
23FTE24	Genetically Modified Foods	PE	3	0	0	3	40	60	100

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Stream – III (Advanced Food Technology)									
23FTE25	ICT Application in Food Industry	PE	3	0	0	3	40	60	100
23FTE26	Application of Nanotechnology in Food Technology	PE	3	0	0	3	40	60	100
23FTE27	Milling technology	PE	3	0	0	3	40	60	100
23FTE28	Downstream Processing	PE	3	0	0	3	40	60	100
23FTE29	Intelligent Food Industries	PE	3	0	0	3	40	60	100
23FTE30	Food Industry Waste Management and By Product Utilization	PE	3	0	0	3	40	60	100
23FTE31	IoT and Deep Learning for Food Quality	PE	3	0	0	3	40	60	100
23FTE32	Data Analytics for Food Supply Chain	PE	3	0	0	3	40	60	100
23FTE33	Nutrition and Metabolism	PE	3	0	0	3	40	60	100
23FTE34	Malting and Brewing Technology	PE	3	0	0	3	40	60	100
23FTE35	Value Added Food Products	PE	3	0	0	3	40	60	100
23FTE36	Green Technology in Food Industries	PE	3	0	0	3	40	60	100

ONE CREDIT COURSES									
Code No.	**Course**	**Category**	**Periods/Week**			**C**	**Maximum Marks**		
			L	**T**	**P**		**CA**	**FE**	**Total**
23FTA01	Food Adulteration and remedies	EEC	1	0	0	1	100	0	100
23FTA02	Water Quality Analysis for Food Industries	EEC	1	0	0	1	100	0	100
23FTA03	Automation in Food Industries	EEC	1	0	0	1	100	0	100
23FTA04	Halal Compliance in Food Audits	EEC	1	0	0	1	100	0	100
23FTA05	Statistical Tool in Data Analysis	EEC	1	0	0	1	100	0	100
23FTA06	HACCP in Food Industries	EEC	1	0	0	1	100	0	100

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CREDIT SUMMARY

S. No	CATEGORY	CREDITS PER SEMESTER								TOTAL CREDITS (AICTE)	CREDITS in %
		I	II	III	IV	V	VI	VII	VIII		
1.	HSS	4	4	3	-	-	-	-	-	11 (10-14)	6.67
2.	BS	8	8	4	4	-	-	-	-	24 (22-28)	14.55
3.	ES	3	4	-	-	-	-	-	-	7 (24)	4.24
4.	PC	6	8	15	17	16	11	11	-	84 (48)	50.91
5.	PE	-	-	-	-	3	6	6	3	18 (18)	10.91
6.	OE	-	-	-	-	3	3	3	-	9	5.45
7.	EEC	-	-	-	-	-	3	1	8	12 (12-16)	7.27
8.	MC	0	0	0	0	0	-	-	-	0	0
Total		21	24	22	21	22	23	21	11	165	100%

HSS - Humanities and Social Sciences
BS - Basic Sciences
ES - Engineering Sciences
PC - Professional Core
PE - Professional Elective
OE - Open Elective
EEC - Employability Enhancement Course
MC - Mandatory Courses (Non-Credit Courses)
CA - Continuous Assessment
FE - Final Examination

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23MA102	MATRICES AND CALCULUS (Common to all B.E/B.Tech Programmes)	L	T	P	C
		3	1	0	4
Nature of Course	Basic Sciences				
Pre requisites	Nil				

Course Objectives

The course is intended to

1. Introduce the concept of orthogonal transformation to convert the square matrix into diagonal form.
2. Acquaint the student with mathematical tools needed in evaluating derivatives and differentiation of one variable.
3. Familiarize the functions of two variables, Taylor series and Jacobian techniques
4. Impart knowledge of double integral techniques in evaluating volume of the solid.
5. Learn the Green's theorem Stoke's theorem and the Divergence theorem to compute integrals

Course Outcomes

On successful completion of the course the students will be able to

CO. No	Course Outcome	Bloom's Level
CO 1	Apply the concept of orthogonal reduction for diagonalization of the given matrix	Apply
CO 2	Execute the rules of differentiation to differentiate the functions.	Apply
CO 3	Demonstrate the maxima and minima for a given function with two variables	Apply
CO 4	Apply integration to compute area and volume using multiple integrals	Apply
CO 5	Interpret the Green's theorem, Stokes' theorem and Divergence theorem to evaluate integrals.	Apply

Course Contents

Module – I MATRICES 9+3

Eigen values and Eigenvectors of a real matrix – Characteristic Equation- Properties - Cayley Hamilton Theorem - Orthogonal transformation of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation – Nature of Quadratic Forms.

Module – II DIFFERENTIAL CALCULUS 9+3

Functions of single Variable -Limits and Continuity - Derivatives - Differentiation rules(sum, product, quotient, chain rule) – Implicit differentiation-Logarithmic differentiation-Maxima and Minima of function of one variable –Taylors series.

Module – III FUNCTIONS OF TWO VARIABLES 9+3

Limits and Continuity –Partial differentiation–Homogeneous functions and Euler's theorem– Jacobians –Partial differentiation of implicit functions–Taylor's series– Maxima and minima – Lagrange s method of multipliers.

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Module – IV **MULTIPLE INTEGRALS** 9+3

Double integrals – Change of order of integrations- Double integrals in polar coordinates – Areaenclosed by plane curves – Triple integrals – Volume of solids.

Module – V **VECTOR CALCULUS** 9+3

Gradient and directional derivative — Divergence and curl — Green's, Gauss divergence and Stoke's theorems — Verification andapplicationinevaluatingline, surfaceandvolumeintegrals (cube, rectangular parallelepiped)

Total : 60 Periods

Text Books

1. B.K.Pal and K.Das , "Engineering Mathematics", Volume-1, 10th Edition, U.N.Dhur and Sons private limited,2020
2. Grewal B.S, "Higher Engineering Mathematics", Khanna Publishers, Delhi, 44th Edition. 2019

Reference Books

1. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company. 1st Edition, 2018
2. N.P.Bali, Manish Goyal, "A text book of Engineering Mathematics Semester II", Laxmi Publications, 6th Edition 2015.
3. Veerarajan T," Engineering Mathematics for Semester I and II", Tata McGraw Hill. 3rd Edition 2017.

Additional References

1. NPTEL-https://nptel.ac.in/courses/111105035
2. NPTEL-https://nptel.ac.in/courses/111104144
3. NPTEL- https://nptel.ac.in/courses/111105122

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	2	2										1	
CO 2	3	3	2										1	
CO 3	3	1	1										1	
CO 4	3	2	1										1	
CO 5	3	2	2										1	
	3-High				2-Medium				1-Low					

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Formative Assessment			
Blooms Taxonomy	**Assessment Component**	**Marks**	**Total marks**
Remember	Quiz	5	15
Understand	Tutorial class / Assignment	5	
Apply			
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations (IAE)**			**Final Examinations (FE)**
	IAE – I (5)	**IAE – II (10)**	**IAE – III (10)**	**60**
Remember	10	10	10	20
Understand	30	30	30	60
Apply	10	10	10	20
Analyse				
Evaluate				
Create				

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23FT101	Biochemistry & Nutrition	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Nil				

Course Objectives

The course is intended to

1. Learn fundamentals of biochemical processes and biomolecules
2. Provide the core principles and topics of biochemistry
3. Understand the roles of each nutrients in growth and metabolism
4. Acquire a specialized knowledge and understanding of micronutrients
5. Understand the concept of metabolic function and its synthesis

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Classify the fundamentals of biomolecules, biochemical reactions in a living organism	Understand
CO2	Demonstrate the importance of nutrients in physiological function and biochemical pathways	Understand
CO3	Interpret biochemical data using appropriate quantitative, technological and critical thinking skills	Apply
CO4	Explain the core biochemical techniques with principles and its applications	Understand
CO5	Describe the nutritive values of foods and deficiency of different nutrients	Understand

Course contents:

Module I Introduction to Biochemistry 9

Biomolecules, Proteins- structure of proteins, essential amino acids, protein metabolism (digestion and absorption), transamination, deamination and decarboxylation. Nitrogen balance, nitrogen pool and urea cycle.

Module II Metabolism - Concepts and Regulation 9

Carbohydrates- Definition, classification. Metabolic pathways: Glycolysis, pentose phosphate pathway, Electron Transport chain. Lipids- general chemistry of lipids, essential fatty acids, digestion and absorption of lipids, ketosis and breakdown of phospholipids.

Module III Concepts of Food and Nutrition 9

Functions of food, basic food groups, nutrients supplied by food, water and energy balance-water intake and losses, basal metabolism, formulation of diets, classification of balanced diet, preparation of balanced diet for various age groups, recommended dietary allowances for various age groups, malnutrition, potentially toxic substances in food.

Module IV Vitamins, Minerals and Hormones 9

Water soluble and fat-soluble vitamins, function, recommended intakes, vitamin deficiencies and toxicities. Major minerals such as sodium, potassium and calcium. Importance of minor minerals such as selenium, copper, fluoride and chromium. Fluid/electrolyte balance and acid-base balance.

Module V Nutrition and Energy Balance 9

Definition and classification of nutrients. Energy balance using the RDA, nutritional status, nutritional requirement and malnutrition. Balanced diet planning: Glycemic and non-glycemic carbohydrates. Anatomy and physiology of the digestive tract, mechanical, chemical digestion and absorption of nutrients. Energy balance: body weight and body composition; health implications, Obesity, BMR, BMI.

Total: 45 Periods

Text Books:

1. Nelson DL and Cox MM, “Lehninger’s Principles of Biochemistry”, 5th Edition, W.H. Freemen & Co., 2015
2. Satyanarayana U and Chakerpani U, “Biochemistry”, 4th Edition, Books & Allied (P) Ltd., 2013
3. Michael JG, Susan A, Aedin C and Hester HV, “Introduction to Human Nutrition” 2nd Edition, Wiley Blackwell, 2009.

References:

1. Sareen SG and Jack LS, “Advanced Nutrition and Human Metabolism”, 5th Edition, Wadsworth Publishning, 2008.
2. Berg, Jeremy M, Tymoczko JL, Stryer and Lubert, “Biochemistry” 6th Edition, W.H. Freemen & Co., 2006
3. Voet D and Voet JG, “Biochemistry”, 3rd Edition, John Wiley & Sons Inc., 2004

Web References

1. http://unaab.edu.ng/funaab-ocw/index.php/biochemistry-80342/lecture-notes-32095
2. http://microbenotes.com/amino-acids-properties-structure-classification-and-functions/
3. http://www.biosciencenotes.com

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	**Pos**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2												3		
CO2	2												3		
CO3	3	1											3		
CO4	2												3		
CO5	2												3		
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom’s Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom’s Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE – I (5)	**IAE – II (10)**	**IAE – III (10)**	
Remember	20	10	20	20
Understand	30	30	30	60
Apply		10		20
Analyze				
Evaluate				
Create				

23FT102	Food Microbiology	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Nil				

Course Objectives

The course is intended to

1. Understand the morphology of different microorganisms and its isolation methods.
2. Grasp the inhibition of microbial growth through physical and chemical methods
3. Learn the role of microbes in food spoilage
4. Know the specialized knowledge about use of microbes in fermentation process
5. Learn the food borne pathogens from spoiled food

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Discuss about to identify the microorganism and its detection	Understand
CO2	Explain the microbial growth in various food products	Understand
CO3	Estimate and interpret the parameter which influencing the food spoilage in various food products	Evaluate
CO4	Explain the various food fermentation process by microbes and its industrial applications	Understand
CO5	Illustrate the controlling of food borne pathogens by various techniques	Apply

Course contents:

Module I Introduction to Microorganism 9

Introduction- definition, historical development and significance of food microbiology, Microbial classification, nomenclature, structural organization and multiplication of bacteria, viruses, algae and Fungi. Nutritional requirements -Types of media used for growth and detection for microbes, growth curve.

Module II Control of Microbes in Foods 9

Control of microbes- Physical methods- Low and high temperatures, drying, radiation and high pressure. Chemicals - organic acids, sugars, sodium chloride, nitrites, phosphates, sulphites, Benzoates, Sorbates / Propionates. Disinfection & disinfectants- Pasteurization-techniques, types, sterilization. Thermal Inactivation of microbes; Concept, determination & importance of TDT, F, Z & D values.

Module III Microbial Food Spoilage 9

Factors influencing spoilage of food– Temperature, pH, moisture, oxidation – Reduction Potential, Nutrient content and Inhibitory substances and biological structure. General principles underlying spoilage and contamination of perishable and non- perishable foods. Spoilage of food – cereals, vegetables, fruits, egg, meat and milk – canned foods and sea foods.

Module IV Microbes in Food Fermentations 9

Microbes importance in food fermentations. Homo & hetero fermentative - Bacteria, yeasts & fungi; Lactic acid bacteria fermentation and starter cultures, Alcoholic fermentations –Yeast fermentations. Microbes associated with typical food Fermentations- yoghurt, cheese, kefir, kumis, bread, idly, fermented vegetables-Pickled cucumber, sauerkraut – soysauce.

Module V Microbial Examination of Foods 9

Food borne diseases & Food Quality control Measures – Food poisoning and Food borne Infections – Bacterial and Mycotoxins – Investigation of food poisoning. Detection & Enumeration of microbes in foods; Indicator organisms and microbiological criteria; Rapid and automated microbial methods - Applications of immunological, techniques in food industry.

Total: 45 Periods

Text Books:

1. Prescott Harley, Klein “Microbiology “: Authored by Wiley, Sherwood, Woolverton, McGraw-Hill Higher Education, 10th edition, 2017.
2. Ananthanarayanan, R. and C.K. JayaramPaniker, “Textbook of Microbiology”, Orient Longman, 9th Edition, 2013.
3. Vijaya Ramesh “Food Microbiology”. MJP Publishers, 1st Edition, 2007.

References:

1. Pawsey, R.K. “Case Studies in Food Microbiology for Food Safety and Quality”, The Royal Society of Chemistry, 3rd Edition, 2015.
2. Harrigan, W.F. “Laboratory Methods in Food Microbiology”, Academic Press, 4th Edition, 2007.
3. Forsythe, S.J. “The Microbiology of Safe Food”. Blackwell Science, 4th Edition, 2006

Web References

1. https://www.youtube.com/watch?v=WWGRTSbvef0
2. https://www.youtube.com/watch?v=MYOvhAWh-E0
3. https://www.youtube.com/watch?v=VpQ8ezlI91Q

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	**Pos**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2												3		
CO2	2												2	2	
CO3	3	3	3										2	2	
CO4	2													2	1
CO5	3	1					1				1		2	3	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom’s Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom’s Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE – I (5)	**IAE – II (10)**	**IAE – III (10)**	
Remember	20	10	10	20
Understand	30	20	30	40
Apply		10	10	20
Analyze		10		10
Evaluate				10
Create				

Passed in Board of Studies Meeting

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Approved in Academic Council Meeting

23LET07 **தமிழர் மரபு** LTPC 1 0 0 1

அலகு I **மொழி மற்றும் இலக்கியம்:** 3

இந்திய மொழிக் குடும்பங்கள் – திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி – தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் – திருக்குறளில் மேலாண்மைக் கருத்துக்கள் – தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் – சிற்றிலக்கியங்கள் – தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு II **மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை:** 3

நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள்– பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் – தேர் செய்யும் கலை – சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரிமுனையில் திருவள்ளுவர் சிலை – இசைக் கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்: 3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

அலகு IV **தமிழர்களின் திணைக் கோட்பாடுகள்:** 3

தமிழகத்தின் தாலரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக்கோட்பாடு – சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் – சங்ககால நகரங்களும் துறை முகங்களும் – சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு V **இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு:** 3

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

TOTAL : 15 PERIODS

TEXT BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)

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REFERENCE BOOKS

1. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
2. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (In print)
3. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
4. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
5. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)

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23LET07 **HERITAGE OF TAMILS** L T P C
1 0 0 1

UNIT I LANGUAGE AND LITERATURE 3

Language Families in India - Dravidian Languages – Tamil as aClassical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

UNIT II HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE 3

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

UNIT III FOLK AND MARTIAL ARTS 3

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT IV THINAI CONCEPT OF TAMILS 3

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE 3

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books

TOTAL : 15 PERIODS

TEXT BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)

REFERENCE BOOKS

1. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
2. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
3. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
4. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
5. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)

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23ENE01	COMMUNICATIVE ENGLISH Common to all B.E./B.Tech Programmes	L	T	P	C
		2	0	2	3
Nature of Course	Humanities and Sciences				
Pre requisites	Nil				

Course Objectives

The course is intended to

1. Improve lexical, grammatical and semantic competence.
2. Enhance communicative skills in real life situations.
3. Augment thinking in all forms of communication.
4. Equip with oral and written communication skills.
5. Gain employability skills.

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Use effectively the lexical, grammatical and semantic knowledge	Understand
CO2.	Communicate with clarity using intentional vocabulary in English	Apply
CO3.	Articulate perfectly and express their opinions confidently	Apply
CO4.	Accomplish listening and reading skills for life long learning	Apply
CO5.	Comprehend, interpret and present data	Understand

Course Contents:

MODULE I BASIC GRAMMAR AND USAGE 9

Grammar: Parts of Speech – Verb (Primary & Modal Auxiliary) – Prefixes and Suffixes **Listening:** Listening Skills: Importance and Types of Listening – Barriers of Listening - **Listening** to short monologues **Speaking:** Introducing oneself – Role play **Reading:** Types of Reading – Intensive reading – Extensive Reading – Reading Comprehension **Writing:** Permission letter (Industrial Visit) – Informal letter – Dialogue writing

MODULE II APPLICATIONS OF LANGUAGE SKILLS 9

Grammar: Tenses (Present, Past and Future) – Different Forms of a word – Types of Questions **Listening:** Listening strategies – Listening to Announcements **Speaking:** Likes and dislikes- Movie Reviews – **Reading:** Skimming - Scanning - Reading Newspaper and Articles **Writing:** Inviting Dignitaries – Accepting Invitation – Declining Invitation.

MODULE III CONVERSATIONAL SKILLS 9

Grammar: If conditionals – Numerical Adjectives **Listening:** - Listening to Telephonic calls and taking notes – Listening Lectures **Speaking:** Technical Presentation – Group Discussion **Reading:** Reading Magazines - Cloze Test **Writing:** Calling for Quotation – Complaint Letter – Process Description

MODULE IV GRAMMATICAL ACCURACY COMPETENCE 9

Grammar: Subject verb agreement – Discourse markers - One word substitution **Listening:** Listening and gap filling – Listening and Match the answers **Speaking:** Narrating Story - Asking and giving directions **Reading:** Rearranging Jumbled sentence - Note making **Writing:** Instructions – Hints Developing – Report Writing (Fire and Accident Report)

Passed in Board of Studies Meeting on 17.03.23 *Passed in Academic Council Meeting on 27.04.23*

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MODULE V TECHNICAL WRITING SKILLS **Grammar:** Homophones and Homonyms - Abbreviation and Acronyms **Listening:** Listening announcements – Listening and Summing up **Speaking:** Impromptu speech – Presentation at a business meeting **Reading:** Reading and summarizing articles **Writing:** Paragraph Writing – Checklist – Story writing.

Total: 45 Periods

Laboratory Components

S.No.	List of Exercises	CO Mapping	RBT
1	Self Introduction	1	Understand
2	Movie Review	2	Apply
3	Group Discussion	3	Apply
4	Asking and Giving Directions	4	Apply
5	Impromptu Speech	5	Apply
6	Listening to short monologues	1	Understand
7	Listening to Announcement	2	Understand
8	Listening Telephone calls	3	Understand
9	Listening and Gap Filling	4	Apply
10	Listening and Match the answers	4	Apply

Text Books

1. Rizvi, Ashraf.M, "Effective Technical Communication",Tata McGraw Hill Publishing company Limited,New Delhi, 2nd Edition, 2018.
2. Hewings. M, "Advanced English Grammar", 3rd Edition, Cambridge University Press, Chennai, 9th Edition, 2019.
3. Board of Editors, "Using English – A Course book for Undergraduate Engineers and Technologists", Orient Black Swan Private Limited, Hyderabad, 3rd Edition, 2019.

Reference Books:

1. Raman M & Sangeetha Sharma, "Technical Communication", Oxford University Press,USA,13thEdition,2018.
2. Norman Whitby, Business Benchmark – "Pre-Intermediate to Intermediate, Students Book", Cambridge University Press, 1st Edition, 2006.
3. Dhanavel S. P., "English and Soft Skills", 1stEdition, Orient Black Swan Private Limited, Hyderabad, 1st Edition, 2010.

Web References:

1. https://www.englishclub.com/grammar/
2. https://learnenglish.britishcouncil.org
3. https://www.indiabix.com/verbal-ability/questions-and-answers/
4. https://www.elllo.org
5. https://englishforeveryone.org/Topics/Reading-Comprehension.html

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Passed in Board of Studies Meeting on 17.03.23 *Passed in Academic Council Meeting on 27.04.23*

Mapping of Course Outcomes (CO) with Programming Outcomes (PO) Programme Specific Outcomes (PSO)															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1										3	1	2	2		
CO2										3	1	2	2		
CO3										3	1	2	2		
CO4										3	1	2	2		
CO5										3	1	2	2		
	3	High			2	Medium				1	Low				

Summative assessment						
Bloom's Level	Continuous Assessment					Final Examination (Theory) [50 marks]
	Theory Marks				Practical	
	IAE-I [5]	IAE-II [10]	IAE -III [10]	Attendance [5]	Rubric based CIA [20 Marks]	
Remember	-	-	-		-	-
Understand	40	40	40		40	40
Apply	60	60	60		60	60
Analyse	-	-	-		-	-
Evaluate	-	-	-		-	-
Create	-	-	-		-	-

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23CH102	CHEMISTRY FOR MATERIALS SCIENCE (Common to AERO, AGRI, CIVIL, MECH, PCT and SF)	L	T	P	C
		3	0	2	4
Nature of Course	Basic Sciences				
Pre requisites	Nil				

Course Objectives

The course is intended to

1. Impart knowledge and understanding about the constituents present in water and the need for purification of water.
2. Provide knowledge about the basic principles, preparatory methods and applications of nanomaterials.
3. Understand the causes and control measures of corrosion.
4. Learn about the nature, types of the soil and suitable fertilizers for different types of soil.
5. Gain knowledge about fuels and calorific value of solid fuel, liquid fuel and gaseous fuel.

Course Outcomes

On successful completion of the course the students will be able to

CO.No	Course Outcome	Bloom's Level
CO 1	Develop innovative and eco-friendly method for water purification to meet the growing industrial demand.	Apply
CO 2	Discuss the basic principles, synthesis and applications of nanomaterials	Understand
CO 3	Demonstrate the importance of protection of metals from corrosion.	Understand
CO 4	Identify the nature of the soil and to decide fertilizer for a particular soil depending on its nature	Understand
CO 5	Classify fuels based on their efficiency of combustion.	Apply

Course Contents

Module – I WATER ANALYSIS AND WATER TREATMENT 9

Water analysis: Sources of water, hard water and soft water, Hardness of water, acidity, alkalinity, pH value. Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD). Water treatment: Definition, Zeolite process, Conditioning methods: internal conditioning (Phosphate, Calgon) and external conditioning (Demineralization). Desalination, Reverse-osmosis (RO).

Module – II NANOCHEMISTRY 9

Basics: Distinction between molecules, nanomaterials and bulk materials. Size-dependent properties, Types of nanomaterials: Definition, properties, and uses of nanoparticle, nanocluster, nanorod, nanowire and nanotube. Synthesis: Sol-Gel and laser ablation methods. Applications of nanomaterials in medicine, agriculture, energy, electronics and catalysis.

Module – III CORROSION AND ITS CONTROL 9

Corrosion: Classification, Types: Chemical corrosion and Electrochemical corrosion. Corrosion control: Corrosion Inhibitors, cathodic protection (sacrificial anodic protection, impressed current cathodic protection), Protective coating, Paint and Electroplating.

Passed in Board of Studies Meeting on 17.03.2023 Passed in Academic Council Meeting on 27.04.2023

CHAIRMAN - BOARD OF STUDIES

Module – IV SOIL CHEMISTRY& FERTILIZER 9

Types of soil: saline soil, acidic soil and alkaline soil, submerged soil, salt affected and calcareous soil. Characteristics and Reclamation. Effect of N, P, K, Secondary nutrients and micronutrients on plant growth and development. Importance of nitrogenous fertilizers. Green manuring- definition and examples.

Module – V FUELS AND COMBUSTION 9

Solid fuel: Coaland its varieties, analysis of coal: proximate and ultimate with their significance. Manufacture of metallurgical coke (Otto-Hoffmann method).Liquid fuel: petroleum oil. Knocking: octane number. Diesel: cetane number. Gaseous fuels - Water gas and Liquefied Petroleum Gas. Combustion: Introduction, Calorific value- Gross and net calorific value, Dulong's formula and problems.

Total : 45 Periods

Laboratory Component

S.No.	Name of the Experiment	CO Mapping	RBT
1	Determination of hardness of water.	3	Apply
2	Determination of chloride content in water sample.	3	Apply
3	Conductometric titration of strong acid versus strong base.	3	Apply
4	Determination of strength of HCl by pH metry.	3	Apply
5	Estimation of copper in brass by EDTA method.	3	Apply
6	Determination of rate of corrosion by weight loss method	3	Apply
7	Estimation of strength of iron by potentiometric titration	3	Apply
8	Determination of strength of acids in a mixture of acids using conductivity meter	3	Apply

Total Periods: 30

Text Books

1. Dr. A. Ravikrishnan, "Engineering Chemistry" Sri Krishna Hitech Publishing Company, Chemistry, 2021.
2. N. Krishnamurthy, "Engineering Chemistry" PHI Learning, 4th Edition, 2020.
3. Dr.Sunita Rattan. Publisher, S.K. Kataria& Sons. Edition. Reprint, 2020

Reference Books

1. S S. Dara. "A Text Book of Engineering Chemistry", S. Chand Publishing, 12th Edition, 2018
2. B.S Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, "Text book of nanoscience and nanotechnology", Universities Press-IIM Series in Metallurgy and Materials Science, 2018.
3. Murthy, V.N S. "Soil Mechanics and Foundation Engineering", UBS Publishers and Distributors, New Delhi, 2017

Additional References

1. https://nptel.ac.in/downloads/122101001
2. https://nptel.ac.in/courses/103103033/module9/lecture1.pdf
3. https://nptel.ac.in/courses/102103044/3
4. https://www.youtube.com/watch?v=jFOeDef6bug

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Passed in Board of Studies Meeting on 17.03.2023 Passed in Academic Council Meeting on 27.04.2023

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	2									1			
CO 2	3	2									1			
CO 3	3	1									1			
CO 4	3	2									1			
CO 5	3	2									1			
	3-High				2-Medium				1-Low					

Summative Assessment						
Bloom's Level	Continuous Assessment					Final Examination (Theory) [50]
	Theory				Practicals	
	IAE-I [5]	IAE-II [10]	IAE-III [10]	Attendance [5]	Rubric based CIA [20]	
Remember	20	20	20		-	30
Understand	25	25	25		40	60
Apply	5	5	5		60	10
Analyze	-	-	-		-	
Evaluate	-	-	-		-	
Create	-	-	-		-	

CHAIRMAN - BOARD OF STUDIES

Passed in Board of Studies Meeting on 17.03.2023 Passed in Academic Council Meeting on 27.04.2023

23ME101	Engineering Graphics (Common to All Branches)	L	T	P	C
		1	0	4	3
Nature of Course	Engineering Sciences				
Prerequisites	Nil				

Course Objectives:

The course is intended to

1. Understand visualization concepts, layouts and pictorial views in various fields of engineering
2. Imagine and visualize the principal planes of engineering objects.
3. Translate the geometric information of engineering objects into projections of solids.
4. Develop the graphical skills for communication of concepts, ideas and design of engineering products through sectional technical drawings.
5. Visualize and draw isometric views

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO 1	Develop the conic sections, special curves, and draw orthographic views from pictorial views.	Apply
CO 2	Apply the principles of orthographic projections of points in all quadrants, lines and planes in first quadrant.	Apply
CO 3	Construct the projections of simple solids like prisms, pyramids, cylinder and cone.	Apply
CO 4	Build the sectional views of solids like cube, prisms, pyramids, cylinders & cones and development of its lateral surfaces.	Apply
CO 5	Organize and draw isometric view of simple solids.	Apply

Course Contents

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.

Module -I Plane Curves and Free Hand Sketching (3+12)

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – 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

Module –II Projection of Lines and Plane Surface (3+12)

Orthographic projection- principles-Principal 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. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

Module –III Projection of Solids (3+12)

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

Module - IV Projection of Sectioned Solids and Development of Surface (3+12)

Sectioning of above 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

Module -V Isometric Projections (3+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.

TOTAL: (15+60) Periods

TEXT BOOKS

1. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2011
2. Natarajan K.V., “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2012.

REFERENCE BOOKS

1. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 50th Edition, 2010.
2. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. Parthasarathy N S and Vela Murali, “Engineering Graphics”, Oxford University, Press, New Delhi, 2015.

Web References

1. http://nptel.ac.in/courses/112103019/Engineering drawing
2. http://pioneer.netserv.chula.ac.th/~kjirapon/self-practice.html

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 only to Final Examinations of 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. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO 1	3	2										1	2		
CO 2	3	2										1	2		
CO 3	3	2										1	2		
CO 4	3	3										1	2		
CO 5	3	2										1	2		
	3	High				2	Medium				1	Low			

Summative assessment						
Bloom's Level	**Continuous Assessment**					**Final Examination (Theory) [50 marks]**
	Theory				**Practical**	
	IAE-I [7.5]	**IAE-II [7.5]**	**IAE-III [10]**	**Attendance [5]**	**Rubric based CIA [20 Marks]**	
Remember	10	10	10		20	20
Understand	20	20	20		40	40
Apply	20	20	20		40	40
Analyse						
Evaluate						
Create						

23MA202	MATHEMATICAL FOUNDATIONS FOR ENGINEERING (Common to all B.E. / B.Tech Programme)	L	T	P	C
		3	1	0	4
Nature of Course	Basic Sciences				
Pre requisites	Fundamentals of Basic Mathematics				

Course Objectives

The course is intended to

1. Understand the curvature and calculate the radius of curvature, centre, evolutes, involutes.
2. Acquire the mathematical skills required to solve ordinary differential equations.
3. Familiarizethe concepts of Laplace transform and its inverse.
4. Gain knowledge of analytic approach to analyse the conformal mapping.
5. Obtainthe knowledge of evaluating contour integrals using residue theorem.

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Identify the circle of curvature, evolutes and involutes of the curves.	Apply
CO2	Demonstrate various techniques to solve ordinary differential equations.	Apply
CO3	Select Laplace transform to standard functions and solve initial value problems / differential equations .	Apply
CO4	Find an analytic function ,when its real or imaginary part is known	Apply
CO5	Classify the Singularities and its corresponding Residues for the given function	Apply

Course Contents:

Module – I	APPLICATION OF DIFFERENTIAL CALCULUS	12
Curvature – Curvature in Cartesian co-ordinates - Centre and Radius of curvature- Circle of curvature- Evolutes and Involutes.		
Module – II	**ORDINARY DIFFERENTIAL EQUATION**	**12**
Higher order linear differential equations with constant coefficients – Method of variation of parameters – non-Homogenous equation - Euler and Legendre Equations.		
Module – III	**LAPLACE TRANSFORMS**	**12**
Laplace transform –Transform of elementary functions –Properties –Transforms of derivatives and integrals -Transform of periodic functions. Inverse Laplace transform –Statement and applications of Convolution theorem - Method of solving second order ordinary differential equations with constant coefficients by using Laplace transform technique.		

Module – IV	ANALYTIC FUNCTIONS	12
Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates – Properties – Harmonic conjugates – Construction of analytic function – Conformal mapping : w = a+z, az, 1/z – Bilinear transformation.		
Module – V	**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.		
		Total: 60 Periods

Text Books:

1. Grewal B.S, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2019.
2. Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons (Asia) Limited, 10th Edition, 2016.

Reference Books:

1. Bali.N.P and ManishGoyal N.P, "A text book of Engineering Mathematics", Laxmi Publications, 6th Edition, 2015.
2. Ramana B.V, "Higher Engineering Mathematics",Tata McGraw Hill Publishing Company, 1st Edition, 2018.
3. Veerarajan T," Engineering Mathematics for Semester I and II", Tata McGraw Hill, 3rd Edition 2017.

Additional References:

1. https://onlinecourses.nptel.ac.in/noc24_ma12/preview
2. https://onlinecourses.swayam2.ac.in/cec24_ma10/preview
3. https://onlinecourses.nptel.ac.in/noc24_ma37/preview

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

	Pos												PSOs		
COs	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3												
CO2	3	3	2												
CO3	3	2	2												
CO4	3	3	3												
CO5	3	3	3												
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	Internal Assessment Exam			Final Examination (60)
	IAE I (5)	IAE II (10)	IAE III (10)	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	30	60
Analyze				
Evaluate				
Create				

23FT201	Fundamentals of Food Processing	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Food Microbiology				

Course Objectives

The course is intended to

1. Understand the basics of food processing
2. Study the methods of food storage.
3. Gain knowledge on principles of food preservation
4. Understand the concept of preservation by uses of chemicals.
5. Acquire a specialized knowledge in recent advances in food preservation

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Explain the basic concepts in processing of foods and its needs	Understand
CO2	Describe the food product handling and important methods of storage	Understand
CO3	Identify and apply the suitable food processing methods	Apply
CO4	Choose the appropriate chemicals to process the foods	Apply
CO5	Summarize the traditional and recent methods in food processing	Understand

Course contents:

Module I Introduction to food processing **9**

Historical perspective, traditional technologies used in food processing; Classification and constituents of food; Processing of Foods – Primary, Secondary and Tertiary processing; Food processing need and its significance.

Module II Methods of food products handling and its storage **9**

Nature of harvested crop, plant and animal; Storage of raw and cooked food; storage methods and its importance; effect of cold storage and its importance, storage of grains.

Module III Principles of Food Processing **9**

Mode of action and changes in foods; **High temperature** – Moist and Dry heat methods, Blanching, Dehydration, Concentration, Canning, Sterilization, Pasteurization; **Low temperature** – Freezing and Refrigeration; Dehydration; Ionizing radiation and microwave heating.

Module IV Food Processing by use of chemicals **9**

Principles, Technological aspects and applications of sugar and salt, antimicrobial agents, biological agent, mold inhibitor, effect of various food processing operations on the nutritive value of foods.

Module V Traditional methods and recent advances in food processing **9**

Traditional methods of food processing – Smoking, Sun drying, Pickling/ Salting, Fermentation; Recent advances in food processing - Pulse electric field packaging, Use of technology for minimal processing for preservation of fresh foods, Preservatives on food labels.

Total: 45 Periods

Text Books:

1. Anjum Ayoub, Fozia Hameed, Nadira Anjum Food Processing and Preservation (Volume - 1), 2022, Astral International Pvt Ltd.

2. Introduction to Food Engineering. A volume in Food science and technology. Elsevier Fifth Edition 2014. R. Paul Singh and Dennis
3. Desrosier N W and Desrosier J N (1987) The technology of Food Preservation, 4th Edition, CBS, New delhi.
4. Jelen, P. (2005). Introduction to food processing. Prentice Hall

References:

1. Scottsmith and Hui Y.H (Editiors) (2004) Food Processing – Principles and Applications London Blackwell Publishing

2. Subbulakshmi, G and Udipi, S. A. (2001).Foods Processing and Preservation, New Delhi: New Age International (P) Ltd. Publishing.

Web References

1. https://nptel.ac.in/courses/126105015
2. https://archive.nptel.ac.in/courses/103/107/103107088/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	**Pos**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	1											3		
CO2	3	1				1	1						3	2	1
CO3	3	2				2	1	1				1	3	2	1
CO4	3	2	1			2	1	1				1	3	2	1
CO5	3	2	1		2	1	1	1				1	3	2	2
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE – I (5)	**IAE – II (10)**	**IAE – III (10)**	
Remember	20	10	10	20
Understand	30	30	30	60
Apply		10	10	20
Analyze				
Evaluate				
Create				

Passed in Board of Studies Meeting *Approved in Academic Council Meeting*

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23FT202	Food Chemistry	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Nil				

Course Objectives

The course is intended to

1. Understand the relationship between nutrition and human well-being.
2. Grasp the major and minor components of foods
3. Learn the composition and properties of food
4. Know the functions, importance of all nutrients
5. Learn the pigment characteristics in animals and plants

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Discuss about food chemistry and role of nutrition in health	Understand
CO2	Explain the Carbohydrates - protein sources and its functions	Understand
CO3	Interpret the properties of lipids and processing of oils	Apply
CO4	Explain the various vitamins, minerals and its role	Understand
CO5	Illustrate the pigments in the animal and plant and its technology	Understand

Course contents:

Module I Food Chemistry and its scope **9**

Introduction to different food groups, significance of food chemistry, Role of Food chemists, Nutrition-Definition, Inter relationship between nutrition and health, Water in foods and its properties, Functional properties of water; Role of water in food spoilage, water balance – effect of deficiency

Module II Carbohydrates and Proteins in Food **9**

Carbohydrates - composition, classification, sources, functions, structure, physical & chemical properties, modification of carbohydrates, Proteins in foods: Processing induced, physical, chemical and nutritional changes in protein, chemical and enzymatic modification of protein

Module III Lipids in Food **9**

Lipids – composition, nomenclature, saturated, unsaturated fatty acids, classification, food sources, functions of fats , Role and use of lipids/fat, crystallization and consistency, chemical aspects of lipids, lipolysis, auto-oxidation, thermal decomposition, Oil processing: Refining, safety use of oils and fats in food formulation, Rancidity and its types

Module IV Vitamins, Minerals, Nutraceuticals in Food **9**

Vitamins – Classification, units of measurement, Fats soluble vitamins, Water soluble vitamins, Enrichment and Restoration, Minerals- Functions and Sources, Vitamin and Mineral Deficiency, Nutracueticals in food: antioxidants, phenols, tannins.

Module V Pigments in animals and plants **9**

Introduction, Heme pigments, chlorophyll, carotenoids, phenolic and flavonoids, betalins, effect of processing on pigment behaviour; Technology for retention of natural colours of food stuffs.

Total: 45 Periods

Text Books:

1.Food Chemistry and Nutrition: A Comprehensive Treatise – S.Sumathi, BSP Books, 2020

2. Swami Nathan M. (2012). Advanced Text book on food and Nutrition, Vol. II. The Bangalore Printing.

References:

1. Introductory Food Chemistry, John W. Brady, Cornell University Press, Ithaca, USA. 2013
2. Food The Chemistry Of Its Components 6Th Edition by Coultate T, C PUBLISHING, 2015
3. Food Biochemistry and Food Processing, Benjamin K. S., Wiley-Blackwell, London, 2012

Web References

1. https://www.youtube.com/watch?v=16FtnBamrpE&list=PLCT8
2.https://www.youtube.com/watch?v=T1Z0iYyYu38&list=PLh8k8L3SxcjM6yjqazC3uXhcDwRqHiG9

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	**Pos**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	1											2	2	1
CO2	3	2											2	2	1
CO3	3	1	1										2	2	2
CO4	3	1											2	2	1
CO5	3	2											2	1	2
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE – I (5)	**IAE – II (10)**	**IAE – III (10)**	
Remember	20	20	20	20
Understand	30	20	30	40
Apply		10		40
Analyze				
Evaluate				
Create				

Passed in Board of Studies Meeting

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Approved in Academic Council Meeting

23LET08	தமிழரும் தொழில்நுட்பமும் TAMILS AND TECHNOLOGY (Common to all B.E. / B.Tech Programme)	L	T	P	C
		1	0	0	1

Nature of Course	Humanities and Sciences
Pre requisites	Tamil

Course Objectives

The course is intended to

1. Introduce students to the great technology of ancient Tamil society.
2. Realize the contribution of various technologies for the development of governing area.
3. Highlighting the different manufacturing technology to make the coins, jewels, stones, art etc.
4. Know the role of agriculture, water management system and food processing.
5. Learn about the Scientific Tamil and Tamil computing of the past and how it has evolved over the generations.

Course Outcomes

On successful completion of the course the students will be able to

CO. No	Course Outcome	Bloom's Level
CO 1	Remember the life style and technology of the Sangam people.	Remember
CO 2	Get an updated knowledge of ancient designing and construction of House, Temple, hero stones etc.	Understand
CO 3	Learnt the speciality of manufacturing technology types and usages.	Understand
CO 4	Gain the knowledge on production of agricultural products based on the ancient technologies.	Understand
CO 5	Understand the evaluation of Tamil language through the digital system.	Understand

Course Contents (in Tamil)

அலகு - I	நெசவு மற்றும் பானைத் தொழில்நுட்பம்	2
சங்க காலத்தில் நெசவுத் தொழில் – பானைத் தொழில் நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் – பாண்டங்களில் கீறல் குறியீடுகள்.		
அலகு - II	வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்	2
சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப்பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் – மாமல்லபுரச் சிற்பங்களும், கோவில்களும் – சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் – நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் – செட்டிநாட்டு கட்டிடக் கலை – பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ - சாரோசெனிக் கட்டிடக் கலை.		

அலகு - III	உற்பத்தித் தொழில் நுட்பம்	2
கப்பல் கட்டும் கலை – உலோகவியல் – இரும்புத் தொழிற்சாலை – இரும்பை உருக்குதல், எஃகு – வரலாற்றுச் சின்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் -நாணயங்கள் அச்சடித்தல் – மணி உருவாக்கும் தொழிற்சாலைகள் – கல்மணிகள், கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் – எலும்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.		
அலகு - IV	வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்	2
அணை, ஏரி, குளங்கள், மதகு – சோழர்காலக் குமுழிகள் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் முத்துக்குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார்.		
அலகு - V	அறிவியல் தமிழ் மற்றும் கணினித்தமிழ்	2
அறிவியல் தமிழின் வளர்ச்சி – கணினித்தமிழ் வளர்ச்சி – தமிழ் நூல்களை மின் பதிப்பு செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக் கழகம் - தமிழ் மின் நூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்.		
		Total : 10 Periods

Course Contents (in English)

Module – I	WEAVING AND CERAMIC TECHNOLOGY	2
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.		
Module – II	DESIGN AND CONSTRUCTION TECHNOLOGY	2
Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.		
Module – III	MANUFACTURING TECHNOLOGY	2
Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold Coins as source of history - Minting of Coins – Beads making-industries Stone beads –Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.		
Module – IV	AGRICULTURE AND IRRIGATION TECHNOLOGY	2
Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea – Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.		
Module – V	SCIENTIFIC TAMIL & TAMIL COMPUTING	2

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.
Total : 10 Periods

பார்வை நூல்கள் (TEXT-CUM-REFERENCE BOOKS)

1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித்தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நகரிகம் (தொல்லியல் துறைவெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

23LEE02	ADVANCED COMMUNICATIVE ENGLISH (Common to all B.E. / B.Tech Programme)	L	T	P	C
		2	0	2	3
Nature of Course	Humanities and Sciences				
Pre requisites	Communicative English				

Course Objectives

The course is intended to

1. Hone professional communication skills, including email etiquette and formal presentation.
2. Develop advanced vocabulary and collocation for official communication.
3. Communicate effectively and actively in social interactions.
4. Improve writing skills such as project and report writing for various purposes.
5. Foster collaborative communication abilities through group discussion in diverse contexts.

Course Outcomes

On successful completion of the course the students will be able to

CO.No	Course Outcome	Bloom's Level
CO 1	Communicate professionally in various contexts.	Understand
CO 2	Make use of common English phrases and vocabulary.	Understand
CO 3	Integrate basic English communication skills at a personal and a professional level in day-to- day interaction.	Apply
CO 4	Implement listening, reading and writing skills in real - life situations	Apply
CO 5	Decipher collaborative communication skills through diversified contexts.	Understand

Course Contents

Module – I	TECHNICAL VOCABULARY AND USAGE	9
Grammar: Technical Vocabulary (Synonyms and antonyms) - Articles - Reported Speech - **Listening**: Listening to video lectures (TED / INK Talks) **Speaking**: Describing pictures, places – Speaking practice to improve pronunciation **Reading**: Critical reading from the given text **Writing**: Job Application with Resume - E mail writing.		
Module – II	**EFFECTIVE OFFICIAL COMMUNICATION**	**9**
Grammar: Collocation – Question tags – Prepositions **Listening:** Listening to telephonic conversation **Speaking:** Role plays – Telephonic Etiquette and telephonic phrases **Reading:** Company profile - Advertisement (job / product) **Writing:** – Preparing Memo – Prepare Circular, Agenda and Minutes – Placing Order – Prepare Advertisement.		
Module – III	**TECHNICAL LANGUAGE SKILLS FOR CONVERSATION**	**9**
Grammar: Degrees of Comparison – Conjunctions **Listening:** Sports commentaries – Animated short stories **Speaking:** Asking for and giving directions – Describing simple process **Reading:** Reading and understand technical vocabulary **Writing:** Letter to the Editor – Review of Favourite Movie / Book – Recommendations.		

Module – IV	LANGUAGE FOR BUSINESS CORRESPONDENCE	9
Grammar: Idioms and Phrases – Single line definitions Phrasal verbs **Listening:** Listening to informal communication **Speaking:** Narrating personal experience **Reading:** Speed reading – reading passage within the time limit **Writing:** Project writing – Report writing (Accident and Survey) – Preparing welcome address and vote of thanks.		
Module – V	**VERBAL ABILITY FOR WRITING**	**9**
Grammar: Verbal Analogy – Cause and effect expressions **Listening:** Listening to Iconic Speeches - debate and reviewing the performance **Speaking:** Group communication skills – Discussing social issues and current affairs **Reading:** Short story – critical reading **Writing:** Itinerary –Interpretation of charts (Flow chart and Pie chart) - Essay Writing and Paragraph.		
		Total : 45 Periods

Laboratory Components:

S.No	List of Experiments	CO Mapping	RBT
1	Describing Picture / Place	1	Understand
2	Listening	1	Understand
3	Role Play	2	Understand
4	Prepare Circular, Agenda & Minutes	2	Understand
5	Asking and Giving Directions	3	Apply
6	Narrate a Favourite Movie / Book	3	Apply
7	Welcome Address	4	Apply
8	Vote of Thanks	4	Apply
9	Discussing Social Issues	5	Understand
10	Interpretation of Charts	5	Understand
		Total	**15 Periods**

Text Books

1. Rizvi, Ashraf.M, "Effective Technical Communication", Tata McGraw Hill Publishing Company Limited, New Delhi, 8th Edition, 2020.
2. Hewings. M, "Advanced English Grammar", 3rd Edition, Cambridge University Press, Chennai, 9th Edition, 2019.
3. Board of Editors, "Using English – A Course book for Undergraduate Engineers and Technologists", Orient Black Swan Private Limited, Hyderabad, 3rd Edition, 2019.

Reference Books

1. Dr. Krishnakumar TP, "Rudiments of Communication Skills", Buddha Publication, 1st Edition, 2023.
2. Raman M & Sangeetha Sharma, "Technical Communication", Oxford University Press, USA, 13th Edition, 2018.
3. Dhanavel S. P., "English and Soft Skills", 1st Edition, Orient Black Swan Private Limited, Hyderabad, 2010.

Web References:

1. https://nptel.ac.in/courses/111104031
2. https://nptel.ac.in/courses/111106139
3. https://nptel.ac.in/courses/111105134

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)														
COs	Pos												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1									1	3	1		2	
CO 2									1	3	1		2	
CO 3									1	3	1		2	
CO 4									1	3	1		2	
CO 5									1	3	1		2	
	3-High				2-Medium				1-Low					

Summative assessment						
Bloom's Level	Continuous Assessment (IAE)					Final Examination (FE) [50marks]
	Theory Marks				Practical	
	IAE-I [5]	IAE-II [10]	IAE-III [10]	Attendance [5]	Rubric based CIA [20 Marks]	
Remember	25				4	10
Understand	25	25	25		8	20
Apply		25	25		8	20
Analyse						
Evaluate						
Create						

23LEJ06	JAPANESE	L	T	P	C
		2	0	2	3
Nature of Course	HSS				
Pre requisites	Nil				

Course Objectives

The course is intended to

1. Read & Write Hiragana and Katakana (Japanese Alphabets) letters.
2. Use words and phrases of greeting in Japanese, identify names of objects and do a self-introduction using short and simple sentences.
3. Demonstrate the use of time-related words, verb conjunctions and make light conversation asking for directions and answering questions.
4. Express their likes and dislikes, hobbies, describe the locations of different things and demonstrate counting in Japanese.
5. Demonstrate the minimum day to day conversation and describe their ability and experiences.

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1.	Read & Write Hiragana and Katakana (Japanese Alphabets) letters	Understand
CO2.	Identify names of objects and do self-introduction using short and simple sentences	Apply
CO3.	Demonstrate the use of time-related words	Apply
CO4.	Articulate their likes and dislikes, hobbies and describe the locations of different things	Apply
CO5.	Express day to day conversation and describe their ability to share their experiences	Understand

Course Contents

Module – I		9
INTRODUCTION- はじめまして – ALPHABET - Hiragana - NUMBERS- すうじ- Classroom Words- きょうしつのことば – LISTENING		
Module – II		**9**
ALPHABET-Katakana - BASIC SENTENCE- じぶんのなまえ - COUNTRY NAMES- くにのなまえ- SAYING AGE- なんさいですか - LISTENING		
Module – III		**9**
SAYING MONTH- なにつき - SAYING BIRTHDAY- たんじょうび - KAZOKU- かぞく - KNOWINGTHINGS- あ/こ/そ – LISTENING		

Module – IV		**9**
PRONOUNS - ADJECTIVES - SAYING TIME, SHOPPING – LISTENING		
Module – V		**9**
SELF INTRODUCTION - MY TOWN - Watashino machi - GO, COME, RETURN - BASIC VERBS – TRANSPORT – LISTENING		
		Total : 45 Periods

Text Books

1. Minna no Nihongo – Elementary Japanese 1
2. Minna no Nihongo- Translation & Grammar Notes 1
3. Gateway to Japan Japanese Language school e-handouts / e-course materials.

Summative Assessment						
Bloom's Level	**Continuous Assessment**					**Final Examination (Theory) [50 marks]**
	Theory Marks				**Practical**	
	IAE-I [5]	**IAE-II [10]**	**IAE - III [10]**	**Attendance [5]**	**Rubric based CIA [20 Marks]**	
Remember	50				4	10
Understand		20	20		8	20
Apply		30	30		8	20
Analyse						
Evaluate						
Create						

23PH202	MATERIALS PHYSICS (Common to Aero, Agri, Civil, FT, Mech, PCT & SF)	L	T	P	C
		3	0	2	4
Nature of Course	Basic Sciences				
Pre requisites	Fundamentals of Basic Physics				

Course Objectives

The course is intended to

1. Impart knowledge in production of laser and their applications in engineering and medical field.
2. Understand on the concept and properties of matter like elasticity and its applications.
3. Provide a valuable theoretical introduction and an overview of the fundamental structures of the crystal physics.
4. Apply the concepts of thermal conductivity to solve the thermal coefficients.
5. Give an idea on new engineering materials like shape memory alloys, metallic glasses and nanomaterials.

Course Outcomes

On successful completion of the course the students will be able to

CO.No	Course Outcome	Bloom's Level
CO 1	Compare the types of lasers for various industrial applications.	Understand
CO 2	Study the elastic behavior and working of torsional pendulum.	Understand
CO 3	Account for how crystalline materials are studied using miller indices, including concepts like coordination number and packing factor.	Understand
CO 4	Demonstrate the thermal conductivity of good and bad conductors.	Apply
CO 5	Explain a conceptual understanding about the properties of new engineering materials like shape memory alloys, metallic glasses and nanomaterials.	Apply

Course Contents

Module – I	LASER PHYSICS	9
Lasers: Introduction- characteristics of laser - population of energy levels, Einstein's A and B coefficients derivation - resonant cavity - semiconductor lasers: homojunction and heterojunction - Applications of lasers - particle size determination and holography.		
Module – II	**PROPERTIES OF MATTER**	**9**
Elasticity - stress-strain diagram and its uses - factors affecting elastic modulus and tensile strength - torsion pendulum: theory and experiment - bending of beams - bending moment – cantilever - uniform and non-uniform bending - I-shaped girders.		
Module – III	**CRYSTAL PHYSICS**	**9**
Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures.		

Module – IV	THERMAL PHYSICS	9
Transfer of heat energy - thermal expansion of solids and liquids - expansion joints - bimetallic strips - thermal conductivity - Forbe's and Lee's disc method: theory and experiment – thermal insulation - applications: heat exchangers in refrigerators, ovens and solar water heaters.		
Module – V	**MODERN ENGINEERING MATERIALS**	**9**
Metallic glasses – preparation, properties and applications – Shape memory alloys – Types, characteristics and applications – Nanomaterials – preparation– Physical Vapour Deposition (PVD) - sol gel method, properties and applications. Carbon Nano Tube (CNT) –properties and applications.		
		Total : 45 Periods

Laboratory Components (Any Five)

S.No	List of Experiments	CO Mapping	RBT
1	Determination of wavelength and particle size of the given Laser beam.	CO1	Apply
2	Determination of numerical aperture and acceptance angle of an optical fiber.	CO1	Apply
3	Determination of the rigidity modulus of a given wire by using Torsion pendulum.	CO2	Apply
4	Determination of Young's modulus of a material by non-uniform bending method.	CO2	Apply
5	Determination of Young's modulus of a material by uniform bending method.	CO2	Apply
6	Determination of thermal conductivity of a bad conductor by Lee's Disc method.	CO4	Apply
		Total	**15 Periods**

Text Books

1. Bhattacharya, D.K and Poonam, T, "Engineering Physics", Oxford University Press, 2nd edition, 2015.
2. M.N. Avadhanulu, M.N. &Kshirsagar PG. "A Text book of Engineering Physics", S.Chand and company, Ltd., New Delhi, 10th edition, 2014.
3. Singh Dheeraj Kumar, "Nanomaterials", Springer International Publishing, 1st Edition, 2023.

Reference Books

1. David Halliday, Robert Resnick and Jearl Walker., "Principles of Physics", Wiley, 10th Edition, 2014.
2. Raymond A Serway and John W Jewett., "Physics for Scientists and Engineers", Cengage Learning, 9th Edition, 2019.

Web References:

1. https://nptel.ac.in/courses/115/107/115107095/
2. https://spaceplace.nasa.gov/laser/en/
3. https://www.coursera.org/lecture/fe-exam/stresses-in-beams-strains-in-pure-and-nonuniform-bending-6aMRx

4. https://nptel.ac.in/courses/113106093

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1	3	1												
CO 2	3	1												
CO 3	3	2	2											
CO 4	3	2	2											
CO 5	3													
	3-High				2-Medium				1-Low					

Summative Assessment						
Bloom's Level	Continuous Assessment (IAE)					Final Examination (FE) [50marks]
	Theory Marks				Practical	
	IAE-I [5]	IAE-II [10]	IAE-III [10]	Attendance [5]	Rubric based CIA [20 Marks]	
Remember	10	10	10			20
Understand	35	35	35		40	60
Apply	5	5	5		60	10
Analyse						10
Evaluate						
Create						

23CS203	PROBLEM SOLVING USING PYTHON PROGRAMMING (Common to Aero,Agri,Civil,Mech,SF,PCT,FT)	L	T	P	C
		3	0	2	4
Nature of Course	Engineering Sciences				
Prerequisites	Mathematical and Logical Knowledge				

Course Objectives

The course is intended

1. Understand the basics of algorithmic problem solving.
2. Discuss the basics of simple python programs.
3. Develop python programs with conditionals and loops.
4. Explain python functions and call them.
5. Test the Python data structures—lists, tuples, dictionaries and files.

Course Outcomes

On successful completion of the course the students will be able to

CO. No	Course Outcome	Bloom's Level
CO1	Develop algorithmic solutions to simple computational problems and read, write, execute by simple python programs	Understand
CO2	Read, Write, Execute by hand simple python programs.	Understand
CO3	Write simple Python programs using conditionals and loops for Solving problems	Apply
CO4	Develop python string functions and lists	Apply
CO5	Illustrate the compound data using python Tuples, Dictionaries, Files and Packages.	Apply

Course Contents

Module–I	Basics of Computers & Problem solving	9
Computer Basics – Components-Computer organization - Computer Software- Types of software-Software Development steps –Need for logical analysis and thinking-Algorithms – Flowchart - Number system.		
Module– II	**Introduction of Python Programming**	**9**
Introduction-PythonIDLEInstallation-PythonInterpreter-Interactiveandscriptmode-Valuesand types, variables, operators, expressions, statements, precedence of operators, Multiple assignments, comments, Input and Output Statements.		
Module– III	**Control statements and Functions**	**9**

Conditional(if),alternative(if-else),chainedconditional(if-elif-else)-Iteration-while,for,break, continue, pass – Functions - Introduction, inbuilt functions, user defined functions, passing parameters, return values, recursion, Illustrative Programs: Students Mark Statement.		
Module–IV	**Strings, Lists**	**9**
Strings-String slices, immutability, string methods and operations -Lists-creating lists, list operations, list methods, mutability,aliasing,cloninglists,listand strings, list and functions-list processing-list comprehension, Sorting: Merge Sort, Insertion Sort. Illustrative Programs: Reverse String, Adding Elements to a List, Adding List to a List.		
Module–V	**Tuples , Dictionaries ,Files and Packages**	**9**
Tuples- Tuple assignment, lists and tuples, Tuple as return value- Dictionaries-operations and methods,FilesandException-Textfiles,readingandwritingfiles,Exception handling, Modules and Packages.		
		Total:45 Periods

Laboratory Components

S.No	List of Exercises	CO Mapping	RBT
1	Write a algorithm & draw flowchart for simple Computational problems.	CO1	Apply
2	Write a program to perform different arithmetic operations on numbers in python.	CO1	Apply
3	Write a python program to implement the various control structures.	CO2	Apply
4	Write a python program for computational problems using recursive function.	CO2	Apply
5	Demonstrate use of list for data validation.	CO3	Apply
6	Develop a python program to explore string functions.	CO3	Apply
7	Implement linear search and binary search.	CO4	Apply
8	Develop a python program to implement sorting methods.	CO4	Apply
9	Develop python programs to perform operations ondictionaries.	CO5	Apply
10	Write a python program to read and write into a file.	CO5	Apply
11	Create a game activity using Pygame like bouncing ball, car race etc.	CO5	Create

Text Books

1. Reema Thareja, "Problem Solving and Programming with Python", Oxford University Press, 1st Edition 2021.
2. Dr. R. Nageswara Rao, "Core Python Programming", Dream tech Press, 1st Edition 2019.

Reference Books

1. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2nd Edition 2021.
2. Ashok Namdev Kamthane, Amit Ashok Kamthane, "Programming and Problem Solving with Python", Mc-Graw Hill Education, 1st Edition 2020.
3. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem Solving Focus", Wiley India Edition, 2nd Edition 2019.
4. Timothy A. Budd," Exploring Python", Mc-Graw Hill Education (India) Private Ltd., 1st Edition 2015.

Additional References

1. **Python Research Association of India** - https://www.araiindia.com/services/technology-and-products
2. **NPTEL** - https://nptel.ac.in/courses/107/106/107106088/
3. **MOOC Courses** - https://www.mooc-list.com/tags/automotive-engineering

Mapping of Course Outcomes(COs) with Programme Outcomes(POs) Programme Specific Outcomes(PSOs)

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1		1							2	3	1	
CO2	3	2	1		1							2	3	1	
CO3	3	2	2		1							2	3	1	
CO4	3	2	2		1							2	3	1	
CO5	3	2	2		1							2	3	1	
	3	High				2	Medium					1	Low		

Bloom's Level	Summative Assessment					
	Continuous Assessment					Final Examination (Theory) [50]
	Theory				Practicals	
	IAE-I [5]	IAE-II [10]	IAE-III [10]	Attendance [5]	Rubric based CIA [20]	
Remember	10	10	10		20	20
Understand	20	20	20		20	40
Apply	20	20	20		10	40
Analyze						
Evaluate						
Create						

Passed in Board of Studies Meeting 29.03.2023 *Approved in Academic Council Meeting 27.04.2023*

CHAIRMAN-BOARD OF STUDIES

23MC002	ENVIRONMENTAL SCIENCES (Common for all branches)	L	T	P	C
		2	0	0	0
Nature of Course	Mandatory, Non Credit				
Pre requisites	Nil				

Course Objectives

The course is intended to

1. Understand the concept of eco system and environment.
2. Become conversant with ecological balance and values of biodiversity.
3. Know the role of human in prevention of pollution and making a clean environment.
4. Get knowledge about conservation of non-conventional energy resources.
5. Study about the nature and management of e-waste and solid waste.

Course Outcomes

On successful completion of the course the students will be able to

CO.No	Course Outcome	Bloom's Level
CO 1	Explain the knowledge about ecosystem and environment	Understand
CO 2	Interpret the ecological balance and preservation of bio diversity	Understand
CO 3	Demonstrate various types of pollution in order to control pollution	Apply
CO 4	Classify the energy sources for the conservation of non conventional energy sources	Understand
CO 5	Identify the nature and management of e-waste and solid waste	Apply

Course Contents

Module – I	ECOSYSTEM	6
Eco system - Food chains, Food webs and Ecological pyramids. Ecosystem (a) Forest eco system, (b) Aquatic eco system (pond ecosystem and marine ecosystem).		
Module – II	**BIODIVERSITY**	**6**
Introduction to Bio diversity, Values of Bio diversity, Threads to Bio diversity, Endangered and Endemic species of India, Hotspots of biodiversity. Conservation of Biodiversity: In-Situ and Ex-Situ conservation of biodiversity.		
Module – III	**ENVIRONMENTAL POLLUTION**	**6**
Definition, Causes, Effects and Control of (a) Air pollution (b) Water pollution (c) Soil pollution. Electrostatic Precipitator for controlling air pollution.		
Module – IV	**NON-CONVENTIONAL ENERGY RESOURCES**	**6**
Introduction, Types, Working and Applications of: Solar Energy- Photovoltaic (PV) solar energy, Wind Energy-Onshore wind power- and Geo Thermal Energy-Geo thermal power plant.		

Module – V	ENVIRONMENTAL MANAGEMENT	6
Sustainable Development, Waste Management: Types, sources and disposal of municipal, industrial solid Waste, Role of Information technology in Environment and Human. COVID-19 and JN-1 Virus.		
		Total : 30 Periods

Activity Components

S.No	List of Experiments	CO Mapping	RBT
1	Field study of simple eco system: pond, river and hill slopes	CO1	Understand
2	Case study regarding environmental management	CO5	Apply

Text Books

1. AnubhaKaushik and C.P. Kaushik, "Environmental Science and Engineering, New Age International Publishers, New Delhi, 2nd Edition, 2019.
2. V. Kumar, "An Introduction to Green Chemistry" Vishal publishing Co. Reprint Edition, 2020.

Reference Books

1. Santosh Kumar Garg and Rajeshwari Garg "Ecological and Environmental Studies", Khanna Publishers, Nai Sarak, Delhi, 2nd Edition, 2019.
2. Masters, Gilbert M, "Introduction to Environmental Engineering and Science", Pearson Education, New Delhi, 2nd Edition, 2020.

Web References:

1. https://nptel.ac.in/courses/122103039/38
2. https://bch.cbd.int/cms/ui/collaboration/download/download.aspx?id=909
3. https://nptel.ac.in/courses/105102089/air%20pollution%20(Civil)/Module-3/3a.htm
4. www.vssut.ac.in/lecture_notes/lecture1428910296.pdf
5. nptel.ac.in/courses/120108004/module7/lecture8.pdf

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO 1		3					1					3		
CO 2		3					3					1		
CO 3		3					2					3		
CO 4		2					3					2		
CO 5		3					3					2		
	3-High				2-Medium				1-Low					

Summative Assessment					
Bloom's Level	Continuous Assessment				
	IAE-I [20]	IAE-II [20]	IAE-III [20]	Attendance [20]	Activity [20]
Remember	20	20	15		
Understand	30	25	25		
Apply		5	10		
Analyze					
Evaluate					
Create					

23MC003	INTERPERSONAL SKILLS (Common to all B.E. / B.Tech Programme)	L	T	P	C
		0	0	2	0
Nature of Course	Mandatory – Non Credit				
Pre requisites	Nil				

Course Objectives

The course is intended to

1. Evaluate current relationships and their communication style.
2. Identify ways for improving important relationships.
3. Explore how the Bible correlates with principles from the chapter.
4. Describe how the communication processes impacts our ability to effectively communicate.
5. Identify challenges that may arise from interpersonal communication.

Course Outcomes

On successful completion of the course the students will be able to

CO.No	Course Outcome	Bloom's Level
CO 1	Practice interpersonal communication skills to influence and build good relationships.	Remember
CO 2	Identify and pursue personal learning goals.	Understand
CO 3	Give evident feedback.	Apply
CO 4	Reveal group dynamics and amiable behaviour.	Apply
CO 5	Emphasis the communication process.	Understand

Course Contents

Module – I	FUNDAMENTALS OF INTERPERSONAL COMMUICATION	6
Facts of communication and Interpersonal communication - culture and gender - Communication and Self disclosure - Presentation of Interpersonal perception - Learning goals - Feeling and feedback.		
Module – II	**INTERPERSONAL COMMUNICATION IN ACTION**	6
Nature of language - language and culture - usage and abuse of language -Positive communication -Non verbal communication - Listening strategies - Barriers of listening.		
Module – III	**EMOTIONAL INTELLIGENCE**	6
Influence of emotional experience and expressions - Accepting the responsibilities and changes - Negotiation tactics - Dealing with criticism and appreciation - Collaborative Problem Solving - Resilience Building.		
Module – IV	**TRANSACTIONS**	6
Different types of transactions - Building Positive Relationship - Managing Conflict - Connecting across Difference -Factors hampering Interpersonal interactions - Assertiveness in communication.		

Module – V	**ESSENTIAL INTERPERSONAL COMPETENCIES**	6
Behaviour - understanding limiting behaviour - Interpersonal and small and lateral thinking-Win -Win attitude - Positive thinking - Stress feedback - Personal Evaluation of Interpersonal Relationship Skills group behavior - Critical management - Assertive		
		Total : 30 Periods

Text Books

1. Bozeman, Jeanine C and Argile Smith, “Interpersonal Relationship Skills for Ministers” Gretna, LA: Pelican Publishing Company, 1st Edition, 2004.
2. Floyd, Kory, “Interpersonal Communication”, 2d. Boston: Mccraw-Hill, 2nd Edition, 2011.

Reference Books

1. Augsburger, David, “Caring Enough to Confront How to Understand and Express Your Deepest Feelings Towards Others”, updated ed Ventura, CA: Regal Books, 2nd Edition 2009.
2. Vohs, Kathleen D., and Eli J., Finkel, eds, “Self and Relationships: Connecting Intrapersonal and interpersonal Processes”. New York Guilford Press, 1st Edition, 2006.

Web References:

1. https://nptel.ac.in/courses/111104031
2. https://nptel.ac.in/courses/111106139
3. https://nptel.ac.in/courses/111105134

Laboratory Components:

S.No	List of Experiments	CO Mapping	RBT
1	Presentation of Interpersonal perception	1	Remember
2	Non-Verbal Communication	2	Understand
3	Negotiation tactics	3	Apply
4	Managing Conflict	4	Apply
5	Stress Management	5	Understand

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)														
COs	**Pos**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO 1										3	2	1	2	
CO 2										3	2	1	2	
CO 3										3	2	1	2	
CO 4										3	2	1	2	
CO 5										3	2	1	2	
	3-High				**2-Medium**				**1-Low**					

Bloom's Level	**Summative Assessment (Internal Mode)**	
	Assessment 1 (50 Marks)	**Assessment 2 (50 Marks)**
Remember	20	20
Understand	10	10
Apply	20	20
Analyse		
Evaluate		
Create		

23FT203	Food Practice Laboratory	L	T	P	C
		0	0	2	1
Nature of Course	Professional Core				
Pre requisites	Food Microbiology				

Course Objectives

The course is intended to

1. Learn the Anthropometric Indices and its importance.
2. Understand the properties and estimation of proteins as well as carbohydrates.
3. Study the characteristics of oils.
4. Know the media preparation, isolation of microorganisms, and Gram's staining techniques
5. Acquire a specialized knowledge on microbiological analysis of water and milk

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Determine and interpret the anthropometric indices	Evaluate
CO2	Estimate the protein and its properties as well as carbohydrates	Evaluate
CO3	Measure the solubility and refractive index of oils	Evaluate
CO4	Examine the microorganism's isolation and Gram's staining method	Analyze
CO5	Quantify the bacterial count and microbiological analysis of milk	Evaluate

List of Experiments

S. No	Name of Experiments	CO mapping	RBT Level
1	Assessment of Anthropometric Indices	CO1	Evaluate
2	Quantitative estimation of protein	CO2	Evaluate
3	Determination of foaming properties of proteins	CO2	Evaluate
4	Determine the total reducing and non-reducing sugars	CO2	Evaluate
5	Experiment to study the properties of carbohydrates – caramelization, Mailard reaction	CO2	Evaluate
6	Determination of solubility, specific gravity and refractive index of oils	CO3	Evaluate
7	Culture Media Preparation, Isolation of microorganisms	CO4	Analyze
8	Gram's Staining and study of morphology	CO4	Analyze
9	Quantification of Microbes Sampling and Serial Dilution; Bacterial count in food products TVC	CO5	Evaluate
10	Microbiological Quality of Water (MPN) and milk	CO5	Evaluate

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	1	1		1				1	3	3	1
CO2	3	3	2	2	1	1		1					3	3	1
CO3	3	3	2	2		1		1					3	3	1
CO4	3	3	2		1	1		1				1	3	3	1
CO5	3	3	2	2	1	1	1	1				1	3	3	1
	3	High				2	Medium					1	Low		

Passed in Board of Studies Meeting *Approved in Academic Council Meeting*

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Assessment	Marks	Weightage	Marks		
			CA	FE	Total
Rubrics based continuous assessment	100	30	60	40	100
Preparatory examination	100	25			
Attendance	5	5			

Bloom's Level	Rubric based Continuous Assessment [30 marks]	Preparatory / Model examination (25 Marks)	Final Examination [40 marks]
Remember	20	20	20
Understand	30	30	30
Apply	40	30	30
Analyze	10	20	20
Evaluate			
Create			

23FT301	Food Process Calculation	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	NIL				

Course Objectives

The course is intended to

1. Study the basic units, dimensions and basic related functions involved in food process engineering
2. Recognize the various law governing the gases and vapor and perform humidity calculations
3. Enable the students to perform material balances
4. Solve the problems related to energy balances
5. Acquire a specialized knowledge in enthalpy and its related changes

Course Outcomes

On successful completion of the course, students will be able

CO.No.	Course Outcome	Bloom's Level
CO1	Classify the units and dimensions of various physical quantities	Understand
CO2	Identify the properties of ideal, real gases and humidity chart	Apply
CO3	Examine the stoichiometric principles for the material balance in a process industry	Analyze
CO4	Solve energy balance for unit operations	Apply
CO5	Examine the performance of processing units and enthalpy changes	Analyze
CO6	Construct material and energy balances for various unit operations involved in food industries	Apply

Course contents:

Module I Units and Dimensions **7**

Fundamental units, derived units, Definitions of some basic physical quantities – Force, momentum, pressure, work and energy, power, concept of mole, methods of expressing composition of mixtures and solutions - weight, volume, atomic and mole Percentages, Conversions and calculations of normality, molality, molarity.

Module II Ideal gas, Real gas and Humidity **10**

Ideal and real gas laws - gas constant, volume and temperature using ideal gas law, Van der Waal's equation, Humidity: Calculation of absolute humidity, molal humidity, relative humidity and percentage humidity –Application of humidity in different food industries- Psychrometry chart, Dew point.

Module III Principles of Material Balance **10**

Law of Conservation of mass- Process flow diagram, Stoichiometric principles, material balance without chemical reaction, Importance of material balance in a food industry , Application and Problems of material balance to food operations like distillation, Evaporation, Drying.

Module IV Principles of Energy Balance **10**

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

Module V Enthalpy **8**

Enthalpy, Effect of pressure and temperature on heat of reaction, Combustion of solids, liquid and gas, Determination of Net Heat Value (NHV) and Gross Heat Value (GHV) of food products.

Use of Psychrometric chart is permitted in the examination

Total: 45 Periods

Text Books:

1. Bhatt B.I and Thakore S.B., "Stoichiometry", McGraw-Hill, India, 6th Edition, 2021.

2. Gavhane, K.A "Introduction to Process Calculations"(Stoichiometry), Nirali Prakashan Publications, Pune, 37th Edition, 2022.

3. Bhatt B.L. and Vora S.M., “Stoichiometry”, 4th Edition, Tata McGraw Hill Publishing Company, New york, 2004

References:

1. Himmelblau, D.M., "Basic Principles and Calculations in Chemical Engineering",9th Edition, Prentice Hall India, New Delhi, 2023

2. Venkataramani, V. and Anantharaman, N., "Process Calculations" , Prentice Hall of India, New Delhi, 2nd Edition, 2011.

Web References

1. https://nptel.ac.in/courses/103/103/103103165/
2. https://nptel.ac.in/courses/102/106/102106069/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	**Pos**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	3	3			2				2	1	1	
CO2	3	2	2	3	2			2				2	1	2	
CO3	3	2	2	2	2			1				2	2	1	1
CO4	3	3	2	3	3							2	1	1	2
CO5	2	2	2	2	2							2	1	2	1
CO6	2		2	2	2							2	2	1	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE – I (5)	**IAE – II (10)**	**IAE – III (10)**	
Remember	20	10	10	20
Understand	30	10	10	20
Apply		10	10	40
Analyze		20	20	20
Evaluate				
Create				

Passed in Board of Studies Meeting

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting

23FT302	Applied Thermodynamics for Food Technology	L	T	P	C
		3	0	0	3
Nature of Course	Professional core				
Pre requisites	Nil				

Course Objectives

The course is intended to

1. Provide the fundamentals and calculations involved in first law of thermodynamics.
2. Learn the second law of thermodynamics
3. Understand the PVT behavior of pure fluids
4. Recall the steam properties
5. Gain knowledge about thermodynamic properties of pure substances, its phase change processes and to study the working principle of steam boilers.

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Explain the basic concepts and apply the first law of thermodynamics in processes	Understand
CO2	Solve the second law of thermodynamics and Carnot principles	Apply
CO3	Identify the principles and concepts of PVT behavior of pure substances, ideal and real gases	Apply
CO4	Examine the properties of steam and its quality	Analyze
CO5	Develop an efficient food processing method	Apply
CO6	Conclude the microbial growth rate	Evaluate

Course Contents:

Module I	**Basic Concepts and First Law**	**10**
Fundamental concepts of thermodynamics: microscopic and macroscopic approach, systems, properties, process, functions, units, energy, heat and work, zeroth law, equilibrium state and phase rule. First law: statement of first law for flow and non-flow process, internal energy, enthalpy, heat capacities (CV and CP), Application of first law of thermodynamics: flow through nozzles, throttling process. Maxwell relationship and its application		
Module II	**Second Law of Thermodynamics**	**9**
Second Law of thermodynamics: Kelvin-Plank, Clausius statements and its equivalence, reversible cycle – Carnot cycle and theorem – thermodynamic temperature scale. Entropy, Clausius theorem, Clausius inequality, estimation of entropy changes during processes, available and unavailable energies.		
Module III	**PVT Behavior of Pure Fluids**	**9**
PVT surfaces: P-V, P-T, T-S and H-S Diagrams. Fundamentals of phase equilibria, fugacity. Equation of state and the concept of ideal gas: Process involving ideal gases - constant volume, constant pressure, and constant temperature, adiabatic and polytrophic process. Equation of state for real gases: Vander Waals equation, RedllichKwong equation, Virial equation of state. Principle of corresponding states, generalized compressibility charts.		
Module IV	**Steam Properties**	**9**
Determination of properties of steam using steam tables. Determination of dryness fraction of steam: Calorimeters – Tank or barrel type. Steam distribution systems. Types of steam traps and their characteristics. Application of steam in food process industries.		
Module V	**Thermodynamic description of microbial growth and Product formation**	**8**
Thermodynamics of microbial growth stoichiometry thermodynamics of maintenance, Calculation of the operational stoichiometry of a growth process at different growth rates, Including Heat using the Herbert –Pirt Relation for Electron Donor.		
		Total: 45 Periods

Passed in Board of Studies Meeting

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Text Books:	
1. Narayanan K.V., ―A Text Book of Chemical Engineering Thermodynamicsǁ, 2nd Edition, Pentice Hall of India, New Delhi, 2013. 2. Rajput, R.K. Engineering Thermodynamics. 3rd Edition. Laxmi Publication. New Delhi. 2009 3. Pauline M. Doran, "Bioprocess Engineering Principles" 2nd Edition, Academic Press, New Delhi, 2020	
ReferenceBooks:	
1. Sadhu Singh and Sukumar Pati, ―Thermal Engineeringǁ, 1st Edition, Pearson India Education Services Pvt. Ltd., Noida, 2018. 2. Romeo T. Toledo, ―Fundamentals of Food Process Engineeringǁ, 4th Edition, Springer, New York, 2018. 3. Nag P.K., Engineering Thermodynamics, McGraw Hill Education (India) Pvt Ltd, 2nd Edition, 2014	
Additional References:	
1. www.digimat.in/nptel/courses/video/104106089/L01.html 2. www.digimat.in/nptel/courses/video/103103144/L12.html	

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme SpecificOutcomes (PSOs)															
	Pos												PSOs		
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	2	1									2	2	1
CO2	3	3	2	1									2	2	2
CO3	3	3	3	2									2	2	1
CO4	3	3	3	2									2	1	1
CO5	3	3	3	1									1	2	1
CO6	3	3	2	1									2	2	2
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Exam**			**Final Examination**
	IAEI (5)	**IAE II (10)**	**IAE III (10)**	
Remember	10	10	10	20
Understand	10	10	10	20
Apply	30	30	20	40
Analyze			10	20
Evaluate				
Create				

Passed in Board of Studies Meeting

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting

23FT303	Fluid Mechanics and Unit Operations	L	T	P	C
		3	0	0	3
Nature of Course	Professional core				
Pre requisites	Nil				

Course Objectives

The course is intended to

1. Recall the concepts of fluid mechanics
2. Calculate the pressure variations in fluids and measurement devices.
3. Criticize the equations of motion and kinetics of fluid flow.
4. Compare the various types of equipments involved in drying and dehydration.
5. Learn the operations involved in mechanical separations.

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Explain the various properties of fluids.	Understand
CO2	Categorize the different devices to measure the pressure of fluids.	Apply
CO3	Employ the basic design calculations for fluid flow	Apply
CO4	Explain the models involved in the moisture and its measurements.	Understand
CO5	Demonstrate the filtration, sedimentation and centrifugal separations.	Understand
CO6	Predict the appropriate equations and principles to analyze pipe flow problems.	Apply

Course Contents:

Module I	PROPERTIES OF FLUIDS	9
Introduction- units and Dimensions – Properties of fluids-Density – Specific weight - Specific Volume- Specific gravity- Viscosity-Thermodynamic properties-Compressibility and Bulk modulus- Surface tension and capillarity - vapor pressure and cavitation.		
Module II	**PRESSURE AND ITS MEASUREMENT**	**9**
Fluid pressure at a point- Pascal's law- Pressure variation in a fluid at rest-Absolute, Gauge, Atmospheric and vacuum pressures- Measurement of pressure Simple manometers-Differential manometers.		
Module III	**BASIC CONCEPTS OF FLUID FLOW AND MEASUREMENT**	**10**
Pump-definition- Classification, Positive displacement, centrifugal pump, Gear pump, Diaphragm pumps, vacuum pump, peristaltic pump, principles and application, characteristics and Performance; selection and specification,- Equations of motion- Euler's equation of motion- Bernoulli's equation- Practical applications of Bernoulli's equation – Venturi meter- Orifice meter Pitot tube. Rotameter.		
Module IV	**DRYING AND DEHYDRATION**	**9**
Moisture and its measurements - direct and indirect methods – Equilibrium moisture –Methods of determination – EMC Models -PET and GAB models – importance of EMC- water activity –Drying theory – Drying rate – Mechanical Drying – hot air dryers -fluidized bed		
Module V	**MECHANICAL SEPARATION**	**8**
Screening: Types, Equipments; Filtration: Filter media types and requirement – constant rate filtration – constant pressure filtration – filter cake resistance – filtration equipments – filter press – rotary drum filters – sedimentation – gravitational sedimentation – Stoke's law – sedimentation in cyclones. Centrifugal separations – rate of separation – centrifuge equipment		
		Total: 45 Periods

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Text Books:	
1. Bansal, R.K., "Fluid Mechanics and Hydraulic Machines",9th edition, Laxmi Publications, New Delhi. (2011). 2. Geankoplis CJ. Transport Processes and Separation Processes Principles. Prentice Hall India, New Delhi, 5th Edition, 2018. 3. Jain A K "Fluid Mechanics" Khanna Publishers,2004	
Reference Books:	
1. Som, S.R and Biswas, (2007). "Introduction to Fluid Mechanics and Fluid Machines" 2nd edition, Tata McGraw Hill. 2. Earle, R.L. Unit Operations in Food Processing". Pergamon Press. UK, 2nd Edition, 2003. 3. Grade RJ" Fluid mechanics through problems" wiley eastern Ltd,Madras,2002	
Additional References:	
1. www.digimat.in/nptel/courses/video/112105171/L45.html 2. https://archive.nptel.ac.in/courses/126/105/126105011/	

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme SpecificOutcomes (PSOs)															
	Pos												PSOs		
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	2		2							3	2	
CO2	3	2	2	2		2							3	2	
CO3	3	3	2	2									3		
CO4	3	2	2	2		2							3	2	
CO5	3	2	1	2									3	2	
CO6	3	3	2										3	2	
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Exam**			**Final Examination**
	IAEI (5)	**IAE II (10)**	**IAE III (10)**	
Remember	20	10	20	30
Understand	30	10	30	30
Apply		30		40
Analyze				
Evaluate				
Create				

Passed in Board of Studies Meeting

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting

23FT304	FOOD ANALYSIS	L	T	P	C
		3	0	2	4
Nature of Course	Professional Core				
Pre requisites	Nil				

Course Objectives

The course is intended to

1. Understand the sampling and proximate analysis of food substances
2. Learn the quality standards and adulterants of lipids, proteins and carbohydrate
3. Know the different spectroscopic techniques involved in food analysis
4. Acquire a specialized knowledge on various chromatographic methods employed in analysis of foods
5. Gain knowledge on electrophoresis, refractrometry and polarimetry in food analysis
6. Understand the food sampling and analyse the adulteration in food commodities

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Summarize the appropriate sampling methods for food analysis	Understand
CO2	Identify the physiochemical and quality standards of lipids, proteins and carbohydrates	Apply
CO3	Examine the composition of foods using spectroscopic methods	Analyze
CO4	Choose the appropriate chromatographic methods for analysis of food samples	Apply
CO5	Explain the tests on food substances using electrophoresis, refractrometry and polarimetry	Understand
CO6	Assess the adulteration in the given food commodities	Evaluate

Course contents:

Module I	**Introduction to sampling methods and basic food analysis**	**9**
Introduction, Food Regulations and standards, sampling procedures and methods, sample preparation for analysis, Evaluation of analytical data accuracy and precision, sources of errors; Determination of moisture content, ash content, acidity in foods, dietary fiber and crude fiber.		
Module II	**Lipids, Protein and Carbohydrate analysis**	**9**
Determination of total fat in foods, physiochemical analysis of oils and fats, quality standards and adulterants, different methods of determination of protein amino acids in foods, determination of total carbohydrate, starch, disaccharides and simple sugars in foods.		
Module III	**SPECTROSCOPIC TECHNIQUES**	**9**
Basic principle of spectroscopy – Spectrophotometric analysis of food components; Instrumentation and application of UV-Visible, IR, AAS and ICP-AES in analysis of mineral elements and fluorimeter in vitamin analysis, Tintometer in vanaspathi analysis		
Module IV	**CHROMATOGRAPHIC TECHNIQUES**	**9**
Basic principles and types of chromatography- Paper chromatography, thin layer chromatography, column chromatography – Advantages, disadvantages and its applications. Gas chromatography and High Performance Liquid chromatography (HPLC): Introduction, Principle, instrumentation and applications. Significance of MS detectors in HPLC and GC, detection of adulterants in foods.		
Module V	**ELECTROPHORESIS, REFRACTOMETRY AND POLARIMETRY**	**9**
Basic principles; type - paper, starch, gel, Application of the electrophoresis in food analysis, Brixs value of fruit juices; refractive indices of oils and fats, total soluble solids in fruit products; specific rotations of sugars; simple sugars and disaccharides by polarimeter.		
		Total: 45

Passed in Board of Studies Meeting *Approved in Academic Council Meeting*

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List of Experiments:

S. No.	Name of the Experiment	CO Mapping	RBT
1	Estimation of moisture and ash content of food sample	CO1	Evaluate
2	Determination of pH and Titratable acidity in food products	CO1	Evaluate
3	Estimation of carbohydrates present in food samples	CO2	Evaluate
4	Examine the vitamin content in food samples using UV-Visible spectrophotometer	CO3	Apply
5	Examine the food dyes using chromatographic technique – Thin Layer Chromatography	CO4	Apply
6	Quantitative determination of sugars in fruit juices using refractometry	CO5	Analyze
7	Analysis of protein content in food samples using gel electrophoresis	CO5	Analyse

Text Books:

1.Joseph Sherma, “Handbook of Thin-Layer Chromatography”, CRC Press, 4th edition, Volume 1, 2020

2.B. G. Derrick, “Gatos Chromatography: Principles, Techniques, and Applications”, CRC Press, Volume 1, 2018

3.David Rickwood, “Electrophoresis: Theory, Methods, and Applications”, Oxford University Press, Volume 1, 2018

References:

1. B. K. Sharma, “Instrumental Methods of Chemical Analysis”, Krishna Prakashan Media, 32nd edition, Volume 1, 2019

2. Y. H. Hui, “Food Analysis”, CRC Press, 4th edition, Volume 1, 2019

Web References

1. https://archive.nptel.ac.in/courses/104/106/104106122/
2. https://nptel.ac.in/courses/103108100

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	**Pos**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	2	3	1		1	2			1		2	1	1
CO2	3	2	1	3	2		1	2						1	2
CO3	3	2	2	3	1			1					1		
CO4	3	2	3	2	2		1	2					2	2	
CO5	2	1	1	3	2										
CO6	2		1	1			1	1			1		2	2	2
	3	High				2	Medium					1	Low		

Summative Assessment							
Bloom's Category	**Internal Assessment Examinations**						**Final Examination (50)**
	Theory				**Practical**		
	IAE – I (5)	**IAE – II (10)**	**IAE – III (10)**	**Attendance (5)**	**Rubrics Based CIA (10)**	**Model (10)**	
Remember	20	20	10		10		20
Understand	30	10	20		20		30
Apply		10	10		10		30
Analyze		10	10		10		20
Evaluate							
Create							

Passed in Board of Studies Meeting

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting

23FT305	Fluid Mechanics and Unit Operations Laboratory	L	T	P	C
		0	0	4	2
Nature of Course	Professional Core				
Pre requisites	Fundamentals of Food Processing				

Course Objectives

The course is intended to

1. Gain knowledge of the various types of equipments used in the food industry.
2. Demonstrate the different types of distillation involved in the food processing
3. Analyze the various flow measuring equipment involved in food industries.
4. Acquire knowledge about the various size reduction equipments.
5. Understand the concept of Evaporator Performance.

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Describe and demonstrate the equipments for various unit operations	Apply
CO2	Perform and calculate the experiment on flow of fluids	Evaluate
CO3	Measure the various distillation processes	Analyze
CO4	Examine the performance of evaporation process	Analyze
CO5	Evaluate the various milling processes used in the food industries.	Evaluate

List of Experiments

S. No	Name of Experiments	CO mapping	RBT Level
1	Determination of coefficient of discharge of Venturi meter	CO2	Evaluate
2	Determination of coefficient of discharge of Orifice meter	CO2	Evaluate
3	Determine the discharge coefficient of the flow by using Rotameter	CO2	Evaluate
4	Evaluate vaporization efficiency (Ev) for the given sample using steam distillation	CO2	Evaluate
5	Evaluate the efficiency of the sample using Simple distillation	CO3	Evaluate
6	Determination of the particle size distribution of granular material	CO3	Evaluate
7	Estimate the steam economy of given sample using single effect evaporator	CO4	Analyze
8	Determination of rate of evaporation of given solution using Rotary Evaporator	CO4	Analyze
9	Determination of size reduction using the hammer mill	CO5	Evaluate
10	Determination of work index using the Ball mill	CO5	Evaluate

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
COs	**Pos**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	1	1		1				2				1	2	2
CO2	3	1	1		2				1				1	2	1
CO3	3	2	1		1				2				2	1	2
CO4	3	2	1		2				1				1	2	1
CO5	3	2	1		2				1				1	2	2
	3	High				2	Medium					1	Low		

Assessment	**Marks**	**Weightage**	**Marks**		
			CA	**FE**	**Total**
Rubrics based continuous assessment	100	40	60	40	100
Preparatory examination	100	20			

Bloom's Level	**Rubric based Continuous Assessment [40 marks]**	**Preparatory / Model examination (20 Marks)**	**Final Examination [40 marks]**
Remember	20	10	10
Understand	30	30	30
Apply	40	30	30
Analyze	10	30	30
Evaluate			
Create			

Passed in Board of Studies Meeting

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Approved in Academic Council Meeting

23FT401	Heat and mass Transfer in Food Technology	L	T	P	C
		3	0	0	3
Nature of Course	Professional core				
Pre requisites	Applied Thermodynamics for Food Technology				

Course Objectives

The course is intended to

1. Understand about laws of heat conduction and theories of insulation.
2. Learn the different modes of convection heat transfer.
3. Understand the different modes of radiation heat transfer.
4. Gain knowledge in the types of heat exchanger and their applications in food industry.
5. Acquire a specialized knowledge in the diffusion mass transfer.

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Summarize the conduction mode of heat transfer in simple and composite systems	Understand
CO2	Identify the heat transfer coefficients concept on natural convection.	Apply
CO3	Explain the basics and influence of radiation in food processing operations	Understand
CO4	Compare heat exchanger performance by using the method of log mean temperature difference	Analyze
CO5	Develop the basics of diffusion mass transfer and its application in food Processing.	Understand
CO6	Conclude the heat exchanger and its application	Evaluate

Course Contents:

Module I	**HEAT TRANSFER – CONDUCTION**	**9**
Modes of heat transfer – Conduction, Convection and Radiation. Fourier's Law of Heat conduction-Thermal Conductivity for gases, liquids and solids-Thermal diffusivity- Thermal resistance-Steady heat conduction in simple geometries: Plane wall, hollow cylinder and hollow sphere through solids in series -plane wall and multilayer cylinder. Theory of insulation, critical radius of insulation.		
Module II	**HEAT TRANSFER – CONVECTION**	**10**
Convection heat transfer – forced and natural; Evaluation of convection heat transfer coefficient, Forced convection- Heat Transfer Coefficient for Laminar flow inside a tube -heat transfer coefficient for turbulent flow inside a pipe. – Heat Transfer outside various Geometries in Forced Convection – Flow parallel to flat plate – Natural convection from vertical planes and cylinders –boiling and condensation-mechanisms		
Module III	**HEAT TRANSFER – RADIATION**	**8**
Basics of Radiation heat transfer- Types of surfaces – Kirchhoff's Law-radiation from a body and emissivity (Stephan Boltzmann Law) to a small object from surroundings –Planck's Distribution law-Wein's Displacement law- combined Radiation and Convection Heat Transfer.		
Module IV	**HEAT EXCHANGERS**	**9**
Types-Overall Heat Transfer Coefficient-Shell and Tube–Plate Heat Exchanger-tubular heat exchanger-Parallel Flow and Counter Flow- Cross flow Types- Scraped surface exchangers-Compact Heat exchanger- Heat exchanger Analysis-Log mean Temperature Difference; Simulation of Heat Exchanger		
Module V	**MASS TRANSFER**	**9**
Mass transfer – introduction – Fick's law for molecular diffusion - molecular diffusion in gases – equimolar counters diffusion in gases and diffusion of gas A through non diffusing or stagnant B - diffusion through a varying cross sectional area and diffusion coefficients for gases - molecular diffusion in liquids, biological solutions and gels.		

Total: 45 Periods

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Text Books:	
1. Rao,D.G. Fundamentals of Food Engineering. PHI learning Pvt Ltd. New Delhi, 2009. 2. Mccabe W.L., Smit J.C and Harriott P. Unit Operations of Chemical Engineering. McGraw-Hill International. New York, 7th Edition, 2017. 3. C. P. Kothandaraman and S. Subramanyan, Fundamentals of Heat and Mass Transfer, New Age International private limited, New Delhi, 2014.	
ReferenceBooks:	
1. Paulsingh R, Dennis R. Heldman. Introduction to Food Engineering. Academic press 5th edition. 2013. 2. EcKert, E.R.G. "Heat and Mass Transfer". McGraw Hill Book Co., New York, 1981 3. Coulson,J.M and et al. Coulson and Richardsons Chemical Engineering, 6th Edition Vol.I and II, Butterworth- Heinman, 2004	
Additional References:	1. www.digimat.in/nptel/courses/video/103101137/L01.html 2. https://nptel.ac.in/courses/112101097

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme SpecificOutcomes (PSOs)

	Pos												PSOs		
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1			2							2		1
CO2	3												2	1	1
CO3	3	2	2	1		2							1		
CO4	3	2											2	1	2
CO5	3		2	1		1							1		2
CO6	3	2	1			2							2	2	1
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	15
Understand	Tutorial Class /Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Exam**			**Final Examination**
	IAEI (7.5)	**IAE II (7.5)**	**IAE III (10)**	
Remember	20	10	10	20
Understand	30	20	10	20
Apply		20	20	50
Analyze			10	10
Evaluate				
Create				

Passed in Board of Studies Meeting

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting

23FT402	Meat, Fish and Poultry processing technology	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Fundamentals of food processing.				

Course Objectives

The course is intended to

1. Provide information about the principles of meat, poultry and fishery industry.
2. learn the different types of processing concepts of meat.
3. Understand the basics of fish food processing.
4. Understand the processing techniques of poultry.
5. Gain knowledge in the egg processing and its related aspects.

Course Outcomes

On successful completion of the course, students will be able to

S. No	Course Outcome	Bloom's Level
CO1	Outline the principles of meat, poultry and fishery industry.	Understand
CO2	Summarize the concept of meat processing.	Understand
CO3	Develop the fish spoilage factors, Handling and processing methods.	Apply
CO4	Relate the basics of poultry processing.	Understand
CO5	Interpret the egg processing and its related aspects.	Understand
CO6	Compare the different processing analyse technologies.	Analyze

Course contents:

Module I Introduction **9**

Types and its sources, composition, structure, Importance and Status of meat, poultry and fishery industry in India. Research and development activities on meat, poultry and fishery products, EU Hygienic regulations, HACCP, ISO, MFPO, Kosher, Halal, FSSAI guidelines on FSMS compliance for meat and meat products.

Module II Meat Processing **9**

Abattoir, Ante-mortem inspection of meat animals, evaluation of animal carcasses, composition of meat, slaughtering, post-mortem changes in meat, factors affecting post-mortem changes in meat, Mechanical deboning, grading and aging. By products from meat industries and their utilization. Preservation of meat and meat products – Electrical stimulation, chilling, cold shortening, thaw rigor, freezing, Cured, smoked, and canned products. Nutritive value and packaging of meat.

Module III Fish Processing **9**

Types of fish, composition, structure and spoilage factors of fish. Post-mortem changes in fish. Handling and transportation of fish. Bacteriology of fish, Chilling of fish, Freezing and Individual quick freezing. Canning and smoking operations, Salting and drying of fish, pickling. Radiation processing of fish and fish products. Seafood quality Assurance, Advances in fishery by products technology.

Module IV Poultry and Products **9**

Types poultry, factors affecting poultry farming, chemical composition and nutritive value of poultry meat, methods of stunning, slaughter, pre- and post-slaughter, scalding and dressing. Utilization of poultry industry by products.

Module V 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.

Total: 45 Periods

Text Books:

1. Jhari Sahoo, "Textbook on Meat, Poultry and Fish technology", Daya Publishing House, 2016.

2. Jhari Sahoo, "Textbook on Meat, Poultry and Fish technology", Daya Publishing House, 2016.

3. Isabel Guerrero- Legarreta, "Handbook of Poultry Science and Technology", Wiley, 2010.

References:

1. Joseph Kerry, John Kerry and David Led wood. —Meat Processing, Woodhead Publishing Limited, England (CRC Press), 2002.

2. Poultry Meat Processing and Quality, Woodhead Publishing, England, 2004.

Web References

1. https://www.pdfdrive.com/food-science-and-technology-d41395460.htm

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	**Pos**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	2			2	2	1						1		
CO2	2	2											2		
CO3	3	3	2	3	2	1	3						1		
CO4	2	2	2	1	1	1	2						2		
CO5	3	3		2	1		3						1		
CO6	3	3	3	2	3										
	3	High				2	Medium						Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE – I (5)	**IAE – II (10)**	**IAE – III (10)**	
Remember	20	10	20	20
Understand	30	10	30	20
Apply		30		60
Analyze				
Evaluate				
Create				

Passed in Board of Studies Meeting

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting

23FT403	Food Processing and Preservation	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Food Analysis and Food chemistry and Nutrients				

Course Objectives

The course is intended to

1. Provide information about the scope and importance of preservation
2. Learn the different types of processing and preservation
3. Understand the preservation techniques by controlling water activity.
4. Understand the Non thermal methods of food processing.
5. Gain knowledge in the area of novel food techniques and packaging.

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Explain about principles of food processing and preservation.	Understand
CO2	Summarize the high and low temperature processing of foods.	Understand
CO3	Distinguish into the shelf life of foods processed and preserved by natural and chemical agents.	Analyse
CO4	Identify with the recent non - thermal methods.	Apply
CO5	Develop the novel processing methods.	Apply
CO6	Make use of different preservation methods to increase the shelf life of products	Apply

Course contents:

Module I INTRODUCTION TO FOOD PROCESSING AND PRESERVATION 9

Overview of food processing and preservation, Historical development and significance, Factors influencing food spoilage and deterioration, Principles of Food Processing and Preservation.

Module II HIGH AND LOW TEMPERATURE PROCESSING OF FOODS 9

Methods of applying heat to food - commercial sterility, calculation of process time - equipment. Methods of low temperature preservation – Chilling- Freezing - freeze drying and freeze concentration – theory and principles- Effect of freezing: Physical and chemical changes in Foods- Enzyme activity- Microbe inactivation and Food quality -nutritional aspects.

Module III PRESERVATION BY CONTROL OF WATERACTIVITY 9

Dehydration: Theory of Drying-Factors influencing drying rate-traditional and modern methods of drying- types of driers-Effect of drying on Foods-pigments and enzymes-Osmotic dehydration: Concept of Osmotic Dehydration-Factors influencing osmosis-Preservative effects on foods-Food Concentration: Evaporation and membrane technology- Intermediate moisture food concepts.

Module IV NON - THERMAL METHODS OF FOOD PROCESSING 9

Food Irradiation – High Pressure Processing –Pulse dielectric field processing, pulse delight treatment and Ultrasound – Theory and Principles - Chemical Preservatives, Salting and Curing, Smoking, Pickling, Fermentation, Food Irradiation technology, Ultrasound technology, Hurdle technology.

Module V NOVEL PROCESSING METHODS & FOOD PACKAGING 9

Novel processing: Ohmic heating - Radio frequency heating and Infra-red heating-Ozone processing - Dense phase carbon dioxide processing of fluid foods Pulsed electric field-Pulsed X-Ray. Packaging: Definition-Significance-functions-basic packaging materials-role of different packaging methods in food preservation

Total: 45 Periods

Text Books:

1.Anjum Ayoub, Fozia Hameed, Nadira Anjum Food Processing and Preservation (Volume - 1), 2022, Astral International Pvt Ltd.
2. Gopala Rao, Chandra. "Essentials of Food Process Engineering". B.S. Publications, 2006.
3. Jelen, P. (2005). Introduction to food processing. Prentice Hall

References:

1.Sivasankar, B., "Food Processing and Preservation", Prentice Hall of India, New Delhi, 2005.
2.Scottsmith and Hui Y.H (Editors) (2004) Food Processing – Principles and Applications London Blackwell Publishing

Web References

1. https://nptel.ac.in/courses/126/105/126105018/
2. https://nptel.ac.in/courses/126/105/126105015/

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	Po's												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2										3	2		
CO2	3	3										2	2		
CO3	3	2	2	3								2	1		
CO4	3	3	2										1		
CO5	3	3											1	3	
CO6	3	3	2	1											
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE – I (5)	**IAE – II (10)**	**IAE – III (10)**	
Remember	20	20	10	50
Understand	30	10	20	20
Apply		10	20	20
Analyze		10		10
Evaluate				
Create				

Passed in Board of Studies Meeting

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting

23FT404	Food additives	L	T	P	C
		3	0	0	3
Nature of Course	Professional Core				
Pre requisites	Chemistry & Nutrients				

Course Objectives

The course is intended to

1. Learn the Indian laws and regulations pertaining to food additives
2. Familiarize with the safety assessment of food additives
3. On permitted food additives and its functional role.
4. study the effects of food additives on food matrix.
5. Understand the role of natural ingredients as food additives.

Course Outcomes

On successful completion of the course, students will be able to

Sl. No.	Course Outcome	Bloom's Level
CO1	Explain the safety regulations and quality standards to food additives in food processing	Understand
CO2	Identify appropriate preservatives and antioxidants.	Understand
CO3	Describe food colours, flavours, emulsifiers and stabilizers.	Understand
CO4	Distinguish the role of Taste and Flavouring agents in food.	Apply
CO5	Summarize the applications of all food additives and food ingredients.	Understand
CO6	Comprehend about different types of food additives.	Understand

Course contents:

Module I Introduction to Food Additives **9**

Food additives - definition and classification (INS), food safety levels as per the Specifications, Safety Evaluation of Additives – Determination of Acute and Chronic Toxicity Test Methods - NOAEL, ADI, LD50 value, FSSAI regulations, GRAS status & Regulations.

Module II Preservatives **9**

Defining - Types of preservatives and their mechanism- permitted levels - Antioxidants - defining antioxidant-permitted antioxidants; mechanism of action, permitted levels and food application. Preservatives of chemical and microbial origin, factors affecting the performance of preservatives, active forms of preservatives, necessity in a food and levels of usage, permitted preservatives and food applications.

Module III Emulsifiers, Stabilizers and Thickeners **9**

Emulsion-surface tension-Hydrophilic and Lipophilic balance (HLB), role of emulsifiers, different classes of emulsifiers and their chemical structure- stabilization-role of different stabilizers and other substances in emulsion stability-permitted emulsifiers and stabilizers- Optimization of emulsifiers and stabilizers- Thickeners – definition- chemical structure- role in food processing - list of permitted thickeners and food application.

Module IV Colour, Flavours, Flavour Enhancers and Sweeteners **9**

Colour – Natural and synthetic food colours- their chemical structure-permitted list of colours-usage levels and food application-Flavouring agents- natural and synthetic flavourings-Stability of flavours during food processing- Extraction techniques of flavours-flavour enhancers- Chemical Properties-Functions in foods-Glutamate in foods - Biochemical properties & Toxicology Sweeteners – list-structure-taste profile-permitted list-usage levels and food applications.

Module V Other Food Additives & Food Ingredients **9**

Anticaking agents, Antifoaming, glazing agents, Bulking agents, Humectants, firming agents, softening agents, Crystal modifiers, Flour improvers, Dough conditioners, and Enzymes – definition, role and mode of action, permitted list of agents and food application.

Total: 45 Periods

Text Books:

1. "Essential guide to food additives" Mike Saltmarsh, 4th Edition, Royal Society of Chemistry, UK (2019).
2. "Food Additives" Turhan Sahin and Semih Otles, CRC Press, 2019.
3. "Handbook of Food Additives" Michael Ash and Irene Ash, Synapse Information Resources, 2015.

References:

1 Branen, A. L. "Food Additives" 2nd Edition, CRC press, 2002.
2. Subbulakshmi, G and Udipi, S. A. (2001), Foods Processing and Preservation, New Delhi: New Age International (P) Ltd. Publishing.
3. Emerton, V. "Food Colours", Blackwell, 2008

Web References

1. https://www.google.co.in/books/edition/Food_Additives/87XK5Uwvs94C?hl=en&gbpv=0
2. https://www.fda.gov/food/food-additives-petitions/everything-added-food-us-eafus.

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)															
Cos	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	2	1								2	1	1
CO2	3	3	2	1	2								2	2	1
CO3	3	2	2										2	1	1
CO4	3	3	3	3	2								2	1	2
CO5	3	2	1	2	1								2	1	1
CO6	3	3	2	2	3										
	3	High				2	Medium					1	Low		

Formative assessment			
Bloom's Level	**Assessment Component**	**Marks**	**Total marks**
Remember	Online Quiz	5	15
Understand	Tutorial Class / Assignment	5	
	Attendance	5	

Summative Assessment				
Bloom's Category	**Internal Assessment Examinations**			**Final Examination (60)**
	IAE – I (5)	**IAE – II (10)**	**IAE – III (10)**	
Remember	20	10	20	20
Understand	30	20	30	30
Apply		20		50
Analyse				
Evaluate				
Create				

Passed in Board of Studies Meeting

CHAIRMAN - BOARD OF STUDIES

Approved in Academic Council Meeting

23FT405	Fruits and Vegetable Processing Technology	L	T	P	C
		3	0	2	4
Nature of Course	Professional Core				
Pre requisites	Fundamentals of Food Processing				

Course Objectives

The course is intended to

1. Learn about keeping fruits and veggies fresh.
2. Understand diverse methods of fruit and vegetable storage, to ensure preservation and quality retention post-harvest.
3. Understand the principles of fruit and vegetable processing to produce a variety of food products
4. Educate to keep fresh-cut produce from spoiling
5. Explore canning to keep fruits and veggies safe for a long time.
6. Understand the scientific ideas are applied in the processing of fruits and vegetables.

Course Outcomes

On successful completion of the course, students will be able to

CO.No.	Course Outcome	Bloom's Level
CO1	Explain about physiology and classification of fruits and vegetables.	Understand
CO2	Identify the preservation techniques for fruits and vegetables.	Apply
CO3	Demonstrate various products of fruits and vegetables.	Apply
CO4	Provide freshness and quality of minimally processed products.	Analyze
CO5	Determine safe and effective preservation using hurdle and canning technologies	Understand
CO6	Discuss the specific processing technologies used for different foods and the various products derived from these materials.	Understand

Course contents:

Module I Introduction **9**

Definition of Fruits and vegetables, Difference between fruits and vegetable, Fruits and vegetables available in different parts of the country; Classification of fruits and vegetables-General structure, composition and nutritional aspects.

Module II Post-Harvest Storage and Preservation Techniques **9**

Pre harvest and post-harvest changes; Concept of maturity indices - Factors leading to deterioration of fruits and vegetables; Methods to reduce post-harvest losses. Storage of fruit and vegetables under ambient conditions - refrigeration and freezing concept in post-harvest storage; Freezing methods-Air Blast Freezer, Immersion Freezer, Cryogenic Freezer. Hypobaric Storage.

Module III Fruit and Vegetable Products **9**

Production of IMF- jam, jellies and marmalades -Defects in jam and jelly; Candies; Dehydrated vegetable whole and powder; soup mix, Ketchup/sauces, Chutneys, Vegetable Purees; Vegetables fermentation – sauerkraut, olives, Pickles – Types – Brine curing, Raw salt method, Vinegar process.

Module IV Minimally Processed Fruits and Vegetables **9**

Factors affecting the shelf life and the quality of the minimally processed fruits and vegetables, physiology and biochemistry of the fresh cut fruits and vegetables. Processing, quality parameters and biochemical changes in the final quality of the fresh produce.

Module V Hurdle Technology **9**

Types of hurdle, aspects of hurdle technology, stress- effect on fresh produce, shelf stable products; History and development of Canning process, Types of cans and materials, syruping and brining, Filling techniques – methods, Flowchart of canning operations– equipment; Factors affecting heat penetration in cans. Precautions in canning operations, Types of spoilage in can–chemical and Microbial.

Total: 45

List of Experiments:

S. No.	Name of the Experiment	CO Mapping	RBT
1	Determination of Maturity Index of Fruits	CO1	Evaluate
2	Experiment on Osmotic Dehydration Of Fruits	CO2	Analyze
3	Experiment on Drying using Tray Dryer	CO2	Analyze
4	Measure juice yield using extractors, pulpers, presses.	CO3	Evaluate
5	Preparation of Jam	CO3	Apply
6	Preparation of Tomato Sauce	CO3	Apply
7	Determining the pH of Homemade Pickled Vegetables	CO3	Evaluate
8	Preparation and analysis of syrups and Brines	CO3	Apply
9	Freezing of fruits and vegetables	CO2	Analyze
10	Canning of fruits and vegetables	CO5	Analyze

Text Books:

1.R. Wills, T. W. Witham, and J. L. Wismer, "Postharvest: An Introduction to the Physiology and Handling of Fruit, Vegetables and Ornamentals", CABI, 4th edition, Vol 1, 2023.
2. S. Z. Ali, "Food Preservation and Processing: Theory and Practice", CRC Press, Vol 1, 2022
3. P. J. Fellows, "Food Processing Technology: Principles and Practice", Woodhead Publishing, Vol 1, 4th edition, 2021.

References:

1. S. P. Burg, "Minimally Processed Refrigerated Fruits & Vegetables", CRC Press, Vol 1, 2023.
2. G. L. Robertson, "Food Packaging: Principles and Practice", CRC Press, 3rd edition, Vol1, 2022.

Web References

1. https://archive.nptel.ac.in/courses/126/105/126105023/
2. https://onlinecourses.nptel.ac.in/noc22_ag03/preview

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2		1		1				1		2	1	
CO2	2		1		1		1						2	1	2
CO3	3	2	2		1		1	1					1	1	1
CO4	3	1					1	2					2		
CO5	2	1											2		
CO6	2	2	1	1		1				1			2	2	2
	3	High				2	Medium					1	Low		

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Summative Assessment						
Bloom's Category	**Internal Assessment Examinations**					**Final Examination (50)**
	Theory				**Practical**	
	IAE – I (5)	**IAE – II (10)**	**IAE – III (10)**	**Attendance (5)**	**Rubrics BasedCIA (20)**	
Remember	20	10			20	40
Understand	30	20	20		20	40
Apply		20			10	20
Analyze			30			
Evaluate						
Create						

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23FT406	Food Processing and Preservation Laboratory	L	T	P	C
		0	0	2	1
Nature of Course	Professional Core				
Pre requisites	Fundamental of food processing				

Course Objectives

The course is intended to

1. Enable students learn the different preservation techniques.
2. Understand the properties and estimation of proteins as well as carbohydrates.
3. Study the characteristics of dehydrated foods.
4. Know the isolation of microorganisms and adulteration techniques
5. Acquire a specialized knowledge on packaging of food products

Course Outcomes

On successful completion of the course, students will be able to

CO. No.	Course Outcome	Bloom's Level
CO1	Determine the characteristics and quality of food products	Apply
CO2	Estimate the protein and its properties as well as carbohydrates	Evaluate
CO3	Identify the suitable dryers for different food to increase the shelf life	Evaluate
CO4	Examine the microorganism's isolation and adulterants present in the food.	Analyze
CO5	Prepare the bottling and canning of food products	Evaluate

List of Experiments

S. No	Name of Experiments	CO mapping	RBT Level
1	Determination of rehydration ratio of dehydrated foods	CO3	Evaluate
2	Demonstration of Effect of Blanching on Food quality characteristics of given food sample	CO1	Apply
3	Experiment on osmotic dehydration of foods	CO3	Evaluate
4	Determination of drying rate of fruits and vegetables in Tray dryer	CO3	Evaluate
5	Experiment on properties of food through microwave oven heating	CO4	Analyze
6	Experiments on detection of Food Adulteration in different types of food materials	CO4	Analyze
7	Estimation of protein in various food products	CO2	Analyze
8	Canning & bottling of vegetable and fruit products	CO5	Apply
9	Estimation of microbial load in food materials	CO3	Analyze
10	Experiment on oil absorption characteristics of given product on frying	CO4	Analyze

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) Programme Specific Outcomes (PSOs)

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1		2	1	2		1				1	2	1
CO2	3	3	2		2	2	1		1				1	1	1
CO3	3	3	1		1	2	2		1				1	1	2
CO4	3	2	1		1	1							1	2	1
CO5	2	2	2		2	1	2		1				1	2	1
	3	High				2	Medium					1	Low		

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Assessment	Marks	Weightage	Marks		
			CA	FE	Total
Rubrics based continuous assessment	100	30	60	40	100
Preparatory examination	100	25			
Attendance	5	5			

Bloom's Level	Rubric based Continuous Assessment [30 marks]	Preparatory / Model examination (25 Marks)	Final Examination [40 marks]
Remember	20	20	10
Understand	30	30	30
Apply	40	30	30
Analyze	10	20	30
Evaluate			
Create			